# Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement

## Comment Response Supplement
## Volume II
## Public Comments

September 1997

Department of Energy
Carlsbad Area Office
Carlsbad, New Mexico

This Document Printed on Recycled Paper

# TABLE OF CONTENTS
# VOLUME II

## PUBLIC COMMENTS

Agency Comments ..... PC – 1
U.S. Environmental Protection Agency: Region 6 (A-001) ..... PC – 3
State of New Mexico Environment Department (A-002) ..... PC – 4
State of Texas: Office of the Governor (A-003) ..... PC – 6
State of Ohio: Office of the Governor (A-004) ..... PC – 6
Colorado Department of Public Health and Environment (A-005) ..... PC – 7
National Park Service: Carlsbad Caverns National Park (A-006) ..... PC – 8
State of Illinois: Department of Nuclear Safety (A-007) ..... PC – 8
Attorney General of New Mexico (A-008) ..... PC – 9
California Energy Commission (A-009) ..... PC – 27
State of Tennessee (A-010)
Office of the Governor ..... PC – 30
Emergency Management Agency ..... PC – 31
Department of Environment and Conservation ..... PC – 31
U.S. Department of the Interior: Office of Environmental Policy and Compliance (A-011) ..... PC – 34
State of Idaho Oversight Program: Idaho National Engineering and Environmental Laboratory (A-012) ..... PC – 35
New Mexico Energy, Minerals & Natural Resources Department (A-013) ..... PC – 47
State of Nevada (A-014)
Department of Administration ..... PC – 51
Department of Transportation ..... PC – 51

Public Comments C-001 through C-167 ..... PC – 52

Video Comments: Los Alamos National Laboratory (V1) ..... PC - 659

This page intentionally left blank.

# PUBLIC COMMENTS

The *Waste Isolation Pilot Plant* (WIPP) *Disposal Phase Draft Supplemental Environmental Impact Statement* (SEIS-II) was published in November 1996. The Notice of Availability was published on November 29, 1996, initiating the extended 90-day comment period to February 27, 1997. Public hearings on the WIPP SEIS-II were held from January 6, 1997, to January 23, 1997, in eight cities around the country, and transcripts of these hearings were produced. Copies of those comments are contained in Volume I of this supplement. Additional comments were received throughout the public comment period by mail, electronic mail, facsimile, and the Internet; those copies are contained in this volume. To accommodate as many respondents as possible, comments were accepted after the close of the comment period.

## PRESENTATION OF PUBLIC COMMENTS

Comments in this volume are presented in the following order and are printed as two original sheets per page.

- Agency comments (A-001 through A-014)
- Public comments (C-001 through C-167)
- Video comments (V1)

## COMMENT CODING SYSTEM

Each comment is coded with an alphanumeric code. This code indicates the origin of the correspondence (A – from an agency; C – from the public; V – from a video tape from Los Alamos National Laboratory), the document number assigned to the correspondence, and the number assigned to the specific comment(s) extracted for a response. For example, comment C-10-5 would indicate that it was the fifth comment extracted from the 10th piece of correspondence received from the public.

Sidebars in correspondence, transcripts, and exhibits indicate the specific lines from which the comments were extracted.

This page intentionally left blank.

Comment A-001, Page 1 of 3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

January 28, 1997

Harold Johnson
NEPA Compliance Officer
Carlsbad Area Office
Department of Energy
P.O. Box 9800
Carlsbad, New Mexico 87119

Dear Mr. Johnson:

In accordance with our responsibilities under Section 309 of the Clean Air Act, the National Environmental Policy Act (NEPA), and the Council on Environmental Quality Regulations for Implementing NEPA, the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas, has completed its review of the Department of Energy's (DOE)'s Draft Supplemental Environmental Impact Statement (DSEIS) for the Waste Isolation Pilot Plant Disposal Phase II. Associate reviews were also conducted by EPA Regions 4,5,8,9 and 10; along with several offices within EPA Headquarters which include the Office of Radiation and Indoor Air, Office of Solid Waste and Emergency Response, Office of Water, Office of Research and Development and the Office of Air and Radiation. Their views have been incoporated with this letter for your review and consideration.

The action considered is to assess the potential environmental impacts of six alternatives for disposal of DOE transuranic (TRU) waste. Under the proposed action, DOE would continue with the phased development of WIPP by disposing post-1970 defense TRU waste in the WIPP repository. The proposed action is to dispose of transuranic waste packaged to meet planned Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria at WIPP, up to the volume limits imposed by Congressional legislation. There are no changes since the SEIS Phase I for long term controls for WIPP, which includes controls, monitoring, and permanent markets or signs and other passive controls.

The following comments are offered for your consideration in preparation of the Final SEIS:

Comments Provided by EPA Region 9

1 1. The Council on Environmental Quality has issued a draft guidance for addressing Environmental Justice (EJ) under the National Environmental Policy Act (NEPA). The guidance seeks to advance the goals of Executive Order 12898: Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. EPA believes that there are elements of the

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 100% Recycled Paper (40% Postconsumer)

Comment A-001, Page 2 of 3



1 guidance that relate to this SEIS, for example, the Rocky-Flats Technology Site and the Savannah River Site. Both of these sites have been reported as having environmental justice concerns. EJ should be considered in evaluating the alternatives in the Final Statement.

Comments Provided by EPA Region 10

2. Generally speaking, the opening of WIPP is an important element in the Superfund programs for Hanford and the Idaho National Engineering Laboratory (INEL), since WIPP will represent the sole long-term repository for TRU wastes currently stored at both sites as well as TRU wastes that will be generated as a result of future site remedial actions. The proposed action is the only one consistent with legislated waste volume limitations, schedules, and the requirement for ultimate disposal of transuranic wastes. The proposed action does not; however, address transuranic wastes to be generated from future remedial actions. From this perspective, the following comments are offered for consideration in the Final SEIS.

2 a. The Final SEIS should note that in 1995 Idaho, DOE and the Navy entered into a settlement agreement which commits DOE to opening WIPP and sending the first shipments of TRU waste to WIPP from INEL no later than 1999. This schedule appears to be inconsistent with some of the alternatives presented in the Draft SEIS. The Final SEIS should provide some indication of how these discrepancies can be alleviated.

3 b. The proposed action specifies shipment to WIPP of only post-1970 transuranic waste volumes, consistent with the waste volume limitations of the Land Withdrawal Act. It is not clear, however, why the proposed action should be limited to post-1970 TRU when there are "additional inventories" (including TRU from remedial actions) that will also need disposition. The "additional waste" volumes are similar to the "basic inventory" volumes (for contact-handled waste). The FSEIS may want to discuss what consideration has been given to these additional volumes of TRU waste at each site and address what flexibility exists to prioritize which TRU (post-1970, or "additional inventory" or some combination) to send to WIPP. Discussion on this matter should be provided in the Final SEIS.

4 c. The FSEIS should discuss whether the cost estimates for the proposed alternative include costs for management of "additional inventories" of TRU waste since alternative actions include costs associated with disposition of these inventories. Since the alternative actions include the cost of the disposition of these inventories, the proposed action may want to incorporate and address costs for management of the same waste volumes for comparison even if not all are sent to WIPP.

d. Action Alternative 2 includes thermal treatment to meet the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDR)s, and also has the effect of volume reduction. Clarification is needed in the Final SEIS to discuss whether 5 simple treatment for volume reduction alone is a viable alternative to the proposed action. Volume reduction by a factor of 2 would mean that most of the "previously disposed" TRU waste could be addressed under the waste volume limitations of the Land Withdrawal Act as well as the "basic inventory". Discussion of this matter should be included in the Final SEIS.

6 The EPA rates your DSEIS as "LO," i.e., EPA has " a Lack of Objections" to the DOE preferred alternative. However, we are requesting some additional information to strengthen the Final SEIS in the areas mentioned above. Our classification will be 6 published in the Federal Register according to our responsibility under Section 309 of the Clean Air Act, to inform the public of our views on proposed Federal actions.

We appreciate the opportunity to review the DSEIS. We request that you send our office one copy of the Final SEIS at the same time that it is sent to the Office of Federal Activities, (2251A), EPA, 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460.

Sincerely yours,

Michael P. Jansky, P.E.
Regional Environmental Review
Coordinator



*State of New Mexico*
*ENVIRONMENT DEPARTMENT*
*Harold Runnels Building*
*1190 St. Francis Drive, P.O. Box 26110*
*Santa Fe, New Mexico 87502*
*(505) 827-2850*

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

February 4, 1997

Harold Johnson
NEPA Document Manager
Attn: SEIS comments
P.O. Box 9800
Albuquerque, N.M. 87119

Dear Mr. Johnson:

**RE: WASTE ISOLATION PILOT PLANT DISPOSAL PHASE, DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT; DEPARTMENT OF ENERGY, CARLSBAD AREA OFFICE, CARLSBAD, NEW MEXICO (NOVEMBER 1996)**

The following transmits New Mexico Environment Department (NMED) staff comments concerning the above-referenced Draft Supplemental Environmental Impact Statement (DSEIS).

**(1) Requirements/conflicts with NMED laws and regulations.**

20 NMAC 4.1 in general, and Subparts V and IX (40 CFR §§264 and 270) in particular, define New Mexico's hazardous waste management program, identify standards for owners and operators of hazardous waste management facilities, and describe hazardous waste permitting procedures. The DSEIS assesses the impact the Proposed Action of operating the Waste Isolation Pilot Plant for disposal of defense related transuranic (TRU) and TRU-mixed waste, the latter of which is regulated under 20 NMAC 4.1. The DSEIS also considers several alternatives to the Proposed Action, including increasing the inventory of waste to be disposed of at WIPP, various treatment alternatives, and two no-action alternatives in which waste would be stored at the generator sites and WIPP would be dismantled. In general, the DSEIS addresses many issues which fall outside of the regulatory purview of 20 NMAC 4.1, and those issues, such as transportation and radiological impacts, were not reviewed. Likewise, alternatives to the Proposed Action were not evaluated on their relative merits.

The U.S. Department of Energy (DOE) and Westinghouse Waste Isolation Division (WID) have submitted a Resource Conservation and Recovery Act (RCRA) Part B Permit Application to NMED to operate WIPP as a hazardous waste storage and disposal facility. This permit application serves as a primary information source for DSEIS.

No conflicts with hazardous waste management or permitting regulations were found in the SEIS-II.

## Comment A-002, Page 2 of 3



**(2) Deficiencies/inaccuracies in the information provided which prevent an adequate environmental assessment of the project.**

1 The time frame for waste generation is inconsistent between the DSEIS and other documents produced by or for DOE. While the DSEIS assumes 35 years of waste generation, the documents used to support the inventory assumptions estimates projected waste volumes until the year 2022, or for only 25 years in the future (Table S-1). Likewise, the RCRA Part B Permit Application describes operations at WIPP as lasting for 25 years, followed by an 8- to 10-year closure period. DOE's assumption of 35 years for waste generation (and therefore facility operation under the Proposed Action) is inadequately justified in the DSEIS.

2 For transportation activities under the Proposed Action, DSEIS assumes transportation by truck only (Section 3.1.2, page 3-7), even though the RCRA Part B Permit Application states that "RH TRU mixed waste will arrive at the WIPP facility in a shielded road cask on a tractor trailer or in a railroad cask loaded on a railcar." (*RCRA Part B Permit Application, Revision 6, DOE/WIPP 91-005*, page D-81, lines 24+). Eliminating assessment of rail transport in the Proposed Action may preclude shipment of RH TRU waste by rail. DOE should reevaluate rail shipments in the Proposed Action in light of statements made in regulatory application documents submitted to NMED.

3 For TRU waste handling operations at the surface (Section 3.1.3.2, pages 3-10 - 3-11), DOE states that "For RH-TRU waste to be shipped in the RH-72B cask, the Department would not finalize the waste handling operation procedures until the NRC certifies the RH-72B transportation cask." However, DOE provides detailed descriptions of procedures for handling RH TRU mixed waste in the RCRA Part B Permit Application (for example, Section D-10a(3)(c) of Chapter D). Again, DOE may wish to reconsider statements which appear contrary to information contained within regulatory application documents.

4 Assumptions in the DSEIS about the location of maximally exposed individual (MEI) at WIPP are inconsistent with information provided in the RCRA Part B Permit Application. In the DSEIS (page 5-28), the MEI noninvolved worker from normal disposal operations at WIPP is located 200 meters **east** of the exhaust filter building, which would put him nearly 170 meters outside the Property Protection Area fence, half-way to the SPDV Salt Storage Area. Likewise, when evaluating WIPP disposal accidents (page 5-37), the MEI member of the public and the noninvolved worker were at the same location, 300 meters **south** of the exhaust filter building. This may be the closest physical access a member of the public has to the exhaust, but air dispersion modeling conducted for the RCRA Part B Permit Application (Appendix D10, and depicted graphically in Figures D9-2 and D9-3) indicate this location to be directly *upwind* of any releases from the exhaust filter building. According to the RCRA Part B Permit Application, the MEI noninvolved worker would be located 10 meters south of the exhaust outlet, while the MEI member of the public would be located on the north boundary of the Exclusive Use Area. DOE must reevaluate DSEIS calculations of risk based on releases to the air considering the information contained in other regulatory application documents.

**(3) Other information which may be helpful to understand the environmental impact of the project.**

## Comment A-002, Page 3 of 3



5 DOE has already submitted a RCRA Part B Permit Application to the State and a 40 CFR §191 Compliance Certification Application to EPA for permission to operate the WIPP facility as described in the DSEIS Proposed Action. This gives the impression that DOE has already predetermined which course of action they will pursue, and that the DSEIS is simply a formality.

6 The DSEIS is valuable as a single, concise document which evaluates the risks (from both radiological and chemical hazards) at generator sites, along transportation routes, and at the WIPP facility which is unavailable from any other single WIPP document. However, some of the inconsistencies noted above indicate that risks presented in the DSEIS do not agree with descriptions of risk provided in the other regulatory application documents.

**(4) Other Comments.**

7 Although the DSEIS indicates it was published in November 1996, and includes information reflecting changes in the WIPP Land Withdrawal Act as of September 23, 1996, it contains inconsistent references to the correct versions of both the Final No-Migration Variance Petition and the RCRA Part B Permit Application. Page S-3 refers incorrectly to the Final ***Draft*** No-Migration Variance Petition; pages 1-8 and 1-15 refer to the RCRA application incorrectly as being Revision 5.2 and issued in 1995; and subsequent chapters reference the superseded RCRA application Revision 5.2 instead of the current Revision 6 issued in April 1996. These are relatively minor errors which nonetheless should be corrected.

8 One minor annoyance which permeates the entire document is the apparently arbitrary use of the terms "probability" and "percent chance" when referring to latent cancer fatalities (LCF). When the text is compared to tables listing probabilities, it is clear that the values in the text are multiplied by 100 whenever a "percent chance of an LCF" is provided. This sort of mental gymnastic burden on the reader is unnecessary, and DOE should reconsider the use of "percent chance" throughout the text.

We appreciate the opportunity to review this document. Please let us know if you have any questions on the above.

Sincerely,

Gedi Cibas, Ph.D.
Environmental Impact Review Coordinator

NMED File No. 1045ER

## Comment A-003

Feb-07-97 07:29A nina murrill (505)887-6970 P.12

STATE OF TEXAS
OFFICE OF THE GOVERNOR

GEORGE W. BUSH
GOVERNOR

January 23, 1997

Mr. Harold Johnson
Department of Energy
101 W. Greene Street
Carlsbad, New Mexico 88220

RE: TX-R-96-12-09-0001-50-00 / WASTE ISOLATION PILOT PLANT DISPOSAL PHASE

Dear Mr. Johnson:

Your application for assistance referenced above has been reviewed. The comments received are summarized below and are attached.

1 The Department of Public Safety (DPS) expressed concerns about the safe transportation of waste shipments through Texas to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. They pointed out that there will be a need for training the officers stationed along the proposed route and strong communication required between the transporters and law enforcement agencies prior to the inception of shipping.

The East Texas COG commented that the proposal was consistent with the policies, goals, and objectives identified in ETOG's Regional Land Resource Management Plan, but raised essentially the same concerns as DPS about pre-shipment training needs. No other comments were received.

We appreciate the opportunity to review your proposal. Please let me know if we can be of further assistance.

Sincerely,

T. C. Adams, State Single Point of Contact

TCA/yjy

Enclosures

POST OFFICE BOX 12428 AUSTIN, TEXAS 78711 (512) 463-2000 (VOICE)/(512) 475-3165 (TDD)

## Comment A-004, Page 1 of 2

GEORGE V. VOINOVICH
GOVERNOR

STATE OF OHIO
**OFFICE OF THE GOVERNOR**
COLUMBUS 43266-0601

January 28, 1997

Mr. Harold Johnson
NEPA Compliance Officer
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

Thank-you for the opportunity to comment on the Waste Isolation Pilot Plant Disposal Phase Supplemental Environmental Impact Statement II (SEIS-II) dated November 1996. The safe and timely management of transuranic (TRU) waste is very important to Ohio, both in terms of public safety and the cleanup and reuse of Department of Energy (DOE) facilities in Ohio.

The basis for our comments is the fact that under current plans the Mound facility is to be privatized in approximately 8.5 years and placed in industrial reuse creating jobs for the community. Much effort and planning has gone into this shared, ambitious, and feasible goal. However, in order for this goal to be achieved, transuranic waste must not remain at the facility. Further, we do not think that Mound should be considered a consolidation facility for other wastes. Our specific comments are:

1 1. Ohio supports the Department of Energy's proposed action in that it will result in movement of a significant amount of TRU-waste from Mound to WIPP and will use the routes recommended by both Ohio and DOE. In addition, the timing is consistent with the site reuse plans.

2 2. Because of the privatization of the Mound facility, Mound is a poor candidate for acceptance of any additional transuranic waste. Any specific proposal should be evaluated based on timing issues, waste compatibility, environmental and health implications. Any such evaluation should include full participation by the State of Ohio.

3 3. Ohio requests the opportunity to review any changes to the proposed TRU-Waste Truck Transportation Routes as may be deemed necessary for the transport of RH-TRU-waste. Battelle in Columbus has the second largest inventory of RH-TRU-waste as of 1995. It is assumed that the RH-TRU-waste from Battelle would be transported to Oak Ridge National Laboratories (but it is unclear what routes DOE proposes to use). We recommend routing is I-70 E. (from Battelle) to I-270 E to I-71 S to I-275 E (around Cincinnati) to Kentucky (I-75).

4 4. Ohio is interested in any legislative proposals that DOE might be considering that would permit the ultimate disposal of all transuranic waste at the WIPP site including the waste commingled with polychlorinated biphenyls (PCB's). This issue is important because of

4 | the 20 cubic meters of such waste that would remain at the Mound facility under the proposed action.

The State of Ohio submits these comments in good faith with appreciation for the fact that DOE is attempting to resolve the problem of transuranic waste in a manner suitable for all stakeholders.

Sincerely,

GEORGE V. VOINOVICH
Governor



STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Executive Director

*Dedicated to protecting and improving the health and environment of the people of Colorado*

4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
1210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Colorado Department
of Public Health
and Environment

February 4, 1997

Mr. Harold Johnson
NEPA Document Manager
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

1 | We have reviewed the Draft Supplemental Environmental Impact Statement (SEIS) dated November, 1996 for the Waste Isolation Pilot Disposal Phase. Colorado supports the opening of WIPP as long as the process to open the facility fulfills the necessary regulatory requirements. Our very few specific comments on the SEIS are as follows:

2 | General Comment on Alternative Actions 1, 2, and 3: Obviously, given the projected span of operations in excess of 100 years for these alternative actions, accurate predictions of process and impacts are impossible. No one can really make an accurate projection of social conditions and technological changes that may occur that far in the future.

3 | Page 3-4: The CH-TRU map on Figure 3-1 shows the TRU waste from Teledyne-Brown Engineering in New Jersey being shipped to Oak Ridge National Labs for consolidation. Based upon information received last year from DOE's Carlsbad Area Office and from the Rocky Flats Office, it is our understanding that this waste will be consolidated at Rocky Flats.

4 | Page E-58: A statement is made that all communities on WIPP highway transportation routes have been offered WIPP specific emergency response training. This is incorrect. Training has only been offered along the route from Idaho Nuclear Engineering Labs to WIPP.

5 | Appendix I: In discussion of No-Action Alternative 2 where TRU waste remains at generator sites with minimal treatment, it is pointed out that there would be a loss of institutional controls after 100 years, allowing degradation and leaching to occur. In our review of the SEIS, we could not find any place in the document where impact from degradation and leaching from pre-1970 waste buried at generator sites is discussed. In the proposed action, this waste would remain in place at generator sites, and would eventually be subject to the loss of institutional controls.

If you have any questions, please contact me at (303) 692-3022.

Sincerely,

Steven H. Gunderson, Director
Emergency Management Program

xc: Doug Young, Governor's Office
Bob Quillin, CDPHE/LARS
Ron Ross, Western Governors' Association

## Comment A-006

United States Department of the Interior

NATIONAL PARK SERVICE
Carlsbad Caverns National Park
3225 National Parks Highway
Carlsbad, New Mexico 88220

IN REPLY REFER TO

A3815

FEB 7 1997

Memorandum

To: Harold Johansson, WIPP, DOE

From: Superintendent, Carlsbad Caverns National Park

Subject: Comments on WIPP EIS

1 We reviewed pertinent Sections of the "WIPP Disposal Phase Draft Supplemental EIS". We feel this draft EIS provides an objective and exhaustive review of the affected environment and environmental impacts of this project. Although we have no major comments, this project presents a concern, because of its scale and its location 38 miles from Carlsbad Caverns National Park.

2 We would like to take this opportunity to discuss the importance of measures to reduce air pollution emissions. We recognize that your project emissions are low, however as a Class 1 PSD Air Quality Areas even incremental increase could degrade air quality at Carlsbad Caverns National Park.

2 Regional oil and gas development has resulted in reduced visibility and hydrogen sulphide odors at the Park. Therefore, we are concerned with any cumulative deterioration that could hamper preserving the Park's ecosystem and providing for the public enjoyment. The recreation and scenic values of this wilderness area are dependent on aesthetic values, such as a pristine viewshed. We encourage careful and precise monitoring of air quality parameters.

2 We wish to continue to comment on external environmental review documents related to federal actions that could effect our park's pristine environment. We appreciate you providing this document for our review and request that you select measures to reduce threats to Carlsbad Caverns National Park.

Frank J. Deckert

cc:
Jacob Hoogland, WASO Chief, Environmental Quality Division

## Comment A-007

Feb-27-97 08:19A nina murrill (505)887-6970 P.02

STATE OF ILLINOIS
**DEPARTMENT OF NUCLEAR SAFETY**
1035 OUTER PARK DRIVE
SPRINGFIELD, ILLINOIS 62704
217/785-9900
217/782-1322 (TDD)

Jim Edgar
Governor

Thomas W. Ortciger
Director

February 21, 1997

Dennis S. Hurtt, Team Leader
Office of Public Affairs
U.S. Department of Energy
Carlsbad Area Office
P. O. Box 3090
Carlsbad, New Mexico 88221

Dear Mr. Hurtt:

The Illinois Department of Nuclear Safety has reviewed the Supplemental Environmental Impact Statement associated with the Waste Isolation Pilot Plant disposal phase. IDNS would like to comment on the Fact Sheet describing TRU shipments from Argonne National Laboratory. (SEIS-II-14).

1 According to the map and route description, waste will leave ANL-E on I-55 and immediately head northeast directly towards downtown Chicago. The first 20 miles of this route would be over a series of very congested urban highways. Also, the fourth leg of the trip from I-80 to I-57 cannot possibly be 35 miles. This might be a simple typographical error, since 3.5 miles seems more appropriate.

Therefore, we suggest that you consult with the DOE Chicago Operations Office staff. These are people that commute on these highways every day and should be in a much better position than either you or me to choose an acceptable local route to I-57 south.

If you have any questions about this comment, please call me at (217) 782-1322.

Sincerely,

Richard Allen, Manager
Office of Environmental Safety

RA:tlk

**Attorney General of New Mexico**

PO Drawer 1508
Santa Fe, New Mexico 87504-1508

505/827-6000
Fax 505/827-5826

TOM UDALL
Attorney General

MANUEL TIJERINA
Deputy Attorney General

February 27, 1997

Mr. Harold Johnson
NEPA Document Manager
P.O. Box 9800
Albuquerque, NM 87119

Attention: SEIS Comments

To the Docket:

The following comments concerning the Waste Isolation Pilot Plant Disposal Phase Supplemental Environmental Impact Statement ("SEIS-II") are submitted on behalf of the New Mexico Attorney General's Office.

Comments were previously presented orally by the Attorney General on January 8, 1997.

1 DOE has submitted its Compliance Certification Application to the U.S. Environmental Protection Agency ("EPA") on October 29, 1996, despite not having an effective final environmental impact statement to support that decision. Such action violated the National Environmental Policy Act. It would be appropriate for DOE at this point to withdraw its application and complete the NEPA process before making any further commitments of that nature.

2 The SEIS-II is much more than a regulatory formality. This document ought to be the study that shows, with the best available information, what risks are presented by this project, what option is the best way to operate this project, and what risks are presented by reasonable alternatives. The draft does not accomplish this purpose.

3 Even the analysis of the preferred alternative--DOE's present plans--is deficient. For example, the SEIS-II draft analyzes the long-term risks of disposal, using assumptions that clearly do not represent the real future risks. The draft assumes that human intrusion into the repository will take place only by drilling and mining methods in use now or previously in the Delaware Basin and does not even consider techniques that are now used in other areas. In addition, the SEIS-II analyzes only a single drill penetration into the repository, even though DOE recognizes that there will be





3 more than one penetration. Such unrealistic assumptions make it impossible to evaluate actual risks and compare alternatives.

Attached are comments concerning the performance assessment of the repository, addressed principally to compliance with the 40 CFR Part 191 disposal regulations.

4 There are other unjustified assumptions. The draft seems to assume that emplacement of remote-handled transuranic waste will commence in the year 2002, as DOE now plans, but this starting date must be regarded as doubtful. In addition, it states that disposal operations are planned to take 35 years, but it also says that disposal operations will not end until WIPP's capacity limit is met--and that may take far longer than 35 years, one reason being that DOE's projected waste volume after 35 years falls well short of the repository's capacity.

5 In addition, the draft does not analyze the actual risks of transportation of radioactive waste. For example, the study assumes that there is a limit on the amount of particulate waste that can be contained in each drum, but in fact DOE has rescinded that safety requirement.

6 The SEIS-II fails to reflect decisions that have actually been made. DOE has announced its decision to construct a mixed waste treatment facility at Idaho National Engineering Laboratory to treat and vitrify at least 65,000 cubic meters of waste stored at INEL. However, the analysis of DOE's preferred alternative in the SEIS-II does not include such treatment.

7 Another major problem is the draft's failure to analyze the impact of intentional interference with waste storage, treatment, and shipment--in other words, nuclear terrorism. To raise this problem, unfortunately, may raise the risk. But the fact is that shipment of waste, as distinguished from storage, significantly elevates the risk of intentional outside interference with the waste. Therefore, when one of the decisions is to ship or not to ship, the risk of such interference must be assessed. Nothing on the subject appears in the draft SEIS-II. We do not know of any studies of the effects of attacks with explosive devices (e.g., antitank weapons) upon trucks transporting CH-TRU or RH-TRU waste. 7 Clearly, the TRUPACT-II transportation containers are not designed to withstand deliberate attacks. Some studies have been done of the effect of explosives upon high-level shipping containers, but their sufficiency has been questioned. Moreover, the technology available to potential attackers is constantly changing. The draft SEIS-II should be expanded to show the possible effects in terms of injuries and fatalities as well as economic and social costs of deliberate attacks using modern weapons and explosives in the course of waste transportation.

The second major problem is that the draft does not present the realistic alternatives available at this time to achieve DOE's stated objectives. This is a fundamental legal requirement. DOE now plans to dispose of all existing waste that has been generated since 1970 and all future-generated transuranic waste in WIPP, to the extent capacity is available. The draft discusses the environmental impacts of doing so. However, the draft does not show the environmental impact of any alternatives for dealing with that same inventory of waste. Instead, the draft contains only alternatives for dealing with the different and much bigger problem of the entire transuranic waste inventory, including the pre-1970 waste that DOE must, of course, dispose of properly some day. But no one imagines that WIPP is the solution to that much larger problem. Comparing such alternatives with DOE's current plans for WIPP is like comparing apples with oranges. 8

DOE's insistence on discussing only alternatives that include the entire transuranic waste inventory leads to absurd results. The alternative actions in the draft have time frames of 150, 160, and 190 years--periods that are completely unrealistic. No one would seriously propose such projects, and to imply that they are the only alternatives produces a useless document. One suspects that DOE has exaggerated the time required to carry out some alternatives, to make them seem undesirable. DOE itself states that the alternatives in the SEIS-II should be practical or feasible from the technical and economic standpoint and should use common sense, but DOE has failed to follow its own advice. 9

There are practical alternatives to DOE's present plans. Such alternatives include specific methods for treating the waste inventory that DOE plans to bring to WIPP, so that it will be less mobile and less dangerous to future generations. Some such alternatives are even referred to in the draft, but they are only analyzed for the entire transuranic inventory, leading to century-long projects that cannot be compared with DOE's present plans. 10

DOE's alternatives have other unsupported aspects. For example, they assume that transuranic waste generation will continue for only 35 years, even though disposal goes on for more than 100 years. Surely, DOE will have ongoing programs that generate transuranic waste for more than 35 years, because DOE has made no commitment to terminate its nuclear programs within 35 years. Moreover, the analysis of the impact of waste treatment at various locations rests upon the analyses done in the draft Waste Management Programmatic Environmental Impact Statement, which is not yet a final document and is not expected to become final until an uncertain future date. 11 12

There are other problems. The alternative which involves thermal treatment and long-term storage, rather than disposal at 13





WIPP, assumes that waste will also be repackaged every 20 years, which on its face seems unnecessary and would make that choice appear less desirable than it would be otherwise. 13

DOE also rejects certain alternatives, such as transmutation, use of other geologic repositories, and various engineered waste modifications, because they would not meet what DOE calls its need to dispose of transuranic waste in a timely manner, but in light of DOE's willingness to contemplate 150-year alternatives, one has to ask what the cutoff for timeliness is. Moreover, DOE has refused to consider the possibility of improvements in the technology of waste treatment and disposal, which is an unrealistic position clearly designed to make today's plans look like the best choice. 14

Further, the discussion in the draft SEIS-II of alternative treatment sites and methods and of generator-storage site impacts is entirely dependent upon the analysis in the Waste Management Programmatic Environmental Impact Statement (the "WM-PEIS"). That document exists only in draft form. Since the draft WM-PEIS may be significantly changed before it becomes final, the analysis in the WIPP SEIS-II would need to be changed as well. The final SEIS-II must await a final WM-PEIS. 12

It is extremely important that the environmental analysis of the operation of the Waste Isolation Pilot Plant be as thorough and accurate as Congress intended when it enacted the National Environmental Policy Act. A complete analysis is essential not just for DOE but for the guidance of other agencies, members of Congress, state officials, and the interested public. The draft SEIS-II does not contain such an analysis. 15

Very truly yours,

Lindsay A. Lovejoy, Jr.
ASSISTANT ATTORNEY GENERAL

LAL:mh

Comments on Compliance Certification Application

This attachment contains comments on the Compliance Certification Application ("CCA") submitted to the U.S. Environmental Protection Agency ("EPA" or the "Agency") by the U.S. Department of Energy ("DOE") on October 29, 1996, pursuant to §8(d)(1)(A) of the Waste Isolation Pilot Plant Land Withdrawal Act of 1992, as amended (the "WIPP Act").

This document contains a summary of comments, followed by detailed comments on the CCA, as submitted and amended through this date. The CCA has been amended several times since October 29, 1996 and probably will be amended further by DOE. The Agency's rules for public participation require the application to be filed, "made available for inspection in Agency dockets," and thereafter call for a 120 day comment period (40 CFR §194.61 (b), (c)). It is the intent of the rule to allow the public a reasonable period of time to review and comment on the complete application that the Agency will consider. That intent has been frustrated by the Agency's practice of receiving amendments from DOE without any apparent time limit on DOE's amendments, while refusing to allow the public a similar extension of the time limit on the right to comment. The comments contained herein concern the application as it exists in the docket at this date.

The application is intended to show that no releases of radioactivity in excess of specified limits occur for a period of 10,000 years. The performance assessment ("PA") which models the performance of the repository is meant to consider all plausible scenarios that may lead to such releases of radioactivity and to calculate the consequences of such releases. We have reviewed the CCA and considered the comments of scientists and engineers in various oversight groups, including the Environmental Evaluation Group ("EEG"), DOE's own peer review groups, the National Academy of Sciences WIPP Committee, EPA's own staff, and consultants to this office. We conclude that there are several serious and unresolved questions as to the PA analysis of the ability of WIPP to contain radioactive waste for the regulatory period. Among the most important are:

1. There is a risk that injection of pressurized brine for enhanced oil production or brine disposal may fracture the marker beds overlying and underlying WIPP. The injected brine may inundate the repository, become contaminated, and flow from the repository to various release points. This scenario is not considered in the PA.

2. The CCA assumes that boreholes drilled into the repository in the future will be sealed with ineffective borehole plugs in most instances. Thus, in the PA analyses gas pressure does not build up in the repository, since gas escapes through the plugs. As a result, in later intrusion events, releases caused by gas pressure are minimal. The PA assumption that plugs will be



ineffective is unrealistic and results in the understatement of releases of radioactivity.

3. The specific type of release of waste called a spallings release, which occurs in the event of a drilling intrusion when pressurized gas propels waste toward the surface, is not adequately represented by the model used in PA, as has been noted by DOE's own peer review group.

4. The chemistry of the disposal rooms is important in determining the amount of radioactivity that may be released. DOE has assumed that the magnesium oxide backfill will react instantly and completely with the waste, gas, and brine in the repository, reacting with $CO_2$, reducing gas pressure and also reducing the solubility of the radionuclides. However, DOE has not shown that these processes will in fact take place. DOE's peer review panel has rejected DOE's PA assumption in this respect also.

5. The Castile Formation, underlying WIPP, contains reservoirs of pressurized brine, which would enhance releases of radioactivity if a driller penetrated WIPP and also hit such a reservoir. In the CCA DOE has severely underestimated the likelihood of encountering a Castile brine reservoir, in disregard of data showing the presence of such brine reservoirs beneath WIPP. DOE also has underestimated the volume of such a brine reservoir, again in disregard of available data.

6. DOE has projected that its proposed system of monuments and markers will almost entirely deter future drilling into the repository for at least 700 years. However, the projections ignore risks that the markers may never be built or may be destroyed, that future people will misunderstand their message, or that people using future drilling technology will miss the message entirely. Thus, DOE's projection is based in sheer speculation.

7. Future climate change may increase precipitation, which in turn may dissolve minerals in the Culebra aquifer and increase its permeability. The Culebra is the principal release route for subsurface releases. DOE's PA model does not even consider whether climate changes may affect the permeability of the Culebra.

8. The amount of radioactivity that may be released depends largely on the amount of radionuclides that are dissolved in the brine that the repository will contain. Thus, radionuclide solubility is an important part of the PA. In the CCA dissolved actinide solubility values are based on mistaken assumptions, as EEG has shown, resulting in an underestimate of the amount of radionuclides which will be dissolved in any brine which is released from WIPP.

9. Another critical parameter is the retardation coefficients, which describe how fast radionuclides are transported

in brine which escapes from WIPP into the Culebra aquifer. In the CCA these retardation coefficients ($K_d$'s) are overestimated, so that the amount of radioactivity that escapes is underestimated. In the absence of valid retardation data, DOE should assume that there is no retardation in the Culebra.

10. Potash is mined near WIPP, and potash occurs in the Salado Formation itself, which is the formation in which WIPP is excavated. Future potash mining may create new pathways for radionuclides to escape from WIPP, either by changing the permeability of the Culebra aquifer or by creating release routes thorough the Salado Formation itself. However, in the CCA DOE seriously underestimates the areas where potash will be mined in the future. This underestimate results in an underestimate of the future effects of such mining.

11. Many elements of DOE's plan for WIPP are simply missing from the CCA. The CCA contains no definitive design for shaft seals, panel closures, active institutional controls, or passive institutional controls.

12. The CCA does not contain the waste analysis of characteristics influencing the containment of waste, with limiting values, plausible combinations of limiting values, and a showing of compliance at the limits--all as required by EPA's regulations.

13. DOE does not demonstrate that it will enforce limits on the waste that may be brought to WIPP. Specifically, there is no showing of a system of controls to enforce waste limits that EPA's regulations require.

14. Many of the parameters in the CCA are the result of expert judgment, rather than scientific data. EPA has a rule that calls for specific procedures when expert judgment is used. However, DOE insists that expert judgment was not used at all in the CCA. This is not a credible position, and the EPA rules have plainly been violated.

Detailed comments
addressed to Compliance Certification Application

The following are detailed comments on the CCA, set forth in the approximate order of the discussion in the CCA and using the section designations of that document.

Chapter 2

Many of the important topics discussed in Chapter 2 are treated much too briefly and frequently in a biased and tendentious approach. It is unfortunate that a scientific work ostensibly created to equip the Agency to make an objective assessment of the





merits of a proposed repository should assume an adversary approach.

The discussion in Chapter 2 should be linked directly to the other portions of the application which supposedly employ site data, specifically, the discussions of FEPs retained or dropped from consideration and the PA. Further, the support for parameter values that form related parts of a model should appear together in Chapter 2, so that the interrelationships and the importance of various parameters may be perceived.

Groundwater basin model: In general, there is a lack of support for the DOE groundwater basin model, which is not used in PA directly but is used to support the PA modeling of the behavior of the Culebra. If the groundwater basin model is to have any credence, it must be shown how the site characterization activities and data emerging therefrom support the groundwater basin model in the specific form adopted, and how they justify the selection of the particular conceptual model used and the rejection of other models.

System and modeling approaches: Many strata are represented in the model with uniform characteristics as to certain parameters (albeit sometimes variable parameters). What is missing is some discussion of the potential magnitude of spatial variability of the pertinent characteristics, with justification for the range postulated. Specifically, the CCA must address the issue of scale and representativeness of data, such as when employing data from aquifer tests of a stated scale in modeling phenomena on a much larger scale. Use of small-scale data in large-scale models cannot occur on the assumption that no justification is required.

Initial and boundary conditions: The CCA should present information about factors known to bear upon initial conditions in the geologic units, such as the experience in excavating the WIPP shafts and the effects upon pressure in strata penetrated. Recent anomalous water level rises in Culebra wells should be discussed. The Culebra initial conditions should be presented with the associated uncertainties displayed, so that the model may be evaluated in light of them. There should be discussion of the disturbed rock zone. Recharge to the Culebra is assumed areally uniform in the groundwater basin model; what data support this assumption? Far field (boundary) pressures for all units should be presented and defended. The role of the Malaga Bend area as a recharge or a discharge area for Rustler waters should be explained and defended. Brine geochemistry, including geochemistry of Castile and Bell Canyon brines, should be presented and supported.

Data-time relationships: The CCA should defend the use of, e.g., data spread over a ten-year time frame in modeling the potentiometric heads in the Culebra. Also, there should be some justification for modeling the transmissivity of the Culebra as

unchanged with respect to possible dissolution in response to climate change, infiltration, or injection of brine from lower strata through an intrusion borehole. There is lacking any discussion of the possible increase in water levels upon the Dewey Lake and its availability as a transport path.

Processes omitted from modeling: Some processes are omitted from the PA and other models; discussion of the omissions and justification should be provided. Dispersivity as an attribute of the diffusion of radionuclides into the Culebra has not been discussed. The modeling of anhydrite fracturing is not based in data from the site. The role of fluid density flow is not depicted. Culebra tracer tests prior to the H-19 hydropad tests are not depicted. Data should be presented to support the various models of Salado flow. The possible sources of recharge into the Culebra should be presented. If it is asserted that recharge into the Culebra may be neglected, such position should be made clear and defended. Other model simplifications should be defended, such as the use of a uniform thickness in modeling the Culebra and the omission of density-dependent flow.

Parameter data presented should include:

1. Data sources and collection methods.

2. Parameter range, median, distribution, and rationale for the assigned distribution.

3. Sources of uncertainty.

4. Representativeness of the data with respect to the modeled phenomena.

5. Number of measurements and potential data limitations.

Graphic displays: The occurrence, location, volume, pressure, and other characteristics of Castile brine pockets are matters of considerable importance. Chapter 2 should present all available data on such points and representative interpretations, if deemed valid, of the data. Graphic displays should be used.

The variability of the present hydrologic characteristics of the Rustler Formation is an important issue. Maps should show the range of variation of permeability and porosity of pertinent members of the Rustler Formation as shown in data.

All oil and gas wells (including dry holes) in the area should be shown on a borehole data map, depicting the nature of the well and any fluid injection activities for which it as been used.

2.1.3 Stratigraphy and lithology in the vicinity of the WIPP site: Use of the Appendix GCR to supply basic geologic data is





disappointing, since GCR dates from 1978, and much work has been done since. A more up-to-date presentation should be prepared.

2.1.3.1 General stratigraphy and lithology below the Bell Canyon: The CCA should include discussion of rock bodies below the Bell Canyon or should justify the exclusion of such units. Has there been any analysis of the effect of penetration of pressurized formations below the Castile?

Isopachs of all rock bodies discussed should be included.

2.1.3.3 The Castile: The occurrence or potential occurrence of dissolution is of major importance in assessment of the disposal system's performance. Therefore, any interpretation of phenomena which may be regarded as evidence of dissolution (e.g., at 2-24)--whether or not the conclusion is for dissolution--must be thoroughly defended.

2.1.3.4 The Salado: The characteristics of the Salado anhydrites above and below the repository are also important. The CCA should include detailed treatment of the thickness and other characteristics of these rock bodies. Likewise, it should discuss the studies that led to the modeling of pressure-dependent fracture characteristics of the anhydrites.

2.1.3.5 The Rustler: The CCA (at 2-35, 2-38) supports the Holt and Powers theory that the variation in Rustler halite results from depositional conditions. There should be a very thorough explanation of the reason for selecting this theory, and all pertinent data should be included.

If variations in Rustler transmissivity are said to be due to fracturing (at 2-38), the CCA should discuss the factors that give rise to variation in fracturing and should mention ways in which the patterns of fracturing may be expected to change in the future.

The transmissivity characteristics of the Culebra, as modeled, include a low-conductivity zone to the south of the repository, causing any releases from the site to be delayed while they follow a lengthy path to the east before moving south toward the boundary of the controlled area. The modeled transmissivity must be fully justified in the CCA.

2.1.3.5.2 The Culebra: Fracturing in the Culebra is not discussed here. The origins and spatial variation of Culebra fractures are important to PA and should be thoroughly discussed. The relation between fracture occurrence and presence of gypsum fracture fillings should be explained, with supporting data. There should be explanation of the methods to quantify gypsum fracture fillings, as shown in Figure 2-12. The effect of fracture characteristics on Culebra flow and transport should be fully

discussed. The evidence for and against the occurrence of clay in Culebra fractures should be presented (at 2-46).

2.1.3.5.3 The Tamarisk: There should be discussion of the variation in halite presence in the Tamarisk and the causes thereof.

2.1.3.5.4 The Magenta: There is essentially no discussion of the Magenta. To determine whether the PA treatment of the Magenta is conservative, detail should be presented of the current understanding of the Magenta.

2.1.3.5.5 The Forty-niner: Again, there is no substantive discussion of the Forty-niner Member. To evaluate PA treatment of this rock body, the CCA should set forth the latest understanding of the Forty-niner's characteristics.

2.1.3.6 Dewey Lake Redbeds: Discussion should be added of the relation between the Mescalero Caliche and the recharge characteristics of the Dewey Lake.

2.1.3.9 Mescalero Caliche: The CCA states that the Mescalero, where flat-lying and not breached by erosion, is an indicator of stability (at 2-60). What this means is not clear. There are reports that the Mescalero is intermittently breached, creating pathways for infiltration (See Chaturvedi, L., ed., The Rustler Formation at the WIPP Site, EEG-34, at 21 (1987); Bachman, G.O., Assessment of Near-'Surface Dissolution At and Near the Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico, at 24 (1985); Bachman, G.O., Geology of Nash Draw, Eddy County, New Mexico, USGS Open File report No. 81-31, at 3 (1981)). The CCA should address such points and discuss processes which may lead to further thinning or penetration of the Mescalero.

2.1.3.10 Surficial sediments: There should be discussion of the surface soil characteristics, including hydraulic conductivities, infiltration capacities, thickness, and chemistry.

2.1.6.2 Evaporite dissolution: The CCA should present a balanced report of the data supporting both syndepositional and postdepositional dissolution in the WIPP area. The processes should be better quantified. For instance, it is said that dissolution of Salado halite has occurred west of the WIPP (at 2-90). How close to the site are such data? Is a dissolution front observed? There should be specific description of the limits of halite present in the various members of the Rustler, with supporting data.

Dissolution may be a factor in Culebra transmissivity. The CCA relates the transmissivity variations to open fractures, which in turn are related to overburden thickness, Salado dissolution, and gypsum fracture fillings in the Culebra (at 2-38). Thus,





dissolution as it may affect the Salado or the gypsum fracture fillings may have a future role in Culebra transmissivity changes. The possibility must be addressed. Possible climate change, leading to enhanced dissolution rates, must be accounted for.

The CCA takes the position that the work of Holt and Powers rules out significant post-depositional dissolution of the Rustler halite (at 2-38, 2-90). Since the nature of Rustler dissolution has been disputed, the CCA's selection of a particular theory must be fully defended. The CCA needs to present all alternative interpretations of dissolution processes and the data which support them. The present discussion is entirely too superficial to present alternatives fairly. Issues to be discussed include karst development, including the impacts of overlying features on possible infiltration; breccia pipe hypotheses and occurrences; rates of dissolution and supporting data; and potential dissolution front progression within the Salado. What is the basis for concluding, for example, that no active karst features are present within the WIPP site (at 2-89)? What are the alternative theories of breccia pipe formation and their implications for the location and timing of formation of breccia pipes?

The CCA should contain a comprehensive presentation of the oil and gas development of the Delaware Basin (including the Capitan Reef area), from which the effects of fluid injection activities can be assessed. Maps should show the location of all oil and gas wells and the usage of such wells for withdrawal or injection activities. All known leases should be shown. There should be a historical description of the exploration and production activity in each field, including the timing and progress of exploration and development, the installation of field development facilities and gas gathering systems, and the specific timing and nature of secondary recovery employed. The CCA should show, for injection activities, the pressure, timing, volumes, geologic characterization of injection intervals, and porosity and permeability of injection zones. Regulatory requirements as to injection and their enforcement should be discussed. Specific attention should be paid to the question of the sufficiency of records of actual fluid injection activities. Also, borehole plugging practices and the factors that control the use of particular plugging patterns and techniques should be discussed.

The CCA should discuss the future consequences of mining within and outside the controlled area. There should be a presentation with supporting data of the areas anticipated to be mined, the mining methods used, and the consequences to potential flow paths from the repository. It should be shown how such effects are incorporated into the conceptual model and PA.

2.2 Surface water and ground water hydrology: The CCA should contain for each significant geologic unit fundamental information on hydraulic conductivity, storage coefficients, transmissivity,

permeability, thickness, matrix/fracture characteristics, and hydraulic gradients. Such data should cover units below WIPP which might be encountered during drilling. For units on possible release pathways, recharge and discharge, groundwater flow patterns, flow boundaries, physical characteristics, factors affecting transport, groundwater geochemistry, and water table data should be shown.

2.2.1.1 Conceptual models of groundwater flow: The discussion of the groundwater basin model should support the selection of the model boundaries. For example, in a confined aquifer, the boundaries may not be reasonably defined by reference to topography.

2.2.1.2.2 Castile hydrology: There seems to be an omission at the bottom of page 2-107. Also, the CCA should contain a full discussion of available data on brine pocket characterization, including size, storage characteristics, volumes, pressures, and areal extent, and should show how these values are incorporated into the PA or relate to values used in PA. There should be a discussion of the methods used to derive the values and the nature and extent of the uncertainty. Even if DOE's proposed conceptual model for the occurrence of Castile brine does not rely on certain of the available data as to the frequency of occurrence of such pockets or as to their size, the CCA should present such data so that the appropriateness of the conceptual model can be assessed.

Castile brine chemistry should be presented in sufficient detail to assess the PA treatment of actinide solubility. How was a representative Castile brine chemistry selected to incorporate in experiments and PA, given the differences among the ERDA-6 and WIPP-12 brines?

2.2.1.3 Hydrology of the Salado: There should be a full discussion of the data supporting the modeling of the behavior of the Salado anhydrite interbeds. It should include site characterization and laboratory results, capillary pressure and relative permeability curves at various pressures versus permeabilities. How the site data are used to create the conceptual model should be explained.

Data supporting and possibly conflicting with the different models of brine flow in the Salado (Darcy flow, non-Darcy flow) should also be presented.

2.2.1.4 Units above the Salado: The groundwater basin model should be supported by data demonstrating that potential sources of recharge and discharge have been identified, divides have been described based on data, and such points will remain valid (if so modeled) over any possible variations due to climate change.





The connection between the groundwater basin model and the two-dimensional SECO model of Culebra flow needs to be explained and justified. For example, the groundwater basin model incorporates significant vertical recharge to the Culebra. No such recharge can be depicted in the SECO model. There should be justification of the two-dimensional model in light of this difference.

2.2.1.4.1.2 The Culebra: The CCA should include discussion of the important parameters as to flow and transport and other parameters which have been examined and found unimportant. For instance, dispersivity may be considered. Fracture block size needs to be discussed. Correlations between parameters should be examined.

The Culebra varies from point to point and may be described at some locations as a single-porosity body and elsewhere as dual or multiple-porosity (see 2-119). It is modeled as dual-porosity throughout. The simplification should be explained and justified. Some of the material presented at the State-DOE consultation and cooperation meeting on October 11, 1996 should be included. There should ba a map, depicting the areas where various porosity models seem to prevail.

Gypsum fracture fillings in the Culebra should be discussed, including a theoretical explanation of the formation of the fractures themselves, the timing of gypsum precipitation, and the processes of dissolution that may have occurred. Data sources should be discussed, along with the issues of scaleup and representativeness of the information sources.

There should be a discussion of all aspects of Culebra geochemistry which have been studied with relation to flow and transport, including those questions which remain unresolved. The relation between the groundwater basin modeling studies and the geochemical issues should be elaborated, and discussion should refer to data or published studies; the unsupported narrative at 2-123 and 2-124 is insufficient.

Experimental data supporting corrections to the free-water diffusion coefficients should be given.

There is reference to water-level rises in wells to the south of the site, termed "unexplained" (at 2-124). This is insufficient; the CCA must explain these data, presenting alternative theories, if applicable. How may these events be accounted for in the PA models?

Modeling of the Culebra flow field has recently changed; the modeled thickness is now only 4 feet, based on observations at the H-19 hydropad. The CCA should examine the effect of this modeling change on transmissivity values and results.

The role of fluid density in Culebra flow, how it has been studied, and how density effects are represented in PA modeling need to be included in the CCA.

A map should be presented showing observed Culebra hydraulic heads and the modeled flow directions and reconciling any discrepancies.

These values as to the Culebra derived from site characterization should appear in the CCA, and their use in PA modeling should be justified:

1. Fracture block size and spacing
2. Matrix tortuosity
3. Brine viscosity
4. Longitudinal, transverse, and vertical dispersivity
5. Storativity of matrix and fractures

2.2.1.4.1.3 The Tamarisk: The CCA should include the characteristics of the Tamarisk Member, including its vertical conductivity and the role of the Tamarisk in isolating the Culebra from the Magenta.

2.2.1.4.2.1 The Dewey Lake: Hydraulic conductivity based upon lithologies observed in the WQSP wells should be stated. Explanation of the accuracy of the water table data should be given, in light of the possibility of error in identification of the moisture level.

2.2.1.5.2 Hydrology of the Rustler-Salado contact zone in Nash Draw: Very high TDS figures are given (at 2-136), and the concentrations of minerals are said to be related to residence time. Another possibility is evaporation in a closed depression. The CCA should examine the alternatives and select and support a theory.

2.3.1.1 Potash resources at the WIPP site: The CCA should explain the origins of the depiction of economically mineable potash reserves inside the site boundary, shown on Figure 2-38. The CCA should also present other current estimates of potash reserves, such as the depiction in current maps published by the Bureau of Land Management. Data should be presented on current mining practices and the nature of the ore and minerals currently mined. Justification for selecting one or another interpretation of the extent of mineable potash should be presented.

2.3.2.2 Land Use: The CCA should explain the analyses that showed that drilling below the 6000 foot limit would not be of





consequence to WIPP (2-157), covering both normal operations and possible unplanned occurrences, such as interception of pressurized brine.

Chapter 3

3.2 Repository configuration: The CCA should explain fully what methods of ground control and roof support, such as installed in Room 1, Panel 1, will be employed in other areas of the repository. Such information is needed, inter alia, for assessment of the projected iron content of the repository.

3.3 Engineered barriers: The CCA asserts that the shaft seals, panel closures, borehole plugs, and backfill are all considered "engineered barriers" (at 3-14). The CCA must show as to each claimed engineered barrier that it will "prevent or substantially delay the movement of water or radionuclides toward the accessible environment." A quantified demonstration must be made.

The CCA also seems to disclaim any engineered barrier function for panel closures, for which no final design exists (3-27). Shaft seals simply seek to close off release routes created in construction and do not constitute engineered barriers. Borehole plugs only contain a specific portion of the waste and do not apply to the repository as a whole. The performance of magnesium oxide backfill is not demonstrated.

3.3.1: Shaft seals: There is no final shaft seal design, and the claims as to seal performance are supported by little test data, and that only concerns small-scale tests (Appx. SEAL, Appx. A). Test data from large-scale tests should be provided.

3.3.1.3.4 Compacted salt column: Claims are made as to the removal of void space through creep consolidation and as to correlation between creep closure and depth (at 3-20). Data support should be given for these points.

3.3.1.6.1 Downward migration of Rustler groundwater: The significance of the maximum cumulative flow of 353 $ft.^3$ in 200 years should be set forth.

3.3.1.6.3 Upward migration of brine: The mechanics of and the criterion for determining the "healing" of the DRZ must be set forth.

3.3.2 Panel closure system: The CCA should contain a definitive design for this element, which has not yet been made final (at 3-27, -28). It is also stated that the current panel closure designs will "maintain their structural integrity for the regulatory period" (at 3-33). Data supporting the claim as to the regulatory period should be set forth.

3.3.3 Backfill: The CCA does not contain support for the modeling assumption that the MgO backfill will behave as modeled, i.e., mix instantaneously with incoming brine and alter the pH of the repository, thus inhibiting actinide solubility. Data must be presented. DOE's conceptual model peer review group has called for such a showing. (Conceptual Models Second Supplementary Peer Review Report, Jan. 1997).

Chapter 4

Under §194.24(b) the CCA must contain an analysis assessing all waste characteristics influencing containment of waste and all waste components influencing the waste characteristics, with limiting values for each component, uncertainty ranges, and a demonstration of compliance at the limits of each value and for plausible combinations of upper and lower limits that would cause the greatest estimated release. The waste description in Chapter 4 and the associated appendices is not sufficient to determine whether all waste characteristics and components have been identified and evaluated. Section 194.24(b)(1)-(3) requires an analysis of all waste characteristics and associated components for their impact on disposal system performance, except as to characteristics and components whose exclusion is justified. The sensitivity analysis in Appendix SA does not cover the items required.

Support for the assertion that no limiting values need be imposed has not been presented. Such an assertion must be based upon determinations as to the upper and lower limits for waste components and uncertainties related thereto. Plausible combinations of upper and lower limits must be shown, and the limits must be justified. It must appear that the combinations of limits selected result in the greatest projected release. Such information does not appear in the CCA or Appendix WCL. The CCA must also show that performance was modeled at the upper and lower limits and that compliance is achieved at the limits. No such showing appears.

The overview of waste characterization methodologies does not satisfy §194.24(c)(2). There is a lack of information about nondestructive examination/nondestructive assay techniques and process knowledge in particular. Further, how will each component be identified and quantified in waste characterization?

The CCA should show specifically how quality assurance will be imposed upon asserted process knowledge of radiological content and physical components.

The CCA must demonstrate facts supporting the assertion that, pursuant to §194.24(c)(4), a system of controls will be put in place to ensure that the waste actually introduced will fall within the specified limits. Discussion must include sampling





technologies, measurement techniques, chain of custody records, record keeping systems, waste loading schemes, and inventory control. In this connection the discussion of the WIPP Waste Information System ("WWIS") must be made more concrete. There must be a showing that waste characterization records are monitored, controlled, and accounted for in a systematic and traceable manner. The process of approval and certification of a generator site by the NTPO and the QA manager should be described in detail, including acceptance criteria for such approval.

4.1.3.2 Nonradionuclide inventory roll-up: The discussion of the WMP disposal inventory leaves unanswered the question of the accuracy of these figures, which are not claimed to be waste characterization information (at 4-12).

4.1.3.3 Radionuclide inventory roll-up: Again, the accuracy of the data is not explained.

4.2.2 Repository limits: The origin of the "emplacement limits" listed in Table 4-10 is not explained. It is clearly insufficient to offer only the footnoted information, which does not set forth all the calculations and assumptions involved. As noted above, the CCA must contain limits, plausible combinations of upper and lower limits, a showing of compliance at the limits, and a showing that the combinations result in the greatest releases.

4.3 Waste controls: The CCA does not contain a showing that the limits imposed pursuant to §194.24(c)(4) will be enforced in operation or that the other limitations on waste acceptance, such as the Waste Acceptance Criteria, the requirements of the WIPP Land Withdrawal Act, and the requirements of the State-DOE Consultation and Cooperation Agreement, will be effectively applied.

4.3.1 Load management: It is said that compliance is demonstrated based on the assumption that waste containers from 569 waste streams are randomly placed throughout the repository (at 4-34). Therefore, it is said, a load management plan is not required. However, with no load management plan the facility may well be managed so that waste from one or another stream is concentrated. Thus, performance under random distribution is not the relevant test.

Chapter 5

The CCA states that "[n]o expert judgment activities have been identified." (at 5-10). This is inconsistent with the obvious instances of the exercise of expert judgment throughout the application. Both the requirements of §194.26 and the applicable QA requirements must be complied with.

EPA should review and respond to the presentation made by Ben Walker of EEG on January 21, 1996, which found numerous

shortcomings in the establishment and execution of quality assurance programs. In particular EEG pointed out the failure to adhere to requirements expressly stated in §194.22 and in the CAG, e.g., as to effective date of conformance, and the incompleteness of several parts of the presentation, e.g., the statement that Sandia National Laboratories's field activities were nonexistent, the failure to show that applicable standards have been established and executed in the eight specified areas, the failure to show how data have been assessed for precision, accuracy, representativeness, completeness, and comparability.

Chapter 6

6.2.3 Natural FEPs: Appendix SCR states (at SCR-14) that shallow dissolution is accounted for in PA, because spatial variability in fracture fillings is considered to be a result of past climate changes, is "not considered to be the result of progressive movement of a dissolution front across the area," and will be accounted for by conditioned T-fields. In light of the contrary commentary as to dissolution offered by Roger Y. Anderson (e.g., at the Feb. 16, 1995 EPA workshop) and the additional commentary that day by Fred Phillips that Rustler water at the WIPP site is consistent with recent meteoric inflows, the assertion that a dissolution front has been excluded cannot be made. Shallow dissolution, affecting flow characteristics, has not been excluded.

Deep dissolution (SCR-15, 16) cannot be excluded either. Breccia structures may occur in areas not underlain by the Capitan Reef. As has been shown in the presentation by Roger Y. Anderson on February 16, 1995 and supplemented by comments in this docket on December 2, 1996 (at 5-6), breccia structures may occur in other areas; thus the prospect of deep dissolution affecting the repository exists. DOE has not shown that the probability of deep dissolution is below the regulatory cutoff.

Density effects on groundwater flow cannot be excluded without discussing the effects shown in the modeling presented on behalf of EPA in November 1995 at an EPA-DOE technical exchange (Groundwater Flow and Contaminant Modeling at WIPP, 1995. S. Cohen & Associates, Inc.).

Repository-induced subsidence (SCR-46-49) is eliminated on the reasoning that the hydraulic conductivity of the Culebra may be increased by at most an order of magnitude, which is said to be within the range of uncertainty recognized by T-field sampling (at SCR-48). However, to say so fails to recognize the different probability associated with subsidence. The effect of subsidence should be incorporated by recognizing its substantial certainty.

Thermal effects (SCR-50-52) are excluded on the basis of a study by Arguello and Torres, which assumes placement of RH containers on eight-foot centers (at SCR-50). Since the actual





placement of RH-TRU containers may vary from that spacing, the study is not sufficient to eliminate the question.

Dissolution of waste is said to be accounted for in a conservative approach by assuming equilibrium waste dissolution (SCR-70). However, the PA model now includes the role of MgO backfill in raising repository Ph and limiting the solubility of actinides. Such processes are anticipated to take place instantaneously. Such approach is not conservative. The dissolution of waste and backfill must be modeled in PA.

Drilling, a human-initiated EP, should include drilling associated with solution mining for brine production, a current activity in the Delaware Basin. See the presentations by Matthew Silva of EEG on October 10, 1996 and on January 21, 1997. Further, the assumption that drilling associated with geothermal energy production, liquid waste disposal, hydrocarbon storage, and archaeology need not be considered in PA because they have not taken place in the Delaware Basin is erroneous. DOE relies on the future states rule, but this is mistaken. The future states rule does not limit all projected human activities to those occurring now in the Delaware Basin. Thus, to assume that §194.25(a) directs that drilling for, e.g., fluid storage need not be considered because it has not been practiced in the Delaware Basin, even if it is practiced elsewhere, is erroneous. Moreover, it is unclear what is meant by "liquid waste disposal;" clearly, salt water disposal is now practiced in the Delaware Basin. (See the discussion in M.K. Silva, Fluid Injection for Salt Water Disposal and Enhanced Oil Recovery as a Potential Problem for the WIPP: Proceedings of a June 1995 Workshop and Analysis, EEG-62 (1996)).

DOE excludes drilling-induced fluid flow on the ground of low consequence, citing the Wallace (1996a) study (SCR-108). This study omits to consider the possible effects of multiple boreholes, not randomly placed. Thus, the EP cannot be excluded.

The CCA also excludes boreholes that do not intercept the waste disposal region on the ground that the amount of radionuclides that could be transported into the adjacent areas of MB 139 is less than one EPA normalized unit (SCR-114). However, the calculation referred to cannot have taken into account the effects of well injection on permeabilities in the marker beds and the presence of pressurized and contaminated brine as a result of waterflood operations. Since, as discussed below, the marker bed permeabilities can be dramatically affected by well injection, the EP involving a drillhole penetrating a contaminated marker bed should be reexamined before excluding this EP.

Fluid injection is erroneously eliminated from consideration on grounds of low consequence (SCR-118). As shown in analyses by Dr. John Bredehoeft, presented to EPA on January 22, 1997, fluid injection on the scale reflected in the Hartman Bates well events

would dramatically alter the permeabilities of the Salado marker beds on a regional basis. Further, large volumes of water would penetrate the repository and flow out through the marker bed, after becoming contaminated. The scenario must be considered in PA.

Flow through abandoned boreholes is erroneously eliminated on the grounds of low consequence, based on the Wallace (1996a) study, which concerned only a single borehole; future situations may well involve more than one borehole.

Borehole-induced solution and subsidence is eliminated from consideration on grounds similar to deep dissolution (SCR-127, 128). However, deep dissolution has not been effectively discounted on the grounds that it would not occur outside the area underlain by the Capitan Reef. Thus, similar processes related to abandoned boreholes cannot be eliminated either.

The hydraulic effects of flow through abandoned boreholes has been eliminated as to boreholes adjacent to the repository on consequence grounds (SCR-129, 130), but without considering how well injection would alter the permeabilities of marker beds. The question must be examined further. Further, the Wallace (1996a) study, advanced to justify elimination of the scenario, assumes only a single source borehole and a single sink borehole, when in fact there may be several such.

Borehole-induced solution and subsidence around future abandoned boreholes is eliminated on consequence grounds (SCR-134). However, Wink Sink demonstrates subsidence much more massive than projected by DOE. DOE should model the dissolution occurring at Wink Sink and apply the parameters so derived to the WIPP site to ascertain the likely consequences of dissolution around an abandoned borehole penetrating the site.

The CCA states that solution mining for potash is not expected to occur in the near future in the WIPP area (SCR-137). Something more substantial must be offered in support of such expectation; nothing is cited. The NMBMMR report says that solution mining for potash is a possible future mining activity in the area (NMBMMR Report at IV-4, 5).

6.4.3.2 Repository fluid flow: The CCA does not justify the waste intrinsic permeability value of $1.7 \times 10^{-13}$ (at 6-100). Derivation of the probability distribution for parameters within the two-phase flow equations is also not supported.

6.4.3.3 Gas generation: Exclusion of the aluminum content from corrodible metals is not justified in the CCA.

It is also assumed that there is no passivation of anoxic corrosion of steel because the $CO_2$ reacts with MgO; however, the





pace of reaction between waste and MgO has not been supported by data.

The assignment of 50% probability to microbial degradation and, within that, 50% probability to degradation of plastics and rubbers is simply guesswork. A conservative value should be determined and applied.

6.4.3.4 Chemical conditions in the repository: The reaction of MgO with $CO_2$ is assumed to be instantaneous equilibrium (see CCA at 6-106, 6-107; SOTERM-28, 56-57), but this is neither conservative nor realistic. Empirical data should be presented on the pace of the reaction. The conceptual model peer review group has called for further support for the model before it may be accepted (Second Supplemental Report, Jan. 1997). Also, the reaction of MgO with water is not modeled, making the model less realistic.

The CCA states that the equilibrium assumption, with disequilibrium assumed for oxidation-reduction conditions, "yields the largest reasonable concentration of aqueous actinides in the repository" (at 6-106). No support is cited for this statement, which requires data to sustain it.

It is also said that "[n]o chemical microenvironments that influence the overall chemical environment are expected to persist, nor is supersaturation expected during the 10,000 year regulatory period." (at 6-106). Data should be supplied to support such statements.

6.4.3.5 Dissolved actinide source term: William Lee of EEG has presented a paper concerning the PA estimation of the actinide source term, and the points raised in this paper should be addressed (W. W.-L. Lee, The Waste Isolation Pilot Plant Compliance Certification Application: Under-estimated Dissolved Actinide Source Term, 1997). The paper refers to the PA approach under which Pu is assumed to be either Pu(III) or Pu(IV), with the probabilities assigned 50%-50%, and solubility is estimated by analogy with Nd(III) and Th(IV)(see 6-108). Lee points out that experimental results show that Pu(VI) is stable and has a solubility of $10^{-4}$ M, and other tests showed that Pu(VI) is stable in the brines expected in WIPP. Lee concludes that there is no support for the assumption that Pu will exist as Pu(III) and Pu(IV) in WIPP and that Pu solubilities should be based on the experimental data instead, viz: $8 \times 10^{-5}$ M in Castile brine and $9 \times 10^{-5}$ M in Salado brine. Lee refers to experiments reported in D.T Reed et al., 1996, Stability of Pu(VI), Np(VI), and U(VI) in Simulated WIPP Brine, ANL Interim Report, CCA Add'l. Ref. No. 539.

Appendix SOTERM should include support for the statement that actinides in the same oxidation state exhibit similar chemical behavior, as justification for the use of analogs (SOTERM-24).

Also, SOTERM discounts the effect of organic ligands based on experiments which, again, assume equilibrium conditions; such assumption must be justified (SOTERM-38).

The CCA states that for Pu, U, and Np, it is uncertain whether repository conditions will favor lower or higher oxidation states, and therefore DOE has assumed that in half of the cases extremely reducing conditions prevail and lower oxidation states exist, while in the other half of the cases conditions favor higher oxidation states (6-108). DOE should provide justification for the probabilities so assigned; on its face, the decision seems to be simply guesswork.

The SOTERM discussion of colloids refers to the situation in which dissolved actinides, introduced into the Culebra, sorb onto a separate population of indigenous mineral fragments, and the CCA elects to account for that by multiplying the geometric mean value by a factor of two (SOTERM-50). However, the justification of the value of two is not stated.

There is no stated justification for the use of a single distribution to model the solubility of all oxidation states of all actinides in both Salado and Castile brines (SOTERM-72).

6.4.4 Shafts and shaft seals: The values used for permeability versus time of the critical seal components are not based on data from experiments on the scale of the actual seal system. Thus, questions about the scaleup of values derived from smaller-scale tests have not been addressed. Further, DOE has not committed to a specific design for seals and states that changes will occur before construction (Appx. SEAL at vii). DOE also refers to a design guidance, which should be supplied as part of the application (id. viii and Appx. SEAL at 23).

DOE assumes that the seal system will be allowed to consolidate without disturbance. However, consideration should be given to the likelihood that human activities outside the controlled area, such as well injection, could affect the consolidation of the seals. Modeling should include the injection of brine into nearby wells at high pressure, fracturing interbeds and causing significant waterflows to the area of the seals. It should be noted that the outline of the design guidance (Appx. SEAL at 23) does not address possible disturbed conditions involving waterflows. Appendix C, concerning fluid flow, should be expanded in Model 2 to examine flow in the seal system in conditions of nearby waterflood projects which cause permeability changes (as illustrated in the modeling by Dr. Bredehoeft) in marker beds and allow the introduction of large quantities of injected brine in from the marker beds. In the current CCA the highest permeability attained in marker beds is 2.9 x $10^{-16}m^2$ (Appx. SEAL, Appx. C at C-29), which is considerably lower than projected under waterflood conditions.





It is not clear why the period of 200 years for modeling salt consolidation was chosen, since the CCA states that consolidation takes place for approximately 400 years (Appx. SEAL at 66).

6.4.5 The Salado: Several questions arise concerning the modeling of the anhydrite interbeds in the Salado. First, the 2D BRAGFLO model understates flow in these beds, since flow is effectively confined within a narrow strip. See the analysis by Dr. Bredehoeft concerning the Stoelzel-O'Brien BRAGFLO model of well injection. Second, as explained elsewhere, the interbeds would increase dramatically in permeability in event of a waterflood operation affecting these beds. Such increases must be accounted for. Third, since it is conservative in assessing gas generation to assume that the permeability of the marker beds is low (see CCA at 6-115, -116, concerning impure halite), to the extent it overstates actual permeability, the anhydrite fracture model (at 6-117) may nonconservatively exaggerate gas outflow in certain circumstances. Further, the current anhydrite fracture model includes various unsupported aspects; radial uniform fracturing apparently is assumed (minimizing travel distances), a simplified matrix porosity model is used, and the model parameters themselves are not supported with data.

6.4.5.4 Actinide transport in the Salado: The NUTS tracer calculations do not anticipate the possibility that colloidal particles may travel faster than soluble actinides. Such assumption must be justified. Similarly, the NUTS transport calculations make the same assumption (at 6-120). There is no support for the assumptions that colloidal velocity and sieving offset one another (at 6-121). Nor is there support for the assumption that channel flow will be insignificant (at 6-121).

6.4.6 Units above the Salado: The statement appears that "[i]nsight into the processes occurring in the groundwater basin obtained by modeling and other lines of evidence indicates that significant simplification of the hydrologic models in the units above the Salado is possible to obtain reasonable estimates of actinide transport," and the text cites generally to Corbet and Knupp 1996 and MASS 14.2. The quoted statement is so broad as to be meaningless. Clearly, issues exist as to the way in which the 2D SECO models represent the Culebra, and light may be shed by the cited materials, but the application must be much more precise as to the points to be made and the data said to support the points.

6.4.6.2 The Culebra: The SECOFL2D model assumes a steady-state flow field (at 6-129) and, thus, does not allow for future changes in flow characteristics on account of climate change, increased precipitation, and dissolution of, e.g., fracture fillings. This is a significant failing of the model. See the paper submitted to the docket by Roger Y. Anderson, dated December 2, 1996, and the presentation at the February 16, 1995 EPA workshop. Further, it is unrealistic to assume a single porosity

in flow calculations (at 6-129); if future climate change leads to changes in the hydrologic characteristics of the Culebra, porosity will change locally.

6.4.6.2.1 Transport of dissolved actinides in the Culebra: A paper by William Lee of EEG presents proposed retardation coefficients based on DOE's batch tests, average results of core column tests, and assuming low organic content (W. W.-L. Lee, The Waste Isolation Pilot Plant Compliance Certification Application: Over-estimated Radionuclide Retardation Coefficients, 1997). The $K_d$ values proposed by Lee are:

Am: 73 - 314
Pu: 83 - 270
U: 0.35 - 5
Th: 0.15 - 1.5
Np: 1.0 - 21

EPA should consider whether such values are more realistic than those used by DOE.

In addition, under the State-DOE Consultation and Cooperation Agreement, $K_d$ values of zero must be used in the absence of valid experimental data. The retardation tests conducted by DOE have not been shown to apply to the entire rock body of the Culebra; i.e., the questions of scaleup and representativeness have not been addressed. Until such issues are satisfactorily addressed, $K_d$ values of zero should be used.

The use of a linear isotherm model of retardation requires justification, which is not furnished (at 6-133).

The CCA refers to data from H-19 hydropad tests, but no source is cited (at 6-132). Other statements are made as to tracer test results, but again there is no citation (at 6-132). The H-19 test results should be the subject of a full peer-reviewed report before they are relied upon in support of compliance. Similarly, statements are made (at 6-133) about the presence of clay minerals, but no support is cited. Statements should not be made without data support; if they are made by DOE, they should be disregarded by EPA.

Appendix MASS.15.2.1 refers to work which supposedly indicates the presence of corrensite in significant quantities in the Culebra (at MASS-81). Such claims are erroneous and should be deleted.

6.4.6.2.2 Transport of colloidal actinides in the Culebra: DOE should show how "facilitative transport" of colloids, i.e., transport at a rate greater than the rate of flow of the bulk of the water, is represented in the PA model. Colloid transport, as described, appears to occur only at the flow rate or slower.





6.4.6.2.3 Subsidence due to potash mining: The CCA models potash mining within the controlled area on the assumption that the regulatory "resources, similar in quality and type to those resources currently extracted from the Delaware Basin" (§194.32(b)) are represented in Figure 6-20. The reference materials expressly assume that the regulatory reference to "resources of similar quality" means the 37.5 grade-thickness contour for langbeinite and the 55 grade-thickness contour for sylvite (MASS Att. 15-5, at 7).

However, these contours do not state the limits of currently mineable potash. The BLM map of mineable potash shows the extent of resources that are "of lease quality" (id.). Parameters used by BLM--the agency responsible for leasing potash for development--are "four feet of 10 percent $K_2O$ as sylvite [i.e., a contour of 40] or four feet of four percent $K_2O$ as langbeinite [i.e., a contour of 16] or equivalent combination of the two minerals." Preliminary Map Showing Distribution of Potash Resources, Carlsbad Mining District, Lee and Eddy Counties, New Mexico, 1993, Bureau of Land Management.

Even the BLM map's parameters understate the extent of mined potash. BLM has written to the author of the NMBMMR report, which DOE has used to justify its restricted estimate of mineable potash, stating: "Our records show that during the last five years a significant amount of sylvite ore has been mined at or below the 10% minimum standard. This is also true for langbeinite, meaning that ore is being mined at or below that 4% minimum standard." Letter, L.M. Cone to G.B. Griswold, Oct. 15, 1995. The NMBMMR report itself acknowledges that IMC Fertilizers, Inc. "continues to be the largest producer in Carlsbad while mining ores below the cut-off grades for single product." (NMBMMR Report, vol. 2 at IV-3)(emphasis supplied). Since 40 CFR §194.32(b) specifies an assumption that "mineral deposits of those resources, similar in quality and type to those resources currently extracted from the Delaware Basin" will be mined, EPA requires better information than DOE has provided as to the type and quality of minerals currently mined. See also the presentation by Matthew Silva of EEG, January 21, 1997.

Further, EPA's own consultants have advised that potash reserves overlie the repository footprint (SC&A report, August 25, 1995, at 2 and Fig. 3). With such information, EPA state in its Background Information Document for Part 194 that "Figure 9-4 [showing the same area as MASS Att. 15-5, Fig. 6] ... plots the boundaries of the current [BLM] Lease Grade criteria." No reference to the restrictive criteria proposed by DOE appears in EPA's background document.

6.4.7.1.1 Direct brine release during drilling: DOE should justify the eleven-day maximum brine flow period. The supporting data is recorded as "in progress" (Ref. 3 to MASS att. 16-2). Thus, at present, the parameter is unsupported. Data should be

presented which relates the flow rate and other circumstances to the period of time required to control the flow. Also, the role of regulators (i.e., the Oil Conservation Division) in prohibiting operators from shutting in flowing wells should be discussed. Further, it is not a justification of the gas flow cut-off rate of 100 thousand standard cubic feet per day to say that it is "arbitrarily set" (MASS Att. 16-2, at 11).

The model of direct brine release should also incorporate flow through marker beds into the repository caused by waterflood operations of oil operators in the vicinity. Thus, a model which omits all flow interactions with the Salado except the DRZ is inadequate (at 6-155).

6.4.7.2 Long-term releases following drilling: The CCA states, quoting §194.33, that future drilling practices shall be assumed to be "consistent with practices in the Delaware Basin at the time a compliance application is prepared" (at 6-156) and notes that "[b]orehole plug configurations used today in the Delaware Basin vary based on the local stratigraphy encountered in the hole, its total depth, and the types of fluids present" (id.). Despite noting that the decisive factors in plug design are site-specific, the CCA assigns plug configurations according to a ratio that disregards site conditions and depends entirely on conditions and requirements existing everywhere but at the site of the borehole. Thus, plug configurations are based on the ratio of the occurrence of such configurations throughout the entire area surveyed (MASS Att. 16-3, at 2-3). Nothing in §194.33 requires such a bizarre system, since the regulation refers only to the "fraction of such boreholes that are sealed," and all agree that such fraction is at or near 100%. But much depends on the plug design, since the CCA makes clear that certain designs fail almost immediately, whereas full-length plugs are effective nearly indefinitely. Any future boreholes intruding into the WIPP site would penetrate a potash section, a radioactive waste repository, and a zone of pressurized brine. To project that regulatory authorities would call for anything less that the most effective plugs is wholly unrealistic.

Indeed, under DOE's interpretation of the applicable regulations, 40 CFR §194.33(c)(1), DOE is required to assume the use of concrete plugs through the entire length of the salt section (Salado and Castile Formations) in any hole drilled and plugged within the controlled area. DOE asserts that the plugging practices to be assumed are those called for by existing regulations (MASS Att. 16-3, at A-15). The current regulation applicable to borehole plugging in the controlled area is Rule R-111-P of the New Mexico Oil Conservation Division (MASS Att. 16-3, at 2-3; see Appx. DEL, at DEL-61 and Fig. DEL-8). Further, the Bureau of Land Management follows the requirements of Rule R-111-P with respect to borehole plugging on federal lands within the potash area (id. 3, A-10). Rule R-111-P calls for a full-length plug through the Salado and Castile Formations (id. 4). Such a





plug is expected to form an effective seal for 10,000 years and more, in contrast to the other two configurations of plugs modeled in PA, which rapidly degrade (id. 8-13). Examples of continuous plugs emplaced through the evaporite sections by potash companies confirm the effectiveness of the plugs (id. 13).

The CCA erroneously applies ratios based on a survey of boreholes subject to plugging and abandonment since 1988 in New Mexico--and fails to survey Texas practices on the reasoning that the Texas regulations do not apply at WIPP (MASS Att. 16-1, at 1). Of course, the New Mexico regulations generally applicable to the New Mexico portion of the Delaware Basin also do not apply to WIPP, because WIPP is subject to specific regulations for the potash area. Thus, on DOE's own reasoning, the rules and practices in non-potash areas of New Mexico should be disregarded as well.

6.4.8 Castile brine reservoir: The Castile brine reservoir is modeled as having a volume of from 32,000 to 160,000 $m^3$ (Table 6-26), whereas measured data show a volume of from 100,000 to 2,700,000 $m^3$ (at 2-108). The model is clearly inaccurate. The CCA does not seek to justify the values for brine reservoir volumes or the related probabilities (at 6-164). Thus, this part of the model is unsupported. DOE has not shown that to assume a smaller-than-realistic brine reservoir is a conservative assumption.

The CCA says that "there is little direct information on the areal extent of the reservoirs or the interconnection between them" (at 6-162). Such statement disregards the data about the WIPP-12 reservoir and the TDEM data (see SAND87-7144; MASS Att. 18-5) about Castile brine at the WIPP site.

The CCA states that the compressibility parameter for the Castile brine reservoir has been given a broad range "in an attempt to ensure that all possible values are encompassed" (at 6-163). Such an explanation is specious, since a broad range suppresses the actual value and assigns significant probabilities to values that are far from the actual value. To say that the volumes of brine produced thus "reasonably bound" (id.) reservoir volumes misconceives the function of PA: It is not merely to reflect all possible outcomes but to estimate accurately both the probabilities and consequences of such outcomes--a function that is defeated by an unrealistically broad range of values, such as the range of compressibility values.

EEG has pointed out that the projected maximum artesian flow and the flow to the surface during drilling from a brine reservoir are also established in the CCA without reference to the values actually calculated for WIPP-12 (EEG presentation, Jan. 21, 1997).

Rick Beauheim of Sandia has written that "I believe the treatment of brine reservoirs going into the CCA is neither defensible nor conservative. I believe we are systematically

underestimating the amount of brine that could reach the repository, the Culebra, and the ground surface. . . . I do not see any way for us to defend the statements and data presented in the CCA." (R. Beauheim, Memorandum on Treatment of Brine Reservoirs in CCA, Aug. 22, 1996, at 2). Beauheim's later memorandum (October 3, 1996) accepts the PA treatment on the premise that the PA vectors all generated a volume of brine produced to the DRZ which was within the range of volumes produced by vectors where the product of reservoir volume and pore compressibility is within the range that Beauheim considered appropriate. However, such volumes were consistently below the volume when the product was within the range that Beauheim considered appropriate (see Fig. 2).

The Conceptual Model Peer Review panel's supplementary report (Dec. 1996), deeming these issues resolved, contains fundamental errors. The exclusion of larger reservoirs is justified on the basis of a smaller range of compressibility values ($2 \times 10^{-11}$ to $1 \times 10^{-10}$ $Pa^{-1}$) (report at 40), but in fact the CCA uses $5 \times 10^{-12}$ to $1 \times 10^{-8}$ (at 6-163, Table 6-26). Depletion assumptions were accepted, based on new depletion assumptions, changed from those originally given for PA and stated orally, but there is no showing that such new assumptions have been incorporated in PA at all. It is conceded that depletion assumptions for larger reservoirs were unfounded (Dec. 1996 peer review report at 41). DOE sought to justify the use of an unsupported probability level for the likelihood of encountering pressurized brine by showing that, if no other parameters were changed, releases were not significantly affected by such probability, but in accepting such arguments the peer review panel assumed that no other PA parameters should be changed--an assumption that cannot be sustained within the scope of their assignment, their expertise, or their report.

6.4.9 Climate change: DOE has declined to model changes in the hydraulic characteristics of the Culebra, as they may be brought about by climate change and increased precipitation. Enhanced flow is likely to lead to dissolution in Culebra fracture fillings, leading to increased transmissivity.

6.4.11 Numerical codes used in performance assessment: The models of cavings and spallings in CUTTINGS_S is not supported by data. See the presentation by EEG to EPA on January 21, 1997. EEG showed that the cavings model does not account for the erosive action of particles contained in the drilling fluid. Further, cavings from helical turbulent flow (e.g., return flow) are not considered. Cavings from the action of the drillbit itself, as it penetrates waste, are omitted. Brine ejected before spallings is not considered.

Spallings releases are also modeled improperly. The CCA presentation fails to communicate the PA approach. Two models are presented, but only Model 2 is defended as consistent with experimental data (Appx. CUTTINGS at 50). Model 1, it is





acknowledged, ignores initial flow transients, which may be extreme, depending on waste permeability and gas pressure (id.). Model 1 portrays lofting only; no other processes are depicted (id. 56). Moreover, the ellipsoidal void postulated in model 1 was not confirmed by experiments (id. 51, 58).

Spallings Model 2 attempts to depict the fracture flow observed in experiments (id. 58). Releases are related to the erosion velocity, which in turn depends on the terminal velocity of a waste particle and cohesive strength caused by pore water and cementation (id. 59). The CCA states that experiments will show the effect of cohesive strength and gravity on erosion (id. 59), but there is no report of the results of such experiments. The CCA merely refers to a Sandia contract number but cites no report (id. 64).

Appendix CUTTINGS omits to discuss the parameter of particle size. This parameter has a range from 0.000040 m. to 0.20 m. (Appx. PAR at PAR-115). The higher values are arbitrarily based on 1/3 of a drum diameter. The higher values effectively prevent any spallings releases, creating a very unrealistic result. Further, it is unrealistic to assume uniform particle size.

EEG has pointed out (in its Jan. 21, 1997 presentation) that the spallings model has neither theoretical nor experimental basis. The only experiments done so far showed that after blowout, channels formed, and solids were eroded by flowing gas (Lenke et al. 1996). The experiments were essentially designed to justify a preexisting model (which they failed to do). Sensitivity to important factors, such as vent diameter, was not tested. The model, in effect, describes transient behavior by using a steady-state description. Lifting and lofting of particles are not modeled. Phenomena known to occur in wind erosion (suspension, saltation, creep, and fetch) are not modeled, although known to be significant. Particle diameter is the only sampled parameter (and the range is unrealistically large). Cementation strength, a very sensitive and little-known parameter, is not sampled. Waste permeability is not sampled. Drillbit diameter is not sampled. Waste radioactivity content is assumed to be the average of the repository, although spallings is a comparatively localized phenomenon.

The Conceptual Model Peer Review Panel Supplementary Report (Dec. 1996) states serious concerns as to the spallings model, even after supplemental presentations by DOE (at 35-37). These issues include, in summary, disregard for the gases exciting waste matter into the cavity, inappropriateness of data on static tensile strengths, disregard of time effect considerations, lack of verification of the bounding equation (e.g., dropped g term), lack of experimental data on cementation, failure to explore analogues, inappropriateness of quasi steady state experiments, lack of experimental control over moisture content, failure to address

scaling, failure to consider transonic flow velocities, and failure to model processes related to high pressure gradients.

The Conceptual Model Peer Review panel has made a further report (Second Supplementary Report, Jan. 1997), which rejects the spallings model as inadequate. The panel stated, inter alia: "Although erosion phenomena may be a later mechanism acting for dislodging waste in a spallings release, the early-time tensile failure of waste under high, transient pressure gradients may be capable of removing waste particles that would not have been predicted to be removed under the steady-state assumptions of the Spallings model, leading to underestimating the release volume. Because of these concerns, the Panel does not believe that it has been adequately demonstrated that the equilibrium state determined by the erosional forces assumed in the model conservatively predicts the volume of waste released." (id. 7)

6.4.12.3 Location of intrusion boreholes: Spallings releases are assumed not to involve RH-TRU waste. No data are presented to justify this omission. It is not shown that gas pressure could not propel RH-TRU waste nor that the characteristics of RH-TRU waste should be excluded from consideration in modeling spallings.

6.4.12.4 Activity of the intersected waste: Waste activity is modeled without accounting for the extremes that may occur in RH-TRU waste variability. Also, direct brine releases and spallings releases are modeled based on average activity. It is not shown that either of these assumptions is conservative.

6.4.12.6 Probability of intersecting a brine reservoir: The probability of intersecting a brine reservoir is established strictly from the Powers geostatistical study (MASS Att. 18-6), which employs inadequate data, since there is no showing that the records on which the analysis is based would necessarily report brine reservoir occurrences. Moreover, the exclusive reliance on the Powers study neglects other data indicating a higher probability of brine reservoir occurrence (e.g., MASS Att. 18-5, which shows a range of probabilities from 10% to 55%). Indeed, the projected surface footprint of a cylindrical brine reservoir 24 m. thick and with compressibility of $1 \times 10^{-10} Pa^{-1}$ containing the estimated volume of the WIPP-12 reservoir would extend beyond the limits of the waste panels (See EEG presentation, Jan. 21, 1997).

6.4.12.7 Plug configuration in the abandoned intrusion borehole: See the discussion in section 6.4.7.2, above.

6.4.12.8 Probability of mining occurring within the land withdrawal area: It does not make sense to project the same effectiveness for PICs in reducing the rate of mining as for drilling, because miners seeking resources in the upper Salado may well believe that they stand less of a chance of causing a release than drillers and may be more inclined to mine. Mining regulators





may be more inclined to allow mining for the same reason. Further, there is no indication that institutional controls will even attempt to prevent human actions which affect the hydrology of the Culebra and no reason to believe that future humans will regard such actions as creating a threat to them.

6.4.13.2 Scaling methodology for disturbed performance scenarios: DOE must justify the scaling methodology by showing that the results reached are conservative as compared with calculations addressed to the precise time of the projected release.

6.4.13.6 Multiple scenario occurrences: The CCA states: "Based on model results for this analysis, the DOE has established that it is more reasonable in constructing a CCDF to assume that brine does not flow between panels." Support for such position must be provided.

6.4.13.7 Estimating releases during drilling for all scenarios: There should be a demonstration of the validity of the use of interpolation to calculate scenario consequences. Linear interpolation, in a PA model with coupled nonlinear processes, is not necessarily an accurate way to project consequences.

6.4.13.8 Estimating releases in the Culebra and the impact of the mining scenario: The CCA contains no justification for the treatment of mining in which actinides in transit when mining occurs continue to travel at the pre-mining velocity.

Chapter 7

The performance of passive institutional controls ("PICs") is so speculative that to allow any credit is unjustified. There are too many unknowables involved in the construction, survival, and comprehensibility of PICs and in whether future intrusion techniques may entirely avoid the message, even if it were comprehensible if received.

To begin with, the CCA contains no commitment to a specific plan for assurance requirements. DOE plans to reevaluate and change its plans for active institutional controls (at 7-2) and does not identify its archiving practices (at 7-79). The development timeline is merely "tentative" (at 7-81). There is no basis for the Agency to assume that the plan will be followed.

No design of passive institutional controls sufficiently definite to evaluate appears in the CCA. The design in Appendix PIC is conceptual only and is "not intended to represent the final configurations" (Appx. PIC at 4). Nor is there a commitment by DOE to construct a particular design. Density of buried markers is undetermined (id. 43); berm surfacing is undefined (id. 67); design of buried magnets is undecided (id. 68-69). Archived records have

not been established, and the contents of the important summary document have not been decided (id. 93). Appendix EPIC Supplement states that DOE plans to institute quality assurance procedures to ensure effectiveness of encoding in language, capturing in media, and transmitting information (at 6-12), underscoring the unfinished nature of DOE's plans. There will be further tests, on the basis of which the design will be finalized at some future date (id. 74-77). EPA cannot assume that the optimum design decisions will be made on all these points.

Moreover, design and assessment of the effectiveness of passive institutional controls involves the exercise of expert judgment, but there has been no compliance with §194.26.

Further, there is no assurance that funding will be made available to carry out DOE's ambitious plans for monuments and markers and other institutional controls. DOE has not claimed that the plans have been funded. It has not presented any assurance from responsible congressional committees supporting the plans. Apparently DOE has designed passive institutional controls without regard to cost and has asked EPA to assume that cost will not be a factor in determining whether the plans are actually carried out. Such an assumption is completely unrealistic.

The assessment of the effectiveness of PICs (Appendix EPIC, as amended, Dec. 6, 1996) has fundamental flaws. It is clear that the future states rule, 40 CFR §194.25, has nothing to do with the assessment of the effectiveness of PICs (Appx. EPIC, at 3-2). If the future states rule applied in this context, the issue would be trivial, since the monuments, languages, knowledge, and technology of today would be assumed to exist for the entire period in issue--thus assuming that the message of the PICs is delivered. EPA's own Compliance Application Guidance so states (CAG at 61).

Similarly, DOE errs in assuming that present drilling and mining methods are the only means of intrusion to be considered in assessing the effectiveness of PICs (Appx. EPIC Supp. at 3-3). DOE relies on 40 CFR §194.33(c) in so assuming, but that rule does not apply to estimation of the probability of intrusion; to the contrary, it speaks only of assumptions to be made in "analyzing the consequences of drilling events" (§194.33(c)). Compare §194.33(b), which specifically refers to assumptions to be made in assessing the "likelihood and consequences of drilling events."

To assume constant drilling practices is plainly unrealistic. Drilling methods are changing, incorporating electronic control methods, horizontal drilling techniques, cheaper and more transportable drilling methods, and new methods of increasing production (see NMBMMR Report, at X-1 through X-15). It is unrealistic to assume, as DOE does, that potential future intruders will not have available any advances in drilling technology. As DOE notes, this assumption "has widespread implications" (Appx.





EPIC Supp. at 3-3; see, e.g., Addendum). The PICs peer review noted the need to consider such technological advances in designing PICs, and that this had not been done (Appx. PEER 8, at 4-5, 4-6).

DOE's premises underlying its assessment of the effectiveness of PICs are unrealistically narrow. DOE assumes, for example, that resource exploration and development will, throughout the relevant time, be carried out by private companies motivated by profit (see, e.g., Appx. EPIC Supp. at 3-6, 3-7, 3-9, 3-10). However, that is not the only possible form of economic organization. Should resources be owned by government (as in China, Russia, and elsewhere), the nature of the exploratory motive, the value placed on record-keeping, relationships with putative "competitors," and the role of government regulation vis à vis exploration would be quite unlike what prevails in New Mexico today. Assumptions based on supposed economic benefits cannot be extended to a socialized society. Further, assumptions as to the understandability of English might be different if the prevailing government had an ideological or cultural bent hostile to English.

Similarly, the assumption that the assumed drilling rate means also that there will be "records centers ... processing and maintaining permits" (id. 3-10) assumes that drilling will be conducted for private profit and regulated by a government like today's--when in fact drilling might be conducted by government agencies for bureaucratic purposes remote from economics or for purposes not known to us, and the motive to consult "records centers" might not exist.

The entire Addendum (Dec. 6, 1996) to Appx. EPIC Supp. is premised upon a natural resource industry, and indeed a society, organized like the present-day industry and society. Thus, the effectiveness of PICs is premised upon such assumption, which for a 700 year period is plainly speculative and unfounded.

DOE also assumes that the fact that historical monuments have endured many hundreds of years supports the projected durability of monuments planned by DOE (id. 3-11). But it does not follow from the survival of one or more ancient monuments that future monuments will survive. DOE omits to consider, inter alia, the number of ancient monuments that have not survived. The Colossus of Rhodes, the Lighthouse at Alexandria, the hanging gardens of Babylon, the Temple of Artemis at Ephesus, the statue of Zeus at Olympus, the Mausoleum at Halicarnassus--all these were constructed of stone or other supposedly permanent materials and have vanished. How many unrecorded monuments have also disappeared is unknown; obviously, DOE does not provide such information.

Future monuments at WIPP will face destructive forces different from those of the past. The fact that some monuments have survived past stresses does not assure that others will survive new forces brought to bear in the future. DOE declines to

consider these prospects, considering them outside a prudent extrapolation of society's conditions (at 5-3, 6-2). However, the Acropolis has already suffered from air pollution (id. 5-17), and markers at the SHOAL site, indicating contaminated areas at the Nevada Test Site, have been destroyed.

DOE's projection of the durability of the markers excludes "unforeseen failure mechanisms" (at 6-3). However, some failure mechanisms of the future can be foreseen. Future societies might destroy the markers by war, industrial pollution, large-scale vandalism or terrorism, reckless action such as military exercises, or deliberately, e.g., to prevent site identification and anticipated exploration. No such action is discussed in Appendix EPIC Supp. No such action would render later intrusion intentional. See PEER-8, at 5-15.

Further, records of the WIPP repository may in the future be converted into centralized electronic media, which in turn may be subject to loss far more easily than multiple paper copies. Again, intrusion in ignorance of the repository would not be intentional.

DOE asserts that the PICs will perform "virtually perfectly" in enduring and preserving messages (at 6-12) and applies a failure rate based solely on mislocation of drilling sites (at 6-13). DOE concedes that continued effectiveness of PICs also depends upon human errors in the permitting process (id.). EEG has shown a high rate of failure in performance of the DOE-BLM Memorandum of Understanding concerning review of requests to drill near the WIPP site (EEG presentation, Jan. 21, 1997). Why such rate should not be considered in establishing a failure rate is unexplained.

Moreover, DOE's chosen analogue--drill site mislocation as to properly issued permits in the United States and Canada--ignores other examples of similar processes that may not be so effective. DOE's case might be more convincing, had DOE shown that similar performance is attained in China, Russia, Argentina, and Indonesia. Further, DOE's showing assumes, in effect, that the system generates a record of every occurrence of a mislocation, which it does not; DOE's only data consists of personal recollection (at 6-14). The demonstration is a weak one.

More basically, there is no study of the failure rate associated with each component of the PICs system and the uncertainty associated with that failure rate. What is the likelihood, rigorously determined, that monuments will survive? How frequently are permits granted for locations where a permit should have been denied? How frequently are archival records misplaced or allowed to deteriorate? There are many links in the chain of performance of PICs, and DOE has not presented a model and an assessment of performance which includes all of them. Only such a study could credibly generate a quantitative expression of the credit to be assigned for PICs. See PEER-8, at 5-15 through 5-17.





Further, as the PICs peer reviewers pointed out, the probability of the effectiveness of PICs should be subject to an uncertainty range in PA (PEER-8, at 5-7, 5-17).

Moreover, there is no basis to assign the same level of effectiveness to all intrusion methods. Horizontal drilling, for instance, might be conducted without observing any of the monuments and markers and certainly without striking any of the buried markers. Nevertheless, DOE assigns the same probability of effectiveness to the PICs in deterring horizontal drilling as in deterring vertical drilling (id. 5-4). This is not logical. The PICs peer reviewers saw that the markers would not deter horizontal drilling (PEER-8, at 5-14).

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET - MS 32
SACRAMENTO, CA 95814-5512
SALLY RAKOW
COMMISSIONER
Telephone (916) 654-3992
Telefax (916) 654-4420

February 27, 1997

Mr. Harold Johnson
NEPA Compliance Office
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, New Mexico 87119

Dear Mr. Johnson:

Enclosed are comments prepared by the State of California on the Draft Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant Disposal Phase (DOE/EIS-0026-S-2). Our comments incorporate the views of several State agencies including the California Energy Commission, California Highway Patrol, California Department of Transportation, Office of Emergency Services, and the California Department of Health Services.

We appreciate the opportunity to provide these comments on this draft environmental impact statement. Our comments pertain primarily to transuranic waste transport to the proposed facility. If you have any questions about our comments, please contact Barbara Byron at (916) 654-4976.

Sincerely,

Sally Rakow

SALLY RAKOW
Acting Chair

cc: George Dials, Carlsbad Area Office
Western Governors' Association
California Highway Patrol
CalTrans
California Department of Health Services
Governor's Office of Emergency Services

Enclosure



**STATE OF CALIFORNIA COMMENTS ON THE**

**WIPP DISPOSAL PHASE DRAFT**
**SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT**
**DOE/EIS-0026-S-2**

February 27, 1997

The *Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement* (WIPP SEIS-II) estimates that contact-handled transuranic waste shipments in California will include approximately 162 shipments from the Lawrence Livermore National Laboratory (LLNL), 1 shipment from the Engineering Technology and Engineering Center (ETEC), and 1 shipment from the Lawrence Berkeley Laboratory (LBL). ETEC will also have an estimated 5 shipments of remote-handled transuranic (TRU) waste, which are planned for shipment to WIPP or to consolidation and treatment sites such as Hanford. In addition, approximately 86 shipments of contact-handled transuranic waste would be shipped through California from the Nevada Test Site enroute to WIPP. The following comments pertain to these proposed shipments.

**Shipment Inventory**

1 The number of projected transuranic waste shipments from LLNL to WIPP estimated in the WIPP SEIS-II are lower by a factor of 6 from estimates provided in an earlier WIPP SEIS-I (1990). WIPP SEIS-II estimates there will be 162 shipments from LLNL to WIPP, whereas WIPP SEIS-I estimated there would be 969 shipments from LLNL to WIPP. What is the basis for such a large disparity between these estimates? Do these estimates assume that a truck would carry three TRUPACT-II containers (42 drums per shipment)? Shipment estimates will be significantly affected by these assumptions.

2 DOE has indicated to the State that all of the TRU wastes to be transported in California will be in less-than-highway-route controlled quantities. In previous years the State was told that these shipments would be made in greater than highway-route-controlled quantities. What is the basis for this change in estimated radioactivity of the waste?

3 **Recommendation 1**: DOE should explain why estimates of the number of TRU waste shipments from LLNL to WIPP have varied by nearly a factor of 6 since 1990 and why the waste, once characterized as greater than highway-route-controlled quantities, is now characterized as less than highway-route-controlled quantities. The State of California wishes to be notified at least 6 weeks in advance if planned TRU shipments are expected to exceed route-controlled quantities. Similarly, the planned quantities of transuranic materials to be shipped in California and their radioactive characteristics, packaging to be used, and routing should be provided to the State at least 6 weeks prior to shipment.

**Shipment Packaging and Content Inspections**

4 One of the prerequisites for the safe shipment of transuranic waste is that the waste will be certified by the facilities generating the waste as meeting the WIPP Waste Acceptance Criteria and that the contents of the drums and shipment packaging meet certain safety criteria. The safety of these shipments largely depends upon proper treatment of the waste, loading into drums, and packaging, with strict adherence to the WIPP Waste Acceptance Criteria. This would help ensure that the contents of the drums and packages are within prescribed safety limits.

The State of California requests the option for State inspections of TRU-waste packaging and certification by DOE of shipment contents prior to shipment.

5 **Recommendation 2:** The California Department of Health Services should have the option of conducting onsite, independent safety inspections of package preparation and loading at DOE facilities (e.g., LLNL, ETEC, LBL) in California prior to shipment.

**Route**

6 DOE's proposed routes for transuranic waste shipments from the Nevada Test Site to WIPP include State Route (SR) 127 in California. Inyo County has expressed concern over the physical condition of SR 127 for the transportation of nuclear waste. For most of its length, SR 127 parallels the Amargosa River, which is the drainage for large portions of eastern California and western Nevada. With only limited drainage improvements provided along the highway, flooding is a common occurrence. Current drainage can only accommodate a small portion of the flood waters, with the remainder often overflowing the roadway and undermining the pavement and roadbed. Additionally, there is a recorded incident in which a truck transporting hazardous materials was swept off the roadway.

6 Although the State of Nevada wants to route shipments away from the greater Las Vegas metropolitan area, the State of California does not believe that SR 127 is the best option for the reasons stated above. In addition, no significant improvements are planned for SR 127 in the near future.

6 **Recommendation 3:** SR 127 should not be used in its current condition for nuclear waste shipments in California.





**WIPP Transport Safety Program**

7 DOE should be commended for its efforts to work with affected states to develop mutually acceptable transportation protocols and procedures to improve the safety of these shipments. The WIPP Transport Safety Program developed through cooperation between the Western Governors' Association (WGA) and the DOE has helped prepare states along the initial shipping corridors (Idaho, Colorado, Wyoming, Utah, New Mexico, Washington, Oregon). However, the WIPP SEIS-II failed to mention this program and that extensive transuranic waste shipping procedures and protocols have been developed through this WGA/DOE cooperative effort. The elements of this transport safety program are described in the Western Governors' Association WIPP Transportation Safety Program Implementation Guide.

8 WGA adopted a resolution (96-019) calling for the federal government to provide financial and technical assistance for emergency preparedness at least 3 years before shipments. To date, California has not received DOE assistance, for example, for emergency response training for WIPP shipments. With DOE's plan to begin shipments from LLNL and NTS to WIPP in 1999, assistance to California should be expedited. It is essential that all states affected by these shipments (including California, Nevada, Arizona) have sufficient lead time and federal assistance to ensure that the emergency responders along the proposed routes are trained and equipped to handle an emergency and that other necessary transport safety procedures are in place. The remaining states need to begin developing this emergency response capability specific to the WIPP transport safety program, public information program, and State-specific transport safety procedures.

**Recommendation 4:** The WIPP SEIS-II should include the WGA WIPP Transportation Safety Program in its description of transport plans for these shipments. In addition, adequate federal assistance and funding, e.g., through the WGA/DOE Cooperative Agreement, must be provided to California to begin preparing shipments **a minimum of three years** before transuranic waste shipments begin in California.

**Characterization of TRU Wastes**

9 The State needs accurate projections of the quantities and types of shipments to be made in California in order to appropriately prepare for these shipments. The WIPP SEIS-II provides estimates of the radionuclide inventory and number of shipments anticipated for LLNL, ETEC, and LBL. The recent Integrated Data Base Report-1995 (DOE/RW-0006, Rev. 12) shows transuranic waste stored at General Electric at Vallecitos in California. However, the WIPP SEIS-II does not provide information on the characteristics and plans for shipments from this facility.

9 **Recommendation 5:** DOE should provide accurate and updated projections of TRU shipments in California, including total alpha curies per shipment (including bounding or maximum alpha-curie levels feasible). Plans for transuranic waste shipments from GE Vallecitos should be included in the final WIPP SEIS-II.

**Packaging**

DOE plans to use TRUPACT-II packaging for transporting contact-handled-TRU waste and RH-72-B casks for transporting remote handled-TRU waste. The TRUPACT-II packaging is viewed as a superior container that will significantly enhance the safety of the TRU waste shipments. Other containers (a halfpack container, Super Tiger) have also been mentioned for possible use for certain TRU waste shipments, e.g, for over-sized or odd-sized TRU waste shipments.

A key component of the WIPP Transport Safety Program is the superior quality of the container (TRUPACT II) planned for these shipments. If packaging other than TRUPACT II is anticipated for use for TRU shipments in California, the State of California should be notified. Only U.S. Nuclear Regulatory Commission certified transport containers (containers that meet current plutonium shipping requirements) should be used.

10 **Recommendation 6:** Only NRC certified transport containers (meeting current plutonium shipping requirements) should be used for waste shipments to WIPP. DOE should notify the State of California if packaging other than TRUPACT-II is planned for use in California.

**Compliance With Transport Requirements**

The DOE, U.S. Department of Transportation, and the WIPP corridor states and Indian tribes must continue to work together to ensure that the carrier's drivers and maintenance personnel are adequately qualified and trained. Procedures must be kept in place over the duration of the shipping campaign to ensure strict compliance with applicable transport regulations.

11 **Recommendation 7:** DOE, DOT, Corridor States and Tribes must work throughout the duration of the WIPP shipping campaign to verify strict compliance with transport regulations. This would include periodic inspections to assess quality assurance and maintenance programs for the shipping container and to ensure that waste packaging procedures at shipment origination facilities, carrier's drivers qualifications, and transport vehicles comply with WIPP Transport Safety Procedures and Protocols and transport regulations.





**Notification**

DOE must provide timely notification to state authorities prior to each shipment, so that State activities can be coordinated and implemented. Such State actions might include inspection of the shipment, including vehicle and packaging inspections, assessing potential radiation exposure to workers and the public, and assessing road and weather conditions prior to shipment.

DOE's Transuranic Materials Transportation Guide states that (p. 2-2) state-designated agencies will be pre-notified of transuranic material shipments through TRANSCOM seven days in advance. The State of California requests that this 7-day prenotification of shipment be provided in writing through certified mail to the California Highway Patrol.

12 **Recommendation 8:** The State should be provided timely notification of TRU waste shipments. The California Highway Patrol should be provided written notification (certified mail) 7 days prior to the scheduled shipment. Shipment dispatch from the DOE facility should depend on whether such timely notification to the State has been provided, i.e., shipments would be subject to delay until such notification to the State is provided. In addition, DOE should provide timely notification (7 days prior) to the State of any projected changes in shipment plans (e.g., changes in schedule, packaging, or routing).

WIPP SEIS-II
Document # A-10

**STATE OF TENNESSEE**

**DON SUNDQUIST**
GOVERNOR

February 27, 1997

Deputy Secretary Charles B. Curtis
United States Department of Energy
1000 Independence Avenue, S.W.
Room 7A-257
Washington, D.C. 20585

Dear Deputy Secretary Curtis:

The State of Tennessee is pleased to provide the attached comments on the *Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant (WIPP)* located near Carlsbad, New Mexico. This letter constitutes the official response of the State of Tennessee to the Supplemental Environmental Impact Statement. On behalf of Governor Sundquist and the citizens of the State of Tennessee, I concur with the action to store Transuranic (TRU) waste at WIPP.

1 The State of Tennessee has a clear interest in and dependence on the initiation of the WIPP storage facility combined with the proposed RH-TRU waste processing facility. As you know, the Oak Ridge National Laboratory (ORNL) is currently poised to construct the processing facility. The processing facility is critical to meeting the Waste Acceptance Criteria for WIPP. With the completion of this facility, DOE would be appropriately equipped to treat these wastes for shipment to WIPP.

The processing facility should be considered only if the following key conditions are met:

2 • Under no circumstances should there be any waste consolidation of RH-TRU waste with long term storage on the Oak Ridge Reservation. This is fundamental and, in Tennessee's views, is non-negotiable.

3 • DOE should provide adequate funding for development and management of the processing facility for remote-handled transuranic (RH-TRU) wastes so that the entire inventory of RH-TRU wastes from Oak Ridge can be moved to WIPP in a timely manner.

State Capitol, Nashville, Tennessee 37243-0001
Telephone No. (615) 741-2001







We note with considerable concern that DOE's Proposed Action does not give priority for waste removal at ORNL. ORNL must receive the highest possible priority for waste removal. Reasons for this include:

4
- Currently, ORNL has the largest inventory of RH-TRU waste in the DOE's complex.
- The data summary for the *Draft Waste Management Programmatic Environmental Impact Statement* indicates that the Oak Ridge Reservation currently produces the highest "population dose" among the 54 DOE sites around the nation.

We further advise you of the Commissioner's Order dated September 26, 1995, and the Oak Ridge Mixed Waste Site Treatment Plan. These place affirmative obligations on the United States of America with which the State of Tennessee will insist compliance.

5 In addition, the nation's taxpayers have made sizable investments in the creation of space for storage of RH-TRU wastes at WIPP. As you know, DOE must begin storing RH-TRU in advance of contact-handled transuranic (CH-TRU) waste to efficiently utilize the storage capacity at WIPP. Therefore, it is clear that the taxpayers will expect DOE to maximize the storage capacity of WIPP.

Governor Sundquist has repeatedly stated that Oak Ridge has borne more than its share of Manhattan Project and Cold War responsibilities for this nation in current waste storage and waste processing activities. With these considerations in mind, the State of Tennessee strongly urges that DOE should move forward to store RH-TRU wastes at WIPP.

Sincerely,

Justin P. Wilson
Deputy to the Governor for Policy

JPW/bls

cc: Harold Johnson, WIPP EIS

THE STATE OF TENNESSEE
TENNESSEE EMERGENCY MANAGEMENT AGENCY
EMERGENCY OPERATIONS CENTER
MILITARY DEPARTMENT OF TENNESSEE
3041 SIDCO DRIVE, P.O. BOX 41502
NASHVILLE, TENNESSEE 37204-1502
(615) 741-0001

Mr. Dod Galbreath
TN Environmental Policy Office
20th Floor, L&C Tower
401 Church Street
Nashville, TN 37243-0454

Dear Mr. Galbreath:

RE: Document No. DOE/EIS- 0026-S-2, WASTE ISOLATION PILOT PLANT DISPOSAL PHASE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT.

6 The Tennessee Emergency Management Agency concurs with the Proposed Action to emplace Transuranic waste in the Waste Isolation Pilot Plant near Carsbad, New Mexico. The following information is offered first, as a correction to the map on page S-22 , and the second issue of changing priorities for facilities scheduled for waste removal.

7 COMMENT: Page S-22, Figure S-4 Correct route is U.S. 95 to SR321 to I-75 South to I-24 West to I-59 South.

8 COMMENT: The original EIS called for implementing removal of TRU Waste from the Oak Ridge National Laboratory during the first phase of the disposal program. Due to the large quantity and limited adequate storage, and the close proximity to metropolitan population centers, the Tennessee Emergency Management Agency highly recommends the inventory of Transuranic materials be accorded a high priority when the shipment of Transuranic radioactive materials to the Waste Isolation Pilot Plant is initiated.

Sincerely,

Elgan H. Usrey, Director
Plans and Programs

RECEIVED BY
FEB 03 1997
TN. ENVIRONMENTAL POLICY OFC.





STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DOE OVERSIGHT DIVISION
761 EMORY VALLEY ROAD
OAK RIDGE, TENNESSEE 37830-7072

February 20, 1997

Milton Hamilton, Commissioner
Tennessee Department of Environment and Conservation
c/o Tennessee Environmental Policy Office
14th Floor L&C Tower
401 Church Street
Nashville, Tennessee 37243-1553

Dear Commissioner Hamilton,

**Document NEPA Review -- Draft Supplemental Environmental Impact Statement: "Waste Isolation Pilot Plant Disposal Phase," (WIPP) DOE/EIS-0026-S-2, November 1997**

The Tennessee Department of Environment and Conservation, DOE Oversight Division (TDEC/DOE-O) has reviewed the above document for your concurrence and transmittal to the following DOE office:

Harold Johnson, WIPP EIS
US Department of Energy
101 W. Greene Street
Carlsbad, NM 88220

The Division's review was conducted in accordance with the requirements of the National Environmental Policy Act (NEPA) and associative implementing regulations 40 CFR 1500-1508 and 10 CFR 1021.

After review and research, the Division would like to reiterate the State's position on the proposed action. Tennessee may consider consolidation of remote-handled transuranic (RH-TRU) waste on a site by site basis for processing and shipment to WIPP. It would oppose shipment from other sites for the purpose of long term storage of RH-TRU on the Oak Ridge Reservation.

Comment A-010, Page 5 of 9





9

The document states: *"It was assumed, for the purposes of analyses, that the excess RH-TRU waste, which amounts to approximately 43,000 cubic meters (1,500,000 cubic feet), would be located at the Hanford Site (Hanford) and Oak Ridge National Laboratory (ORNL) and would remain in storage at these sites for an indefinite number of years following treatment."* The State of Tennessee expects the entire inventory plus additional generations of TRU wastes to be fully addressed in a timely manner (i.e., ultimate disposal at the Waste Isolation Pilot Plant) commencing in accordance with schedule contained in the Oak Ridge Reservation Site Treatment Plan. Assumptions like this and those of a similar nature are unacceptable. The criteria selected, to arrive at the stated assumption in the analysis, are not apparent; therefore, the selection of ORNL seems to be arbitrary.

10

The document states: *"DOE is not proposing to give some sites' waste higher priority for disposal at WIPP. For the purposes of analyses in SEIS-II, it was assumed that waste would be shipped from all four RH-TRU waste consolidation sites at similar rates so that the entire projected INEL and LANL RH-TRU waste volumes would be accepted, and the remaining capacity for RH-TRU waste disposal would be filled proportionally with waste from ORNL and Hanford."* The above mentioned assumption is not acceptable. The State's primary concern is the inventory of RH-TRU waste as it exists on the ORR. The consolidation of RH-TRU wastes from other sites to several "major" locations, prior to shipment to WIPP, has to be handled as a separate issue. The ORR inventory of RH-TRU waste, by far the largest existing within the Department of Energy (DOE)'s complex, posing a unique threat to the large surrounding population and the environment, deserves immediate attention. The State expects the DOE to address ORR inventory on a high priority basis.

In addition, please find attached comments for DOE's consideration in the preparation of the Final Supplemental Environmental Impact Statement. If you have any questions regarding the Division's review, please contact Bill Childres at (423) 481-0995 or Steve Nisley at (423) 481-3032.

Sincerely

Earl Leming
Director

el281.99



Comment A-010, Page 6 of 9



**Tennessee Department of Environment and Conservation/DOE Oversight Division**

**Comments on Draft Supplemental Environmental Impact Statement, DOE/EIS-0026-S-2, November 1997, Waste Isolation Pilot Plant Disposal Phase**

## General Comments

11

The document evaluates four different action options and two no action alternatives based on the Waste Management Programmatic Environmental Impact Statement. Recent EIS documents on the Nevada Test Site, Pantex, Stockpile Stewardship and Management, etc., have resulted in Records of Decisions for the proposed plan alternative. The proposed action alternative has been weighted heavier than the other options in this review.

12

Accordingly, the statements on the assumptions for analyses and consolidation of TRU wastes at four different sites are of great concern to the State of Tennessee. If in enacting the proposed alternative Oak Ridge does become a consolidation site, the net result of the phased WIPP disposal to the Oak Ridge Operations will not realize any changes in RH-TRU inventory at best, or face an increase in inventory if any of the contributing sites happen to identify or revise their inventories upwards.

The CH-TRU waste inventory depletion is definite under this phased WIPP disposal activity. Oak Ridge Operations and Bettis Site will be completely depleting their CH-TRU inventory in this proposed alternative. There is no advantage to Oak Ridge to bring wastes from the Bettis Site or any other site. Other sites should make their shipments directly to WIPP and Tennessee opposes any attempts at being targeted as a consolidation site.

13

A second issue, affecting this document is the fact that Oak Ridge Operations' RH-TRU waste inventory as presented in the Site Treatment Plan and Federal Facility Compliance Act document is less than the inventory figures in the Basic Inventory on which this document is based.

Oak Ridge should try to make sure they can ship RH-TRU at WIPP start-up, since the RH-TRU inventory that can be disposed will be less if delays in shipping RH-TRU relative to CH-TRU are encountered.

## Specific Comments

14

1. Page S-4, The last bullet, second sentence, at bottom
*"SEIS-II includes analysis of CH-TRU waste, RH-TRU waste, post-1970 defense TRU waste, nondefense TRU waste, commercial TRU waste, pre-1970 buried TRU waste, and PCB-commingled TRU waste."* Several DOE ORNL TRU waste documents mention "Special Case TRU (SC-TRU)" waste stored and/or disposed of at SWSA 5 North and SWSA 5 South trenches at ORNL. There is no mention of SC-TRU wastes in the SEIS-II

Comment A-010, Page 7 of 9



14 document. Are SC-TRU wastes of no concern/significance as ORNL TRU wastes? Are SC-TRU wastes "lumped" into another category, i.e., CH-TRU? Also, SC-TRU is omitted from discussion of Transuranic waste on pages 1-1 and 1-2 (Chapter 1 -- Introduction).

15 2. Page S-6, Table S-1
Explain the order by which the sites have been listed. It seems that they have been ranked based on the projected total of both the contact handled (CH) and remote handled (RH) transuranic (TRU) waste through the year 2033. However, considering the unreliability and speculative nature of projections, it may be more appropriate to use the current inventory. In this case, the Oak Ridge Reservation (ORR) would place fifth.

16 3. Page S-27, paragraph 7
The primary aquifers in the Oak Ridge area are (as in all the Valley and Ridge province in East Tennessee) bedrock aquifer in carbonate rock. The total dissolved solids in these aquifers range from about 150 to 400 PPM. Only in the clastic rocks or at depths of many hundred of feet in the carbonate rock will total dissolved solids limit the use of groundwater.

17 4. Page 3-2, paragraph 2
*It was assumed, for the purposes of analyses, that the excess RH-TRU waste, which amounts to approximately 43,000 cubic meters, would be located at the Hanford Site (Hanford) and Oak Ridge National Laboratory (ORNL) and would remain in storage at these sites for an indefinite number of years following treatment.* The State of Tennessee expects the entire inventory plus additional generations of TRU wastes to be fully addressed in a timely manner (i.e., ultimate disposal at the Waste Isolation Pilot Plant) commencing in accordance with schedule contained in the Oak Ridge Reservation Site Treatment Plan. Assumptions like this and those of a similar nature are unacceptable. The criteria selected, to arrive at the stated assumption in the analysis, are not apparent therefore, the selection of ORNL seems to be arbitrary.

18 Tennessee's interests will be best served if the operations do not involve consolidation of sites. The transportation of RH-TRU material (Battelle and Bettis) into Oak Ridge for pre-treatment increases the risk associated with transportation and handling. The magnitude of such incremental risks has not been clearly analyzed and stated in this document. While RH-TRU waste related activities might increase on the Reservation, the end result to the Oak Ridge Reservation and the State of Tennessee is little or no inventory reduction. Therefore, it will be prudent for individual sites to send their wastes directly to WIPP.

Tennessee will consider consolidation for processing and shipment to WIPP. It would oppose shipment from other sites for the purpose of storage.





Comment A-010, Page 8 of 9



5. Page 3-2, Footnote
*"DOE is not proposing to give some sites' waste higher priority for disposal at WIPP. For the purposes of analyses in SEIS-II, it was assumed that waste would be shipped from all four RH-TRU waste consolidation sites at similar rates so that the entire projected INEL and LANL RH-TRU waste volumes would be accepted, and the remaining capacity for RH-TRU waste disposal would be filled proportionally with waste from ORNL and Hanford."* The above mentioned assumption is not acceptable. The State's primary concern is the inventory of RH-TRU waste as it exists on the ORR. The consolidation of RH-TRU wastes from other sites to several "major" locations, prior to shipment to WIPP, has to be handled as a separate issue. The ORR inventory of RH-TRU waste, by far the largest within the Department of Energy (DOE)'s complex, posing a unique threat to the large surrounding population and the environment, deserves immediate attention. The State expects the DOE to address ORR inventory on a high priority basis.

19 Oak Ridge Operations' RH- TRU waste has been characterized to be mixed according to the Inventories. The pretreatment of the Mixed RH-TRU wastes will result in considerable reduction in volume of material for disposal. Oak Ridge Operations is in the process of identifying contractors to treat the RH-TRU wastes to meet the Waste Acceptance Criteria of WIPP and the millions of dollars in resources and man-hours expended will not result in a favorable rate of return to Oak Ridge and the State of Tennessee if the consolidation site for excess storage is implemented.

20 If proposed action analysis is based on the limiting factors set by the WIPP Land Withdrawal Act (LWA) 7080 cubic meters for RH-TRU wastes in the disposal volume, and the Consultation and Cooperation (C&C) Agreement with the State of New Mexico which prescribes a maximum activity level of 5.1 million curies of allowable RH-TRU disposal volume. Therefore, in the interest of optimization of the resources, one of the factors that should have been considered is prioritization of the RH TRU waste inventory for every site by categorization based on activity levels of the wastes. While this could be an involved process, land use available for disposal could be maximally utilized to accommodate all of the disposal volumes at this phase. If such prioritization could be accomplished, the limiting factor of activity and volumes as set by LWA and C&C would be used as justifiable parameters to the satisfaction of all the sites.

21 It is apparent that the factors to consider in combining alternatives, and the activity levels that have played an important role in the phased development of the WIPP have been neglected from any consideration. It is also apparent that the categorization of the RH-TRU wastes based on activity levels probably qualify Oak Ridge Reservation for complete disposal of its RH-TRU waste inventory. It should be noted that the State of Idaho is the only state that required DOE to begin planning for the LDR treatment of the LANL TRU waste, allowing re-negotiation should WIPP open (Chapter 2, page 2-9). It is no coincidence that Idaho National Laboratory is targeted to deplete its inventory of the RH-TRU waste in this phased disposal operation of the WIPP. It is obvious that the proposed alternative analyses is biased in favor of some sites over others by lack of consideration of one of the limiting factors.

22 The numbers do not add up when applied to the inventories projected in Table 3-1 or in tables for some of the other actions. With a capacity of 4080 m3 and equal shipping rates, all of the projected LANL inventory would be disposed at WIPP, but only (7080 - 330)/3 = 6750/3 = 2250 m3 of the INEL RH TRU would go to WIPP leaving 2800 -2250 = 550 m3 at INEL.

23 6. Page 3-4, Figure 3-1
Any consolidation of wastes ( CH-TRU and RH-TRU wastes coming to the ORR from several locations) would require securing of adequate funding to assure that the necessary characterization/treatment/packaging is performed in a timely fashion to efficiently utilize the windows of opportunity that open up at WIPP. Also, it has been the State's long standing position that any funding allocated for the environmental cleanup of the ORR must not be rerouted to other programs. Additionally, a more detailed plan addressing transportation issues/contingencies within the State is required.

24 7. Page 3-7, Paragraph 1
*"The rate at which both CH-TRU waste and RH-TRU waste would arrive at WIPP for disposal would be based on the WIPP waste handling throughput rate and the storage area."* If the handling capacity at WIPP is known, the exact timetable of shipments from the ORR should be provided for the State to review. Again, the State would expect the situation regarding the large inventory of RH-TRU waste on the ORR to be reflected appropriately in the schedule.

25 8. Chapter 5, Section 5.1.3 Biological Resources, page 5-6
*"Analyses conducted during the Draft WM PEIS determined that construction and operation of TRU waste treatment facilities should not have major adverse effects..."* These analyses should be considered questionable since the Draft WM PEIS is not yet final and is also in question.

26 9. Chapter 5, Section 5.1.7.1, Life Cycle Costs
Again, assumptions derived from the Draft WM PEIS should not be considered as accurate for this document.

27 10. Chapter 5, Section 5.1.9.4, Storage of Excess RH-TRU Waste
There should be a capacity of RH- and CH-TRU determined for long-term storage at Oak Ridge.

28 11. Appendix D, Page D-2, Tables D-1, D-2 and D-3
$1,124 million in waste treatment facility costs and a volume adjustment factor of 2.04 is stated for the proposed alternative. When compared with the volume in the Draft Waste Management Programmatic EIS document the costs of the Regionalized 2 alternative under WM PEIS is $678 million and the no action alternative in the SEIS-II costs are $1,401 million. The cost for a treatment facility is much less for ORNL as a decentralized site, $551 million only. Arguments in favor of the proposed alternative need serious justification, given the present state of the economy and dwindling budgets for many programs.









United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

In Reply Refer To:
ER 96/766

FEB 20 1997

Ms. Carol Borgstrom
Director
Office of NEPA Policy and Assistant (EH-42)
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Ms. Borgstrom:

The U.S. Department of Interior (Department) has reviewed the draft Supplemental Environmental Impact Statement (SEIS-II) for the Waste Isolation Pilot Plan (WIPP) Disposal Phase, Proposed Transuranic Waste Shipment Routes, and offers the following comments. The SEIS-II describes the transportation, disposal, and storage of transuranic (TRU) wastes at the WIPP located 26 miles east of Carlsbad, New Mexico, in Eddy County. The Department provided comments on the more limited scope of SEIS-I in 1990.

GENERAL COMMENTS

1 In the evaluation of potential impacts to the environment for alternatives presented, the Department of Energy (DOE) estimated any where from 3 to 331 nonradiological accidents which might occur during the transportation of wastes to WIPP. These are potential accidents not associated with external radiation or breach of TRU waste packages. If the proposed alternative were selected, as many as 76 accidents involving tractor-trailers could occur during the project. Each fully loaded tractor-trailer weighs about 80,000 pounds and has a fuel (diesel) capacity of 1,100 pounds (125 gallons). These 76 accidents have the potential to release 9,500 gallons of diesel fuel into the environment. Depending on the amount released, its timing, location, and proposed method of cleanup (or lack thereof), the accident may adversely affect fish and wildlife and their habitats. This potential impact was not addressed by the SEIS-I or SEIS-II.

The Department believes that the DOE needs to address the impacts to the environment from the release of materials other than TRU wastes in the accident scenarios. However, rather than spend an inordinate amount of time modeling and predicting the amount and location of diesel fuel spills during any particular accident scenario, the Department recommends the development of a spill contingency plan under the Oil Pollution Act of 1990. The plan

should be coordinated with the Environmental Protection Agency, the Department of Transportation, the Department of the Interior, state governments, and the Native American Tribes along the proposed transportation routes. One possible alternative that is practical and feasible from a technical and economic standpoint would be to provide spill containment materials (e.g., polymer encapsulation products, booms, sorbent pads, etc.) either with the driver of the tractor-trailer or with the emergency on-scene commander. The DOE could identify the type, quantity, and source of materials best suited for a diesel spill, train the driver to utilize these spill containment materials, and develop a method to evaluate the timing of their use given other spill contingency plans. In the event of a diesel spill, the fuel could be contained using containment materials to prevent migration to the soil and subsequent contamination of natural resources. Such planning would result in increased protection for the environment and decreased costs as well as collateral injury during the cleanup of the spill.

1

SUMMARY

The Department's concerns regarding the WIPP Disposal Phase include the lack of contingency planning associated with the release of diesel fuel during any accident scenario. We have included recommendations to assist in reducing the potential for harm to the environment from any accidental spills of petroleum from the vehicles used in the shipment of wastes to the WIPP.

We appreciate the opportunity to review this draft supplemental environmental impact statement and to provide these comments. We hope that our comments are useful and if there are any questions regarding them, please contact Vijai Rai in the Office of Environmental Policy and Compliance at (202) 208-6661.

Sincerely,

Willie R. Taylor
Director
Office of Environmental Policy
and Compliance



State of Idaho Idaho National Engineering & Environmental Laboratory
OVERSIGHT PROGRAM • 800/232-4635
900 N. Skyline, Suite C • Idaho Falls, ID 83402 • 208/528-2600 • (FAX) 208/528-2605
1410 N. Hilton • Boise, ID 83706 • 208/373-0498 • (FAX) 208/373-0429

PHILIP E. BATT
Governor
KATHLEEN E. TREVER
Coordinator-Manager

February 26, 1997

Mr. Harold Johnson, NEPA Compliance Officer
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Subject: *State of Idaho Comments on the Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement (DOE/EIS-0026-S-2)*

Dear Mr. Johnson:

Enclosed are comments addressing specific concerns of the State of Idaho with the above-referenced document. Key issues were also identified in testimony given by Governor Batt at the public hearing in Boise, Idaho on January 15, 1997. My staff and I look forward to working with the U.S. Department of Energy-Carlsbad Area Office to ensure the successful resolution of these comments.

General Comments

1) The draft SEIS-II does not acknowledge the obligations of the U.S. Department of Energy (DOE) specified in the 1995 court settlement between the State of Idaho, DOE, and the Department of the Navy, hereafter referred to as the Agreement (for your convenience, a copy of this document is enclosed). While the Agreement does not rule out disposal options other than the Waste Isolation Pilot Plant (WIPP) for the 65,000 cubic meters ($m^3$) of transuranic waste slated to leave the INEEL, the SEIS should still reference and consider these legal obligations. Notably, the Agreement was recognized in the National TRU Waste Management Plan published by the DOE in September 1995. In recognition of the potential relationship between disposal operations at the WIPP and the Agreement, please note the following concerns:

1

a) The Agreement specifies several deadlines related to the removal of transuranic waste (TRU waste) from the INEEL:

2

1) The first shipments of TRU waste shall begin by 4/30/99.
2) A minimum of 3,100 $m^3$ must be shipped by 12/31/02.
3) A running average of at least 2,000 $m^3$ per year must be shipped after 1/1/03.
4) All TRU waste shall be shipped by 12/31/18.

State of Idaho Comments
on the draft WIPP SEIS-II
Page 2 of 7

The schedules provided in the draft WIPP SEIS-II indicate that for some of the action alternatives it may be difficult, if not impossible, to comply with the terms set forth in the Agreement, assuming the WIPP is the primary disposal option. Obviously, under the "no action" alternative, which presumes on-site storage of TRU waste, DOE would have to make other arrangements to meet the commitments outlined in the Agreement. The SEIS should identify those alternatives that are inconsistent with the Agreement.

The State has discussed its concerns regarding the Agreement with DOE-Carlsbad and supports the addition of the following language to the summary and to the main text of the final SEIS:

2

> "There are numerous legally binding agreements and orders that govern how DOE must treat and dispose of transuranic waste. As an example, DOE is under a court order[1] that, among other things, sets forth a schedule for treatment and removal of all transuranic waste located at the INEEL (including some low-level alpha waste that is expected to be categorized as transuranic waste after planned treatment). While the SEIS-II does not discuss the specific details of all of the applicable agreements, DOE recognizes the final decision needs to comply with the legal requirements that exist at the time of the decision as well as to allow DOE sufficient flexibility to respond to any changes in legal requirements that may take place in the future. To accomplish this, DOE may reach a decision that is a combination of alternatives to accommodate the differing legal requirements applicable to each site."
>
> [1] United States v. Batt, Civil No. 91-0054-S-EJL (October 17, 1995).

b) The volume of TRU waste at the INEEL destined for WIPP, as published in the SEIS-II, does not conform to the volume specified in the Agreement. For example, Table S-1 of the SEIS-II states there are 28,000 $m^3$ of contact-handled TRU (CH-TRU) and 200 $m^3$ of remote-handled TRU (RH-TRU) in the "basic inventory" at the INEEL. Table S-1 notes an "additional inventory" of 57,000 $m^3$ of CH-TRU and 440 $m^3$ of RH-TRU.

3

In contrast, the Agreement specifies an estimated 65,000 $m^3$ of TRU waste slated for shipment from the INEEL. The final SEIS should state the reason for this discrepancy, whether it is related to treatment or some other factor such as varying assumptions in the references from which the estimates were derived.



State of Idaho Comments
on the draft WIPP SEIS-II
Page 3 of 7

2) The document does not take into account potential treatment at the proposed Advanced Mixed Waste Treatment Facility. This facility is expected to coprocess approximately 39,000 $m^3$ of transuranic waste and 26,000 $m^3$ of alpha low-level mixed waste (between 10 to 100 nanocuries), with the resulting reduced volumes eligible for disposal at WIPP. The overall waste reduction is expected to be 65%. In addition to the large amount of INEEL waste that may be treated at the facility, the RFP for the project also calls for an additional capacity of 120,000 $m^3$ for the treatment of offsite TRU waste. The possible treatment of TRU waste on that scale should be included in the EIS.

4

3) In addition to the Agreement, the DOE, Department of the Navy, and the State of Idaho are signatories to a Consent Order which makes the INEEL Site Treatment Plan (STP) of October 31, 1995 a legally binding agreement. Currently, the STP mandates specific treatment methods for all stored INEEL mixed transuranic waste (MTRU), including waste targeted for disposal at WIPP. The treatment plans are subject to public review and approval by the Idaho Division of Environmental Quality; however, if portions of the INEEL waste inventory which the STP specifies for disposal at the WIPP are not in fact sent to WIPP, treatment of the MTRU becomes necessary unless other regulatory relief is obtained. The DOE may be in violation of Idaho Rules and Standards for Hazardous Waste (IDAPA 16.01.05.011) if it fails to comply with the various requirements specified in the STP.

5

4) The waste inventory for the proposed action does not include projected transuranic waste volumes from environmental restoration activities. The State of Idaho considers transuranic waste generated or treated during environmental restoration activities to be newly generated waste eligible for disposal at WIPP, regardless of the date of the original emplacement.

6

Specific Comments

1) Pages S-6 to S-9; also Section 3

Some of the inventory waste volumes presented in table S-1 are significantly different from those in previous inventories, such as in the "Draft Waste Management Programmatic Environmental Impact Statement." A more thorough explanation of differences would be helpful (at least for the sites with large inventories, including Hanford, INEEL, LANL, RFETS, and SRS). For example, differences resulting from revised estimates should be distinguished from those resulting from planned volume reduction due to treatment. See also General Comment #1b.

7

State of Idaho Comments
on the draft WIPP SEIS-II
Page 4 of 7

2) Pages S-9 to S-11, 3-49 and 3-50

8 The waste volumes on the bar graphs (figures S-2 and S-3; 3-9 and 3-10) for No Action Alternative 2 appear to be inconsistent with those in the associated tables (for example, table S-3). Differences should be explained or corrected.

3) Pages 3-2 and 3-20 to 3-52

9 The timetables and maps indicating treatment at INEEL and shipment from INEEL after 2018 and the discussion of consolidation at INEEL are inconsistent with the Agreement. The statement in the footnote on page 3-2 ("DOE is not proposing to give some sites' waste higher priority for disposal at WIPP") should be reconsidered in the light of the Agreement's requirements. See also General Comment #1.

4) Page 5-16; Appendix A; pages E-30 and E-31

10 Transportation indices for loaded shipping containers are significantly lower than those estimated in "Comparative Study of Waste Isolation Pilot Plant (WIPP) Transportation Alternatives" (February 1994; DOE/WIPP 93-058), presumably because of changes in per-container radioisotope inventories. The final SEIS should discuss this change, particularly since it is difficult to compare inventories between the two documents (inventories in the "Comparative Study" are per container, while those in the SEIS-II are per site).

5) Page 5-59, paragraph 7 (first paragraph following second list of bullet items)

11 "The standard method of calculating the number of accidents and fatalities per commercial train is to divide the average number of rail cars per train by 70." This sentence is unclear (dividing the average number of rail cars per train by 70 will result in 1). What is probably intended is something to the effect of: "The standard method of calculating the number of accidents or fatalities per rail car is to divide the number of accidents or fatalities per train by the average number of rail cars per train, which is 70."

6) Appendix E

12 The word "TRUCK" should be added to headers E.2 through E.5, since rail transportation is discussed only in Section E.7.



State of Idaho Comments
on the draft WIPP SEIS-II
Page 5 of 7

7) Page E-28

13 "ACCIDENTS" should be deleted from the header for E.4, since this section deals with accident-free transportation as well as with accidents.

8) Pages E-58 to E-68 (Section E.7)

14 Three assumptions that are probably conservative were made in the assessment of rail transportation impacts that make it difficult to meaningfully compare them with truck transportation impacts. First (page E-60), the same per-train accident rate is assumed for 3-car dedicated trains as for 70-car trains, resulting in relatively large estimated numbers of accidents and accident-related fatalities for shipment by dedicated train. The difficulty of coming up with a better estimate is acknowledged by the INEEL OP, and, as noted, the numbers can be reduced by enlarging the dedicated trains, but the inadequacy of these estimates should perhaps be emphasized. Second (page E-62), "the aggregate radiological impacts for rail transportation were assumed to be the same as those reported for truck..." This assumption may be overly conservative, because the probability of rail accidents (per shipment-kilometer) is likely less than that of truck accidents, and because average population density near rail lines may be lower than near highways. Third, the breach of two containers is modeled for the worst-case train accidents, while the breach of one container is modeled for the worst-case truck accidents.

9) Pages E-62 and E-63

15 In the bullet items, "...a breached TRUPACT-II..." or "...a breached RH-72B..." should be changed to "...two breached TRUPACT-IIs..." or "...two breached RH-72Bs..." to make it more clear that, as discussed on p. E-62, the breach of two containers was modeled in each case.

10) Page G-2, Second paragraph

16 The text states "Impacts from external dose pathway ... are not included in the impacts reported here." As defined by EPA 400 for emergency planning purposes, the plume phase of an accident includes the contribution from inhalation, ground surface deposition, and immersion or external exposure from the plume. To be consistent with the format of other EIS documents published by the DOE, we suggest including these pathways even if they are several orders of magnitude below the inhalation dose.

State of Idaho Comments
on the draft WIPP SEIS-II
Page 6 of 7

11) Page G-6, Section G.1.3

17 If the information is available, the final SEIS should include the estimated probability of the selected accident scenarios (e.g. probability of a beyond design basis earthquake with a given magnitude).

12) Page G-11, Section T2 (also Page G-15)

18 The final SEIS should include a reference and an explanation for the assumption that 60% of the particles released will plate out onto interior building surfaces.

13) Page G-11, Section T3 (also Page G-39)

19 The final SEIS should provide a reference and an explanation for the estimated airborne release fraction of 0.001 of the entire inventory. Also, four breaths appear to be a very short exposure duration for the estimated escape time for individuals exiting a collapsing building. Please provide the basis for this assumption.

14) Page G-18

20 Is E/Q equivalent to $\chi$/Q?

15) Page G-19

21 The final SEIS should describe the location of the nearest public access point for the maximally-exposed individual (MEI). Also, was INEEL-specific 95% annual meteorological data used to determine highest concentration factors?

16) Page G-21, Section G.2.4

22 The maximally impacted sector should be based on the highest $\chi$/Q for that particular area. Population weighted sectors produce the highest person-rem exposure used in determining latent cancer fatalities, but the MEI and nearest public access should be based on the highest annual average $\chi$/Q.



State of Idaho Comments
on the draft WIPP SEIS-II
Page 7 of 7

17) Page G-53, Section G.4.2

23 The impact from a waste box accident should also be described using a probability based on the number of waste boxes received, relative to the total number of shipments made to the facility.

Should you have any questions regarding these comments, please do not hesitate to contact me at (208) 373-0498.

Sincerely,

Kathleen E. Trever

Kathleen Trever
Coordinator-Manager

cc: Ann Dold, INEEL-OP Manager
Jeff Schrade, Special Assistant to the Governor
Brian Monson, Idaho DEQ

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF IDAHO

RECEIVED
OCT 17 1995
OFFICE OF THE ATTORNEY GENERAL

UNITED STATES COURTS
DISTRICT OF IDAHO

OCT 17 1995

8:34 A M. REC'D
LODGED FILED

Civil No. 91-0035-S-EJL
(Lead Case)

PUBLIC SERVICE COMPANY OF COLORADO,

Plaintiff,

v.

PHILIP E. BATT, individually and as Governor of the State of Idaho,

Defendant.

---

UNITED STATES OF AMERICA,

Plaintiff,

v.

PHILIP E. BATT, in his official capacity as Governor of the State of Idaho; STATE OF IDAHO,

Defendants.

Civil No. 91-0054-S-EJL

**JOINT MOTION FOR ENTRY OF CONSENT ORDER BASED ON SETTLEMENT AGREEMENT**

The parties have negotiated and executed a settlement agreement that resolves all issues in this action. Accordingly, the parties hereby jointly move for entry of a consent order that (1) incorporates the terms of the Settlement Agreement, (2) vacates all prior injunctions in this action except paragraph 4 of the Order entered December 23, 1993 and entitled Amended Order Modifying Order of June 28, 1993 and (3) administratively terminates this action, subject to continuing jurisdiction of the Court and the right of the parties to reopen the action for good cause.



The parties attach hereto the fully executed Settlement Agreement and a proposed consent order.

Respectfully submitted,

SCOTT L. CAMPBELL
WILLIAM G. DRYDEN
JEFFERY J. VENTRELLA
ELAM & BURKE, P.A.
Key Financial Center, 10th Floor
702 West Idaho Street
Post Office Box 1539
Boise, Idaho 83701
(208) 343-5454

Attorneys for Governor
PHILIP E. BATT

ALAN G. LANCE
Attorney General

CLIVE J. STRONG
Deputy Attorney General
Chief Natural Resources Division

C. NICHOLAS KREMA
KATHLEEN E. TREVER
Deputy Attorneys General
Natural Resources Division
Statehouse, Room 206
Boise, Idaho 83720
(208) 334-2400

Attorneys for State of Idaho

October 17, 1995

D. MARC HAWS
Assistant U.S. Attorney
P.O. Box 032
Boise, Idaho 83707
(208) 334-1211

DAVID F. SHUEY
CHARLES W. FINDLAY
ANN NAVARO
MARIA A. IIZUKA
Attorneys
Department of Justice
Environment and Natural Resources Division
P.O. Box 663
Washington, D.C. 20004-0663
(202) 272-6341\6960\8339
(916) 554-2800

Of Counsel:

ROBERT R. NORDHAUS
General Counsel
Department of Energy
Washington, D.C. 20585

STEVEN S. HONIGMAN
General Counsel
Department of the Navy
Washington, D.C. 20350-1000

Attorneys for United States

October 16, 1995

UNITED STATES COURTS
DISTRICT OF IDAHO

OCT 17 1995

M. REC'D
LOGGED and FILED

SETTLEMENT AGREEMENT

The State of Idaho, through the Attorney General Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0054-S-EJL (D. Id.):

**A. DEFINITIONS**

For purposes of this Agreement, the following definitions shall apply:

1. The "State" shall mean the State of Idaho and shall include the Governor of the State of Idaho and the Idaho State Attorney General.

2. The "federal parties" means U.S. Department of Energy (DOE) and the U.S. Department of the Navy (the Navy), including any successor agencies.

3. "Treat" shall be defined, as applied to a waste or spent fuel, as any method, technique, or process designed to change the physical or chemical character of the waste or fuel to render it less hazardous; safer to transport, store, dispose of; or reduce in volume.

4. "Transuranic waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

5. "One shipment of spent fuel" shall be defined as the transporting of a single shipping container of spent fuel.

6. "High-level waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

7. "DOE spent fuel" shall be defined as any spent fuel which DOE has the responsibility for managing with the exception of naval spent fuel and commercial spent fuel which DOE has accepted or will take title to pursuant to the Nuclear Waste Policy Act of 1982, 42 U.S.C. § 10101 et seq. or comparable statute.

8. "Naval spent fuel" shall be defined as any spent fuel





removed from naval reactors as a result of refueling overhauls (refueling) or defueling inactivations (defueling).

9. "Metric ton of spent fuel" shall be defined as a metric ton of heavy metal of spent fuel.

10. "Naval reactors" shall be defined as nuclear reactors used aboard naval warships (submarines, aircraft carriers, or cruisers), naval research or training vessels, or at land-based naval prototype facilities operated by the Naval Nuclear Propulsion Program for the purposes of research, development, or training.

11. "Calendar year" shall be defined as the year beginning on January 1, and ending on December 31.

12. "Mixed Waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

13. "EIS" shall be defined as the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Program Final Environmental Impact Statement issued April, 1995.

14. "ROD" shall be defined as the Record of Decision issued by DOE on June 1, 1995, concerning the EIS.

15. "INEL" shall be defined as the Idaho National Engineering Laboratory.

16. "Running Average" shall mean the total number of shipments of naval spent fuel to INEL, or transuranic waste from INEL, over any period of three years, divided by three.

17. The "Court" shall mean the United States District Court for the District of Idaho before which is pending Public Service Company of Colorado v. Batt, No. CV 91-0035-S-EJL and United States v. Batt, No. CV 91-0054-S-EJL, and any appellate court to which an appeal may be taken, or with which an application for a writ of certiorari may be filed, under applicable law.

**B. TRANSURANIC WASTE SHIPMENTS LEAVING IDAHO**

1. DOE shall ship all transuranic waste now located at INEL, currently estimated at 65,000 cubic meters in volume, to the Waste Isolation Pilot Plant (WIPP) or other such facility designated by DOE, by a target date of December 31, 2015, and in no event later than December 31, 2018. DOE shall meet the following interim deadlines:

a. The first shipments of transuranic waste from INEL to WIPP or other such facility designated by DOE shall begin by April 30, 1999.

b. By December 31, 2002, no fewer than 3,100 cubic meters (15,000 drum-equivalents) of transuranic waste shall have been shipped out of the State of Idaho.

c. After January 1, 2003, a running average of no fewer than 2,000 cubic meters per year shall be shipped out of the State of Idaho.

2. The sole remedy for failure by DOE to meet any of these deadlines or requirements shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1.

C. SPENT FUEL & HIGH-LEVEL WASTE SHIPMENTS LEAVING IDAHO

1. DOE shall remove all spent fuel, including naval spent fuel and Three Mile Island spent fuel from Idaho by January 1, 2035. Spent fuel being maintained for purposes of testing shall be excepted from removal, subject to the limitations of Section F.1 of this Agreement.

2. Until all of the aluminum-clad spent fuel then stored at INEL has been shipped to the Savannah River Site, the cumulative number of shipments of spent fuel from the Savannah River Site to INEL under Section D as of the end of any calendar year shall not exceed the cumulative number of shipments of aluminum-clad spent fuel from INEL to the Savannah River Site for the same period.

3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035.

D. SHIPMENTS OF SPENT FUEL TO INEL

The federal parties may transport shipments of spent fuel to INEL only in accordance with the following terms and conditions.

1. Shipments of naval spent fuel to INEL shall take place as follows:

a. The Navy may make only those shipments of naval spent fuel to INEL that are necessary to meet national security requirements to defuel or refuel nuclear powered submarines, surface warships, or naval prototype or training reactors, or to ensure examination of naval spent fuel from these sources. The





Secretary of Defense, upon notice to the Governor of the State of Idaho, shall certify the total number of such shipments of naval spent fuel required to be made through the year 2035.

b. The Navy shall not ship more than twenty four (24) shipments to INEL from the date of this Agreement through the end of 1995, no more than thirty six (36) shipments in 1996, and no more than twenty (20) shipments per year in calendar years 1997 through 2000. From calendar year 2001 through 2035, the Navy may ship a running average of no more than twenty (20) shipments per year to INEL. The total number of shipments of naval spent fuel to INEL through 2035 shall not exceed 575. Shipments of naval spent fuel to INEL through 2035 shall not exceed 55 metric tons of spent fuel.

c. Prior to January 1 of each calendar year through the year 2035, the Navy shall provide to Idaho an estimate of the number of shipments and the number of metric tons of naval spent fuel to be shipped during the following calendar year.

d. By January 31 of each calendar year, the Navy shall provide to Idaho the actual number of shipments and actual number of metric tons of naval spent fuel shipped during the preceding calendar year.

e. The naval spent fuel stored at INEL on the date of the opening of a permanent repository or interim storage facility shall be among the early shipments of spent fuel to the first permanent repository or interim storage facility.

f. The sole remedy for the Navy's failure to meet any of the deadlines or requirements set forth in this section shall be suspension of naval spent fuel shipments to INEL as set forth in Section K.1.

2. Shipments of DOE spent fuel to INEL shall take place as follows:

a. If DOE and the U.S. Department of State adopt a policy to accept spent fuel from foreign research reactors into the United States, DOE may send to INEL a maximum of 61 shipments of spent fuel from foreign research reactors during the period beginning on the date such a policy is adopted and ending on December 31, 2000. The Secretary of Energy, upon notice to the Governor of the State of Idaho, must certify that these shipments are necessary to meet national security and nonproliferation requirements. Upon such certification, DOE may ship not more than 10 such shipments from the date such policy is adopted through December 31, 1996, not more than 20 such shipments from the date the policy is adopted through December 31, 1997, and not more than 40 such shipments from the date the policy is adopted

through December 31, 1998.

b. Until such time as a permanent repository or interim storage facility for storage or disposal of spent fuel, located outside of Idaho, is operating and accepting shipments of spent fuel from INEL, DOE shall be limited to shipments of spent fuel to INEL as set forth in Sections D.2.a., c., d., e., and f. After a permanent repository or interim storage facility is operating and accepting shipments of spent fuel from INEL, the State of Idaho and DOE may negotiate and reach agreement concerning the timing and number of shipments of DOE spent fuel that may be sent to INEL, in addition to those otherwise permitted under this Section D.2., for preparation for storage or disposal outside the State of Idaho.

c. After December 31, 2000, DOE may transport shipments of spent fuel to INEL constituting a total of no more than 55 metric tons of DOE spent fuel (equivalent to approximately 497 truck shipments) and subject to the limitations set forth in Sections D.2.e., f., g., and h. below, except that the limitations of Section D.2.a. above will not apply.

d. No shipments of spent fuel shall be made to INEL from Fort St. Vrain, unless a permanent repository or interim storage facility for spent fuel located outside of Idaho has opened and is accepting spent fuel from INEL, in which case such shipments may be made for the purpose of treating spent fuel to make it suitable for disposal or storage in such a repository or facility. Shipments of spent fuel from Fort St. Vrain shall remain at INEL only for a period of time sufficient to allow treatment for disposal or storage in such a repository or facility. The total number of Fort St. Vrain shipments shall not exceed 244, constituting no more than sixteen (16) metric tons of spent fuel, and shall be in addition to those allowed under Section D.2.c. above.

e. Except as set forth in Section D.2.d. above, DOE will make no shipments of spent fuel from commercial nuclear power plants to INEL.

f. After December 31, 2000, and until an interim storage facility or permanent repository is opened and accepting spent fuel from INEL, DOE shall not ship to INEL more than 20 truck shipments of spent fuel in any calendar year, except that:

(i) In one calendar year only, DOE may make not more than 83 truck shipments of spent fuel to INEL from the West Valley Demonstration Project;

(ii) DOE may not make more than 13 truck shipments in any of the nine calendar years succeeding the





shipment of the West Valley Demonstration Project spent fuel to INEL; and

(iii) Shipments DOE is entitled to make to INEL in any calendar year, but has not made, may be shipped in any subsequent calendar year, notwithstanding the limitations in this Section D.2.f. on the number of shipments per year.

For purposes of this section and Section D.2.c., in determining the number of truck shipments, one rail shipment shall be deemed equivalent to 10 truck shipments, except that in the case of shipments from West Valley Demonstration Project, seven rail shipments shall be deemed to be equal to 83 truck shipments. DOE may elect to make rail shipments in lieu of truck shipments, in accordance with this conversion formula and subject to other limitations of this section.

g. Prior to January 1 of each calendar year through the year 2035, DOE shall provide to Idaho an estimate of the number of shipments and the number of metric tons of DOE spent fuel to be shipped during the following calendar year.

h. No later than January 31st of each calendar year, DOE shall provide to Idaho the actual number of shipments and actual number of metric tons of DOE spent fuel shipped during the preceding year.

i. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1.

**E. TREATMENT & TRANSFER OF EXISTING WASTES AT INEL**

1. **Treatment Commitment.** DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho.

2. **Mixed Waste Treatment Facility.** DOE shall, as soon as practicable, commence the procurement of a treatment facility ("Facility") at INEL for the treatment of mixed waste, transuranic waste and alpha-emitting mixed low-level waste ("Treatable Waste"). DOE shall execute a procurement contract for the Facility by June 1, 1997, complete construction of the Facility by December 31, 2002, and commence operation of the Facility by March 31, 2003. Commencement of construction is contingent upon Idaho approving necessary permits.

a. **Treatment of Non-INEL Wastes.** Any and all Treatable Waste shipped into the State of Idaho for treatment at the Facility shall be treated within six months of receipt at the Facility, with the exception of two cubic meters of low-level mixed waste from the Mare Island Naval Shipyard which will complete base closure for nuclear work in 1996. DOE may request an exception to the six month time period on a case-by-case basis, considering factors at the shipping site such as health and safety concerns, insufficient permitted storage capacity, and base or site closures. Any transuranic waste received from another site for treatment at the INEL shall be shipped outside of Idaho for storage or disposal within six months following treatment. DOE shall continue to use the Federal Facility Compliance Act process, as facilitated by the National Governors' Association, to determine what locations are suitable for mixed low-level waste treatment and storage.

3. **Operation of High-Level Waste Evaporator.** DOE shall commence operation of the high-level waste evaporator by October 31, 1996, and operate the evaporator in such a manner as to reduce the tank farm liquid waste volume by no fewer than 330,000 gallons by December 31, 1997. Efforts will continue to reduce the remaining volume of the tank farm liquid waste by operation of the high-level waste evaporator.

4. **Calcination of Remaining Non-Sodium Bearing Liquid Wastes.** DOE shall complete the process of calcining all remaining non-sodium bearing liquid high-level wastes currently located at INEL by June 30, 1998.

5. **Calcination of Sodium-Bearing Wastes.** DOE shall commence calcination of sodium-bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012.

6. **Treatment of Calcined Wastes.** DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside Idaho. To support this effort, DOE shall solicit proposals for feasibility studies by July 1, 1997. By December 31, 1999, DOE shall commence negotiating a plan and schedule with the State of Idaho for calcined waste treatment. The plan and schedule shall provide for completion of the treatment of all calcined waste located at INEL by a date established by the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste. Such Record of Decision shall be issued not later than December 31, 2009. It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035. The State





expressly reserves its right to seek appropriate relief from the Court in the event that the date established in the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste is significantly later than DOE's target date. In support of the effort to treat such waste, DOE shall submit to the State of Idaho its application for a RCRA (or statutory equivalent) Part B permit by December 1, 2012.

7. **Transfer of Three Mile Island Fuel.** DOE shall complete construction of the Three Mile Island dry storage facility by December 31, 1998. DOE shall commence moving fuel into the facility by March 31, 1999, and shall complete moving fuel into the facility by June 1, 2001.

8. **Transfer out of Wet Storage.** By December 31, 1999, DOE shall commence negotiating a schedule with the State of Idaho for the transfer of all spent fuel at INEL out of wet storage facilities. DOE shall complete the transfer of all spent fuel from wet storage facilities at INEL by December 31, 2023. If DOE determines that transfer to dry storage of any portion of such spent fuel is technically infeasible, or that transfer to such dry storage presents significantly greater safety or environmental risks than keeping the fuel in wet storage, DOE shall inform the State and propose a later date or alternative action. If the State does not agree to such later date or alternative action, DOE may apply to the Court for appropriate relief. DOE shall, after consultation with the State of Idaho, determine the location of the dry storage facilities within INEL, which shall, to the extent technically feasible, be at a point removed from above the Snake River Plain Aquifer ("Aquifer").

9. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipment to INEL as set forth in Section K.1.

F. SPENT FUEL PROGRAM

1. **Establishment of INEL as DOE Spent Fuel Lead Laboratory.** DOE shall, within thirty days of entry of this Agreement as a court order, designate INEL as the Department's lead laboratory for spent fuel. DOE shall direct the research, development and testing of treatment, shipment and disposal technologies for all DOE spent fuel, and all such DOE activities shall be coordinated and integrated under the direction of the Manager, DOE-Idaho Operations Office. Such designation shall not permit the shipment to INEL of any spent fuel beyond that permitted by this Agreement with the exception that quantities of spent fuel brought to INEL for testing in excess of those

permitted by this Agreement shall leave the State of Idaho within five years of the date of receipt at INEL.

2. **Construction of Dry Storage.** DOE shall include in its appropriation request for federal fiscal year 1998 to the Executive Office of the President funds necessary for DOE to initiate the procurement of dry storage at INEL to replace wet, below ground facilities. Spent fuel loading into dry storage shall commence by July 1, 2003.

3. **Funding for Dry Cell Expansion Project.** The Naval Nuclear Propulsion Program shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 funds necessary for the Dry Cell Expansion Project ("Project") at the Expended Core Facility at the Naval Reactors Facility to accommodate removal of excess material and examination of naval spent fuel in a dry condition. The Project shall commence as soon as Idaho issues the required permit under the Clean Air Act and funding is appropriated. Completion of this project shall result in the expenditure of approximately $26 million dollars over the next five years.

4. **Multi-Purpose Canisters.** DOE and the Navy shall employ Multi-Purpose Canisters ("MPCs") or comparable systems to prepare spent fuel located at INEL for shipment and ultimate disposal of such fuel outside Idaho. Procurement shall be performed in accordance with the Federal Acquisition Regulation which ensures that companies in Idaho will have opportunity to bid on and obtain any competitive contracts for such work. The Record of Decision on the NEPA analysis shall be completed by April 30, 1999.

5. **ECF Hot Cell Facility Upgrade.** The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds necessary to proceed with upgrades which shall require approximately $12 million of expenditures during the next three years.

6. **ECF Dry Storage Container Loading Station.** The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds necessary to proceed with design and construction of a dry storage container loading station at ECF. This project shall require no less than $20 million of expenditures during the next five years.

7. **Funding for Discretionary Environmental Remediation Work at the Naval Reactors Facility.** The Naval Nuclear Propulsion Program shall undertake environmental remediation efforts at the Naval Reactors Facility totaling approximately $45





million over the next five years.

8. **Water Pool Reracking.** DOE may proceed with installing new racks into the water pool in the building at the Idaho Chemical Processing Plant Facility currently holding naval spent fuel to provide enhanced capability for spent fuel storage in the existing water pool space until dry storage can be made available. Installation of the new racks may commence as soon as Idaho issues the necessary permit under the Clean Air Act. Idaho shall issue said permit within 180 days after DOE re-submits its application to Idaho.

## G. INEL ENVIRONMENTAL RESTORATION PROGRAM

1. **INEL Environmental Restoration Program to Continue.** DOE shall continue to implement the INEL environmental restoration program in coordination with Idaho and EPA. Such implementation shall be consistent with the schedules contained in the Federal Facilities Agreement and Consent Order (FFA/CO) entered into with the State of Idaho, EPA and DOE, and it shall include schedule requirements developed pursuant to the completed and future Records of Decision under the FFA/CO. The sole remedies for failure to implement the environmental restoration activities specified in the FFA/CO shall be those specified in the FFA/CO.

## H. OBTAINING TIMELY FEDERAL FUNDING FOR COMPLIANCE WITH THIS ORDER

1. **Compliance Funding.** DOE and the Naval Nuclear Propulsion Program shall share budget information concerning INEL with Idaho prior to submitting the budget request to the Executive Office of the President. Consultations with the State of Idaho shall continue throughout the budget process. The current DOE estimate for the costs of the activities and projects described in Sections A through G over the next five years is approximately $200 million above established budget targets.

## I. FEDERAL FUNDS FOR THIS SETTLEMENT AGREEMENT

1. DOE shall provide to the State of Idaho beginning in federal fiscal year 1996 and continuing through 1997-2000, a total amount of $30 million for community transition purposes and any other purposes that are mutually acceptable to the parties, such as the non-Federal development of Boron Neutron Capture Therapy and Radiological Toxicology technology in Idaho.

2. **Acoustic Research Funding.** The Navy shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 no less than $7 million for the Navy to construct a Ships Model Engineering and Support Facility at the Naval Surface Warfare Center, Carderock Division, Acoustic Research Detachment at Bayview, Idaho.

J. GOOD FAITH COMPLIANCE & AFFIRMATIVE SUPPORT

1. The federal parties and Idaho agree that the activities to be performed under this Agreement and the subsequent Consent Order are in the public interest. The federal parties and Idaho acknowledge the complexity of this Agreement and have agreed to act in good faith to effectuate its fulfillment. The federal parties and Idaho shall affirmatively support this Agreement and its terms, conditions, rights and obligations in any administrative or judicial proceeding. The federal parties and Idaho intend to seek a sense of the Congress resolution expressing support for the terms, conditions, rights and obligations contained in this Agreement and the subsequent Consent Order and recommending to future Congresses that funds requested by the President to carry out this Agreement be appropriated. In any administrative or judicial proceeding, Idaho shall support the adequacy of the EIS and ROD against any challenges by third parties. Idaho shall have the ability, in its sole discretion, to waive performance by the federal parties of any terms, conditions and obligations contained in this Agreement.

2. Idaho shall promptly issue, upon submission of legally sufficient applications, all permits, licenses or other approvals needed by the DOE, the Navy or the Naval Nuclear Propulsion Program for the performance of any of their respective obligations set forth in this Agreement.

3. No provision of this Agreement shall compel any party to act without due legal authority. Performance by every party under this Agreement shall be subject to and comply with all applicable federal statutes, regulations and orders, including the Anti-Deficiency Act. The inability of any party to comply with the provisions of this Agreement, or a delay in such compliance, as a result of any applicable federal statute, regulation or order shall not subject that party to judicial enforcement under Section K.2.a, but shall not preclude the application of Sections K.1.a. or K.1.b.

4. In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to conform the action in





the Agreement to that selected action. Approval of such modification shall not be unreasonably withheld. If the State refuses to accept the requested modification, DOE or the Navy may seek relief from the Court. On motion of any party, the Court may extend the time for DOE or the Navy to perform until the Court has decided whether to grant relief. If the Court determines that the State has unreasonably withheld approval, the Agreement shall be conformed to the selected action. If the Court determines that the State has reasonably withheld approval, the time for DOE or the Navy to perform the action at issue shall be as set forth in this Agreement and subject to enforcement as set forth section in Section K.1.

5. **Effect of Certain Court Orders.**

a. **Navy.** In the event that a court order is entered in the case of Snake River Alliance Education Fund v. United States Department of Energy, No. CV-95-0331-S-EJL (D. Idaho), or in any other judicial proceeding, that prohibits in whole or in part any shipment of spent fuel to INEL by the Navy under section D, then all obligations, requirements and deadlines of the federal parties under this Agreement shall be suspended during the period of applicability of the order. Upon the vacating, dissolving or reversing of any such order, the obligations, deadlines and requirements provided for in this Agreement shall be extended by a period that corresponds to their period of suspension.

b. **DOE.** In the event that a court order is entered in the case of Snake River Alliance Education Fund v. United States Department of Energy, No. CV-95-0331-S-EJL (D. Idaho), or in any other judicial proceeding, that prohibits in whole or in part any shipment of spent fuel to INEL by DOE under section D, then the DOE has the option to suspend all DOE shipments to INEL and suspend all of DOE's obligations, requirements and deadlines under this Agreement during the period of applicability of the order. If DOE exercises this option, then upon the vacating, dissolving, or reversing of any such order, DOE's obligations, deadlines and requirements provided for in this Agreement shall be extended by a period that corresponds to their period of suspension.

K. ENFORCEMENT

1. **Suspension of Shipments.**

a. **DOE.** If DOE fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of DOE spent fuel to INEL

shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.

b. **Navy.** If the Navy or the Naval Nuclear Propulsion Program fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of Navy spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.

2. **Other Enforcement**

a. **Judicial Enforcement.** The Court may enforce the rights, obligations and requirements assigned by this Agreement, other than those exclusively enforceable under Section K.1., pursuant to all legal and equitable remedies available to the courts of the United States, including, but not limited to, use of the Court's contempt powers.

b. **RCRA Enforcement.** Nothing in this Agreement shall prohibit the State of Idaho from requiring necessary remedial actions as set forth in the Resource Conservation and Recovery Act, 42 U.S.C. section 6929 ("RCRA") (or statutory equivalent), including penalty and fine procedures, the sums of which shall be payable to the State of Idaho.

c. **Payment Obligation.** In the event that the federal parties do not carry out the requirement that all spent fuel located at INEL be removed from Idaho by January 1, 2035, then subject to the availability of the appropriations provided in advance for this purpose, the federal parties shall pay to the State of Idaho $60,000 for each day such requirement has not been met.

3. **Prior Orders, Agreements and Decisions.** The terms of this Agreement shall supersede all rights, duties and obligations set forth in any prior orders, agreements or decisions entered in this litigation, captioned Public Service Company of Colorado v. Batt, and United States of America v. Batt, Nos. CV 91-0035-S-EJL and CV 91-0054-S-EJL, except for the provisions of paragraph 4 of the December 22, 1993 Court Order.

4. **Dispute Resolution.** In the event that any party to this Agreement contends that any other party has violated any terms of the Agreement, the parties shall seek to resolve their differences informally before asking for resolution by the Court.





L. CONSENT ORDER

1. The parties agree they shall jointly present this Agreement to the U.S. District Court with a proposed Consent Order which will provide for the incorporation of this Agreement, continuing jurisdiction of the Court and the administrative termination of this action without prejudice to the right of the parties to reopen the proceedings for good cause shown. This Agreement and Consent Order shall not preclude any party from applying to the Court under Rule 60, of the Federal Rules of Civil Procedure, or the Court from granting relief thereunder.

2. If the Consent Order is not entered by the Court, in accordance with Section L.1 above, within 45 days of lodging with the Court, then either party to this Agreement may elect to terminate this Agreement, in which case this Agreement becomes null and void, and of no force or effect.

For the Federal Parties:

Robert R. Nordhaus
General Counsel
Department of Energy

Thomas P. Grumbly
Assistant Secretary
for Environmental Management
Department of Energy

Steven S. Honigman
General Counsel
Department of the Navy

Admiral Bruce DeMars
Director, Naval Nuclear
Propulsion Program

For the State of Idaho:

Philip E. Batt
Governor, State
State of Idaho

Alan G. Lance
Attorney General,
State of Idaho



NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OFFICE OF THE SECRETARY
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-5950

Jennifer A. Salisbury
CABINET SECRETARY

February 27, 1997

Mr. Harold Johnson
NEPA Compliance Officer
U.S. Department of Energy
P.O. Box 9800
Albuquerque, New Mexico 87119

ATTN: **SEIS-II COMMENTS of the STATE of NEW MEXICO's RADIOACTIVE WASTE CONSULTATION TASK FORCE**

Dear Mr. Johnson:

On behalf of the N.M. Radioactive Waste Consultation Task Force (Task Force), I offer the following comments and recommendations on the *Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2, November 1996 (SEIS-II). The Department of Energy's (DOE) request for comments on the draft WIPP SEIS-II was noticed in the Federal Register of November 29, 1996, Vol. 61, No. 231, pps. 60690-60693; and February 3, 1997, Vol. 62, No. 22, pp. 4989. These written comments supplement oral testimony I presented at the SEIS-II public hearings in Santa Fe on January 9, 1997.

The Task Force, created by state statute in 1979, is composed of the Cabinet Secretaries of the Energy, Minerals and Natural Resources Department, Environment Department, Department of Health, Department of Public Safety, Taxation and Revenue Department, and the State Highway and Transportation Department. Included among its statutory duties, the Task Force negotiates on behalf of the State of New Mexico with the Federal Government "...in all areas relating to the siting, licensing and operation of new federal disposal facilities, including research, development and demonstration, for high-level radioactive wastes, transuranic radioactive wastes and low-level radioactive wastes." [Section 74-4A-7 New Mexico Statutes Annotated 1978] Hence, the WIPP Project falls within the purview of the Task Force.

GENERAL COMMENTS

1 The State of New Mexico's Radioactive Waste Consultation Task Force concurs in the DOE's Proposed Action, *i.e.* to continue with the phased development of WIPP by disposing of transuranic (TRU) waste at the facility. We believe this alternative is clearly preferable in comparison to the other options when considering the full spectrum of potential near- and long-term environmental consequences. Our preference grows even stronger when comparing alternatives from a public health and safety perspective, taking into account postulated risks to the existing population as well as future generations.

1 Furthermore, it is our belief that the Proposed Action best meets the purpose and need for action as expressed in WIPP's enabling legislation (Public Law 96-164) and in the WIPP Land Withdrawal Act (Public Law 102-579, as amended). The decision-making process for selecting a preferred alternative simply cannot ignore the Congressionally mandated directive in these laws, namely that DOE pursue deep geologic disposal of defense TRU wastes. This directive has been confirmed and supported on a continuing basis since the project's inception, as evidenced by approximately 20 years of annual WIPP appropriations.

2 It is important to emphasize that the State's concurrence in the Proposed Action is necessarily conditioned on DOE demonstrating WIPP compliance with all applicable laws, regulations, and other requirements. This includes DOE meeting all of its commitments to the State of New Mexico--particularly those specified in the 1981 *Consultation and Cooperation Agreement* and the 1982 *Supplemental Stipulated Agreement Resolving Certain State Off-Site Concerns over WIPP*. All such requisite certifications and obligations must be assured before disposing of actual wastes at WIPP.

In reviewing how the facility has developed over the years and what lies ahead, it is evident that the WIPP Disposal Phase represents the most significant component of the project in terms of corresponding impacts on public health, worker safety, and the environment. Consequently, the decision on whether to proceed toward commencement of disposal operations at WIPP is essentially one of public responsibility and accountability. A decision to move forward with the project as currently proposed will initiate a unique federal endeavor of unprecedented dimensions. This becomes readily apparent in light of the long operational life, inherent complexity, substantial cumulative (life-cycle) cost, and far-reaching implications of WIPP's Disposal Phase in comparison to other, more conventional federal projects. Given these facts, DOE should closely

2 re-examine and, as appropriate, revise the draft to ensure the final SEIS-II identifies and assesses in a coherent, comprehensive fashion for all alternatives the full range of impacts in New Mexico, other affected states, and communities located along the transportation corridor.

SPECIFIC COMMENTS

**Chapter 1--Introduction**

3 Page 1-1: The footnote at the bottom of the page should read: "...WIPP could begin disposal operations in November 1997, as encouraged in Public Law 104-201, *provided* the DOE receives all regulatory approvals by that date."

4 Page 1-2, Table 1-1: Neither this table nor the corresponding text provides a source for the DOE TRU waste volumes listed.

5 Page 1-7: In the last bullet (*Changes in the Status of Relevant Regulations*) of the section discussing the need for a second Supplemental Environmental Impact Statement, there is mention of Presidential Executive Order 12856--Federal Compliance with Right-to-Know





5 Laws and Pollution Prevention Requirements. DOE should similarly include a reference to Presidential Executive Order 12898 of February 11, 1994--Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

6 Page 1-8: The two sections that discuss the Compliance Certification Application and the Resource Conservation and Recovery Act (RCRA) Part B Permit Application should be expanded to provide a more in-depth explanation of how these major compliance documents relate to the SEIS-II. Specifically, key assumptions taken from each application and used in the SEIS-II should be identified and discussed to the extent practicable. In addition, the discussion on the RCRA Part B application should clarify that the N.M. Environment Department is the regulatory agency; and that the N.M. Hazardous Waste Act and its implementing regulations is the State analog to the federal RCRA.

7 Page 1-12: In the section entitled *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement*, it is strongly recommended DOE include a discussion of its court-sanctioned agreement with the State of Idaho. [Reference: 1995 Settlement Agreement, *United States of America* v. *Philip E. Batt*, Civil No. 91-0054-S-EJL, filed October 17, 1995 in the U.S. Court for the District of Idaho] This agreement has significant implications for WIPP, particularly in terms of shipment scheduling and the treatment of TRU waste destined for disposal at the repository.

**Chapter 2--Background Information**

8 Page 2-1: Include here in the discussion of *Defense TRU Waste* (and/or other appropriate sections of the document) a reference to the September 9, 1996 Memorandum from DOE General Counsel Robert Nordhaus, entitled "Interpretation of the Term 'Atomic Energy Defense Activities' as used in the Waste Isolation Pilot Plant Land Withdrawal Act."

9 Page 2-3: In the discussion of *TRU Waste Transportation Packaging*, there is no mention of "Type A" containers such as carbon steel 55-gallon drums, standard waste boxes, or 10-drum overpacks that will be emplaced in TRUPACTs. These packagings, while less robust than "Type B" containers, nevertheless represent the first line of defense to contain WIPP TRU waste and should therefore be addressed. In addition, it is recommended that the "Pipe Overpact" (which is intended to be used for higher fissile gram-equivalent plutonium residues) be discussed in relatively explicit detail here or elsewhere in the SEIS-II.

10 Page 2-6: Neither the section starting here (*Waste Management at the Generator-Storage Sites*) nor Appendix B (*Summary of the Draft Waste Management Programmatic Environmental Impact Statement*) provides clear, concise information regarding existing/planned waste treatment capabilities at major sites within the DOE weapons complex. Such relevant information (or references thereto) should be included.

11 Page 2-15: This section (*Treatment to Meet Planning-Basis WAC*) should be clarified by specifically identifying or presenting in summary form the full range of potential treatment options available. The current discussion appears to reference only the removal or solidification of residual liquids and packaging/segregation alternatives.

**Chapter 3--Description of the Proposed Action and Alternatives**

Based on public testimony at the SEIS-II hearings in New Mexico, it is apparent much confusion surrounds the CH- and RH-TRU disposal volume assumptions used in assessing impacts of the various alternatives. The section pertaining to the Proposed Action (Section 3.1, pp. 3-2) states: "...SEIS-II analyses were performed using the disposal volumes of 168,500 cubic meters (5,950,000 cubic feet) for CH-TRU waste (greater than the CH-TRU Basic Inventory) and 7,080 cubic meters (250,000 cubic feet) of RH-TRU waste (much less than the RH-TRU Basic Inventory) allowed by the WIPP Land Withdrawal Act and the Consultation and Cooperation Agreement with the State of New Mexico." Conversely, under Action Alternatives 1, 2, and 3 (Section 3.2.1, pp. 3-4), WIPP would accept <u>all</u> TRU waste for disposal, which would include the Basic Inventory and Additional Inventory. Hence, in the case of the Proposed Action, currently applicable laws and agreements determine the waste volume caps to be used in the analyses. Yet for the other Action Alternatives, existing limits were not applied.

12

While such an approach may assist in ensuring bounding analyses of maximum, reasonably foreseeable impacts, this is not clearly articulated in the text. Every effort should be made to explain and emphasize to the reader how implementation of any of the Action Alternatives would require changes to legally binding laws and agreements now in existence. It is also recommended that DOE include the statutory/regulatory citation for its claim that "...under NEPA, DOE is required to consider reasonable alternatives even if they are in conflict with existing law." (Section 3.2.1, pp. 3-14)

13 Page 3-2: Under the Proposed Action, DOE states that all waste in the Basic Inventory "...would first be treated at the 20 sites as necessary to meet planning-basis WAC, and then consolidated at the 10 largest generator-storage sites to await shipment by truck to WIPP for disposal." DOE officials have indicated to us in recent months that the National Transuranic Waste Program is re-considering such waste consolidation at the 10 major generator-storage facilities and may ship wastes from most small quantity sites (SQS) directly to WIPP. The analyses in the SEIS-II should reflect DOE's current plans with respect to SQS shipments.

14 Page 3-5: In this section (*Activities at the Generator-Storage Sites*), the following statement is made: "The 20 generator-storage sites would ship CH-TRU waste to the 10 generator-storage sites for consolidation and subsequent shipment to WIPP." However, half of those 20 generator-storage sites are the 10 major sites referred to here. Only 8 SQS sites would ship CH-TRU waste to major DOE sites under the Proposed Action. Similarly,





14 only 3 SQS sites would ship RH-TRU to major sites. This should be clarified and corrected in the final.

Page 3-7: The discussions in Sections 3.1.2 (*Transportation Activities*) and 3.1.2.1 (*Shipping Procedures*) do not include any mention of the considerable safety precautions being jointly instituted for all WIPP shipments by DOE, affected states and Indian tribes. These transport safety precautions, which include accident prevention measures as well as those for emergency response, are specified in the Western Governors' Association (WGA) *WIPP Transportation Safety Program Implementation Guide*. The major elements of this cooperative program are as follows:

15

- Accident Prevention
  - High-Quality Drivers and Carrier Compliance
  - Independent Mechanical/Radiological Inspections of Shipments
  - Bad Weather and Road Conditions
  - Safe Parking during Abnormal Conditions
  - Advance Notice and Monitoring of Shipments
- Emergency Response
  - Mutual Aid Agreements
  - Plans, Guidance and Procedures
  - Training, Drills and Exercises
  - Medical Emergency Preparedness
  - Equipment and Supplies
- Public Outreach and Participation

Significantly, the principles and procedures presented in the WGA *Guide* are endorsed in a document entitled "Memorandum of Agreement between the Western States and U.S. Department of Energy: Regional Protocol for the Safe Transport of Transuranic Waste to the WIPP." This Agreement was unanimously approved by the Western Governors on December 1, 1995, and signed by former DOE Secretary Hazel O'Leary in March 1996. At a minimum, the Agreement and *Guide* should be referenced and briefly discussed in the final SEIS-II.

16 In reviewing the transportation-related sections of the draft, we noted there was virtually no mention of relevant DOE Orders. This should be corrected by including references to at least the following directives in the transportation and other appropriate sections of the final SEIS-II:

DOE Order 151.1--Comprehensive Emergency Management System
DOE Order 425.1--Startup and Restart of Nuclear Facilities
DOE Order 460.2--Departmental Materials Transportation and Packaging Management
DOE Order 5632.1C--Protection and Control of Safeguards and Security Interests
DOE Order 5820.2A--Radioactive Waste Management

17 Page 3-19, Text Box: As stated here, the Action Alternatives examined in the SEIS-II "...have waste disposal periods that are much different from the 35-year disposal period of the Proposed Action. Action Alternative 1, all of the Action Alternative 2 subalternatives, and Action Alternative 3 have 160-, 150-, and 190-year disposal periods, respectively." Even though the reasons for these long disposal time frames are identified and discussed in some detail, we question whether the resulting scenarios represent practical alternatives to the Proposed Action. It is difficult enough to envision a 35-year disposal phase--much less operations that extend over periods approaching 200 years.

**Chapter 4--Description of the Affected Environments**

18 Page 4-5: It is recommended that DOE specifically reference its WIPP Memorandum of Understanding (MOU) with the U.S. Interior Department's Bureau of Land Management, included as Appendix C of the *WIPP Land Management Plan*, DOE/WIPP 93-004. This MOU is one of the key mechanisms for protecting the site from inadvertent human intrusion (*e.g.*, drilling for oil/gas resources).

19 Page 4-26: Section 4.1.6 (*Socioeconomic Environment*) should be expanded to provide population, income, poverty, housing, employment and other available socioeconomic characteristics by community for at least the cities of Artesia, Carlsbad, Eunice, Hobbs, and Loving. In addition, the final SEIS-II should include a more in-depth discussion of the tourism-based economy of the region, with particular attention focused on Carlsbad Caverns National Park.

20 Page 4-34: The narrative for each DOE site in this section (*Existing Environment at the Ten Major Generator Sites*) should note the total number of Solid Waste Management Units identified to date; and identify the locations of key TRU waste management facilities.

**Chapter 5--Environmental Impacts**

21 Page 5-3: In general, we are satisfied with the impact analyses presented in this section (*Impacts of the Proposed Action*). Based on our review of these analyses, it appears the results presented are comprehensive and credible. Moreover, the results indicate that the Proposed Action is the clear choice among the action alternatives based on the collective estimated impacts of all consequence categories (*i.e.*, human health, transportation, socioeconomics, etc.). For example, according to analyses presented in the draft SEIS-II, implementation of the Proposed Action could result in 76 truck accidents (non-radiological) resulting in 48 injuries and 6 fatalities over WIPP's 35-year operational life. Yet for the other Action Alternatives, the range of postulated results is as follows: 107-331 truck accidents resulting in 66-208 injuries and 9-25 fatalities. Overall, the Proposed Action compares favorably to the others in terms of potential environmental impacts.





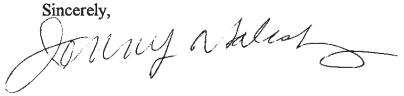
22 Page 5-17: We commend DOE for including this Text Box (*Estimating Radiological Impacts*). Because the estimation of potential human health impacts from radiation dose is often misunderstood by the general public, inclusion of this type of information is an excellent idea and welcomed addition. It is recommended that this Text Box be referenced in each section and table of the final SEIS-II that predominantly addresses such radiological impacts. Similarly, the Text Box on Understanding Scientific and Exponential Notation (pp. 5-18) should be referenced in SEIS-II tables where such notation is used.

**Appendix E--Transportation**

23 In our scoping comments for DOE's use in preparing the draft SEIS-II, dated October 31, 1995, we strongly recommended a thorough discussion of the analyses and finding contained in the report entitled *Comparative Study of Waste Isolation Pilot Plant (WIPP) Transportation Alternatives*, DOE/WIPP 93-058, February 1994. Our position, as stated in those comments, was that "...the WIPP SEIS-II should, at a minimum, reference and build upon the key comparative risk assessments and conclusions..." from the DOE study cited above. In reviewing this appendix and other transportation-related sections of the SEIS-II, it is apparent our recommendation has been implemented. We thank DOE for this and believe it has resulted in a more comprehensive, useful assessment of potential transport impacts.

Thank you for the opportunity to comment on the draft WIPP SEIS-II. The State of New Mexico remains committed to working with DOE and its contractors in the spirit of cooperation to ensure the safe management, storage and disposal of defense TRU waste.

Sincerely,



Jennifer A. Salisbury
Cabinet Secretary and Chair
N.M. Radioactive Waste Consultation Task Force

c: Governor Gary E. Johnson
Task Force Cabinet Secretaries
John Chavez, N.M. Taxation and Revenue Department
Pete Rahn, N.M. State Highway and Transportation Department
Alex Valdez, N.M. Department of Health
Mark Weidler, N.M. Environment Department
Darren White, N.M. Department of Public Safety

BOB MILLER
*Governor*

STATE OF NEVADA

JOHN P. COMEAUX
*Director*

**DEPARTMENT OF ADMINISTRATION**
**Capitol Complex**
**Carson City, Nevada 89710**
**Fax (702) 687-3983**
**(702) 687-4065**

February 27, 1997

Harold Johnson
NEPA Compliance Officer
Attn: SEIS-II Comments
P.O. Box 9800
Albuquerque, NM 87119

Re: SAI NV # E1997-060

Project: DRAFT SUPPLEMENTAL EIS -- Waste Isolation Pilot Plant Disposal Phase

Dear Mr. Johnson:

Enclosed are the comments from the Nevada Department of Transportation concerning the above referenced project. These comments constitute the State Clearinghouse review of this proposal as per Executive Order 12372. Please address these comments or concerns in your final decision. If you have any questions please contact me at (702) 687-6382 or Julie Butler, Clearinghouse Coordinator/SPOC, at (702) 687-6367.

Sincerely,

Terri Rodefer, Environmental Advocate
Nevada State Clearinghouse

Enclosure



STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 S. Stewart Street
Carson City, Nevada 89712

BOB MILLER, *Governor*

January 15, 1997

TOM STEPHENS, P.E., *Director*

In Reply Refer to:

JULIE BUTLER COORDINATOR
NEVADA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
BUDGET DIVISION
BLASDEL BUILDING ROOM 204
CARSON CITY NV 89710

PSD 7.01

Dear Ms. Butler:

The Nevada Department of Transportation has reviewed the project titled Project: DRAFT SUPPLEMENTAL EIS--Waste Isolation Pilot Plant Disposal Phase SAI# E1997-060.

Based on the information submitted, we have the following comments on the proposed projects.

1 Relevant to the SEIS-II Fact Sheet. Both Nevada and California will have the longest non-Interstate highway sections sustaining transport of Transuranic Waste, but have no schedule hearings within their states for public involvement.

Thank you for the opportunity to review this project.

Sincerely,

Thomas J. Fronapfel, P.E.
Assistant Director
Planning

TJF:PAF:dg

December 13 , 1996

Vernon J. Brechin
255 S. Rengstorff Ave. #49
Mountain View, CA 94040-1734
(415) 961-5123

Harold Johnson - NEPA Document Manager
Attn: SEIS comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Harold Johnson:

The following comments are my response to the "Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement," (Draft WIPP SEIS-II) November 1996 (DOE/EIS-0026-S-2).

The DOE has frequently presented quantity data in terms which are inconsistent from one waste category to another waste category. In response to public complaints, the DOE has attempted to create more uniformity in the ways that waste quantities are expressed. A further increase in the engineering units consistency, used to express the quantities of waste stream components, would aid the public's ability to understand, and analyze, the information contained in the WIPP SEIS.

My specific suggestion involves Table A-23: Radionuclide Inventories (Ci) for Stored CH-TRU Waste in 1995, and Table A-24: Radionuclide Inventories (Ci) for Stored RH-TRU Waste in 1995. These two tables appear on page 34 (A-34)
and page 36 (A-36), respectively, in Appendix A: Waste Inventory. They appear in subsection A.4.1: Inventory Information in 1995, which is under section A.4: Radionuclide Inventory.

1 My suggestion is that the Final WIPP SEIS should contain two new tables that would be labeled;
Table A-23b: Radionuclide Inventories (grams) for Stored CH-TRU Waste in 1995;
Table A-24b: Radionuclide Inventories (grams) for Stored RH-TRU Waste in 1995.

The original tables could then be given Table A-23a and Table A-23a designations.

1 Since the tables and text that describe the hazardous components of waste categories express these quantities in terms of their mass, it would be useful to have the radionuclide quantities expressed in terms of the mass, as well as in terms of the radioactivity level.

Producing additional tables, which indicate the mass of the radionuclides, would be very simple. It would only require that the Curie value, for each listed isotope, be divided by the specific activity factor (Curies/gram) for that isotope. Of course, like the original tables, these quantities represent the amounts present on December 31, 1995.





To summarize, it would be useful to have the radionuclide inventory quantities expressed in the same engineering unit terms as the hazardous waste components. The radioactivity level data should be retained despite the addition of limited amounts of radionuclide mass data.

Sincerely,

Vernon J. Brechin

Vernon J. Brechin

cc. Arjun Makhijani, Ph.D. - President, IEER, Takoma Park, MD
Don Hancock - Director, Southwest Research and Information Center, Albuquerque, NM

## Comment C-002

Author: Keith Marlow <kwmarlow@highfiber.com> at ~internet
Date: 12/30/96 12:30 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP Opening
---------- Message Contents ----------

This is in response to your advertisement in the Albuquerque Journal of 29 December 1996.

1 There have been more than enough studies, public hearings and comments about WIPP. The use of WIPP will be safer than temporary storage. Let's get on with it and use WIPP for what it was intended.

Keith W. Marlow

## Comment C-003

Author: HigTew@aol.com at ~internet
Date: 1/2/97 9:14 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: RE:WIPP
---------- Message Contents ----------

1 The US Dept. of Energy should NOT, I repeat NOT, as in N-O-T dispose of defense-generated transuranic radioactive waste near Carlsbad, New Mexico. Keep the damn stuff in Los Alamos.

Alexis Higginbotham
Archie tew

## Comment C-004

Author: "James Kent Sprinkle Jr." <sprinkle@nis5.lanl.gov> at ~internet
Date: 1/6/97 6:06 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject:
---------- Message Contents ----------

1 | The US DOE should open WIPP and use it. Nearly anything is better than the present above ground outside storage. The salt domes are one of the safest options, both from the view of protecting the waste from persons of ill intent and protecting persons from the hazards associated with this waste.

Jim Sprinkle

James K. Sprinkle Jr.
Safeguards Science & Technology Group
Los Alamos National Laboratory
Phone: (505) 667-4181
FAX: (505) 665-5910
email: jsprinkle@lanl.gov
ms E540
Los Alamos, NM 87544
USA

## Comment C-005

Author: GZSN30A@prodigy.com (MR LEN L KUNKO) at ~internet
Date: 1/6/97 9:46 AM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Opening of WIPP Site
---------- Message Contents ----------

1 | Open the site if:
1. DOE has done their job and the WIPP site is indeed safe.
2. Low-level waste only will be stored.
3. Adequate roadways will be built.

Comments:
1. I think you already know what kind of input you will get at your public hearings. Special interest groups who think anything nuclear is bad do not speak for the majority.
2. A lot of tax payer money is being spent each month to maintain WIPP. Use it if its safe or close it down!!

Len and Jeanne Kunko
Roswell NM 88201

## Comment C-006

Author: tadolini@ix.netcom.com (Stephen C. Tadolini) at ~internet
Date: 1/5/97 4:00 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Comment on SEIS II
---------- Message Contents ----------

To Whom It Concerns:

I have had the priveldedge of examing the WIPP facility as a member of the oversite committee that examined ground stability. Without question, this is one of the safest underground facilities that I have ever examined. Additionally, the series of safety procedures and checks and balances exceeded all of my expectations, personally and professionally.

1 | In summary, waste should be placed immediately in this state-of-art facility and removed from temporary storage across the United States. Public safety will be enhanced and the tax-payers will finally see the benefit of their hugh investment. Additional delays will only adversely impact the stability of the openings, that have already exceeded all design expectations. It only makes sense to move forward as quickly as possible.

Stephen C. Tadolini
428 DeFrance Drive
Golden, CO 80401

## Comment C-007

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| MARGE | J | BAKER |

| Location | Date | Time |
|---|---|---|
| Convention Center | 1/7/97 | 3:00 |

Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 | Please place this material in a permanent site such a WIPP. IT is our best option please make use of it. Perfection is not our goal

Tom Baker

## Comment C-008

Author: Linda Whittenberg <whittwil@roadrunner.com> at ~internet
Date: 1/7/97 4:02 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP
-- ---------- Message Contents ----------

Dear Harold Johnson,
I will not be able to attend the public hearings in Santa Fe but wish to have my comments included in responses to the proposed WIPP project.

1 | I feel the idea of disposing of radioactive waste near Carlsbad, New Mexico has been misguided from the outset and am strongly opposed to the proposal.

2 | For one thing we speak of "permanent disposal" at the WIPP site, but I seriously doubt that any site will be permanent since we can only imagine what will occur in terms of leakage or underground pollution after the waste is buried. I realize that to many people it seems better than leaving the waste in Los Alamos; however, I think that is exactly where it should remain until a better solution is created.

3 | Actually I think the more we are all aware of the waste created by nuclear activities the better. I have long believed that it would be good to have a large pyramid constructed above ground where the waste could be stacked. While I can't say what kind of material the pyramid could be made of for it to protect viewers from radiation, I'm sure it could be done. The pyramid could be something like the Vietnam Memorial, a place where we could all go to remember the tragedies nuclear energy has produced and to remember we must never create this much poisonous waste again. The trouble with the Carlsbad site is that it is too easy to forget it, like trying to bury a transgression. People in Los Alamos are aware now of the temporary storage. That is good. It arouses feelings and forces us to think about what we are doing.

Thank you for giving attention to my comments,

Rev. Linda F. Whittenberg
3024 Plaza Blanca
Santa Fe, NM 87505

## Comment C-009

Author: rdwatso@sandia.gov (Bob) at ~internet
Date: 1/7/97 1:22 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: public comment
---------- Message Contents ----------

1 | I support the opening of the WIPP site in Carlsbad, NM for disposal of radioactive waste.

Sincerely Yours,

Robert D. Watson, Ph.D.
Fusion Technology Department
Sandia National Laboratories
Albuquerque, New Mexico

---

Regular Mail Address (e.g. letters):

Robert D. Watson
Sandia National Laboratories
Fusion Technology Department
PO Box 5800, MS-1129
Albuquerque, New Mexico 87185-1129

Phone: 505-845-3139
FAX: 505-845-3130

---

Shipping address (e.g. boxes) and Federal Express Mail Street Address:

Robert D. Watson
Sandia National Laboratories
Org. 6428
MS-1129, Bldg. 6585, Room 1803
Shipping and Receiving Building
1515 Eubank SE
Albuquerque, NM 87123-1129

---

e-mail: rdwatso@sandia.gov

Export Control: GTDA
General Technical Data
No Export Control License Required

---

## Comment C-010

FROM : INNER WINNER SPEECHES PHONE NO. : 5052997708 P01

TO: Mr. Harold Johnson
FAX 505 224-8030
RE: WIPP

1 I feel we should start storing the Alpha emitting waste TODAY, at the WIPP site.

leaving this waste scattered all over the U.S. is not smart. A highway accident would not concern me even if the stuff was in cardboard boxes. We are not talking big Atomic bombs!

J R Matthews, D.D.S.
1-8-97

I have read the Citizens Guide, WIPP Transportation pamphlet & True Progress Vol 2, #1.

James R. Matthews, DDS
11921 Caribou N. E.
Albuquerque, NM 87111

PAGE 1 of 1

## Comment C-011

JAN-08-1997 16:06 OA GEN SVCS*DEPUTY COMMIS 573 751 7819 P.02/03

Mel Carnahan
Governor

Richard A. Hanson
Commissioner

State of Missouri
**OFFICE OF ADMINISTRATION**
Post Office Box 809
Jefferson City
65102

Stan Perovich
Director
Division of General Services

December 23, 1996

Harold Johnson
NEPA Document Manager
Attn: SEIS Comments
P. O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

Subject: 96110052 - Draft Supplemental Environmental Impact Statement - Waste Isolation Pilot Plant Disposal Phase (DOE/EIS-0026-S-2)

1 The Missouri Federal Assistance Clearinghouse, in cooperation with state and local agencies interested or possibly affected, has completed the review on the above project application.

None of the agencies involved in the review had comments or recommendations to offer at this time. This concludes the Clearinghouse's review.

A copy of this letter is to be attached to the application as evidence of compliance with the State Clearinghouse requirements.

Sincerely,

Lois Pohl c.m.

Lois Pohl, Coordinator
Missouri Clearinghouse

LP:cm

## Comment C-012, Page 1 of 3

Author: SANTAFE1@aol.com at ~internet
Date: 1/9/97 7:46 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Emphatic Objection to WIPP. Reply requested!
---------- Message Contents ----------

January 9, 1997

Sirs or Madams:

Today, when I showed up in downtown Santa Fe to make my usual objections to the DOE planning to ship Nuclear Waste to Carlsbad to store 'safely' for 10,000 years , I was astonished to hear they could be actually DOING THAT by December????

So I would like to say several things in regard to the WIPP Project. When I first heard the idea 15 or so years ago, I lived in Denver, and I laughed at the idea that anyone would propose so absurd an idea. I have since moved to Santa Fe and learned that the DOE is, indeed, serious - two billion dollars worth and counting - it would seem. It seems incredible to me that ANYONE, even a bureaucrat in Washington, could/would consider WIPP an acceptable 'solution' to the problem of hazardous waste! When I objected several years ago at the first hearings, I was told that I needed then to propose an alternative, and I said at the time that plutonium is NOT a problem that I created - would have created - nor wished created - not even for my worst enemy - but NOW I'm asked to let my State be further contaminated with this garbage with a TOTAL NON-SOLUTION which is WIPP because I don't have a better alternative???!!!! Gentlemen and ladies, if there is a lady in the DOE inclined to believe this is an acceptable solution, for the LAST TIME, New Mexicans are NOT going to allow truckloads of radioactive waste on its roads - not to go to WIPP nor anywhere else. Personally I am prepared to do whatever it takes to prevent the opening of WIPP. I would gladly lay down and have a truck roll over me - and if that didn't stop the trucks at least I wouldn't be around to witness the further destruction of the earth I have tried to save for my children and grandchildren - Indians plan to the seventh generation but the DOE, in it's infinite wisdom says it can plan the next TEN THOUSAND YEARS where WIPP is concerned? I would ask the DOE then to make those plans for ONLY the people employed by the DOE and their progeny so that the rest of us are not affected. Let DOE employees take TRU packs home and guard them for the next 10,000 years since they're so safe! (And THEN what??? After 10,000 years, we STILL have 230,000 to GO!) Actually, moving that stuff, even to DOE backyards, is a truly bad idea!!! The reasons have been stated OVER and OVER to you people! It is NOT SAFE TO MOVE RADIOACTIVE MATERIAL. It needs to be stored ABOVE GROUND ONSITE where it still exists and transmuted BACK to something safe and non-radioactive. The technology exists to do this now I'm told but has been disgarded as an alternative because it's TOO EXPENSIVE???? Are you people completely out of touch with reality???? We have WASTED now TWO BILLION DOLLARS on a Waste Isolation Pilot Project that will NEVER STORE NUCLEAR WASTE if there is a God, and I'm certain that there is. IT IS NOT SAFE to store radioactive material underground ANYWHERE IN THE WORLD! It does NOT go away because it is out of SIGHT! MAN CREATED PLUTONIUM. And man needs to STOP creating it and to find a way to make non-radioactive and safe that which he has already created. PERIOD! We can't bury this - we can't rationalize it or analyze it away, and we can NOT justify it's existence on our earth. THIS IS COMMON KNOWLEDGE! The only people who support WIPP are people who have been led to believe they have some economic investment in having it go - or people who believe that they will get it out

1
2
3
2
4

## Comment C-012, Page 2 of 3

of THEIR backyard and into someone elses! We have even had employees from Rocky Flats and other sites TELL us that THEY don't wish this stuff on us!!! At the last hearings, the DOE shipped a group of Carlsbad residents up here to tell us how much they wanted this garbage down there! A girl - not more than 19 or 20 said she would gladly ride on the trucks - on top of the Trupaks - so convinced she was that they were safe. Do you people have a conscious at ALL? How do you go to sleep at night KNOWING you have contaminated, not only the earth, but the MINDS of GOOD, HONEST, HARDWORKING people - like the people in Carlsbad? The arguments for WIPP are not rational in any sense - forget about the split between mind and Soul in all this debate - even if WIPP made perfect sense rationally, even if by moving transuranic waste to WIPP we WOULD solve the problem of having it other places, EVEN if it could be moved SAFELY with NO accidents, NO exposure of innocent people to deadly material, etc. it would STILL be wrong to move it there! Once it's there, there is absolutely NO WAY to protect people from it - not for 100 years, not for 10 years, not for ONE year - much less 10,000! (We might actually make it for a year - but that isn't certain at all since one roof was already collapsing while it was still under construction!)

5

So, when I was asked to come up with a solution to a problem I had NOTHING to do with making, I asked a physicist at Los Alamos whether or not we couldn't 'unmake' it - and he said yes. Whether we can or not, and if we can't now we need to be spending our money to figure out how to - with 2 billion dollars you can do a LOT - it's certain that we can NOT safely move it ANYWHERE. We have to store it onsite - as safely as we can - until we can make it into something harmless - and that is the only real solution to this problem.

Man has gotten into a LOT of trouble on this planet by trying to bury his problems. He has gotten into a lot more by not listening to his inner Soul - and WIPP is a perfect example of the worst of both these pitfalls combined to create a true hell on earth if we allow this to open. And that is NOT based on emotion but on solid, well known and common sense FACTS! Do NOT tell me I'm not a nuclear physicist - neither are you - and I KNOW I'm not a nuclear physicist - though I did consider becoming a particle physicist and still might if I live long enough - but I have talked to them. My own SON has a PhD and his salary is partially paid by the DOE, so don't tell me what I don't know. I KNOW what I don't know. I also know what YOU don't know, so PLEASE don't tell me you can guarantee the safety of the WIPP site for 10,000 years, okay? Human history doesn't even go BACK 10,000 years so far as we know. There may BE a WIPP site back there - which may be WHY we're in the mess we're in on the earth right NOW, you know?

I cannot state strongly enough my opposition to WIPP ever opening. I would ask anyone who can prevent its opening to do so. The man from the DOE said today during a break that talking to someone at the DOE, he had said, "I don't know what all the commotion is about. When it started, we were just going to dig a hole down there and dump some barrels into it!" I believe that. People didn't know how dangerous radioactivity was when it was discovered. It was kept on people's desks - many of us remember x-raying our feet in shoe stores to see if the new shoes fit. After we dropped two bombs on people, we started to learn how dangerous radioactivity is, though, and NOW WE KNOW BETTER! And I'm not a pacifist, gentleman. There are some things we should be willing to fight and die for. And stopping the opening of WIPP is one of them! We KNOW now that plutonium is the most posionous substance on the face of the earth. We know it doesn't go away for 240,000 years. And we also know that when we start shipping it - however we do it - there will be accidents and exposure to others - as well as at WIPP. We have a VERY dangerous situation at Los Alamos already - those of us who live here remember the fire last summer - we had ashes falling over Santa Fe for days - happily Los Alamos didn't burn THAT time and we can presume, I hope, that the radioactive material there is stored in glass or some similar non-flammable containers???? Whatever the case may be, we need to STOP making radioactive

6

7

## Comment C-012, Page 3 of 3

substances and to clean up, store as safely as we can what we have made and find a way to 'unmake' it. Trying to transport and store radioactive materials safely is impossible. Radioactive substances are EXTREMELY DANGEROUS for organic life forms and we need to orient ourselves to stopping the creation and use of radioactive substances entirely. For what we already have, we need to learn how to transmute it to a safe, non-radioactive form.

I could go on for DAYS on this subject, but everything I am saying here has been said to you and everyone else concerned with this project OVER AND OVER again! I have been to DOE, EPA and citizen hearings on this. We have said the same things OVER AND OVER! People in Santa Fe are not stupid and we would be terribly remiss in our responsibility as human beings were we to allow this
8 travesty in our State. Many Santa Feans have told me that nuclear waste is already AT WIPP. I don't know whether this is true or not. I don't even EXPECT my own Federal or State Government to give me an honest answer on this. But if I learn there IS radioactive material is buried there, so help me I will dig it up MYSELF! I have HAD it with you guys burning this stuff in the dead of night, dumping it in our ravines and barrancas, and generally trashing one of the most beautiful areas of the earth God ever created. It amazes me that lightning doesn't just strike you all dead as you do this stuff! I have no idea what it is going to take to stop you, but you have to be stopped. I truly believe in my heart that God will not allow WIPP to open. We have spoken - over and over again - and we have said we will not allow WIPP in this State. We have presented it to you in song and verse. We have stated it quietly and at the top of our lungs. We have been saddened and angered by our losses and cheered by our successes, but the bottom line is that WIPP is not going to open in New Mexico - indeed I would oppose a WIPP site anywhere on the face of the earth and I think anyone with any idea at all of how to conduct ourselves in our responsibilities to ourselves and future generations would agree.

9 And I want a reply to this letter. I am tired of talking to vacuous faces and now into cyberspace with no response but a snore or a grunt. I want an intelligent, considered and thought out response to this from an intelligent, thoughtful and caring human being.

Thank you!

Eleanor Ponce

## Comment C-013

Author: Tom VanZandt <vanzandt@al.noaa.gov> at ~internet
Date: 1/9/97 6:16 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP SEIS II
---------- Message Contents ----------

1 I believe that the best of the alternatives is to dispose tranuranic radioactive waste at WIPP.

I am a professional Ph. D. physicist, but not expert in nuclear physics.

Thomas E. VanZandt
2025 Alpine Drive
Boulder CO 80304
303-443-9418 (home)
303-497-3854 (work)

Comment C-014

JAN 10 '97 12:50 WM OHS SHOWROOMS P.1/1

**January 10, 1997**

**FAX TO: Harold Johnson**
**SEIS II Comments**
**U.S. Dept of Energy**
**FAX #: 505-224-8030**

**FROM: Nancy Wilson and William Ohs**
**FAX #: 303-322-4061**

**Responding to advertisement in Denver Post re comments on the WIPP project:**

1 **YES the DOE should dispose of defense-generated transuranic radioactive waste near Carlsbad New Mexico at the WIPP permanently.**

Comment C-015

1-8-97

GERI VELASQUEZ
9180 COORS NW #1010
ALBUQUERQUE, N.M. 87120

HAROLD JOHNSON
SEIS II COMMENTS
DEPT. OF ENERGY
PO BOX 9800
ALBUQUERQUE, N.M. 87119

DEAR SIR,

1 Yes, the DOE should see that the transuranic waste be permanently stored at the WIPP site near Carlsbad, N.M. It is much safer for the communities that have waste stored above ground, especially above water tables, to ship it to a less populated area. I do, however, see some risks that I would like to address.

While finishing my Nuclear Engineering Degree at UNM I had the opportunity to study the WIPP proposal. It did not mention the condition of the drums that are currently housing this waste. The press has explained that groundwater has been contaminated from poor storage. I am familiar with this problem having worked in the chemical

2 industry. I stress that the loading of these drums be done with the utmost of care and that safeguards are in place to handle spills. Additionally, there should be procedures in place at the receiving location to handle damage in shipment.

My other concern is that the DOE has done little PR stressing the safety of the transportation. Just mention of nuclear and people go nuts. Rail is certainly a safer

3 method because the routes are not populated by human traffic. I have studied the routes proposed and yes, there are not that many convenient by rail. Perhaps for the consideration of the safety of the people, rail could be studied further. After all, Washington went all out during the cold war to make these weapons and the same drive could be devoted to safety of the citizens.

Thank you for the opportunity for my input.

Sincerely,

Geri Velasquez

## Comment C-016

Author: Craig Martin <cmartin@rt66.com> at ~internet
Date: 1/10/97 11:36 AM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: No further delays for WIPP
---------- Message Contents ----------

Although many wish we could close our eyes and it would simply disappear, nuclear waste is very real and should be handled in the safest manner. I don't believe that storing it in hundreds of above ground sites in temporary containers, as is the current practice, is the best method.

1 Delaying removal of waste from the current storage sites only increases the chance of an accident. No waste repository will be perfect, so we need to go with the best available sites, ones that have already demonstrated their safety through scientific analysis. I urge that the WIPP site be opened at the earliest possible date.

Craig Martin
465 Grand Canyon Drive
Los Alamos, NM 87544

## Comment C-017

Author: JVH2099@aol.com at ~internet
Date: 1/12/97 9:06 PM
Priority: Normal
BCC: ^WIPPSEIS at ~Battelle_Abq
CC: jvanhecke@lanl.gov at ~INTERNET
Subject: Supplemental Environmental Impact Statement on WIPP
---------- Message Contents ----------

January 12, 1997

Thank you for the opportunity to provide my comments in favor of opening WIPP as soon as possible. WeÆve wasted enough time and money being diverted by people who havenÆt the foggiest idea what they are talking about.

W.W.II was not ended through any efforts of artists. The Cold War was not won by Newsstand operators. The nuclear stockpile will not be safeguarded and nuclear proliferation will not be halted by the efforts of attorneys. All of these were or will be accomplished by highly educated scientists and engineers.

For over 50 years, the world class scientists and engineers of our National Laboratories have been trusted with our countryÆs nuclear deterrent. Time and time again, their successes have demonstrated that that trust has been
1 rightfully placed. If they say WIPP is ready to open, I believe them.

2 The people concerned about the transportation of low level nuclear waste, to WIPP, have a right to be concerned, but I think the final decisions should be made by people who really understand the science, the situation and the capability of WIPP and the transportation system.

The artists, newsstand owners, and attorneys could better spend their time being concerned about the danger of the gasoline tanker trucks that run up and down the streets of our cities, and which I believe pose a much greater danger than the trucks hauling contaminated gloves, etc. to WIPP.

Thank you very much.

Sincerely ,

James F. Van Hecke, Jr.
505 Oppenheimer Dr. #1202
Los Alamos, NM 87544
jvh2099@aol.com

## Comment C-018

Author: mcummings@lanl.gov (Mark Cummings) at ~internet
Date: 1/13/97 1:34 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: SEIS comment
---------- Message Contents ----------

To Those Involved:
I perform economic/environmental assessments of developing technologies for various types of remedial action across the DOE complex. After taking a semester course last year in the hydrogeological/transportation/risk aspects of WIPP, followed by a site visit, it is my opinion that the
1 site should be allowed to start accepting TRU waste on schedule with the caveat that the proposed Santa Fe bypass should be completed first. It is frustrating that the bypass is not finished due to funding problems when so much money continues to be spent to keep the dormant WIPP site open year after year. No one can guarantee that a meteor will not fall from the sky in 5,764 years into the center of the repository, but WIPP has been studied
2 extensively and I believe is our best option for safe, permanent disposal of TRU waste. Thank you for the opportunity to express these thoughts. This opinion is not necessarily shared or endorsed by DOE or by anyone that I work with.

**********
* Mark Cummings *
* Los Alamos National Laboratory *
* P.O. Box 1663 *
* TSA-4, MS F604 *
* Los Alamos, NM 87545 *
* ph: (505)665-3467 *
* fax: (505)665-5125 *
* email: mcummings@lanl.gov *
**********

## Comment C-019

Author: ,"Sandford, Tom and Demuth, Ruth" <ruthtom@trail.com> at ~internet
Date: 1/12/97 10:46 PM
Priority: Normal
BCC: ^WIPPSEIS at ~Battelle_Abq
CC: ruthtom@trail.com at ~INTERNET
Subject: Public Comment on SIES II
---------- Message Contents ----------

To: Harold Johnson
Ref: SEIS II Comments
From: Tom Sandford

1 I wish to comment on the current SEIS draft. I believe that the current document is more than adequate regarding the opening of the WIPP site. I believe that sufficient study, design, construction, and precautions have take place to allow the initial use of WIPP. I believe it is more dangerous to allow waste designated for WIPP to be temporarily stored at Los Alamos and other facilities than to properly store it at WIPP. And I am including transportation. I believe the US taxpayer is being taken to the cleaners by the WIPP oponents through all the delaying tactics used and increasing the risk associated with temporarily storing waste all over the US.

Futhermore, I think you should disregard the opinion of the New Mexico Attorney General. He does not have the power to really do anything helpful for NM citizens, like loosen the gasoline wholesaler's stranglehold on gas prices, trucking rates, etc. Instead he seems to enjoy grandstanding for the WIPP opponents in Santa Fe. Regarding helping the NM citizens, he seems pretty useless.

2 It is time to get on with using WIPP. The US taxpayer has paid a bundle to get it prepared, and I say it is time to act. I hope you agree.

Sincerely,

Tom Sandford
1277 47th St.
Los Alamos, NM 87544

## Comment C-020

Author: "Brian V. Ellison" <102173.1054@CompuServe.com> at ~internet
Date: 1/13/97 1:48 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP
---------- Message Contents ----------

This letter is to express my desire to have the government rethink its position on transporting waste. The people of New Mexico and Texas do not deserve to be "dumped" on by companies and states that have waste. Let the waste stay where it is created and make those who create the waste be responsible for its disposition. Clearly the health and safety of WIPP cannot be guaranteed so there is little benefit to moving the waste. Guaranteeing safety of anything that will still be dangerous in 10,000 to up to 240,000 years is as best an oxymoron.

1

2

In 1996, five New England nuclear reactors have been shut down for safety glitches that were belatedly identified as accidents waiting to happen.

Five years ago the US NRC offered to renew the original 40-year operating licenses of existing reactors if they were upgraded with enough parts to qualify as safe for another mere 20 years. So far not one license renewal application has arrived at the NRC.

Enough. Store the waste where it is and begin the shutdown of the producers.

## Comment C-021, Page 1 of 2

January 10, 1997

Department of Energy
P.O.Box 9800
Albuquerque, N.M. 87119

Dear Department of Energy:

My name if Kayce Cole and I live in Ranchos de Taos. Today I am writing you to try to put into human language form something that might shift something in you to make you change your minds about allowing nuclear waste to be stored in our state of New Mexico. I wish to express something that might halt the already forward motion and seemingly inevitability of this project.

1

For a moment, travel with me to outer space of this amazing universe and become, in your mind's eye, one of the chosen few human beings who have looked out through space at our blue/green planet. For some of these astronauts this has been a transformative experience to such a degree that it has changed their lives forever. Just to see this tiny, beautiful, living sphere, called Earth...a spinning, living, breathing organism from outer space has made many of them vow to do everything in their power to protect her. They sensed the miracle and the fragility of her existence. I can only imagine what this experience was like for them, but I can sense it in my mind's eye. I can see the delicate, fragile nature of this world we inhabit and I cannot begin to fathom the miracle of it all! I have spent a better part of my life taking it for granted; this sphere of dirt, and fire, and air and water that I have ridden upon, walked on, slept on, climbed over, dug into, layed on, breathed upon and lived upon for half a century.

We are all apart of this larger organic system and our tiny lives have lost sight of the bigger picture. What we do to our bodies either weakens or strengthens them depending on our choices. What we do to Mother Earth, in like manner, either strengthens her or weakens her. The indigenous people of this world have known this and they have lived their lives more connected to the earth than technological man and have honored the beautiful interconnectedness of it all.

New Mexico, beautiful New Mexico, is just a tiny patch of skin on the back of Mother Earth. But, she is home to many of us and for us to allow this toxic waste to be stored inside of her would be unconscionable. Out of sight, out of mind just doesn't cut it anymore. We all know better by now. Mother Earth can't tolerate the poison any more than our bodies can. Plus, she acting out these day, shifting and shaking herself

Comment C-021, Page 2 of 2

around. To think that any manmade device could keep this substance safe and secure is ridiculous. Plus, Mother Earth will eventually want to spit the whole bad medicine right up into our faces.

1 No amount of money; no amount of jobs would ever justify this agreement for this tiny speck of earth we call home, New Mexico, to be treated in this way. The questions arise in me of how how much more can this planet take? How much more can our bodies take of these toxins? Isn't it time to say there is no place to them on the planet and stop making them? What if all the states this waste? What if New Mexico said "NO"? Nothing is more important that the health of this planet and an of all it living organisms of which we humans are apart!

Sincerely,

Kayce Cole

Kayce Cole

Comment C-022

JAN. 10, 1997

TO: DOE.

1 I dont want WIPP to open. PLEASE keep the contaminated WASTE where they ARE. At PLACES that generate the WASTE. If the WASTE is so heavily RADIOACTIVE, isnt there

2 A WAY to recycle it? Within the next few years I'm sure someone will have A better solution to our NATIONS nuclear WASTE problem, than W.I.P.P.

3 Our highways ARE not

4 ready, the response teams, when if there is An Accident ARE not ready.

Please dont be in A hurry to Open WIPP. It is not A good idea. I Am opposed to the idea of WIPP

Pam hytle

Pam hytle
P.O Box 29
Hanna, N. Mex
87543

## Comment C-023

Jan 5 1997

Harold Johnson:

1 I firmly suggest you permanently dispose of transuranic waste at the WIPP. I say the DOE to completely dispose the Waste in + near Carlsbad New Mexico. That is My sincere opinion.

Thank you for the chance to say so,

Sincerely

Mrs. E. Johnson,

333 So Eaton St

Lakewood Colo. 80226

PS - sorry for poor Writing.

## Comment C-024, Page 1 of 3

COURIER

WIPP HEARINGS -- 1/10/97, Santa Fe

I have lived in Santa Fe 13 years. Prior to living here, I lived downwind of Rocky Flats throughout the 60's. I observed with concern how a Public Health Dept official jeapordized his career to blow the whistle on Rocky Flats'safety and public health issues -- DOE denied validity and at first I believed the agency. However, history has shown that official to be correct in his warnings -- and I now live with whatever those consequences may mean for me.

So, I view much of the scientific and government information with some scepticism now -- justifiably, I think. Having been a librarian for 20 years and a writer for 30 years, I admire the comprehensive information we have at hand to peruse in searching for what we need in learning about WIPP. I can even believe that individuals who assembled this information are well intended believers in this being what the public and the decision-makers need to know. But, the history of industry compliance or sincere concern for the public safety is neither noteworthy or dependable. Can we trust? I do not have a feeling we can.

From my experience, I also am aware of the impact of such information overkill, sometimes called info-glut, and how it can discourage critical thinking of individuals who find themselves overwhelmed. It can convince and make a position and a plan seem credible by mere weight of paper.

I personally have benefited by living in this area and by valuing life itself — I have been challenged to address this issue, to think about it, to frame its importance to myself and my community, and to prepare myself to speak and write. I have many other things to do with my energy and time. But this is important and I have learned from the investment of others, from what they thought, learned, felt and know. It is my obligation as a human being to use my life and my words to speak my truth.

My comments relate to two areas -- response to the information in these documents and my sense of the larger picture discussed usually inferentially while I have been here at the hearings.

**I. Response to the information in the documents:**

1 Despite the assurance of these many publications, media presentations and educated personnel, I do not have confidence in the site (geology, risk factors), the processing of the material, transportation safety or the limitation of materials to low level wastes.

2 Alternatives discussed during the public scoping process -- including engineered barriers, certain types of developing technologies, transmutation or other sites -- were not analyzed in detail because:

- not technically viable and/or are unreasonable in the present context
- would not adequately or economically meet safe disposal in timely manner
- involve additional environmental and policy concerns that would need to be accommodated

I do not understand how this disregard can be justified.

Conroy p.2

**II. The larger picture:**

Decision-makers in DOE, EPA and at all generator sites and WIPP have a responsibility for leadership beyond what I have seen exercised. Maybe even beyond what our political leaders have officially charged them with.

They have seen this leadership role in the scientific area and accepted the role with alacrity: guiding and advising, consulting and educating us on the scientific rightness of WIPP, how and why it will work.

But, they have not evidenced concern about the ethics, the overall impact on the the family of man as such.

I propose that:

3 **1-The risk is too great** - Potter, the scientist and philosopher in his view of the relationship of man and the universe asserts that all mankind's undertakings have unknown and plentiful consequences and the larger the undertaking, the greater the scope and diversity of those consequences. WIPP is a very large undertaking and will have very impactful consequences that we cannot know here and now.

4 **2-The cost is too high** -- Waste burial incurs costs to the future of life on earth with toxic wastes imbedded in the earth, inaccessible and largely unprotected. Waste burial forecloses the perceived need for the development and application of new technology for safer processing, handling or transmuting it.

5 **3-WIPP is not a <u>real</u> solution** --To regard this plan as disposing of nuclear waste is unrealistic, it is simply re-positioning some of the waste to be out of sight and out of mind, to look tidy. We often consider disposal as flushing the toilet -- getting rid of the waste. But, that waste goes somewhere and even with well planned plumbing and sewage treatment, it must be dealt with honestly, and, in this case, for a very long time. Disposal is permanent, storage is not. WIPP is storage, the problem continues. And, in this case, WIPP prevents disposal because it makes the waste irretrievable and subject to being breached in the future.

6 **4-Present decision-making is not adequate**. We are known as stakeholders and indeed we are. But the internal stakeholders (agencies, contractors, facilities) are even better positioned to assure their own interests when they are the only decision-makers. TRU Progress reported a year ago that three changes have been made due to stakeholder comments. Is that sufficient in view of all the comments made? Are there any internal stakeholders who would admit to this whole plan being a mistake?

**5-WIPP benefits the politicians, scientists, contractors, their employees**



Conroy p.3

**but our society and civilization bear its costs.** We currently have a single dimension leadership, that which follows and drives a wartime economic framework. Times have changed and we no longer can blindly adhere to the necessity of continuing the nuclear circus of trained animals, clowns and high wire tricks.

This short range solution does not take into account the long range view. It is essential not just for Native Americans but for all of us to try to speak for future generations, to exercise our obligation to protect and to be wise rather than to be expedient. WIPP is clearly not ready to open safely, and it may well be the proverbial nose of the camel in the tent.

The SEIS-II summary indicates that DOE "needs to dispose of transuranic waste generated by its past, present, and future activities in a manner that protects public health and the environment." p.S-1 This obviously points to a leadership role broader than it is now interpreted. Past, present and future activities is a condition not met by SEIS-II. Protection is an ethic implicit in the statement, but lost in this rush to judgement.

5 Too much is at stake to proceed with any of the existing alternatives.

## Comment C-025

Author: JFMesiteJr@aol.com at ~internet
Date: 01/14/1997 2:39 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP NOW!
---------- Message Contents ----------

1 | YES! USDoE should dispose of defense-generated transuranic radioactive waste
2 | near Carlsbad, New Mexico. ...and any other low-level nuclear waste that is being "temporarily stored" in rusting old low-tech 55-gallon drums within wind-bearing distance from major metropolitan cities, e.g. Denver.
This "on again-off again" saga must come to an end. The US Government and DoE needs to figure out how to end the domination of the small minorities of backward-thinking environmentalists (isn't it sad that the term "environmentalists" is now a confrontational one?) who are ruling our country by force of lawsuit, loud screams, sit-ins, and intimidation.
According to their backward logic, it is better for us to let the dangerous material sit near large cities, "temporarily" (when did decades become "temporary"??) endangering them, than to endanger those of us near the highway for about 30 minutes each while the truck passes, on the way to a salt mine 2100 feet underground in the middle of nowhere? (Sorry, Carlsbad, you're still a little town near "nowhere")
Start the trucks, load up, activate the satellite tracking and let's get on with it!

....James F.

Mesite, Jr., concerned citizen

10048 Rolling

Ridge Road

Colorado

Springs, CO 80925

## Comment C-026

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| Tom + Nancy F[redacted] | | Flersheim |
|---|---|---|
| First Name (please print) | M | Last Name |

| Santa Fe | 1-10-96 | 10 45 |
|---|---|---|
| Location | Date | Time |

selves
Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 We oppose transporting nuclear wastes through Santa Fe. The government has given assurances before about how safe nuclear projects are. The track record does not instill confidence.

2 Also, I don't think the WIPP waste site has received clearance as a location that is geologically stable. Until a safe place to deposit waste is available, waste should not be moved. It would be best to move toward shutting down the nuclear plants so that we would have less waste to deposit.

3

## Comment C-027

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| Jill | | Young |

| Location | Date | Time |
|---|---|---|
| Santa Fe | 1-10-96 | 11:00 |

Representing: self

**Specific Comment(s) (Summarize & be concise on this form)**

1 Nuclear waste should not be transported through Santa Fe. The possibility of contaminating some part of St. Francis drive is unacceptable

## Comment C-028, Page 1 of 3

DEPARTMENT OF HEALTH & HUMAN SERVICES

January 8, 1997

Harold Johnson
NEPA Document Manager
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

We have completed our review of the Draft Supplemental Environmental Impact Statement (DSEIS) for the Waste Isolation Pilot Plant Disposal Phase. We are responding on behalf of the U.S. Public Health Service.

Technical assistance for this review was provided by the Radiation Studies Branch, Environmental Hazards and Health Effects Division, National Center for Environmental Health, Centers for Disease Control and Prevention. Their comments are enclosed for your consideration in preparing the Final document. If you have questions regarding these comments, you may contact Mr. C.M. Wood at (770) 488-7642.

Thank you for the opportunity to review and comment on this DSEIS. We would appreciate receiving a copy of the Final SEIS when it becomes available, and any future environmental impact statements which may indicate potential public health impact and are developed under the National Environmental Policy Act (NEPA).

Sincerely,

Kenneth W. Holt

Kenneth W. Holt, M.S.E.H.
Special Programs Group (F29)
National Center for Environmental Health

Enclosure

CDC

## Comment C-028, Page 2 of 3

SEIS-2.MEM Page 1

FROM: C.M. Wood

TO: Ken Holt

SUBJECT: Supplemental Environmental Impact Statement #2 (SEIS-II) on the Waste Isolation Pilot Plant, Loving, NM

DATE: January 7, 1997

CDC has one major concern with this document:

1 2 The Glossary on page GL-3 states that salt creeps faster than rock. How fast? On Page E-64 it implies that eventually creep will cause the salt to crush the waste containers, and they must be retrieved before this happens. When will this happen? What will we do with the waste and contaminated salt after it is retrieved? This implies that the site can never be permanently closed. (Page H-21 implies that the creep of the salt formation will consolidate all the containers inside a solid, leakproof matrix.)

CDC has some minor questions with the wording of the document:

1. Table S-1 on page S-6 shows the following increases in transuranic inventory at the Argonne National Laboratory West, which is located on the Idaho National Engineering Laboratory reservation, between 1995 to 2033:

   CH: 7 --> 750 -->1000 cubic feet
   RH: 19 --> 1300 -- 1700 cubic feet

   3 During these same years, the inventory of the INEL remains 28,000 and 220 cubic feet for CH and RH TRU. Most of the national laboratories contain multiple facilities managed by different Operations Offices around the country. Why is the INEL the only laboratory that lists one facility of its facilities, ANL-W, as a separate entity? Do the projected inventories for the other DOE weapons facilities account for all the transuranics located at those sites? (Table 3-1 on page 3-3 show different values.)

2. 4 Page S-24 shows the Latent Cancer Fatalities caused by site operations at the INEL in 1994, while still within safe limits, are much higher than at any other DOE facilities. Why? For that matter, since the purpose of this document is to assess the environmental impact of shipping transuranics to New Mexico, why are the LCF figures for "normal site operations" at other DOE facilities relevant?

5 3. What is "lag storage"?

6 4. The Waste Acceptance Criteria in Appendix A do not prohibit liquid or gaseous waste (although this is implied by the proposed treatments). Are these waste forms prohibited?

## Comment C-028, Page 3 of 3

SEIS-2.MEM Page 2

7 5. Table E-15 on page E-39 shows dose in rem "from CH-TRU and RH-TRU Waste Shipments" to Maximally Exposed Individuals in various categories. Some of the doses are between 2.5 and 3.0 rem. If this is an aggregate number from all shipments over a period of years (p. E-32) these are very safe numbers. If these exposures are possible from a single shipment, then people like "rest stop employees" are exceeding the 10 CFR 20 limits for occupational exposure (exposures to radiation workers). This would be unacceptable, and the SEIS-II would have to be amended to show positive measures to prevent overexposure to members of the general public.

8 6. The Index to this publication contains some invalid references. CDC discovered this while trying to determine how the long term performance assessment dealt with "creep." Other key words such as "exposure path" also cite pages that have no apparent reference to that subject.

## Comment C-029

1744 Camino Uva
Los Alamos, NM 87544
January 13, 1997
505-662-7508

Harold Johnson
SEIS-II Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson,

We understand that you are collecting public comments regarding the second Supplemental Environmental Impacts Statement (SEIS-II), which affects plans to open WIPP. Please add the following comments to your record.

Open WIPP now!

The safest place for the waste for which WIPP was designed is *in* WIPP, and not in temporary storage containers scattered around the country.

1 The containers presently holding the waste were not designed for long-term storage, and delays in moving the waste only increase the chances for leakage from these temporary containers.

WIPP is currently a very well designed facility. The design studies done to date are more than adequate. Additional studies will not make it safer, just more expensive.

1 The special containers for transportation of waste to WIPP are also very well designed. Transportation of the waste presents far less danger to the public and environment than leaving it where it is.

We believe that the people who have been so vocal in their criticism of WIPP are opposed to it in principle and intend to see that it never opens, no matter what. They will never be satisfied, regardless of how many studies are done or what additional design measures are taken. At some point, the weight of scientific peer review must prevail and the project be judged acceptable based on its scientific and engineering merits, not emotions. We believe that time is now.

Proceed!

Jan K. Novak

Judith E. Novak

## Comment C-030

12 January 1997
4480 Laguna Pl. #1
Boulder, Colo. 80303

SEIS - II
P.O. Box 9800
Albuquerque
New Mexico 87119

To Whom it May Concern:

I have been made aware of the hearing on the WIPP supplemental E.I.S. which is taking place tomorrow in Arvada. As I cannot make it to the hearing, I wish to voice my comments by letter.

1 WIPP has not been demonstrated to be safe, and it is doubtful that the D.O.E. will ever be able to prove its effectiveness at isolating the waste from the environment or from human contact.

2 Nuclear dumping is not acceptable in Colorado or New Mexico, and I am strongly opposed to 28,000 shipments of plutonium contaminated waste travelling through Colorado.

3 Therefore, I am writing to express my vehement opposition to the WIPP facility. Please consider the safety of people and animals when making this decision.

Sincerely,
Carole J. Sudenman

## Comment C-031

Author: LOPEZ KRISTIN HILMA <lopezk@spot.Colorado.edu> at ~internet
Date: 01/14/1997 6:26 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: SEIS comments
---------- Message Contents ----------

Thank you for the opportunity to be heard this way, since I was unable to attend the 13 Jan. hearing in Arvada.

I have given this matter considerable though over many many months. Asa a taxpayer, I think about all the millions we have spent to construct the Carlsbad plutonium waste dump, and how much time, energy and money has
1 been spent trying to arrive at a solution. However, all of my "simple" research into the probllllllem has indicated that WIPP has never been demonstrated to be safe, nor never will be. My own gut reaction (as well as what I have read and heard) is that the waste from Rocky Flats and
2 other nuclear weapons facilites are best interred (using the very best available technology) right where they are now. The dangers of trucking all this material is very, very dangerous indeed--and one spill would force the government to rethink the storage, anyway, as there would be a huge outcry from the public along the routes of travel.

3 Most of all., I think this on-site storage method would help the public and the government understand that the ultimate solution is to observe and strengthen the Non-Proliferation Treaty and end all nuclear warheads production forever, and put much conviction in urging all other nations to do the same. In this framework, I also urge that we abandon all plans to convert waste plutonium to commercial use. This, too, sends the wrong message to the world. Thank you.

Nina Johnson, 747 12th Street, Boulder, CO 80302
H. Lopez Dept of EPO Biology University of Colorado Boulder, CO 80309-0334
tel (303) 492-2589
fax (303) 492-8699

## Comment C-032

Author: joank@STC.net (Joan O. King) at ~internet
Date: 01/15/1997 6:31 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP
---------- Message Contents ----------

TO: The DOE concerning the WIPP site.

FROM: Joan O. King

1 Unfortunately I cannot attend the WIPP hearing in Augusta on January 23ed. I am expressing my concerns by Email. I have seen detailed drawings of the WIPP site in New Mexico. It sits over an aquifer, for pity sakes; and it is surrounded by drilling. It is hard to believe that this site was picked for scientific reasons and not political expediencies.

2 However, my area of particular concern is the transportation of transuranics to the site. Having spent considerable time reading about casks, NRC regulations, local emergency preparations (or lack of same), I don't feel the nation is ready to begin shipping radioactive materials around the country.

3 Yes, I know the DOE already does ship some rad waste; but the more you ship, the more likely there will be an accident. Furthermore, this looks like a sneaky way to begin the kind of shipments the utilities want for their spent fuel without going through the proper legislative process. The public doesn't want this stuff shipped through its backyard, and you know it.

## Comment C-033

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

KENT — First Name (please print)
B — M
WILLIAMSON — Last Name

SANTA FE, NM — Location
1/10/96 — Date
4pm — Time

self — Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 Like most of New Mexicans, I have opposed implementation of the "WIPP" since it was first proposed, and opposed, in the early 1980's. I am appalled by the fact that the project continues, in spite of clearly demonstrated defects in the design and construction and overwhelming opposition from the people, State and many municipalities.

The enormous investment of Federal ~~and~~ funds continues, and the project proceeds in spite of and in the face of its own eventual failure.

This project, this policy is doomed, wasteful and wrong. Why can't we give it up?

2 ~~Of course, we~~ I support NO ACTION ALTERNATIVE 2

## Comment C-034

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

LINDA — First Name (please print)
M — M
SCASE — Last Name

ST. FRANCIS DR. SFe — Location
1/10/97 — Date
4:50 — Time

Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 I live on ST. Francis Dr. & the accidents nearly everyday. WIPP must not start before a by-pass of SFe is in effect.

2 Actually, please keep the waste where it is.

## Comment C-035

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| JIM | | HANNAN |

| Location | Date | Time |
|---|---|---|
| SANTA FE | 1-10-97 | |

Representing?

1

**Specific Comment(s) (Summarize & be concise on this form)**

PLEASE HIRE NON-SMOKING TRUCK DRIVERS.

## Comment C-036

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| Sarah | | Stout |

| Location | Date | Time |
|---|---|---|
| Santa Fe N. M. | 01/10/97 | |

Representing? ordinary citizen

**Specific Comment(s) (Summarize & be concise on this form)**

I am a citizen, mother, and professional living in Santa Fe. It is important to me to express my opinions re, the WIPP issue. I am opposed to the operation of WIPP.

1 I continue to have safety concerns about the transport of WIPP materials: the routes, the containers, et

2) I continue to have serious safety concerns about the WIPP facility - I feel that eventual underground and groundwater contamination is inevitable.

2 3) I oppose the attempt to place radioactive materials underground "Out of sight, out of mind." I feel we need to focus on (A) a project for above ground deactivation of nuclear waste; (B) focus on alternatives to a fear based nuclear "defense" system.

Thank you

Sarah Stout

## Comment C-037

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

ERICA — First Name (please print)
[ ] M
SIMONOV — Last Name

Santa Fe — Location
1-10-97 — Date
3:30 pm — Time

Sanity and caution — Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 Until all the kinks and unknowns are worked out and more fully certain leave that dangerous stuff where it is! Keep researching the possibilities.

2 Work to reduce the waste in future.

## Comment C-038

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

Blanche — First Name (please print)
[-] M
Brody — Last Name

S.F. — Location
1/10/97 — Date
2:10 — Time

Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 I object to WIPP coming through Santa Fe and urge that some other
2 method of waste disposal be explored.

## Comment C-039

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| JIM | V. | LYSNE |

| Location | Date | Time |
|---|---|---|
| Santa Fe | JAN 10, 1997 | 11:15 AM |

Representing? My self —

**Specific Comment(s) (Summarize & be concise on this form)**

1 I feel that much more study and work needs to be completed before the transport of nuclear waste happens in this state. I believe that

2 the best alternative is to treat the waste with improving technologies on the site where they are now! Not spread the problem all over the map. For example — I live in Eldorado - on Hwy 285 — with 1,200 +/— homes and only 3 roads out to Highway 285! There is no "back" or alternative routes out of this community for 3000 or 4000 people in case of the unthinkable accident. Call me selfish — but — that makes me nervous. I would imagine there are a few more situations like this on down the road.

3 I do oppose the opening of the WIPP site for other reasons that are obvious — but what does — how long? — gas, water, and other exploration near the site. Need I go on? Please.

## Comment C-040

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| even though CHRISTINE ~~M. ORTIZ~~ | M. | ORTIZ |

| Location | Date | Time |
|---|---|---|
| Sweeney | 1/9/97 | 4p |

Representing? Santa Fe

**Specific Comment(s) (Summarize & be concise on this form)**

1 The current circumstance of transportation on Santa Fe's roads is dangerous. With St. Frances Drive and Cerrillos Rd. being the main thoroughfares, there is no way that the semis carrying nuclear waste will be safe. Everyday is a 'touch-n-go' situation: potholes, speeders, DWI's, pedestrians, tourists, buses. A person has to have 'nerves of steel' to avoid a collission. I haven't even mentioned the lack of lights, and presumption of the street signs that one knows where one is going.

2 When we open that storage facility, it will be the end of our state — present and future — all in the name of greed.

## Comment C-041

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

Nina Zelevinsky — First Name (please print)
M
Zelevinsky — Last Name

Sweeny Hostel — Location
1/9/97 — Date
3:30 — Time

Self — Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

I have Multiple Chemical Sensitivities
Was unable to stay at the
Wipp Hearings due to new building
materials (paint, carpet) being used.
Please try to schedule public
1 meetings in Chemically safer environments
so that we are accessible to
all —

Thank You

## Comment C-042

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

MARIE — First Name (please print)
M
ORTIZ — Last Name

514 CALLE LUCIERO — Location
1-9-97 — Date
4p — Time

Santa Fe — Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 It will hurt us and the future
generation, dangerous roads are
affecting this project from being safe.

## Comment C-043

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| LARRY | R | AVENS |

| Location | Date | Time |
|---|---|---|
| SANTA FE | 1/9/97 | 7 PM |

Representing? MYSELF

**Specific Comment(s) (Summarize & be concise on this form)**

1 Let's Quit DINKin Around And open WIPP

## Comment C-044

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

1 **Written Comment Record** IN SUPPORT OF NO ACTION & ALTERNATIVE

| First Name (please print) | M | Last Name |
|---|---|---|
| Sally | P. | Spencer |

| Location | Date | Time |
|---|---|---|
| Santa Fe | 1/9/97 | 7:30pm |

Representing? Human & other children of the Earth (I am an elementary school teacher)

**Specific Comment(s) (Summarize & be concise on this form)**

2
1. The DOE should be putting energy & money towards developing ALTERNATIVE ENERGY so that nuclear energy, which has created this nightmare of waste, becomes obsolete.
2. NO MORE BOMBS NEEDED! We can destroy the world many times over with the bombs we have. Put these resources towards solutions to the worlds' problems, not compounding them.

3
3. 24,000 years as a HALF-LIFE to this waste is mind-blowing! How can we ever dream that anything can made safe from all unforeseen, unpredictable potentialities in this time? Earth movement, water shifting, the explorations of future uninformed humans or other beings could all be catastrophic! Do we care so little for our home mother Earth, that we would put her & her children at such risk?

## Comment C-045

SENT BY:DOE ; 1-14-97 ; 10:03 ; CAO/OIEA→ 15052248030;# 2

Los Alamos, N. M.
January 8, 1997

SEIS Comments
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88220

1 Please record our comments as favorable to the draft environmental impact statement for the Waste Isolation Pilot Plant. We encourage the opening and use of WIPP for low level nuclear waste as soon as possible.

Sincerely,
Dorothy Minor
Robb Minor
Dorothy and Robb Minor
103 Rover Blvd.
Los Alamos, NM 87544

COPY

## Comment C-046

6 January, 1997
1002 Cedardale Drive
Las Cruces, NM 88005
(505)-523-1867

Harold Johnson, SEIS II Comments
USDE, PO Box 9800
Albuquerque, NM 87119

Dear Sir:

Reference is made to your Notice on page 3 of *El Hispano News*, Vol 31, Nr 35. I have not had the opportunity to read the draft SEIS II. Nevertheless, I feel that I am sufficiently informed on the subject to express my opinion concerning the question posed at the bottom of the above referenced Notice.

My answer is: Yes, get on with it!

1 My reasoning is: It is impossible for me to comprehend any rationale which argues that it is safer, either short- or long-term, to continue storage at the current or any other temporary sites.

Sincerely yours,
William Ohmstede
William Ohmstede

## Comment C-047

SEIS II Comments
c/o Mr. Harold Johnson
P.O.B. 9800
Albuquerque, NM 87119

January 13, 1997

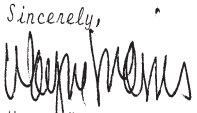
To whom it may concern:

As an engineer with experience in nuclear energy and waste storage projects, I judge the Department of Energy WIPP project to be sound in scientific theory, based on professional engineering principles, and in compliance with strict environmental standards.

In my view, the project site and transportation system meet all the criteria for the ultra-safe and responsible movement and storage of the nuclear waste materials they were designed to accommodate.

1 The Department should be directed to start moving the waste materials to the site and underground as soon as practical. Two decades of discussion and debate are enough; it's time to open WIPP!

Sincerely,



Wayne Morris
524 Rover Blvd
Los Alamos, NM 87544

## Comment C-048

Author: RForthofer@aol.com at ~internet
Date: 1/27/97 6:13 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: EIS for WIPP
---------- Message Contents ----------

To whom it may concern:

1 I am concerned about the plans to store plutonium contaminated waste at WIPP. It seems as if there is any problem with the storage due to water seepage, earthquakes, nearby drilling for oil, etc., that it may be infeasible or impossible to retrieve the waste.

2 Other solutions that seem more reasonable include vitrifying the waste and storing it above the ground where it can be retrieved if new technology for disposing it becomes available.

3 If WIPP is opened, the transport of the material seems like a disaster waiting to happen. Estimates are that there will be 28,000 trips through Colorado. The chances of an accident may be remote, but when there are 28,000 trips, the chances add up. If I-25 is used, the transportation goes close to or through heavily populated areas for a long distance. The risk of a terrible accident seems to outweigh the advantages of this questionable disposal.

I urge you to reevaluate this situation.

Sincerely,

Ronald Forthofer, Ph.D.
former Professor of Biostatistics

Comment C-049

Harold Johnson
SEIS II Comments
U.S. Dept. of Energy
P.O. Box 9800
Albuquerque, NM 87119

1 No, The U.S Dept. of Energy should not dispose of radio-active waste near Carlsbad! Leave it where it is.

2 A better solution would be to cease making any or put

3 scientists to work to use the waste for some good purpose.

Transporting such waste from

1 one place to another is more of a hazzard to more people than if left where it is made.

Lorraine Hanley
1003 La Ladera
Belen, NM 87002

Comment C-050, Page 1 of 2

Howard B. Kreider, Jr.
44 Benzell Drive
Centerville, Ohio 45458
1/12/97

U. S. Dept. of Energy
P. O. Box 9800
Albuquerque, NM 87119
Attn: Harold Johnson, SEIS II Comments

Personal Background

Research Chemist and Supervisor for Callery Chemical Company for five years.
Research Chemist for Monsanto Company and Monsanto Research corporation in Springfield, MA and Miamisburg OH for 10 years.
Senior Nuclear Quality Control Engineer at Monsanto Research Corporation at Mound Facility, Miamisburg OH for 15 years.
Retired as Supervisor of Nuclear Quality Control for Monsanto Research Corporation at Mound Facility Miamisburg OH in 1982.
Independent Review Committee for Waste Management representing Quality Assurance for 6 years.
President of HBK Quality Consultants, Inc. since 1982.

Experience with Nuclear Materials

Having worked with Nuclear Energy since 1964, I have gained some insight concerning the advantages and problems associated with the use of uranium and plutonium and several of the associated isotopes. I have conducted various chemical analysis in glove boxes as well as operated the mass spectrometer for additional identification of the various elements. As a QC Engineer, I have become familiar with many of the hazards in packaging and storing of nuclear products as well as nuclear waste. My association with the Independent review Committee has taken me to the WIPP site and I am somewhat familiar with that operation.

Recommendation

1 With this background, I strongly recommend that the WIPP site be utilized to store the defense generated transuranic radioactive waste. It is my opinion that it is a far safer and less hazardous storage site than any other site or method of storage proposed as of this date. As I recall, the reasons provided by those who object to this site have such a remote possibility of occurrence that they should not be permitted to halt the use of this site. Many of the current sites do provide safe short term storage but they could not reasonably be considered as safe as the WIPP site for long term storage or disposal.

Additional Comments

In the past, I have heard the comments of those who oppose the use of the WIPP site. They consider themselves more knowledgeable than all those who work with these materials and yet they have failed to propose a better solution to the existing problem. I suspect they have ulterior motives such as owning stock in companies that they anticipate would get the contracts to repackage these wastes or clean up storage sites that become contaminated or perhaps even the manufacturers or suppliers of some of the containers for the radioactive waste. Some are also politicians who believe that they will get more votes by convincing the public that radioactive waste is extremely dangerous no matter how it is contained and maintained and therefore the public must oppose all proposals made by the DOE and the government. There are also a few disgruntled employees who worked for one of the DOE facilities who are trying to make the company that operated the site, or the DOE, pay for their belief that they were not adequately compensated for their efforts, either in prestige or financially. They are also not concerned about the cost of their actions to their fellow Americans or their children and grandchildren. They, of course, claim to be concerned about future generations, but these concerns are also based on unrealistic odds that a disaster will occur.

Howard B. Kreider, Jr.



# Choctaw Nation of Oklahoma

DRAWER 1210 • 16th & LOCUST
DURANT, OKLAHOMA 74702
(405) 924-8280 or 800-522-6170

REAL PROPERTY MANAGEMENT

January 14, 1997

Mr. Harold Johnson
NEPA Document Manager
P.O. Box 9800
Albuquerque, New Mexico 87119

Attn: SEIS Comments

Dear Sir/Madam:

After reading the Draft Supplemental Environmental Impact Statement Summary, we are definitely in favor of NO ACTION ALTERNATIVE 2: Basic Inventory, Treat Newly Generated Waste to WAC, Store at Generator Sites, Dismantle WIPP.

1

The largest percentile of our precipitation comes from the South Western United States and our prevailing winds are always from this direction.

We have always been residents of this general area and do not plan to move. We are not in the Waste Production Business. If these poisons have to be produced in a certain location then the by product and its problems should be at that site and not hauled all over the entire United States.

Sincerely,

Tom Williams, Director

TW;ow

pc file

## Comment C-052

Author: Elizabeth A Nanez <naneze@BATTELLE.ORG> at ~internet
Date: 1/17/97 10:36 AM
Priority: Normal
Receipt Requested
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: FW: SEIS Comments
---------- Message Contents ----------

>----------
>From: Miner, Alison - DOE
>Sent: Tuesday, January 07, 1997 3:18 PM
>To: Johnson, Harold - DOE
>Cc: Hurtt, Dennis - DOE; Wayman, Cooper - DOE
>Subject: SEIS Comments
>
>I got a call yesterday from a professor at NMSU,C with comments on the SEIS
>which I will try to summarize below. They came from Mr. Mel Vuk and he also
>indicated that he did not want to testify in public but wanted these concerns
>made known. I am only passing on his comments in case these represent other
>concerns of the public in the hopes that you will find them helpful in your
>dealings with the public. In my conversation with him I just said you were
>out of town but that I would see that you got them.
>
1 >In Appendix E, p. 58-60 it looks like Batelle hasn't done their homework with
>regard to talking to the railroad industry recently. There are lots of
>issues they should take up concerning dedicated train costs, speed, etc.
>Only three railroad cars can be used on a dedicated train, but this could
>probably be negotiated to double that many. The industry is changing quickly
>and there are fewer and fewer competitors all the time due to
>mergers/consolidations. Recommends Alternative 1 - mix of rail and road
>transport. The railroads need the business and there is a public perception
>of safety - get the waste off the highway. Furthermore, there is no
>inconvenience to the public if there's a delay on a dedicated train shipment.
>
>It just so happens that he has a friend who is the Director of Special
>Projects for the Union Pacific Railroad, Mr. James Farrell, (402) 271-4023.
>

## Comment C-053

01-19-1997 03:17PM MAIN STREET CASE COMPANY 208 354 8636 P.01

David Hensel
Box 81
Victor, Id. 83455
208-354-8636 voice/fax

**attn.: Harold Johnson**
**NEPA Document management Manager**
**SEIS Comments**

To whom it may concern;

I wish to comment on the EIS on WIPP. Because I live in the eastern part of Idaho, the INEL is my neighbor, I want to comment by letter rather than driving the 400 miles to Boise.

1 The DOE has spent decades and billions of dollars on WIPP. What all this time and money has brought is the fact that the facility is not suitable for its proposed mission. The salt tunnels are collapsing at a rate that is significantly faster than the early projections suggested. The
2 salt dome, rather than being free of water, is underlain by pressurized brine. WIPP will do little to alleviate the problem of safe long term storage of TRU wastes. It seems that the real push to open WIPP comes from political forces. Opening WIPP and trucking wastes around provides the political cover for those who made short sighted decisions for immediate political gains. Nuclear waste shouldn't be treated as a "prize" for the loser in some high stakes political game of musical chairs.

As a Idahoan, and a neighbor to a huge nuclear waste dump, I find it disingenuous for the DOE to be wasting money shipping waste around from state to state rather than using the money wasted on gas for meaningful cleanup. WIPP is being billed as the solution for Idaho's nuclear
3 waste mess. The truth is that only a minuscule amount of the waste from Idaho will go to WIPP, and that the waste that will leave the state is the TRU waste that poses the least threat to the environment. Roughly a half million curies of radiation is scheduled to be shipped out of the state. This is about 1/6 of the radiation that comes in with a single navy shipment of nuclear waste. To add injury to insult, the DOE in Idaho claims it has to burn the Idaho TRU wastes before they can
4 be shipped to WIPP. The DOE in New Mexico told the EPA that the Idaho waste needs no treatment. So for some undisclosed reason the Idaho DOE is going to take waste that is relatively safely contained, burn it, with all the dangers that entails to Idaho's air and then put it on a truck and ship it to a site that is unsuitable for permanent disposal.

I think that your EIS has missed a few things or that your various state offices are not
5 reading from the same script. Before moving any more waste around I think the DOE should examine the economic consequences of wasting clean up money on shipping and should also examine in detail the cost and contingencies for removing the waste from WIPP if and when things start to go wrong there.

Thank you for your time and please take a little more time to examine this issue.

Sincerely,
David Hensel

TOTAL P.01

## Comment C-054

Author: Mark Trump <marktrump@msn.com> at ~internet
Date: 1/20/97 9:49 AM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP
---------- Message Contents ----------

Please note my response to your request for INPUT on WIPP as seen in the atlanta paper.

1 | I am in favor of the the WIPP facility.

I am also favor the operation of the Yucca Mountain facility.

Mark Trump

## Comment C-055

Author: "Paul E. Sanchez" <pesanch@nwer.sandia.gov> at ~internet
Date: 1/20/97 5:07 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Favorable comment on SEIS-II
---------- Message Contents ----------

Dear WIPP project

I am commenting on the WIPP project and SEIS-II as a taxpayer and a single father who is raising two small children in the Carlsbad area. And as other commenters may be doing, I am also taking this opportunity to personally comment on the project from an ethical standpoint.

I am a 6-year resident of Carlsbad, New Mexico, and prior to coming to Carlsbad, evaluated natural and man-made hazards and risks for many local governments in California, including for Los Angeles County (earthquakes, hazardous materials etc.). As an earth scientist, with considerable background in evaluating such issues, I came to Carlsbad to oversee the WIPP project for a state agency delegated at that time with such authority. During that time, I became convinced that our generation not only had an ethical obligation to permanently store radioactive waste, but that the WIPP project is a viable location for permanent deep geologic disposal.

I also found that other countries prefer deep geologic disposal alternative over reliance on surface storage, the latter of which requires long-term surveillance and maintenance, potentially exposes workers to radiation exposure as containers degrade, and in due course could be neglected by future societies. From an intergenerational and intragenerational standpoint, our society created the problem and we must deal with it. The countries of Germany, Sweden, Switzerland, Japan, Canada, France, Belgium and Italy have all reached this conclusion, so I am not surprised that the SEIS-II concludes the same, as did the independent U.S. National Academy of Sciences, who recently assessed the WIPP project (Library of Congress 96-68944)

Granted, there are speculative scenarios, as suggested by the 1996 National Academy of Sciences WIPP Committee, that could be posed that would undermine any solution involving permanent deep geologic disposal. As well, I am sure there are legal and regulatory arguments that could derail any society's attempt at carrying out it's ethical responsibility to future generations. I am not sure that such arguments benefit a constructive resolution.

1 | I for one, as a father who resides in Carlsbad, agree with the SEIS-II conclusions. I am knowledgeable enough, in terms of education (M.S. Geology), familiarity with hazard evaluation, and the WIPP project specifically, to understand that the risks from WIPP transportation, operations, and permanent disposal are not only acceptable, but also well below voluntary and involuntary risks accepted or imposed on us daily, much less over the course of our lifetime. Any prolonging of a decision on WIPP will only end up costing our society more and jeopardize future generations.

1 | As a resident of the impacted area, I say move the project forward and ensure that implementation of TRU waste disposal at WIPP is conducted safely and with proper oversight.

Thank you,

Paul E. Sanchez
PO Box 2488
20 miles SW of WIPP
Carlsbad NM 88221

Comment C-056

2605 Stanford Av.
Boulder, CO 80303
Jan. 16, 1997

Mr. Harold Johnson
SEIS II Comments
U.S. Department of Energy
PO Box 9800
Albuquerque, N. M. 87119

Dear Mr. Johnson:

1 It is my understanding WIPP should never have been located where it is. The site is geologically unsuited for the purpose.

Even supposing the facility were ideal, transporting to it over 38,000 truckloads of hazardous waste across several states is too frightening to contemplate. The Government's estimate that in 35 years such shipments will 2 result in only 3 deaths is straight out of Never-Never Land. It is naive in the extreme to believe that only one serious accident will occur during that massive operation, and one accident alone could cause hundreds or thousands of deaths.

Yours truly,

Marian Cook March

Mrs. Michael S. March

Comment C-057, Page 1 of 2

1-18-97

Harold Johnson, NEPA Document Manager
Attn: SEIS Comments
Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson,

Having recently moved from Jackson, Wyoming, a town directly east of the Idaho National Engineering Laboratory, I have been greatly concerned with nuclear waste and belong to the Snake River Alliance, which you may know is an organization of concerned citizens who are opposed to nuclear proliferation and the trafficking of its waste from one area to another.

1 Even though I have moved to Las Vegas, I am still concerned about nuclear proliferation and its movements (even more so) and am appalled that the U.S. Government wants to move the waste again from one place to another. The Waste Isolation 1 Pilot Plant (WIPP) will be no safer than where this waste is already held and the chances of a major disaster will only be compounded by moving it to another location. I do not need to quote statistics as I'm sure you know them already.

## Comment C-057, Page 2 of 2

At this time I just want to beg everyone concerned with "WIPP" to use the most sane way to deal with the nuclear problem.

2 | Stop using nuclear products period! And leave the waste where it is!

Thank you,
Diane Reimers
8000 Spring Mtn. Rd. #2170
Las Vegas NV 89117

## Comment C-058

15 January 1997

U.S. Department of Energy
Attn: Harold Johnson, SEIS II Comments
P.O. Box 9800
Albuquerque, N.M. 87119

George L. Miller #60,000-1059
P.O. Box 500 PCF Unit AC-34
Appleton, Minnesota 56208

Mr. Johnson:

Per newspaper add, Rocky Mountain News, dated 5 January 1997 a question was posed..."Should the U.S. DOE dispose of defense--generated transuranic radioactive waste near Carlsbad, New Mexico?"

It is understood that the WIPP is an old abandon salt mine. Should waste be stored there?

1 | What is the depth of this old mine?

Will it be stored in containers (barrels) which will eventually rust and then leak because of the salt content?

2 | If a leak does occur...will the radioactivity leak into the water table?

1 | Will the containers be stored inside another container; or a vault of some type? What type of material is the container or vault constructed from? And how is it constructed?

3 | Will the WIPP store U.S. or Russian radioactive waste...1994 Operation Saphire from Kazakhstan, Russia to Oak Ridge Tenn.?

1 | What is the projected completion date of the storage system?

Could the waste be stored permanently at Rocky Flats utilizing the same system which will be used at WIPP? Why or Why not?

4 | September 1991 the Governor of New Mexico had N.M. State Patrol set up road blocks at the Colorado/New Mexico stateline and refuse to accept Colorado's waste which came from Rocky Flats. Will New Mexico's Governor accept it now?

5 | What will this cost the Colorado taxpayers to construct and maintain this disposal sight for Defense--Generated radioactive waste?

Would it be possible to acquire a "draft" of the Waste Isolation Pilot Plant Disposal Phase (SEIS II)? Perhaps it would answer most of these questions? Thank you for your time.

Sincerely,

George L. Miller

TRIDEC
TRI-CITY INDUSTRIAL DEVELOPMENT COUNCIL
901 N. Colorado • Kennewick, WA 99336-7685 U.S.A. • (509) 735-1000 • FAX (509) 735-6609 • 1-800-TRI-CITY

January 17, 1997

Mr. Harold Johnson
NEPA Compliance Officer
U.S. Department of Energy
PO Box 9800
Albuquerque, NM 87119

WASTE ISOLATION PILOT PLANT
SUPPLEMENTAL ENVIRONMENTAL IMPACT STUDY II

Dear Mr. Johnson:

We appreciate this opportunity to present the view of our organization upon this subject which is of major interest to the Tri-City business community and could have a significant impact upon the clean-up of the Hanford site. The Tri-City Industrial Development Council (TRIDEC) is an organization of over 500 individuals, business firms, and organizations dedicated to the economic growth of the Tri-Cities area. We have been designated by the Department of Energy as the "one voice" spokesman for the community on Department activities related to the Hanford site.

The cleanup of the Hanford site and its future utilization for other purposes is an issue of major importance to the Tri-Cities area. We request that you include the issues discussed below in the preparation and evaluation of the Record of Decision on the Waste Isolation Pilot Plant EIS II.

The selection and development of the WIPP site and its waste disposal facilities has been the subject of many controversies, studies, evaluations, legislation, and issues resolution for many years. With the publication of this final Record of Decision, the WIPP can proceed with its intended purpose which was and is to meet a significant national need for the final disposal of the plutonium residues and waste resulting from our nation's nuclear weapons program. Additional studies and evaluation will not add significant new information to the voluminous mass of data that is already available.

Our following comments on this subject are based upon several criteria and policies which we have developed regarding the Hanford site clean-up program.

1 • Clean-up of the Hanford site should proceed as rapidly as possible consistent with regulatory and technology constraints, and as funding limitations permit.





1 • TRU wastes must be removed from the Hanford site and disposed of at an appropriate national disposal site such as WIPP.

• An appropriate and high degree of site and public health, protection and safety must be achieved in all cleanup, processing, and disposal programs.

• The site clean-up standards must be consistent with future land use planning.

With consideration of these values and policies the following comments are submitted regarding the subject supplemental Environmental Impact Statement.

2 • We support the preferred alternative as the most cost effective, environmentally acceptable solution for the permanent disposal of the nation's TRU wastes at the WIPP site.

3 • The Hanford site currently contains a major portion of the TRU wastes which are planned to be disposed of at WIPP. The current preferred alternative only addresses the disposal of the post 1970 generated TRU wastes. Hanford also has the majority of the pre 1970 generated TRU waste material on site. The disposal of the pre 1970 material by leaving it in the current near surface burial on the Hanford site is not acceptable to this community and region. The retrieval, processing, and disposal of this large volume of material must be addressed. If the Department lacks the authority to address this issue under the current WIPP authorization, then aggressive action must be taken by the Department to obtain the authority to study this issue. This should include expansion of the WIPP facility to accept and safely dispose of an additional volume of TRU waste. The WIPP facility has been shown to be the most suitable site available for the disposal of TRU waste materials.

2 • We do not consider the no action alternatives and Alternatives 1,2, and 3 to be acceptable. The no action alternatives which consist of basicly closing the WIPP site and leaving the existing TRU wastes at various DOE sites is not acceptable for environmental, public, health, safety, and policy reasons.

2 • Alternatives 1,2, and 3 all relate to processing and disposal of the TRU wastes in differing waste forms, with only marginal improvements in environmental protection, are not acceptable. This unacceptability is due to the increased costs for disposal, the increased volumes of processed waste, and the requirements for on site storage for the next 150-160 years. Leaving the waste on site for this period of time would realistically result in permanent disposal of the wastes in temporary storage facilities. This would not meet the WIPP repository or the national waste clean-up program objectives. Since much of the delay associated with these alternatives results from limitations at WIPP in placement of the wastes

Mr. Harold Johnson
January 17, 1997
Page three

2 in appropriate and limited disposal locations, actions to increase the waste disposal rate by an order of magnitude must be developed if these alternatives are to be seriously considered.

4 • We also have significant concerns regarding the transportation of the packaged wastes from Hanford to the WIPP site only by truck as described in the preferred alternative. There are two issues in this regard - the first is the use of available commercial rail transportation is shown in the EIS II to be significantly cheaper and safer than the exclusive use of trucking. It is recognized that the existing safety record for the transportation of nuclear materials and wastes by truck is excellent; however, an accident involving these materials would result in a significant adverse reaction by the public to the transportation activity.

5 • Consideration should be given to a significant program for the training and equipment of local government emergency response capabilities along any rail or highway transportation corridor. Governmental entities, stakeholder organizations, and tribal governments have all expressed repeated concerns regarding this issue. The Department must address as how to best meet these concerns. Consideration should be given to the use of the Hazardous Material Emergency Response (HAMMER) training facility at Hanford in addressing the need for the additional training which should be provided to the emergency response organizations in the transportation corridors. The HAMMER program, which is funded by the Department has a goal of providing this type of training to local, state, tribal and other federal agencies.

In summary, we support the early opening of the WIPP facility for the receipt of TRU waste materials from within the DOE complex. Further delay or study will serve no useful purpose.

Thank you for the opportunity to express our views on this subject.

Very truly yours,

Sam Volpentest

Sam Volpentest
Executive Vice President



To; SEIS II
P.O. Box 9800
Albequerque, N.M.
87119

From; Jeff Moyers
RPM2 Building Services Ltd.
1122 Portland Place #206
Boulder, Co. 80304

RPM 2
& ASSOCIATES

To Whom It May Concern;

1 Shipping all that nuclear waste to the Waste Isolation Pilot Project for burial is really a bad idea. It is a much better idea to keep it on site and store it in a way as to be accessable and monitorable without risking contamination of major waterways, sources of drinking water and major bodies of water such as the Gulf of Mexico.

2 I live in Boulder, Colorado. 25,000 shipments of waste from Rocky Flats, just outside of Boulder, are slated for WIPP. What happens if one or two of these trucks is involved in an accident ? What happens if these accidents are in populated areas of Denver or Golden ? NO MORE COORS BEER ! This would be the least of our trouble, of course ! What happens if some of the shipments are hijacked and used for black-mail ? What security measures are in place to assure safe passage of the wastes ? Are they reasonable ? [In the sense that the probabilities that a catastrophic failure could be avoided]. The odds of a catastrophic failure for the Space Shuttle were set at about 1 in a million. It turned out to be more like ONE IN TEN ! Your response ?

3 Other issues are involved which defie simple engineering and science; [How do you respond to these issues?]

2

4 1. States have a certain amount of autonomy. Why should Colorado allow the shipment of other state's waste thru our beautiful state when it could be stored on the site whereit was generated ? Are we paid for this ? How much ? What about

5 insurance for accident coverage; who pays for it ? Is this insurable ? Probably not since generating was not insurable !

6 2. If we bury the waste at WIPP how will the citizens of this nation monitor it ? What will prevent parts of it disappering ? Is

7 Westinghouse and the DOE that good ? Westinghouse has a dreadful record as a corporate polluter. Why were they chosen for the job of burial ?

Obviously, I could go on and on with the problems. And there are problems with storing on site. But WIPP's problems and potential for catastrophy are much greater ! Please concider this with the utmost care and contemplation.

Sincerely, Jeff Moyers

## Comment C-061

The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
PHONE (208) 238-3708
(208) 238-3709
FAX (208) 327-9736

TRIBAL/DOE COORDINATOR &
PROJECT DIRECTOR
P. O. BOX 306
FORT HALL, IDAHO 83203

January 14, 1997

Mr. Harold Johnson, NEPA Compliance Officer,
ATTN: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

RE: *Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement*

Dear Mr. Johnson:

1 In order to thoroughly and properly review this document and prepare written comments, the Tribes respectably request an extension of the comment deadline from January 28 to February 28, 1997.

Thank you.

Sincerely,

Robert Bobo, Project Environmentalist

cc: Fort Hall Business Council
Richard Suckel, Project Director
Jeanette Wolfley, Attorney

## Comment C-062

SEIS-II
PO Box 9800
Albuquerque NM
87119

Dear sirs,

1 I am writing to express my support of the immediate use of the WIPP facility to store certain long-term radioactive wastes. There is no perfect solution to the problem we face in putting this sort of material into a facility where we will face the least hazard, but the WIPP site and the precautions that go with it seem to be as reasonable as we might expect to find. I am convinced that we will not be able to do any better in any reasonable amount of time. The enormous investment the nation has made in the facility also calls for implementation of the mission for which it was designed.

2 Concerns about the transportation of the material are real, and I urge you to stick to strict rules and a hard-bitten attitude with contractors to make this trucking chore as safe as possible. There will be a transportation problem with this material someday, and there are no technical improvements coming that will ever make this any easier or safer. An effective and orderly plan should begin as soon as possible.

I am writing to begin to counteract the blindly obstructionist opinions I hear, about WIPP and in general, concerning the responsible disposition of radioactive materials. It is irresponsible to leave this problem as it is, or to block reasonable plans. You do, however, carry the important responsiblity to carry out this mission with safety, efficiency and honesty.

I began to live with radiation and radioactive materials in my professional career over thirty years ago, and I have learned to live with their hazards and their opportunities with care and respect. I have every expectation that this is the only way to work with the problem of disposal that we all face, and that the WIPP operation will be the best among the reasonable choices.

Sincerely,

R. O. Peterson, Ph. D.
763 16th Street
Boulder CO
80302

## Comment C-063

Author: Faxman2000@aol.com at ~internet
Date: 1/21/97 2:26 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Transuranic Radioactive waste
---------- Message Contents ----------

1 | I believe the radioactive waste, temporary stored at sites like the Savannah River Plant in South Caroline, SHOULD be moved and managed to New Mexico.
1 | Between the DOE and Sandia National Labs (Lockheed Martin) teams, New Mexico has the best folks to handle the material. There is also less chance of water (river and ocean) contamination.

Thank you for the oppertunty to voice may opion.
Michael

## Comment C-064

Author: michael.potvin@srs.gov at ~internet
Date: 1/22/97 12:51 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP SEIS II
---------- Message Contents ----------

1 | I support DOE's plan to permanently dispose of transuranic waste at WIPP rather than leaving it at the generator site.

## Comment C-065

January 21, 1997

Dear Mr. Johnson,

Please help stop production of nuclear waste. Leave existing waste at the sites where it has been generated – above ground – in the public eye where we will not turn our backs on it. Do not want to grow WIPP as long as there is no plan to stop generation of the wastes and questions as to the the safety of its design shall exist.

1

2

Marilynn,

Dee Homans
andrew Davis
PO 1354
Santa Fe, NM
87504

## Comment C-066

376 N 400 E
Rupert, Idaho 83350
January 17, 1997

U.S. Department of Energy
SEIS II Comments
Att: Harold Johnson
P.O. Box 9800
Albuquerque, New Mexico 87119

Gentlemen:

It is absolutely ludicrous to leave trans-uranic waste sitting over southern Idaho's water supply when there is a site in the barren deserts of southeastern New Mexico where this material could be stored.

The New Mexico site would place this material in an inert salt bed hundreds of feet thick and far below the surface where the likelihood of alteration of its environment would be virtually zero. And there is nothing of value for this material to contaminate.

Compare that to its present location atop the water supply for the entire southern end of the state of Idaho. Thousands of farmers and countless cities and towns depend on the Snake River Plain Aquifer for irrigation water, for drinking and household water and for industrial production.

Should that water supply become contaminated by unforseen release of radiation from this material, it would devastate the entire region.

There is no comparison between the two sites as to their potential for damage to the surrounding area, its people or to future generations.

The WIPP site in New Mexico has been virtually ready to receive this waste for many years. It must be used instead of leaving this radioactive waste stored over the Snake River Aquifer in southern Idaho.

1

Sincerely,

Ralph W. Maughan

Ralph W. Maughan
Retired farmer

## Comment C-067

Farmington NM
Jan20, 1997

Mr. Johnson,

Just a quick comment on the WIPP project. My wife and I both feel that after nearly two decades of research, refining rehashing and fine-tuneing the operation and evironmental concerns of the WIPP site and operation it is time to get the show on the road and start operating. We feel that adequate safeguards are in place and it is
1 time to get this radioactive material out of it's temporary above ground storage places and put into WIPP where it can be monitored and stored safely.

Sincerely,

Norling Anderson

Norling Anderson
1911 E 25th St.
Farmington, NM 87401

## Comment C-068

Author: CharlesFederle@webtv.net (Charles S Federle) at ~internet
Date: 1/23/97 4:17 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Transuranic radioactive wastes
---------- Message Contents ----------

1 Please leave it in temporary storage, so that is available for commercial use. How can I obtain detailed analysis, packaging, and access?

Charles S. Federle

## Comment C-069

William C. Schaefer III
426-4th St. N. Ext.
Nampa, ID. 83687
(208) 466-6565

January 21, 1997

Mr. Harold Johnson
NEPA Compliance Officer
P.O. Box 9800
Albuquerque, NM. 87119

Public Comment on the draft Waste Isolation Pilot Plant (WIPP) Disposal Phase Supplemental Environmental Impact Statement (SEIS II).

Dear Mr. Johnson:

1 For the record, I support and urge, the Department of Energy (DOE), to expedite the opening of the WIPP facility in New Mexico. We have waited long enough for the opening of a repository facility for the disposal of transuranic (TRU) waste.

2 As a disaster preparedness specialist, I have one concern relating to the SEIS II. Pages S-36 through S-40 of DOE/EIS-0026-S-2 covers transportation analysis. I would like to request that the DOE give more consideration to the use of rail service, or a combination of rail and truck service, in the transportation of TRU shipments. If twice as many shipments can be made via rail service than truck, then the number of potential accidents can be reduced. The safety record of TRUPACT-II containers is well documented, so the safety concern is in the number of shipments. By the use of a rail/truck combination, the total number of shipments can be lowered, and the safety factor increased. I would ask the DOE to reconsider the transportation mode, and consider the combination of a rail and truck service for the transportation of TRU waste.

I would also like to urge the DOE to expedite the Yucca Mountain, Nevada site project as the nations waste repository for nuclear waste/spent fuel.

Thank you for allowing me to comment in writing.

Sincerely,

Wm. Schaefer

## Comment C-070

PO Box 2301
Estes Park, Co. 80517
January 19, 1997

Mr. Harold Johnson
NEPA Document Mgr.
Att: SEIS. Comments
PO Box 9800
Albuquerque, N.M. 87119

Dear Mr. Johnson -

1 The WIPP site is unrealistic! There is no such thing as disposal of radioactive material. The transuranic waste from Rocky Flats, that is targeted for WIPP, is contaminated with plutonium. Plutonium will remain radioactive for 240,000 years!

2 Above the WIPP site is a layer of ground water which flows into the Pecos River, which makes its way into the Rio Grande and then the Gulf of Mexico. The area around WIPP is rich in oil, gas and minerals. When will there be future exploration and intrusion? How do we mark the site for future generations? In what languages? What signs will last to tell the dangerous lately? Don't we owe more to our grandchildren and great grand children and future generations?

3

4

5 The transportation of this waste to WIPP is very dangerous! There will be 40,000 shipments of radioactive material to WIPP. There will be accidents thus endangering thousands of people!

6 The containers to transport high radioactive waste have not been approved and built, so the safety of the containers is highly uncertain.

We live on a small planet. We have already done so much damage to it! We all need to work together to save our planet. Please help!

Sincerely,
Alice H. Gray

Comment C-071

12/31/96

Dear Mr Johnson,

1 I firmly believe that the DOE should not store radioactive waste at WIPP because it will leak.

2 The answer is to go solar and quit making the stuff, and employ those who make it in figuring out how to get rid of it. That should be enough full time employment for generations.

3 Also, I know waste from Los Alamos has been all over the roadways for years and there's never been a PUBLICIZED accident, but an accident is inevitable. We're human and we're not perfect. Let's at least shoot for sanity.

Have a good new year.

Sincerely,
Diane Stagner
Santa Fe

Comment C-072

LOS ALAMOS, NEW MEXICO 87544

December 30 1996

Harold Johnson, SEIS II Comments
U.S. Dept. of Energy
PO Box 9800
Albuquerque, NM 87119

Dear Mr Johnson —

1 I wish to register my vote in favor of the DOE opening and operating the WIPP immediately. And yes, the DOE should dispose of defense-generated transuranic radioactive waste as well as reactor waste in the WIPP. This action is long overdue.

2

3 Santa Fe is the worst possible location to conduct your public hearings. There is a certain segment of Santa Fe who are vociferous and negative to anything nuclear. Udall, the attorney general is also anti-WIPP. For the sake of progress, I would urge the DOE to listen to these particular people with restraint & patience to satisfy the current trend of public input, then DOE go in one ear and out the other.

1 In my opinion, we have dragged our feet long enough on this matter. I believe the majority of the people want progress on WIPP and feel it is time to ignore the vociferous minority.

Sincerely,
Carla Williams

## Comment C-073

Warren E. Quinn
98 Navajo Road
Los Alamos, New Mexico 87544

January 9, 1997

SEIS Comment
U.S. Department of Energy
Carlsbad Area Office
PO Box 3090
Carlsbad, New Mexico 88220

Dear Sirs:

1 | The WIPP facility should open as soon as possible to speed the removal of low level nuclear waste from the U.S. DOE nuclear weapons facilities. It is outrageous that the anti-nuclear activist have been successful in stalling the opening of WIPP. These stalling "actions" on WIPP have gone on a very long time and have costs the taxpayers millions of dollars. The storage of radioactive waste in the geologically stable salt beds 2,150 feet underground at WIPP is safe and the best option available.

1 | WIPP will meet federal standards for protection of the environment and will avoid the expense of continued storage of radioactive waste at several other DOE facilities. There are substantial costs in maintaining and certifying that the waste is stored according to federal and state environmental regulations in the various temporary storage areas. These costs will increase until the WIPP repository is available for safe, effective disposal of this waste.

1 | Another major issue frequently raised by the vocal anti-WIPP minority is the safety of transportation of nuclear waste from the various DOE sites where the waste is temporarily stored. This issue has been studied at length and the safe transportation has been demonstrated. The transportation of WIPP shipments on the public highways will be much safer than that of gasoline tankers.

1 | The WIPP facility should be opened as soon as possible for the storage of low level nuclear waste. This permanent storage will be much safer than the many temporary storage areas at the various DOE facilities.

Sincerely yours,

Warren E. Quinn

Warren E. Quinn, Ph.D. Physicist

## Comment C-074

Author: wbriggs@friendly.carlsbadnm.com at ~internet
Date: 1/24/97 11:45 AM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: Comments
---------- Message Contents ----------

Dear Sirs:

1 | Thanks to the wonders of E-mail, I am able to comment on the WIPP site opening. I watched some of the local TV coverage concerning comments by local citizens. I was frankly, embarrased by that elderly gentleman with the impressive credentials ranting and raving on TV, and was incredulous at the assertion that waste would leak out of the barrels, contaminate the ground water and migrate to the Pecos river in a matter of months (I read this in the Current Argus as coming from the citizens against everything in Santa Fe.) I wonder why the aftermath of the Gnome project hasn't killed everyone along the Pecos and hasn't produced mutant mesquitos large enough to stand flat footed and make love to a turkey. I recently retired from the WIPP after spending 11 years in the engineering department, and I have some fairly impressive credentials. The WIPP is so safe that, if they win another safety award people will start throwing up. My gripe with the WIPP site was the amount of paperwork and forms to be filled out. I had never worked with a better educated and knowledgeable crew before. I wonder why the media always listens to the protestors and disregards the National Acadamy of Sciences.

W.E. (wild Bill) Briggs
Former Electrical Engineer
wbriggs@friendly.carlsbadnm.com

Comment C-075, Page 1 of 3



3368 West 8475 South
West Jordan, Utah 84088-5246
January 14, 1998

Department of Energy
Attn: Harold Johnson
P.O. Box 3090
Carlsbad, New Mexico 88221

Your ad, coming officially from the Department of Energy, United States of America, appeared in the Sunday Salt Lake Tribune 1/12/97 asking the question "Should the DOE open and operate WIPP?

Since WIPP has already been built, your statement would read: "With your help, the DOE will determine whether it is better to permanently dispose of transuranic waste at the WIPP or to leave it in temporary storage at generator sites such as the Idaho National Engineering Laboratory?" is cowardly.

The assumption in your question seems to say the transuranic radioactive waste can be permanently disposed of at WIPP.

1 Since we know, from scientists outside the DOE scientific community, and those scientists not beholden to DOE, recognize that

Comment C-075, Page 2 of 3



1 people born after 1945 have strontium 90 in their bones and teeth, cesium 137 in their muscles, iodine 131 in their thyroids from low level radiation, and that low level radiation (man-made) stays in and builds up in the human body, attacking the human's immune system, which, of course means that a person's body is less likely to fight many diseases, your assumption that transuranic radioactive wastes can be permanently disposed of is false.

Even though it may be possible to show that all environmental abuses are exacerbated by low level radiation, how can one hope to convince the powers that rule the world to turn away from the nuclear option?

The Western powers that won World War II and saw in the nuclear bomb the promise of unlimited power are now also beset with an uncontrollable epidemic rise in radiation-induced illnesses and in the costs of medical care.

Your defense-generated transuranic radioactive waste will still be transuranic

Comment C-075, Page 3 of 3

SENT BY:DOE ; 1-21-97 ; 15:19 ; CAO/OIEA→ 5052343195:# 8

3 of 3

radioactive waste whether it stays at Inel, Idaho or whether it goes to WIPP near Carlsbad, New Mexico.

We've one of these low-level radioactive waste dumps, Envirocare, in our state that is in trouble, not because its allowing hundreds of thousands of tons of low-level radiation waste into our state, but because the licensing process was "totally corrupt."

With all this "troublesome trash" (man-created radionuclides, man created pesticides, herbicides, etc., man-created chemical weapons) man may just have "created" his own demise. If all our communes systems fails, who will there be to make all that money to bury us under the mask of censorships, subterfuge and suppression?

2 Hey, you don't need to worry about EPA. What do they know about the dangers of low level radiation or trash? Just as they have changed "sludge" from a hazardous waste, by definition, so that we can now use human excrement as fertilizer on our crops, but we must wash our hands after we go to the bathroom, so that we'll be "safe" from those shitty germs, EPA will surely find a way 2 to make WIPP a "safe" money-maker.

Louise F. Hess

Comment C-076, Page 1 of 2

BRISSENDEN
1130 N. ALLUMBAUGH #258
BOISE, IDAHO 83704-6798

22 Jan 1997

Mr. Harold Johnson, NEPA Document Manager
Attention SEIS Comments
Box 9500, Albuquerque NM. 87119

Dear Mr. Johnson,

I was unable to attend the Public Hearing on Jan 15th at the Red Lion Inn Riverside, Boise, ID. I do want to know:

1 1. Are the best geological information sources being utilized to analyze What ARE the very BEST locations for very long term storage for nuclear waste? Maps I've seen of the parts of the United States Geologically Non-Active and least likely to be influenced by volcanic activity ie: earthquakes - are: in the Dakotas and Part of Iowa. Is there any part of the above area not likely to threaten contaminating the water table of our mid-west food belt? Is the soil composition there comparable to that of Yucca Mountain in N.V., which I hear is very appropriate - (Dense?)?

2 2. What are possibilities for Yucca Mountain facilities, its role?

I will appreciate your consideration of the above.

Sincerely,
Mary Brissenden
1130 No. Allumbaugh #258
Boise, ID. 83704

Qs: Were any of these discussed/answered at the meetings held?
1. Why is Yucca Mtn. not considered?
2. Do these no better alternative than WIPP—?
3. Is it true that the vulnerable least volcanic [illegible] geologically area in the Dakotas and Iowa? Low density population? Has this Country not been considered? Why Not?
See my attached letter,

SNAKE RIVER ALLIANCE
BULLETIN
LIFEGUARD IDAHO
January 1997 • Volume 11, Number 1
Watching Out for Idaho's Quality of Life

# WIPP—WHAT A WASTE

Bad ideas never seem to die, no matter how deep the Department of Energy tries to bury them.

For the past 20 years, the DOE has been intent on burying plutonium-contaminated (transuranic, or TRU) waste 2,150 feet beneath the surface near Carlsbad, New Mexico. It has been trying to ship TRU waste to the Waste Isolation Pilot Plant there since 1988. The latest schedule is to begin shipments in late 1997. If those shipments occur, WIPP would be the world's first nuclear waste repository.

Measured by any number of yardsticks, those shipments should not occur.

**Will WIPP solve a significant part of the nuclear waste problem? No.**

The DOE wants to bury at WIPP only about 32% of existing TRU waste—65,600 cubic meters of 208,100 cubic meters. The DOE does not know what to do with the rest of the TRU waste; nearly 60,000 cubic meters of the excluded waste is already buried in Idaho in places such as Pit 9. It also wants to dispose of 110,000 cubic meters of TRU waste it will generate during the next 35 years. None of that will come from the Idaho National Engineering Laboratory. All the radioactivity of all the waste that will ever be buried at WIPP is only about 5 million curies, less than 0.02% of the radioactivity in all existing DOE and commercial waste. Only about 500,000 curies would be sent from Idaho, 1/6 the radioactivity in a single shipment of nuclear navy waste that comes in.

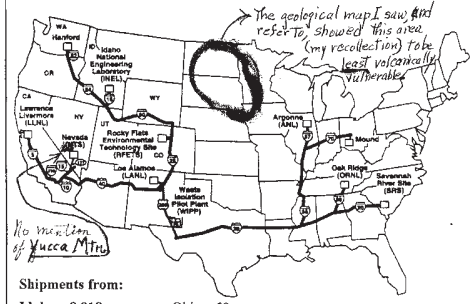
**Is WIPP safe? No.**

The DOE has been unable to open WIPP because of unresolved health and safety problems and unable to show that radiation releases would result in fewer than 1,000 deaths in 10,000 years. WIPP is surrounded by oil and gas wells and potash mines. Future mining at WIPP could allow nuclear waste to escape into groundwater or to the surface. Experts don't understand the groundwater system at WIPP very well, and millions of barrels of pressurized brine underneath its disposal rooms could bring waste to the surface. Small boreholes would not remain sealed for more than 200 years, another pathway for waste to escape.

**Are people endangered by the TRU waste at current storage sites? Yes.**

Nuclear waste is very dangerous. However, major DOE nuclear weapons sites—INEL and facilities

## TRUCK ROUTES FOR WASTE GOING TO WIPP




**Shipments from:**

| | |
|---|---|
| **Idaho—8,918** | Ohio—59 |
| **Washington—16,844** | Illinois—28 |
| Colorado—2,485 | California—162 |
| New Mexico—5,379 | Nevada—92 |
| S. Carolina—2,238 | **Total=38,089** |
| Tennessee—1,884 | |





Date: 1-21-97

Mr. Harold Johnson
SEIS II Comments
US Dept. of Energy
PO Box 9800
Albuquerque, N.M. 87119

Dear Mr. Johnson:

With regard to the WIPP hearing and request for comments, please note the following:

1. I have lived in Oak Ridge since 1973, my profession is environmental quality work, and we have significant surface and groundwater and soils contamination in Oak Ridge, Radiological and non-rad. We have much underground karst and high water tables. We do not represent a good waste disposal site, nor even a good storage site except for the best storage technology, and short term only for certain wastes and levels of radilogical wastes.

2. We need WIPP to open. It is low water table, less population density, no karst, and has advantages for TRU wastes disposal in New Mexico. Oak Ridge TRU in the ground or on the ground is almost simply in the river that runs by ORNL. We cannot afford the maximum of acute leak/spill or exposure nor the minimum of chronic exposure to water, pathways that can ( or have) impacts to living organisms, and varied pathways to humans. Open it and know the best interest of Tennessee and the nation are being served.

3. I express thanks to New Mexico, on acceptance to deal with the tail end of portions of a legacy of effort in defense of USA. Oak Ridge has done its part, and has paid an environmental price--and all damage cannot likely even be cleaned up. New Mexico is better able to hold these wastes to allow decay in an environment less likely to hurt the environment or the people of USA. Thanks, DOE and NM.

Jim Harless
237 Iroquois Rd.
Oak Ridge, TN. 37830

jdh

## Comment C-078

*Alethea L. "Lea" Hill*
*4731 Taylor Ridge Rd., NW*
*Albuquerque, NM 87120*
*Ph: 505-890-7061*

December 31, 1996

Harold Johnson
SEIS II Comments
US Department of Energy
PO Box 9800
Albuquerque, NM 87119

IN RE: Opening of WIPP

Dear Sir:

1 Yes, I think the DOE should dispose of defense-generated transuranic radioactive waste in the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. That was the purpose of building it in the first place.

The arguments I have heard and read against such an action are such things as deterioration of the salt beds in 200 plus years, there will be no way to notify people 5000 years from now of the contents of the facility, the contamination of ground water 100 years from now should the salt beds leak, the possibility of earthquakes, etc., etc.

It seems to me the ones against the use of WIPP are thinking of 200 or more years from now in terms of today. If progress can go from covered wagons to transoceanic super-sonic jet air travel in less than 100 years and have to invent the process as they went along then more rapid progress can be made in the next 100 years to alleviate any problems supposedly found in the WIPP now.

1 Nuclear fusion (implosion), I firmly believe, will be the power source of the future. It uses the materials that are to be stored now. Sandia Laboratories and others are making inroads into the creation of nuclear fusion. With the knowledge, and use of computers, now on hand I see no reason why this will not happen if the laboratories are allowed to continue their exploration and experimentation.

1 Consequently, the material to be stored will be used up and, except for a minor percentage, there will be nothing stored at WIPP. If nothing is there, how can there be a problem?

We must progress into the future; by tomorrow, today will be yesterday. I may be a dreamer of the future but at least I'm not a static relic of the past.

Thank you for letting me express my opinion.

Sincerely,
Alethea L. Hill
Alethea L. Hill

## Comment C-079

Mr. Johnson 134 Columbus cir NE
Calhoun GA 30701

I received the DSEIS "Catalog" (for $3.00 postage!) I have studied the issue. I am familiar with the geology of limestone and the Hobbs Carlsbad area.

1 Over 1 billion has been spent on the site. It is my opinion that ~~storage~~ any storage is safe, lets start storage immediately as studies should have ceased. Get on with the show.

Thanks
Erwin Reinhardt
Erwin Reinhardt

Harold Johnson
NEPA Compliance Officer
Attn: SEIS-II Comments
P.O. Box 9800
Albuquerque, NM 87119

January 23, 1997

Dear Mr. Johnson,
As I was unable to attend Public meetings, I would like this letter to serve as my comments related to the WIPP SEIS-II.

I am a D.O.E. qualified Radiological Control Technician (RCT) at Los Alamos National Laboratory, working at the Plutonium Facility (TA-55). I was also a D.O.E. qualified RCT at WIPP. I have 10 years experience working in underground mining, two of those years working in formations identical to WIPP. I also drove a gasoline tanker around NW New Mexico and NE Arizona for three years. I earned an Associates of Applied Science in Radioactive and Hazardous Materials Technology and am currently working on a B.S. in Radiation Protection.

I have outlined my experience and education for the following reason: Having worked in the areas of Radiation Protection, Underground Mining, and Truck Transportation, **I feel I have excellent qualifications to judge whether or not the WIPP is safe, and if the SEIS-II is adequate.**

1 **Trucks/TRUPACT II:** I have met with the drivers, who are all professional, experienced and well trained. I have surveyed the interior and exterior of TRUPACT II's and provided job coverage for numerous openings. All the procedures are safe, as are the operators, waste handlers, and RCT's. I wrote the current procedure for conducting and documenting the contamination and
1 dose rate surveys for TRU waste WIPP drums here at TA-55. **The drums are packed safe, they are shipped safe (on-site LANL), and they will arrive safe.**

2 **WIPP Underground Storage Area**: The safest, cleanest, best lit, best ventilated, and best maintained mine **IN THE WORLD**. No water, little dust, well trained miners and technicians. If you stand in the bottom of the shaft and look 2150 ft. straight up to the little dot of sunlight, you will have no doubt that the waste will be contained for at least 10,000 years. If you think about the fact that the salt has been in place for 200 plus million years, you will be sure that **the waste will be safe for about a hundred million years.**

3 **WIPP Airborne Radioactivity Monitoring- Exhaust Shaft, Station A, Station B, Offsite Locations, and the Waste Handling Building:** I have performed airborne radioactivity monitoring and functional testing at **ALL** the above mentioned
3 locations, and am completely satisfied that any release would be detected and contained appropriately. Because of the professionalism, training, and skill displayed by the WIPP and the generator site workers, **I am convinced no**



3 **problems related to an offsite release will occur.**

4 **Environment Surrounding the Underground Foot Print: Land Withdrawal Area:** I have been hunting, camping, hiking, and off-roading in New Mexico for twenty years now. There is absolutely no doubt in my mind that **the land surrounding the WIPP Site HAS IMPROVED since the land withdrawal.** There is less bovine erosion, the wildlife is protected (nurtured actually!), less travel on the roads (much, much less off-road travel!), less dust, better water management. I also worked in the Environmental Monitoring Dept. at the WIPP. There is much more wildlife around the WIPP because it is protected. The WIPP Site is a paradise for the wild creatures, and it will remain so during all of the operating phase.

5 **Environmental Justice:** See above paragraph, and take a survey of how many people in Eddy and Lea counties would like to work at the WIPP. I know a lot of people who have applied at the WIPP, and know of no one who has turned down a job there.

6 **Plans for Expansion, Cutting New Levels, and Storage of HLW or Remotely Handled Waste:** I am convinced that expansion of the storage area, and incorporation of HLW and/or Remotely Handled Waste would be the best use of the facilities at the WIPP. **The best use of resources, the best economic solution, and the most environmentally sound course for our nation.**

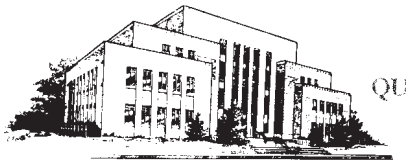
**Tom Udall's Opposition to WIPP:** He is a grandstander, he comes from a family of career politicians, he could not make it to the Senate so he had to settle for State A.G. He does not know jack about WIPP, Rad waste, or working people. He took a poll and jumped on the anti-WIPP band wagon so he can climb up. **He should be ignored.**

7 **Summery: The WIPP is SAFE. The SEIS-II is MORE THAN ADEQUATE. The WIPP should be OPENED. Plans for EXPANSION are CORRECT, ENVIRONMENTALLY SOUND, and will BENEFIT OUR NATION, STATE, and Eddy and Lea counties.**

Sincerely, Michael A. Dempsey

Mike Dempsey
300 Connie Ave.
White Rock, NM 87544

## Comment C-081



QUAY COUNTY GOVERNMENT
300 South Third Street - Courthouse
P.O. Box 1246
Tucumcari, New Mexico 88401
(505) 461-2112

January 22, 1996

Harold Johnson
NEPA Compliance Officer
Attn: SEIS-11 Comments
P. O. Box 9800
Albuquerque, New Mexico 87119

RE: Request for Comments on the Waste Isolation Pilot Plant SEIS-11

Dear Mr. Johnson:

Members of the Quay County Commission have followed the development of the WIPP site with great interest. We have asked for and received copies of your Disposal Phase Supplemental Environmental Impact Statement (SEIS-11) and prior documents. A majority of the members of this Commission have even taken the time to visit the WIPP site to tour the facility.

1 I support the acceptance of this study and the opening of the WIPP site. A great deal of time has been expended in developing the design and safeguards for this disposal facility, and it is time to move forward. WIPP opponents will always be able to find additional imaginary issues and concerns to delay the use of this complex if they are tolerated. The U.S. and the State of New Mexico need this facility now.

1 I believe that it is beyond reason to delay this project any longer, as the information in the SEIS-11 along with all the preceding information more than satisfies the regulatory and scientific requirements needed to allow WIPP to move forward.

Thank you for the extension of the comment period.

Sincerely

Robert Thrasher

Robert Thrasher, Chairman
Quay County Commission

QUAY COUNTY MANAGER
BOARD OF COUNTY COMMISSIONERS

## Comment C-082

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| ALFRED | A | BROOKS |
|---|---|---|
| First Name (please print) | M | Last Name |

| OAK RIDGE TN | 1-21-97 | 7:00 P |
|---|---|---|
| Location | Date | Time |

SELF
Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 WIPP, designed to be the safest long term TRU Storage should be opened and be available for all the OR TRU waste. EAST TN is not geologically suitable for TRU storage and 150 -160 years presents an unnecessary and as far as I know unevaluated risk.

2

## Comment C-083

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

DIANTHA (First Name) | F (M) | PARE (Last Name)

OAK RIDGE (Location) | 1/21/97 (Date) | (Time)

ENVIRONMENT COMMITTEE LEAGUE OF WOMEN VOTERS (Representing?)

**Specific Comment(s) (Summarize & be concise on this form)**

1 Deficiencies in the conditions of buildings suggested for storage of transuranic defense-related waste at the Oak Ridge reservation have been well-documented. Our damp climate also militates against such storage on a long term basis.

2 I support timely removal of transuranic defense related waste from Oak Ridge and transportation to WIPP, which is an appropriate disposal site. All alternatives would result in waste residing in Oak Ridge in unsafe storage for much too long.

## Comment C-084

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

FAY (First Name) | M (M) | MARTIN (Last Name)

Oak Ridge (Location) | 1/21/97 (Date) | 7:15 pm (Time)

(Representing?)

**Specific Comment(s) (Summarize & be concise on this form)**

1 WIPP should be supported so Oak Ridge waste can be taken there. Oak Ridge is not suitable for storing wastes due to unsatisfactory geology.

## Comment C-085

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| Sam | W | Booher |

| Location | Date | Time |
|---|---|---|
| North Augusta, S.C | 1/23/97 | 14:00 hrs |

Representing? Concerned Citizen

**Specific Comment(s) (Summarize & be concise on this form)**

1 I appreciate DOE having the hearing and giving concerned citizens this opportunity

Sam Booher

## Comment C-086

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| First Name (please print) | M | Last Name |
|---|---|---|
| Shelley | T | Buonaiuto |

| Location | Date | Time |
|---|---|---|
| Sweeney Aud. | 1/24/97 | |

Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 ① The Wipp site has proved to be inadequate & unsafe & so there is a grave danger of radioactive leaks.

2 ② the transportation method is unsafe - the Trupact II Containers have not been
3 proved to withstand serious Accident or
2 Fire - So many trucks travelling to Wipp are sure to have some accidents.

4 ③ the opening of Wipp & the shipping of waste are sure to have a negative impact on tourism, & current Land values.

5 ④ LANL & the DOE have been unreliable, & untruthful About leaks & SAfety Violations - This certainly would continue if Wipp should open.

SENT BY:DOE ; 1-29-97 ; 9:41 ; CAO/OIEA→ 15052248030;# 3

# Citizens Advisory Board
## Idaho National Engineering Laboratory

A U.S. Department of Energy Site Specific Citizens Advisory Board

January 28, 1997

Chair:
Charles M. Rice

Vice Chair:
E.J. Smith

Members:
Ben F. Collins
Terry L. Perez
Linda Milam
Clarence F. Bellem
Dieter A. Knecht
Joel R. Hamilton
Dean Mahoney
Stanley Hobson
James Bondurant
Ellis Hamilton
Roy Mink
Richard Suckal
Maxine Dakins

Ex-officios:
Robert Ferguson
Wayne Pierre
Gerald C. Bowman

Jason Staff:
Carol Cole
Amanda Jo Edelmayer
Stephanie Meyers

Harold Johnson
U.S. Department of Energy
101 W. Greene Street
Carlsbad, NM 88220

Fax: (505) 234-7349

Dear Mr. Johnson:

Attached please find the comments on the Waste Isolation Pilot Plant Supplemental Environmental Impact Statement from the Idaho National Engineering Laboratory Citizens Advisory Board.

Thank you again for your presentation to the Board in November. Based on that information and a review of the document, the Board compiled and finalized its recommendation last week during its January meeting.

If you have any questions about the recommendation, or are in need of additional information, please do not hesitate to call me at (208) 522-4955 or call Stephanie Meyers, Board facilitator, at (208) 522-1662.

Sincerely,

Charles M. Rice
Chair

Jason Associates Corporation • 477 Shoup Avenue, Suite 107 • Idaho Falls, Idaho 83402
Phone • (208) 522-1662 Fax • (208) 522-2531
• http://www.uidaho.edu/~hamilton/ssab.html

SENT BY:DOE ; 1-29-97 ; 9:42 ; CAO/OIEA→ 15052248030;# 4

## RECOMMENDATION
## on the
## WASTE ISOLATION PILOT PLANT
## SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

### INTRODUCTION

The Citizens Advisory Board to the Idaho National Engineering Laboratory met with Department of Energy, Carlsbad Area Office personnel during its November 19-20, 1996 meeting and received a presentation on the *Waste Isolation Pilot Plant Supplemental Environmental Impact Statement (SEIS-II)*, which focuses on the Implementation Phase of operations at WIPP. After consideration of the presentation and subsequent analysis of the document, the Board discussed and finalized the following recommendation at its January 20-21, 1997 meeting.

### RECOMMENDATION

1 The INEL SSAB endorses the concept of WIPP and recommends DOE continue with plans to open the facility for disposal of transuranic waste. In addition, the Board supports urgent activity by the U.S. Environmental Protection Agency to complete the certification procedures to allow the facility to become fully operational as soon as possible.

2 There is concern, however, that NONE of the alternatives proposed in the document fully comply with the terms and commitments contained in the Settlement Agreement between the State of Idaho, the Department of Energy, and the U.S. Navy. The Board recommends that this draft SEIS only go forward to the final stages when the proposed actions and a preponderance of alternatives are found that allow conformance with that agreement. For example, the Settlement Agreement states that all transuranic waste now located at the INEL, estimated at 65,000 cubic meters in volume, shall be shipped to WIPP or a similar facility by 2018. The proposed action acknowledges less than half of the amount in the INEL TRU waste inventory. Similarly, the volumes given in the SEIS are not consistent with the site generated numbers provided and available in BIR Revision 3. In addition, the timeline estimated in the WIPP SEIS fails to meet the deadline committed to in the Settlement Agreement to begin shipping TRU waste out of Idaho by April 30, 1999. The TRU waste volumes (and other waste stream volumes) negotiated by the three parties and jointly acknowledged in the legally binding Settlement Agreement must be adequately addressed in the SEIS and all subsequent DOE documents.

3 Many of the alternatives also assume renegotiation of the Federal Facility Compliance Act and INEL Site Treatment Plan. There is also concern that the costs given in the EIS are extreme and should be reexamined to determine how cost savings can occur.

The Board also recommends the final SEIS include:

4 • Consistent discussion about the waste inventory being considered. The proposed action discusses "basic inventory," while the action alternatives address "basic and additional inventory." These volumes should be clearly identified and consistently referred to in each

4 examined alternative. Additional confusion arises because the proposed action is concerned with only 35 years of waste; the others assume much longer periods, making comparisons difficult.

5 • A clearer discussion of the assumptions used to complete the risk calculations. The results included in the draft SEIS are not well explained and can easily be misinterpreted. Therefore, correct the unreasonable conservatism in the risk assessment of the Proposed Action and Alternatives that results in unrealistic estimates of risk to the general public. Examples of the risk assessment conservatism include: the 30-minute traffic jam, 30 minutes at 1 meter of the TRUPACT for the truck inspector, state safety inspector spending 60 minutes within 1 meter, one person exposed to every shipment at a distance of 30 meters for 70 years, and the rest stop employee exposure assumption.

6 In the truck accident scenarios the overly conservative assumptions were that every TRUPACT is filled with the highest level of radioactive and hazardous material that meets WIPP WAC. Other examples include: the statement that "a more realistic release fraction for thermally treated waste would have resulted in estimated accident impacts that were 1000 times lower;" "average inventories per drum for Savannah River and Hanford were increased by approximately a factor of four" without technical or logical justification; the Bounding Case accidents occur in metropolitan areas with a population of 1 million or greater; 3 TRUPACTs fully loaded to WAC planning basis with one breached and engulfed in fire for 2 hours, and a total population dose of 6,730 person-rem was estimated not calculated.

7 • Explanations of the probabilities associated with the accident scenarios. There is no discussion in the Executive Summary of the probabilities of the bounding accidents presented; it appears that they are probable or possibly inevitable. Risks associated with very low probability events must be presented carefully and concisely.

8 • A more complete discussion of the volume of waste allowed at WIPP, along with a listing of the sites and corresponding amounts of waste to be sent to WIPP. This must include discussion of waste resulting from treatment and "consolidation" alternatives occurring at each affected site. As previously stated, the estimated 28,000 cubic meters addresses less than half of the 65,000 cubic meters estimated in the Settlement Agreement.

3 • A clearer discussion of the comparison of alternatives based on cost. First, it is unclear how costs were calculated if waste is consolidated and stored at sites "until its disposal." Second, the total inventory cost was calculated assuming it would take 150 years to handle the total inventory of waste. Depending on the treatment, consolidation, and interim storage options, these costs could be dramatically reduced.

6 • Clarification of the radiological impacts. Consider discussing the impacts associated with each alternative separately, rather than comparing them by transport vehicle type (see Executive Summary, page S-39). Additionally, clarify the relationship between numerical latent cancer fatalities and the percentage chances for latent cancer fatalities.



January 22, 1997

Harold Johnson
US Department of Energy
Carlsbad Area Office
c/o Battelle
PO Box 9800
Albuquerque, NM 87119

Mr. Johnson:

Please consider and enter my comments into the public record of the hearings of the WIPP Disposal Phase Draft Supplemental Environmental Impact Statement. The following comparisons of significant differences in impact and cost identify the No Action Alternative 2 as the best choice.

1 1. Alternatives considered but not analyzed in detail: I concur with your decisions. These methods are all chilling scenarios of disposal methods that would be potentially harmful or actively catastrophic. Deep borehole disposal is also not appropriate for disposal of any radioactive waste.

2. Comparison of proposed action with action alternatives:
2 a)While estimated numbers of deaths among workers, crew, and public were given, there was no mention of estimated cancers and other medical conditions caused by exposure to radiation. This Environmental Impact Statement(EIS) is incomplete without those estimates.
3 b) I did not find a clear description of how the waste will be transported from the additional storage and generation sites to the ten consolidation sites. The EIS is incomplete without this analysis.
c) Type and amount of waste: I concur that the proposed action is the best choice among all the action alternatives. This action involves the least amount/risk and the most consistent inventory of type.
d) Transportation mode:I concur that the proposed action is the best choice among all the action alternatives. For multiple reasons, by truck only is definitely the best option.
e) Control site areas: I concur that the proposed action is the best choice among all the action alternatives. Sixty hectares is still a lot of potential contamination.
Of the action alternatives, the proposed action is the best choice.

3. Comparison of No Action Alternatives(NAA): NAA 2 has the least actual impact in all regions outside of the areas where the facilities are currently storing and generating waste. Two grave considerations, however, are:
4 a)risks due to current or potential increseased population densities combined with potential accidental waste release. This consideration underscores the risky nature of nuclear material. The potential risk estimated in the EIS establishes the urgent need to immediately ending the generation of any more nuclear waste until we can render it less harmful to ourselves and others.

5 b)the decision would need to be re-evaluated after no longer than 100 years. This consideration establishes the need to actively pursue progressive technology that can process this waste into less harmful substances. Given the changes in our knowledge and technologies in the past 100 years, the option to reconsider our decisions is a very good option. Of the no action alternatives, NAA2 is the best choice.

4. Comparison of proposed action and NAA2:

6 a)Actual impact- The proposed action has a greater actual impact than the NAA2. There is also exiting evidence not included in the EIS that the geological formations at the Carlsbad site will not contain the waste for even 50 years, much less the amount of time anlayzed in the EIS.
b)Actual cost-The proposed action costs more than NAA2. As long as transuranic waste is being generated, NAA2 is more cost effective. When waste is no longer being generated, a future analysis may yield a different cost/benefit ratio.

7 Given the significant differences in greater actual impact and cost between the proposed action and NAA2, the No Action Alternative 2 is the best choice.

5. Waste generation: It is unfortunate that potential risks for all choices are so great. It is completely irresponsible to continue to generate transuranic waste when there is no technology to render it benign.

In summary, while it is a good idea to attempt to find a solution to the ever increasing amounts of radioactive waste, it is also irresponsible to ship it across the country to Carlsbad. We must stop generating it and find positive solutions to de-activating radioactive waste on-site. Given the significant differences in greater actual impact and cost between the proposed action and NAA2, the No Action Alternative 2 is the best choice.

Sincerely,

Victoria Parrill
Downwind from Los Alamos
Santa Fe, NM 87501



Author: Timothy_M_Tim_Greager@RL.gov at ~internet
Date: 1/30/97 10:21 AM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: HAROLD JOHNSON - SEIS COMMENTS
---------- Message Contents ----------

Harold,

1 I attended the SEIS public hearings in Richland, Washington on January 15, 1997 after reviewing the SEIS summary. I have no specific technical comment, however, since I am involved with the TRU waste certification process here at Hanford, I am very interested in seeing WIPP open on schedule. I fully support the opening of WIPP and current plans are for TRU waste from Hanford to be shipped to WIPP beginning in 1998. If you have any questions, please contact me at (509) 376-4344 or E Mail at tim_m_greager@rl.gov. Thank you for allowing me to input.

Tim M. Greager

Comment C-090, Page 1 of 2

Jan. 25, 1997

Linda Ewald
949 Ponder Rd.
Knoxville, TN
37923

SEIS-II
P.O. Box 9800
Albuquerque, NM 87119

Dear Sirs:

I am writing to comment on the proposed Waste Isolation Pilot Plant (WIPP) and the ~~se~~draft Second supplemental environmental impact Statement (D-SEIS-II).

I do not believe that WIPP is safe. There are unresolved health and safety problems and DOE ~~has~~ is unable to show that radiation releases would result in less than 1,000 deaths ... 10,000 years. Another major problem is that it is surrounded by oil and gas wells and potash mines. Mining would allow wastes to escape into groundwater or the surface. The ground water system is not well understood and millions of barrels of pressurized brine underneath the disposal rooms could bring wastes to the surface. Also questionable is the assumption that shafts could remain completely sealed for 10,000 years. A second issue is transportation of wastes ~~across~~ across country. a single severe accident could kill and injure and ~~re~~ release of

Comment C-090, Page 2 of 2

plutonium could endanger future generations and contaminate the environment. Even though rail transportation would be safer, plans are to only ship by truck. Other problems are that shipments would not be escorted nor have emergency response personnel, and the ~~safety~~ saftey of waste transport containers is highly uncertain.

WIPP will not solve the nuclear waste problem. There are wastes that DOE does not know what to do with and wastes will continued to be produced. Finally the D-SEIS-II says that the total life cost of WIPP & using the prefered alternative is $19.1 billion. The no action alternative of not using WIPP, not transporting wastes back and forth across country and storing wastes at existing sites is $2.7 billion. I believe that Spending more to provide for safer on site storage is the best alternative at this time.

Sincerely,
Linda Ewald

## Comment C-091

Author: Niels Schonbeck <schonben@mscd.edu> at ~internet
Date: 2/2/97 5:49 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP SEIS
---------- Message Contents ----------

Department of Energy:

1 The proposed WIPP solution to transuranic waste has never been a good idea and still isn't.

2 I would suggest a 100-year plan for subsurface, on-site, monitored storage facilities until we understand more about health effects of low-level radiation exposure and until we understand more about the possible transmutation of these transuranics to more managable isotopes (or some other technical solution that may arise in the course of the next century).

Irretrievable waste disposable precludes better solutions that are likely to emerge in the future.

Sincerely yours,

Niels D. Schonbeck, Ph.D.
Professor of Chemistry
Metropolitan State College of Denver

## Comment C-092

1 Please cancel the WIPP project.

John Sawyer
74 Wolcott Ave
Staten Island
NY 10306

## Comment C-093

January 27, 1997

Mr. Harold Johnson
NEPA Compliance Office
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

This letter is a comment on the Waste Isolation Pilot Plant (WIPP).

1 I am opposed to burying long term waste anywhere for several reasons:

1. It makes that section of the earth, i.e., the burial site, unusable "forever".

2 2. We are burying valuable resources with essentially no hope of recovery.

3. Research is just beginning in a field whose object is to speed up the decay of long-lived radioisotopes. (See Chapter II, Gamma Ray Lasers, American Institute of Physics Conference Proceedings No. 146, "Optical Science and Engineering Series 6--Advances in Laser Science-1", Dallas, Texas, 1985, American Institute of Physics. Also see U. vanBurk, R.L. Mossbauer [the Nobel Prize winner], et al., Phys. Rev. Lett. **59**, 355, 1987; C.B Collins, et al., Phys. Rev. C **37**, 2267, 1988; other references) In time, this research 3 may lead to a way of usefully recovering the energy that these isotopes emit.

We should use the proposed Monitored Retrieval Storage (MRS) system for storage until a method is devised to utilize the "free" energy given off by the elements that will be irretrievably buried at the WIPP site. At the time that the MRS was under consideration, the research described in 3 above was not taken into account. This research offers some hope that radioactive half-lives can be shortened.

2 The energy that the transuranic elements give off is a substantial fraction of the power produced by nuclear reactors. This energy will be given off whether the material is buried or used. It is incredible that we should throw away such a large source of energy until all means of recovery of this energy are exhausted.

Sincerely,

Hugo Bertini

Hugo Bertini
915 West Outer Drive
Oak Ridge, TN 37830

## Comment C-094

CITY OF ARVADA

MAYOR AND CITY COUNCIL
303 431 3000 Office ▲ 303 431 3085 Fax/Night
HD 421 9330

January 30, 1997

Mr. Harold Johnson
NEPA Compliance Officer
P.O. Box 9800
Albuquerque, NM 87119
Attn: SEIS Comments

Subject: Support of the Waste Isolation Pilot Plant

Dear Mr. Johnson:

1 The City of Arvada supports the use of the Waste Isolation Pilot Plant (WIPP) in Carlsbad New Mexico
2 for disposal of low level radioactive wastes from Department of Energy (DOE) Facilities such as the Rocky Flats Environmental Technology Site. The city acknowledges that the DOE has spent more than 20 years of scientific and engineering work specifically dedicated to determine the best way to disposal of low level radioactive waste such as clothing, tools, and rags. The WIPP site is the result of this effort, and is isolated from large centers of population.

In contrast to the WIPP site, the Rocky Flats Environmental Technology Site is on the edge of a fast growing metropolitan area, including Arvada, and does not have the natural characteristics and engineered features of the WIPP site.

I would like to reiterate the Arvada City Council's support for use of the WIPP site for disposal of low level radioactive waste from DOE facilities including the Rocky Flats Technology site.

Thank you for your attention and consideration of these comments.

Sincerely,

Robert G. Frie
Mayor

cc: Arvada City Councilmembers
Christopher K. Daly, Acting City Manager
Ron Culbertson, Director of Public Works

P.O. Box 8101 ▲ [illegible] ▲ Arvada, Colorado ▲ 80001-8101

**K. K.S. Pillay**
**369 Cheryl Avenue**
**Los Alamos, NM 87544**

February 5, 1997

To,
Mr. Harold Johnson
NEPA Document Manager
Attn: SEIS comments
P. O. Box. 9800
Albuquerque, NM 87119

**Subject: Comments on WIPP SEIS-II (DOE/EIS-0026-S-2)**

1 My review of the second supplemental EIS for WIPP (SEIS-II) reveals that plans for the WIPP facility have undergone a number of evolutions since the final EIS was published in 1980. Because TRU wastes destined for WIPP are "attractiveness level E" discards from the Department of Energy safeguards regime, no safeguards and proliferation issues have been anticipated with TRU wastes. However, one of the glaring changes in SEIS-II is the increase in plutonium inventory proposed to be placed at the repository. Examination of Appendix-A reveals that SEIS-II supports decisions of expediency at now defunct nuclear material processing facilities that call for burial of plutonium-rich residues because recovery of special nuclear materials (SNM) from such materials is alleged to be expensive.

2 A large portion of additional materials proposed to be placed in WIPP is considered "attractiveness level C" (high grade materials such as oxides, solutions, or SNM compounds) and are readily convertible to either weapons grade material or other suitable forms for industrial applications. Plans for WIPP disposal of such materials are based on arguments that the country is awash with plutonium and therefore does not need recovered plutonium from residues. The plutonium being discarded did cost the U.S tax payers over two million dollars per kilogram to produce, not to mention the environmental restoration costs that are yet to be paid. Furthermore, it is unconscionable to throw away an additional 4 tons of high-grade plutonium into the environment (making the total amount of plutonium to be placed in WIPP to over 12 tons) when there are environmentally benign alternatives to manage the surplus plutonium to benefit tax payers.

3 It is apparent from discussions with DOE personnel that there is a ongoing effort to circumvent safeguards regulations to accomplish the disposal of plutonium-rich residues at WIPP. Those who are promoting WIPP disposal of plutonium-rich residues view safeguards prohibitions against discard of attractive materials as obstacles to be overcome, as opposed to prudent measures intended to preserve national security and minimize environmental impact. It is also clear that such plans are inconsistent with the DOE's mission of "reducing global nuclear danger" and international agreements on safeguarding of SNM.

[continued on page-2]





Mr. Harold Johnson
NEPA Document Manager
Attn: SEIS comments
P. O. Box. 9800
Albuquerque, NM 87119

**Subject: Comments on WIPP SEIS-II (DOE/EIS-0026-S-2)**

4 While most of us wish to see the WIPP opened for TRU waste disposal, we realize that the changes made in the SEIS-II could create major problems for WIPP as well as for future geologic disposal of all types of radioactive wastes. The proposed increase in plutonium to be disposed of at the WIPP is a violation to the US policies for safeguarding weapons-useable materials and limiting the environmental impact of waste management activities. Although the preferred option in the SEIS-II has several useful elements, the unjustified addition of plutonium-rich residues requires a reexamination. The overall effect of designating plutonium-rich residues as waste merely transfers the problems of storage and environmental impact from Colorado to New Mexico. The accumulation of large quantities of plutonium at one location also poses a proliferation problem that has not been addressed in the SEIS-II document. Both the environmental and proliferation issues are more significant because no institutional controls or care of WIPP will be required after 100 years.

5

6 It is worth recalling that in February 1980, President Carter requested that the Congress rescind funds already appropriated for WIPP because of a proposal to experiment with commercial radioactive wastes at the facility and because there were no provisions for review of DOE's plans by other regulatory agencies. Legislation passed since that time limited the scope of WIPP, restricting the project to experiments with defense wastes. Because of the sudden changes in the nature of materials to be disposed of at the WIPP, as proposed in SEIS-II, the Waste Isolation Pilot Plant could once again become a target of Executive and Congressional actions, further delaying the disposal of TRU wastes.

Sincerely,

K. K. S. Pillay

(K. K. S. Pillay)
369 Cheryl Avenue
Los Alamos, NM 87544

## Comment C-096

2/6/97

Comments on: WIPP Disposal Phase — Draft Supplemental Environmental Impact Statement

1 I THINK THIS FACILITY SHOULD BE UTILIZED TO THE MAXIMUM EXTENT POSSIBLE AS SOON AS POSSIBLE! THE PROPOSED ACTION SEEMS REASONABLE; HOPEFULLY THAT CAN BE ACCELERATED AND EXPANDED WITHOUT DELAY.

2 THE POTENTIALLY ADVERSE EFFECTS OF DOING NOTHING FAR OUTWEIGH the possible, statistically remote, ADVERSE EFFECTS of proceeding post haste — in my opinion.

Thank you For Opportunity to Comment. Sincerely, JM Thompson

## Comment C-097, Page 1 of 4

Feb-07-97 07:28A nina murrill (505)887-6970 P.08

**STATE CLEARINGHOUSE**
**State of Ohio - Office of Budget and Management**

30 EAST BROAD STREET • 34TH FLOOR • COLUMBUS, OHIO 43266-0411 • (614) 466-0697 / 0698

January 14, 1997

Applicant: U.S. DEPT OF ENERGY, NEPA DOCKET MGR
P.O. BOX 3040 SEIS-COMMENTS
CARLSBAD, NM 88221-

Contact: HAROLD JOHNSON

SAI Number: OH961125-F561-36.471

Dear Grant Applicant or Funding Agency:

Our office has notified you that the intergovernmental review has been completed with respect to the above referenced project. We have either recommended that the applicant proceed with the application for appropriate funding or that they must address concerns generated through the review process.

We have received additional comments from a review agency (see attached). Contact must be made with the commenting agency and these comments must be taken into consideration as you proceed with the application process. Please excuse the fact that the comment may be late in getting to you. These comments were received in our office late.

If you have any questions concerning the attached, please contact our office, (614) 466-0697 or (614) 466-0698. NOTE: If your application completion letter contained negative or conditional comments, they are still valid and, if not resolved, need to be satisfactorily addressed.

Sincerely,

Larry W. Weaver
State Federal Funds Coordinator
Office of Budget & Management

cc: Commenting Agency: _____

OBM 6000

Comment C-097, Page 2 of 4

Feb-07-97 07:28A nina murrill (505)887-6970 P.09

OFFICE OF BUDGET AND MANAGEMENT
30 E. Broad St., 34th Floor
Columbus, Ohio, 43266-041
Phone (614) 466-0697 / 0698

## STATE CLEARINGHOUSE TRANSMITTAL

STATE APPLICATION IDENTIFICATION NO: OH961125-F561-36.471
RESPONSE ON 60 DAY REVIEW SHOULD BE RETURNED 15 DAYS PRIOR TO THE CLEARANCE DATE OF: January 6, 1997. FOR FULL APPLICATION CALL BY: 12/2

APPLICANT: U.S. DEPT OF ENERGY, NEPA DOCKET MGR
P.O. BOX 9800, SEIS-COMMENTS
ALBUQUERQUE, NM 87119-
ATTENTION: HAROLD JOHNSON PHONE: 505-224-8030
PROPOSED FEDERAL FUNDING: $0
PROPOSED TOTAL FUNDING : $0
PROJECT TITLE: ENVIRONMENTAL IMPACT STATEMENT/ASSESSMENT/FONSI
PROJECT DESCRIPTION: WASTE ISOLATION PILOT PLANT DISPOSAL PHASE, DOE/EIS-0026-S-2), DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENTS, MOUND PLANT, MONTGOMERY COUNTY, NOV 1996

REVIEWING AGENCIES:
DEPT OF AGRICULTURE
DEPT OF NATURAL RESOURCES
DEPARTMENT OF HEALTH
DEPT OF TRANSPORTATION
ENVIRONMENTAL PROTECTION AGY
OHIO HISTORICAL SOCIETY

| COUNTY | AREA CLEARINGHOUSE |
|---|---|
| MONTGOMERY | Miami Valley Regional Planning Commission (MVRPC) |

Send review info also

JAN 17 1997
State Clearinghouse
Budget & Management

Reviewing agency must complete this section.
COMMENTS - attach another sheet. Comments cited in this Section must include (1) identification of reviewing agency's statute or specific plan or program related to the proposal (2) Description of impact of this proposal on identified plan or program (3) Reviewer's recommended changes for or additions to the proposal. Please type all comments and include SAI number on your comment sheet.

REVIEWING AGENCY POSITION ON PROJECT (Mark one only)
☐ No comment
☒ Clearance of the project should be granted.
☐ Clearance of the project should not be delayed, but applicant should answer the reviewer's questions or concerns. See enclosed comments.
☐ Clearance of the project should only be granted on the condition that the applicant use the recommendations in the enclosed comments. (Executive or Deputy Director Signature Needed.)
☐ Clearance of the project should be delayed until the applicant has satisfactorily addressed the concerns stated in the enclosed comments. (Executive or Deputy Director Signature Needed.)

PLEASE TYPE THE FOLLOWING INFORMATION

Robert E. Owen — Reviewer's Name
Agency Name: Ohio Dept. of Health Div: Prevention
Street Address: 246 N. High St. City: Columbus State: OH
Executive or Deputy Signature — Phone: — Zip Code:

Comment C-097, Page 3 of 4

Feb-07-97 07:28A nina murrill (505)887-6970 P.10

OHIO DEPARTMENT OF HEALTH

246 N. HIGH STREET
Post Office Box 118
Columbus, Ohio 43266-0118
Telephone (614) 466-3543

GEORGE V. VOINOVICH
Governor

PETER SOMANI, M.D., Ph.D.
Director of Health

## MEMORANDUM

DATE: January 6, 1997

FROM: Robert E. Owen
Manager of Technical Services
Bureau of Radiation Protection

SUBJ: Comments on the Draft Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant Disposal Phase (DOE/EIS-0026-S-2)
SAI No. OH961125-F561-36.471

1. Applicable Revised Code and Program

ORC 3748.05(B) empowers the Director of Health to participate in, or conduct studies, investigations, training, research and demonstrations relating to the detection and control of radiation that constitutes unreasonable or unnecessary risk to human health or the environment, the measurement of radiation, the evaluation of potential effects on health of cumulative or acute exposure to radiation, the development and improvement of methods to limit and reduce generation of radioactive waste, and related problems as he considers necessary and advisable. Pursuant to this, the Bureau of Radiation Protection assesses the propriety of planned usage and movement of radioactive waste by any generator of waste within the state, including the U.S. Department of Energy (DOE). The Midwestern Radioactive Waste Committee under the auspices of the Midwest Office of the Council of State Governments acts as a forum for states with regard to this and other DOE issues affecting Midwestern states. The Manager of Technical Services for the bureau represents the State of Ohio on this committee as the gubernatorial appointee.

2. Description of Impact

1 Action Alternative 1 is preferred. This alternative provides for disposal of the total transuranic waste inventory, thus ensuring that such waste does not remain at facilities in Ohio who are less able to store this material for 100 years or more. At least one or two facilities in addition to the Mound Facility currently possess transuranic waste. The health impacts of maintaining this waste at these additional sites are probably greater than at DOE facilities, who will be better

HEA 0312 (Rev. 3/92)

An Equal Opportunity Employer/Provider

## Comment C-097, Page 4 of 4



prepared to store such waste for an extended period of time.

1 Though it is postulated by DOE that the disadvantage of this option is the second highest of all the alternatives for transportation impacts, this may not be the case for Ohio. There is no waste identified as passing through Ohio; thus, only waste generated at Ohio facilities will leave the state. This reduces health impacts at these facilities in the short term, and should significantly reduce such impact for the long term. In summary, the associated risk in storing this material for the long term will be greater than the health risk associated with transporting this waste a short distance out of Ohio.

Accordingly, this option would pose the least threat to the citizens of Ohio overall. It would significantly reduce the threat in the long term to citizens living in proximity to any of the facilities.

3. Recommended Changes or Additions to Proposal

None.

## Comment C-098

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

| JILL | P | COWLEY |
|---|---|---|
| First Name (please print) | M | Last Name |

| SANTA FE | JAN 19 | AM |
|---|---|---|
| Location | Date | Time |

SELF
Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 I STRONGLY OPPOSE OPENING WIPP IN 1997, 98 & BEYOND. THE WHOLE IDEA OF WIPP IS BASED ON FAULTY LOGIC.— THINK ABOUT IT — IT MAKES NO SENSE TO INCUR THE SAFETY & ENVIRONMENTAL RISKS TO TRANSPORT WASTE TO A FACILITY WHOSE EFFECTIVENESS IS SERIOUSLY IN DOUBT (EG PROOF OF GROUNDWATER MOVEMENT) & WHICH WILL ONLY BE A TEMPORARY SOLUTION. (even 160 years is temporary, if we think in "in Generation terms, as we should).

2 WE SHOULD CLOSE WIPP, DIVERT FUNDING TO TECHNOLOGY TO NEUTRALIZE NUCLEAR WASTE AT THE GENERATION SITE, AND INCREASE FUNDING FOR ALTERNATIVE ENERGY SOURCES, WHICH WILL HELP TO REDUCE THE TOTAL AMOUNT OF WASTE PRODUCED

✳ PLEASE DO NOT WRITE OFF THESE COMMENTS AS NAIVE, OR JUST ADD ANOTHER CHECK UNDER "OPPOSE". THE ALTERNATIVE I PROPOSE

2 SHOULD BE RECORDED AS A VIABLE NO ACTION ALTERNATIVE, ONE WHICH I HEARD A NUMBER OF PEOPLE SUPPORT AT THE SANTA FE HEARINGS.

Thankyou. Jcowley

Feb-07-97 07:29A nina murrill (505)887-6970 P.14

WIPP SEIS-II
Document # C-99

# State of South Carolina
## Office of the Governor

DAVID M. BEASLEY
GOVERNOR

OFFICE OF EXECUTIVE
POLICY AND PROGRAMS

January 7, 1997

Mr. George E. Dials
Manager
U. S. Department of Energy
Carlsbad Area Office
Post Office Box 3090
Carlsbad, New Mexico 88221

Project Name: Radiation from proposed New Mexico Waste Site Unlikely to Exceed U.S. Protection Standards, Waste Isolation Pilot plant Disposal Phase Draft Supplemental Environmental Impact Statement.

Project Number: EIS-9612022-022

Dear Mr. Dials,

The Grant Services Unit, Office of the Governor, has conducted an intergovernmental review on the above referenced activity as provided by Presidential Executive Order 12372. All comments received as a result of the review are enclosed for your use.

The State Application Identifier number indicated above should be used in any future correspondence with this office. If you have any questions call me at (803) 734-0485.

Sincerely,

Rodney P. Grizzle
Grants Services Supervisor

Enclosures

Feb-07-97 07:30A nina murrill (505)887-6970 P.15

## Office of the Governor • Grant Services
South Carolina Project Notification and Review

*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

| State Application Identifier |
|---|
| EIS-9612022-022 |
| Suspense Date |
| 12/19/96 |

Beth McClure
S.C. Department of Parks, Recreation and Tourism

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

GRANT SERVICES

- ☐ Project is consistent with our goals and objectives.
- ☐ Request a conference to discuss comments.
- ☐ Please discontinue sending projects with this CFDA# to our office for review.
- ☒ Comments on proposed Application is as follows: No Comment

Signature: Joy Ball Date: 12/12/96

Title: Planner Phone: 734-0187

## Office of the Governor • Grant Services
South Carolina Project Notification and Review

*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

| State Application Identifier |
|---|
| EIS-9612022-022 |
| Suspense Date |
| 12/19/96 |

Joel T. Cassidy
South Carolina Employment Security Commission

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

RECEIVED DEC 1 6 1996 GRANT SERVICES

- ☐ Project is consistent with our goals and objectives.
- ☐ Request a conference to discuss comments.
- ☑ Please discontinue sending projects with this CFDA# to our office for review.
- ☐ Comments on proposed Application is as follows:

Signature: Joel T. Cassidy Date: December 17, 1996

Title: Executive Director Phone: (803) 737-2617





## Office of the Governor • Grant Services
South Carolina Project Notification and Review

*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

| State Application Identifier |
|---|
| EIS-9612022-022 |
| Suspense Date |
| 12/19/96 |

Bruce E. Rippeteau
1 | South Carolina Archaeologist

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

RECEIVED DEC 1 6 1996 GRANT SERVICES

1 | ☒ Project is consistent with our goals and objectives.

- ☐ Request a conference to discuss comments.
- ☐ Please discontinue sending projects with this CFDA# to our office for review.
- ☐ Comments on proposed Application is as follows:

Signature: Bruce E. Rippeteau Date: 12/13/96

Title: Underwater Archaeologist Phone: 777-8170

Feb-07-97 07:31A nina murrill (505)887-6970 P.19

Office of the Governor•Grant Services
South Carolina Project Notification and Review
*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

| State Application Identifier |
|---|
| EIS-9612022-022 |
| Suspense Date |
| 12/19/96 |

Steve Davis
1 | S.C. Department of Health and Enviromental Control

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

1 | [X] Project is consistent with our goals and objectives.

[ ] Request a conference to discuss comments.

[ ] Please discontinue sending projects with this CFDA# to our office for review.

[ ] Comments on proposed Application is as follows:

Signature: [signature] Date: 12/20/96

Title: DIRECTOR, DIV. RAD. WASTE MGMT. Phone: 896-4244



Feb-07-97 07:32A nina murrill (505)887-6970 P.20

Office of the Governor•Grant Services
South Carolina Project Notification and Review
*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

| State Application Identifier |
|---|
| EIS-9612022-022 |
| Suspense Date |
| 12/19/96 |

Olney England
SC Dept. of Commerce-Office Of Community Grant Program

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

RECEIVED - DEC 16 1996 GRANT SERVICES

[ ] Project is consistent with our goals and objectives.

[ ] Request a conference to discuss comments.

[ ] Please discontinue sending projects with this CFDA# to our office for review.

[ ] Comments on proposed Application is as follows:

Signature: [signature] Date:

Title: Phone:

DEC 11 1996

Comment C-099, Page 7 of 7

Feb-07-97 07:33A nina murrill (505)887-6970 P.21

## Office of the Governor • Grant Services
South Carolina Project Notification and Review

*1205 Pendleton Street*
*Room 329*
*Columbia, SC 29201*

State Application Identifier
EIS-9612022-022

Suspense Date
12/19/96

Dr. James A. Timmerman, Jr.
1 South Carolina Wildlife and Marine Resources Department

The Grant Services Unit, Office of the Governor is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0495. Rodney Grizzle

RECEIVED DEC 20 1996 GRANT SERVICES

1 [✓] Project is consistent with our goals and objectives.

[ ] Request a conference to discuss comments.

[ ] Please discontinue sending projects with this CFDA# to our office for review.

[ ] Comments on proposed Application is as follows:

Signature: Danny Johnson for Robert E. Duncan Date: 12/17/96

Title: Env. Programs Director Phone: 737-0800

Comment C-100

Feb-07-97 07:33A nina murrill (505)887-6970 P.22

## STATE CLEARINGHOUSE
**State of Ohio - Office of Budget and Management**

30 EAST BROAD STREET • 34TH FLOOR • COLUMBUS, OHIO 43266-0411 • (614) 466-0697 / 0698

January 6, 1997

U.S. DEPT OF ENERGY, NEPA DOCKET MGR
P.O. BOX 3090 SEIS-COMMENTS
CARLSBAD, NM 88221-

Attention: HAROLD JOHNSON PHONE: 505-224-8030

RE: STATE INTERGOVERNMENTAL REVIEW
ENVIRONMENTAL ASSESSMENT/IMPACT STATEMENT COMPLETION LETTER

State Application Identification (SAI) Number: OH961125-F561 36.471

Project Description: WASTE ISOLATION PILOT PLANT DISPOSAL PHASE, DOE/EIS-0026-S-2), DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENTS, MOUND PLANT, MONTGOMERY COUNTY, NOV 1996

Dear Applicant:

The State Clearinghouse has reviewed the Environmental Assessment/Impact Statement for the above identified project that is covered by the National Environmental Act of 1969, and any amendments; the Intergovernmental Review Process (Presidential Executive Order 12372); Gubernatorial Executive Order authorized under Ohio Revised Code, Section 107.18(A); and/or other pertinent regulations and guidelines.

1 This document has been simultaneously reviewed by interested state agencies, with a notice to the impacted area clearinghouse(s). Our office may have attached comments for your consideration and/or response.

You should be advised that some of the reviewing state agencies may respond directly to you without submitting their comments through the Single Point Of Contact. We encourage our reviewing agencies to keep in direct contact with issuing agencies on all environmental assessment/impact statement reviews. Therefore, consider their directly generated comments as valid responses.

It is recommended that contact be made with all commenting agencies. Addresses and phone numbers are available on individual Transmittal Forms and /or contained in a letter received by our agency. The comments which have been generated should become part of the proposal and responded to before a final decision is made regarding this environmental assessment/impact statement.

Should this be a draft proposal, please provide our office with fourteen (14) copies of the final product.

Sincerely,

Larry W. Weaver, Federal Funds Coordinator
Office of Budget and Management

OBM 6000

## Comment C-101



2 Acoma Lane
Los Alamos, NM 87544
January 10, 1997

SEIS Comment, Department of Energy
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88220

Dear Sir,

1 The Waste Isolation Pilot Plant should be opened and put into operation to store the plutonium contaminated waste as soon as possible.

1 At least 40 years ago the National Academy of Science determined that such a salt deposit is the best place on or in the earth for a repository and this determination has never been challenged. Moreover, this determination has been reiterated throughout the years and most recently only a few months ago. The National Academy stated clearly that the stored waste could not even reach the surface without human intervention, much less cause any harm to people. We cannot find any better source of advice for this problem.

1 Should intervention occur (drilling is the obvious possibility) at some future time, in spite of warnings, the amount brought to the surface would be trivial. Only extreme and convoluted arguments can even find a way for this material to migrate off the site once the assumption is made that drilling would occur. The risk to human health truly would be vanishingly small.

1 The congress of the United States has recognized that leaving this special form of plutonium waste in its present locations is undesirable. Further, the congress has recognized that the health risk to the public will be many, many orders of magnitude lower with the waste stored 3000 feet below the surface in salt deposits. This conclusion is obvious and clear and elaborate proofs that something will not happen are not needed.

The repository has been created and it is ready to be used (it was ready several years ago). This waste problem has been solved. The Waste Isolation Pilot Plant should be opened as soon as possible.

Sincerely,

William R. Stratton

William R. Stratton

## Comment C-102



January 15, 1997

Mr. George E. Dials, Manager
Department of Energy
Carlsbad Area Office
Post Office Box 3090
Carlsbad, New Mexico 88221

Dear George:

Regarding my previous letters and your response regarding public meetings in Roswell, enclosed for your information is an advertisement placed last week in the *Roswell Daily Record* dated January 5, 1997. It appears that the

1 Department of Energy is having public hearings in Carlsbad and not as requested by this office in Roswell. I understand that you have had some meetings in Roswell but these are not the meetings for the Supplemental Environmental Impact Statement (SEIS II) which directly effect Roswell. As

1 Roswell is the largest city on the WIPP route, I again implore you to reconsider and have public hearings that benefit our community as well. Should this not occur in the near future, the City will take action as necessary to ensure that we have an opportunity to expreas our concerns.

I would welcome and appreciate your comments again as to how Roswell is afforded an opportunity to make these comments when we have to travel to other locations at great expense.

Respectfully,

Thomas E. Jennings
Mayor
encl.
TEJ:an/mayor/wipp 1

*Office of the Mayor* *Post Office Box 1838* *Roswell, New Mexico USA 88202 - 1838*
*505.624.6779 - Telephone* *e-mail - mayor@ci.roswell.nm.us* *505.624.6709 - Facsimile*

## Comment C-103, Page 1 of 2

6512 Kraft Ave.,
No. Hollywood,
Calif. 91606
January 31, 1997

Mr. Harold Johnson,
SEIS II Comments,
U.S. Dept. of Energy,
P.O. Box 9800,
Albuquerque, NM 87119

Dear Mr. Johnson,

I was unable to attend the meetings you held for public input into the proposal to transport nuclear waste to more permanent storage/disposal sites. I am writing to you now on this vital question.

Last year I bought land in Carson, New Mexico, with the intention to relocate there in the near future. I understand that nuclear wastes would be transported by road through the Carson area if this proposal were implemented, and naturally I am particularly concerned about this. But the whole problem is much bigger and goes much deeper than this one local area's potential involvement.

1 I think it is highly hazardous to attempt to transport nuclear wastes from their present locations to other "disposal" or "storage" sites. Accidents do happen, whatever form of transportation is used, and such an accident would endanger the health not only of those in the immediate vicinity but also of people hundreds--even thousands--of miles away. In addition, the health of untold future generations would be adversely affected.

2 Apart from the hazards of transporting nuclear wastes, new storage/disposal sites would not be any safer than the present locations, and might very well be even less safe. I understand that you propose to bury these wastes in special containers deep in the earth. You must be very well aware that no storage system has yet been found or invented which can be guaranteed to be 100% leakproof for untold centuries/millenia. Geologically speaking the earth could be contaminated and the hazardous substances spread over hundreds of thousands of square miles through future earth movements, the leaching of these substances into the ground-water, etc.

Unfortunately nuclear wastes already exist at certain sites, and so must be dealt with. The best that can be done, under the circumstances, is as follows:

cont./2

## Comment C-103, Page 2 of 2



The best that can be done is as follows:

3 1) Leave nuclear wastes where they are

2) Keep them stored as securely and safely as possible and above-ground, where they can be monitored

3) Monitor them closely and frequently for leakage or other problems.

4 The other thing, and the very least that we can and should do as a nation, is to keep the already considerable hazard of nuclear wastes at its present level by NOT MAKING ANY MORE OF IT, for either military or civilian (commercial) purposes, now or in the future.

I would appreciate you giving this letter, on such a grave matter, your earnest consideration.

Thank you.

Sincerely,

Judith Babka

Savannah River Site
CITIZENS ADVISORY BOARD
A U.S. Department of Energy Site-Specific Advisory Board

*Chairperson*
Bob Slay
P. O. Box 192
Beech Island, SC 29842

*Vice Chairperson*
Ann Loadholt
P. O. Box 965
Barnwell, SC 29812

*Members*
Arthur Beige
Anne Brown
Aundria Cheever
Thomas Costikyan
Bill Donaldson
Brendolyn Jenkins
Thelonious Jones
Bill Lawless
Suzanne Matthews
Kathryn May
Mildred McClain
Jo-Ann Nestor
Lane Parker
Karen Patterson
Kamalakar Raut
Deborah Simone
Perjetta K. Smith
Ed Tant
Beaurine Wilkins
Vernon Zinnerman

*Ex-Officio Members*
DOE
Tom Heenan
Lee Watkins

EPA
Camilla Warren
Jeff Crane

SCDHEC
Ann Ragan
Myra Reece

February 4, 1997

Mr. Harold Johnson, WIPP EIS
U.S. Department of Energy
101 W. Greene Street
Carlsbad, NM 88220

Dear Mr. Johnson:

I am pleased to forward you a recommendation from the Savannah River Site Citizens Advisory Board regarding the Waste Isolation Pilot Plant Disposal Phase Draft SEIS. This recommendation represents the comments and concerns of the full Board and augments those previously provided to you by our Environmental Remediation & Waste Management Subcommittee.

This recommendation has also been provided to Dr. Mario Fiori, Manager of the Savannah River Operations Office for response. Please feel free to direct any questions regarding this recommendation to our Environmental Remediation & Waste Management Subcommittee Co-Chair Bill Lawless at (706) 821-8340. We look forward to receiving the Final SEIS upon its completion.

Sincerely,

Bob Slay

Bob Slay
Chairperson

cc: SRS CAB Members



Savannah River Site
# CITIZENS ADVISORY BOARD

**Recommendation No. 32**
**January 28, 1997**

**Recommendation on Waste Isolation Pilot Plant Disposal Phase Draft SEIS-II**

The SRS Citizens Advisory Board appreciates the opportunity to comment on the Waste Isolation Pilot Plant (WIPP) Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS-II; DOE/EIS-0026-S-2). We believe that the deep salt repository at WIPP is the best location for SRS transuranic (TRU) wastes. But we are concerned that the data and costs presented in SEIS-II do not support our belief, despite the estimated 2,325 deaths over 10,000 years from the loss of institutional control (viz, SEIS-II attributes 99% of the deaths to Rocky Flats Environmental Technology Site RFETS; see p. 5-153). Our belief is that the special properties of plutonium 238 (Pu-238) should prevent the No-Action Alternative 2 from being chosen. 1 2

**We recommend that SRS:**

3,4 1. Confirm the dose calculations, health consequences, and the Pu-238 and Pu-239 inventory numbers at SRS for all of the action and no action alternatives published in the draft SEIS-II.

5 2. Ship the high activity Pu-238 to WIPP first.

6 3. Include any TRU waste generated as a result of processing Rocky Flats plutonium in the inventory numbers.

**We recommend that WIPP:**

7 1. Plan for the capacity to dispose all SRS TRU wastes at WIPP as our preferred Alternative (Action Alternative 1).

8 2. Determine for the No-Action Alternative 2 and WIPP's Proposed Alternative (which leaves TRU wastes at SRS) the health consequences at SRS in the event of a loss of institutional control followed by a catastrophic release of SRS TRU wastes under two scenarios: for when the TRU wastes at SRS are sufficiently treated and for when the TRU wastes at SRS are not treated at all.

9 3. For No-Action Alternative 2, the loss of life, cancer incidences, and criticality accidents should be included in current dollar costs.

10 4. In the SEIS-II, document the unique characteristics of Pu-238 relative to Pu-239 (see SRT-MTS-96-3026, or SR1-6-MW-51). This means that Pu-238 is roughly 400 to 500 times more dangerous than Pu-239. Although the chemical and physical properties of the two nuclides are identical, their radioactive properties are significantly different. Our concerns are more related to the possibility of inhalation as a valid pathway and should be considered.

SRS CAB Recommendation #32
Adopted January 28, 1997

## Comment C-105

February 11, 1997

Dear Mr Johnson,

1 As a voting resident of New Mexico I wanted to take the time to write and tell you of my strong, constant and unwavering opposition to the proposed waste isolation pilot project (WIPP).

2 I don't believe that New Mexico has safe methods (if such things exist) to dispose or transport its own nuclear waste, let alone accepting transuranic waste from other areas. It is my firm belief that areas which generate hazardous waste must be responsible for storing it; if this is not possible, then hazardous waste production must be reduced and ultimately eliminated.

3 There are no longer "deserted" areas in which to store (not dispose of, such a thing is not yet possible) radioactive wastes. It is the worst sort of economic oppression to consider a "pilot plant" for New Mexico simply because it is a poor state.

4 We are all morally responsible to clean up after ourselves not to inflict others to handle and store the waste that we generate. Please think carefully about what you may be condemning future New Mexicans to before you act.

Sincerely,

Valerie Hawkins (MSW), LISW

## Comment C-106, Page 1 of 2

February 7, 1997

U.S. Department of Energy
SEIS-II
P.O. Box 9800
Albuquerque, New Mexico 87119

To whom it may concern:

I would like to take this opportunity to testify as a concerned citizen on the second supplemental environmental impact statement (SEIS-II) for the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. I also want to testify on the behalf of future generations, who will certainly be the victims of our shortsightedness if this plan is implemented. It is my intent to stress the magnitude of this decision for the planet and all that inhabit it.

1 As I understand it, the purpose of the SEIS-II is to support four decisions, the first of which is whether to open WIPP, or how to store transuranic (TRU) waste if WIPP doesn't open. My response is: do NOT open WIPP! This facility is just one more example of the common attitude, "out of sight, out of mind". You cannot expect this enormous problem to be "solved" by burying the waste permanently. Every reasonable person knows this. Why do you defy this logic? The WIPP site is surrounded by water, which will transport contamination to unplanned and undesirable locations just as sure as the sun rises each day. Your scientists know this. Why do 2 they refuse to acknowledge that the original premise of the National Academy of Sciences' report that salt deposits are dry has been proven wrong? The very fact that salt exists indicates the presence of water at one time. Are you trying to tell me that the water above and below the site will stay away for 240,000 years? After the inevitable event I just eluded to occurs, the brine 3 material will corrode the waste containers and plutonium will be released into the biosphere. Your "permanently entombed" waste has just contaminated the drinking water of my great-granddaughter. Notice I said "your" waste. I, nor almost all of the world's population, did not ask for nuclear weapons or nuclear energy production. WHAT WE DEMAND IS PEACE AND RENEWABLE ENERGY PRODUCTION!!! So, what to do with the current waste if WIPP 1 doesn't open? The answer is simple and logical. Store wastes safely at existing sites where they can be monitored diligently and retrieved if needed.

4 Another decision you expect the SEIS-II to support is what transportation methods to ship wastes to WIPP. AGAIN, DON'T SHIP WASTES TO WIPP!!! I live five miles from Interstate 25, the proposed route for over 25,000 shipments of this waste material. Your estimates of highway 5 accidents involving the truck shipments are blatantly conservative. I understand rail companies won't even consider this task because of the hazards it presents to its employees and the public. 6 Although you have stated that trained emergency personnel will respond to accidents in large metropolitan areas, what about rural areas? Volunteer fire and medical teams will be first on the

## Comment C-106, Page 2 of 2

6 | scene. These teams experience high turnover and variability in qualifications. The notion that these dedicated citizens will be competent in such a serious situation is unrealistic. Then, there's the fact that 2-3 shipments a day will be rolling down the front range of Colorado each day. This figure is dwarfed by the number of shipments traveling the highways of New Mexico each day.

7 | This schedule presents a potential nightmare. If, for some reason, WIPP personnel are unable to process a shipment or shipments, the en route shipments may be forced to stop, wherever they happen to be. Even if they are allowed to continue their journey to WIPP, a bottleneck situation is certain to occur. This will put the public at great risk. It is unacceptable!

8 | You have already spent $2 billion of taxpayers' money on this worthless scheme. Now you want to spend an additional $17-20 billion over the life of the project. This irresponsible expenditure of our taxes is inexcusable. Much less money would be required for safer storage sites at existing locations. It is your duty to choose the most cost-effective alternative. For you to do otherwise is a major violation of the public trust. This is but one more example of corporate welfare, pure and simple. The public is catching on to this abuse and will demand accountability in this matter.

9 | One more thing: the opening of WIPP would promote further abuses of nuclear technology. There is no such thing as the "disposal" of nuclear materials. The generation of this waste must be stopped NOW! For you to continue to produce it is the most irresponsible and shortsighted act this generation could force upon future generations. Native American philosophy takes actions into account for the next seven generations. We would be wise to follow this wisdom. To do otherwise would be to commit an enduring act of violence against the future.

Sincerely,

Jerry L. Gerber

Jerry L. Gerber
1221 1/2 Cherry Street
Fort Collins, Colorado 80521

## Comment C-107

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

DEBORAH (First Name (please print)) | M (M) | BRINK (Last Name)

SANTA FE NM (Location) | (Date) | (Time)

myself

Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 | I am opposed to the establishment of a nuclear waste depository in permeable and corrosive salt deposits. There is no way you can guarantee

2 | safety for 10,000 years - Get real! Whose ~~government~~ government has lasted that long?

Comment C-108

February 18, 1997

Mr. Harold Johnson
NEPA Document Manager
Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

The guest editorial by Steve Hopkins in The Idaho Statesman prompts me to write this letter, with a different perspective than other letters you might receive. **DON'T LET THE KNOW-NOTHINGS DETERMINE OR AFFECT YOUR POLICIES.** I have taught Chemistry at high schools for 30 years and have had and do have an interest in nuclear energy. I have taken students numerous times to the Hanford, Washington nuclear facilities. I have had numerous conversations about nuclear energy and its politics with my son, a Physics professor at Idaho State University.

I have come to these conclusions:

1. There is a direct correlation between ignorance and involvement in anti-nuke movements (the Snake River Aliance is an excellent example).

2. The problems that do exist are political, not engineering or scientific.

1

3. Nuclear "waste" is an oxymoron, and is instead, a wasted resource.

4. Those who are knowledgeable are aware that nuclear energy is far more friendly to the environment that burning oil or coal.

Don't let the neo-Luddites win.

Sincerely,

Richard Shropshire

Richard Shropshire
510 S. Phillippi St.
Boise, ID 83705

Comment C-109

Mr. H. Johnson
U.S. Dept. of Energy
Carlsbad Area Office
P.O. Box 9800
Albq. NM 87119

Dear Mr. Johnson:
Having lived in Taos since 1977 I feel I have a right to be concerned about the state I live in, the safety of the people who live in it and have concern for future generations.
The entire issue over W.I.P.P. is a complex one; but I strongly feel that Yes - it IS, in fact largely an emotional issue.
And for good reason! Peoples lives can be very emotional. And the facts show it has allways been dangerous. I oppose opening the facility now, and in the future.

1

Sincerely,
Dana Middleton
P.O. Box 244, El Prado, NM 87529

## Comment C-110

December 31, 1996

Mr. Harold Johnson
U.S. Dept. of Energy
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

Once again you will be holding hearings in Albuquerque on WIPP and its operation. You placed an ad in the paper asking for public comment, and I would like to do so.

By way of introduction, my name is Rafaelita Bachicha and I am a native New Mexican [illegible] the community. I have always felt very blessed to be born in this beautiful state. I have a profound love of New Mexico and I would like to see it grow in positive ways.

1 I have attended hearings in Santa Fe on this subject, and I have given recorded testimony. I believe it is important to do so. I have concerns about both the storage and transportation of transuranic waste. From my viewpoint, it seems that there is a considerable amount of knowledge in this arena that we simply do not have. We created the waste materials during a time of war, and I do not believe we were thinking about what this would mean for future generations. We were in a "mindset" of protecting our country, and it seems that other considerations were pushed out of our frame of reference.

2 Even DOE projects accidents in transport, and no one can measure the consequences to the fullest extent.
3 What if people are hurt or killed? What if the environment is further destroyed? What of the long-range effects of this "no turning back" action? None of us has the answers to all of this.

4 At the site, there are still questions about safety. Can we really guarantee that there will be no disasters there---not 100%? And, I believe that it is impossible to put a price on human lives. Yes, there have been studies and some people say that storage is safe. I simply do not believe that anyone can say that all aspects of this project have been explored. I continue to have great concerns about placing wastes in the ground with a belief system that it will be OK for future generations. As mortals, with some very real limitations, we do not know this.

I would like to give those that follow an opportunity to keep bringing the best to this part of the country I would like them to have every opportunity to live a qualitative life. If we are right, this will occur, but we move with haste, or without sufficient information, it could be catastrophic.

5 Please note my concerns in your testimony. I want to be counted on the side of those who said, "We don't know everything about this project, and we should not proceed in haste, without the public safety in mind". It is so very important, and I urge you to consider our "quality of life" in the overall project. Do not move rapidly (without sufficient information, especially regarding risk) as this is "home, sweet earth" and it is profoundly important!

Sincerely,

Rafaelita Bachicha

Rafaelita Bachicha
Santa Fe, New Mexico

## Comment C-111, 1 of 2

2/15/97

MR. JOHNSON,

AS A LIFELONG RESIDENT AND OWNER OF TWO COMPANIES ALONG THE I-25 CORRIDOR...I FEEL A NEED TO COMMENT UPON THE DECISION TO TRANSPORT THE NUCLEAR WASTE THRU MY HOME.

1 THE DECISION TO OPEN AND OPERATE WIPP, HAS BEEN A LONG AND EXPENSIVE JOURNEY. THIS PROJECT IS AN ABSOLUTE, HORRENDUS EXAMPLE OF GOVERNMENT RUNNING OUT OF CONTROL, NOT TO MENTION PUTTING THE SAFETY OF MANY AT RISK. FURTHERMORE, YOU ARE
2 COSTING ME, THE TAXPAYER, AN OPERATIONG COST OF OUTRAGOUS PROPORTIONS...IF YOU AND THOSE OPERATING WIPP, WERE IN THE REAL WORLD YOU WOULD HAVE SHUT YOUR DOORS LONG AGO! YOUR PRODUCT IS NOT IN DEMAND AND YOUR OVERHEAD IS BEYOND BELIEF!

3 OUR PRODUCT IS NOT IN DEMAND... NOT TRUE, YOU SAY... THE PRODUCTION OF NUCLEAR WASTE IS AT AN ALL TIME HIGH... THE DEMAND, IS TO SAFELY DISPOSE OF THIS WASTE AND LOOK AT THE BENEFITS,... WEAPONS AND ELECTRICITY! THE FACT IS THAT THERE ARE MANY, PROVEN AND COST EFFECTIVE METHODS TO PRODUCE ELECTRICITY WITHOUT NUKES AND THE WEAPONS WE HAVE NOW WILL BLOW UP THE WORLD MANY TIMES. LOS ALAMOS DOESN'T ANY MORE SOARING CANCER RATES... SO WHY EVEN MAKE THE STUFF!!!

BUT YOUR JOB IS IN THE DISPOSAL...RIGHT? OK LETS LOOK AT THE ISSUE AT HAND. I RECENTLY RETURNED TO COLORADO AFTER LIVING MANY YEARS BETWEEN SANTA FE AND ALBUQUERQUE, NEAR CERILLIOS, NM. WHICH IS APPROX. 10M EAST OF THE LA BAJADA HILL ON I-25. EVERY DAY FOR 5 YEARS, MY BUSINESS TOOK ME UP AND DOWN I-25 BETWEEN SANTA FE AND THE DUKE CITY. IN NEW MEXICO, YOU HAVE FACED VOCAL OPPOSITION AND AN EDUCATED PUBLIC. HERE IN SOUTHERN COLORADO, PEOPLE DON.T HAVE A CLUE WHAT YOU
4 ARE DOING...THEY WOULD BE HORRIFIED IF THEY DID! SO THE PEOPLE THERE, WHO REALIZE WHAT IS GOING ON, ARE OUTRAGED AND THE REST OF THE AREA AFFECTED, LEFT IN THE DARK, IS JUST SILENTLY IGNORANT...GOOD JOB ON SOLICITING PUBLIC COMMENT. IF YOU WORKED FOR ME YOU WOULD BE NOW BE WORKING ON YOUR RESUME. BUT WAIT A MINUTE...YOU DO WORK FOR ME...REMEMBER, I PAY YOUR SALARY!

2 THE TAXPAYERS OF THIS COUNTRY DEMAND ACCOUNTABILITY FROM YOU AND WIPP.
4 ACCOUNTABILITY FOR YOUR HANDLING OUR SAFETY AND OUR MONEY...YOU HAVE FAILED US AND REFUSE TO EVEN LISTEN TO US...LISTEN? YOU SAY... JUST WHAT IS A PUBLIC COMMENT PERIOD? WELL IT IS ONE THAT ALLOWS SUFFICIENT INFORMATION TO BE GIVEN TO THE PUBLIC, NOT HIDDEN. AND IT IS ONE THAT ACTS ON PUBLIC COMMENT, NOT JUST A EXERCISE OF OBLIGATION.

5 THE 1-25 CORRIDOR THRU DENVER, COLORADO SPRINGS, PUEBLO, WALSENBURG, TRINIDAD, RATON, WAGON MOUND, LAS VEGAS, SANTA FE, ALBUQUERQUE, BELEN, ETC, ETC. IS FAR TO NICE A REGION AND FAR TOO DANGEROUS A ROUTE TO TRAVEL WITH THIS WASTE AND IN

- 1 -

## Comment C-111, 2 of 2

THIS MANNER. YOU ARE FOOLISH IF YOU THINK OTHERWISE..I HAVE SPENT 40 YEARS DRIVING THIS STRETCH AND CAN REPORT TO YOU THE FOLLOWING FACTS;

1. NO CHANCE IN DENVER... YOUR ACCIDENT RATE WILL BE HORRIBLE... YOU'LL PROBABLY HAVE PEOPLE TAKING SHOTS AT YOU!
2. COLORADO SPRINGS IS TWENTY YEARS BEHIND IN THE INTERSTATE KEEPING UP WITH THE GROWTH OF THE CITY, THE TRAFFIC IS OFTEN WORSE THAN DENVER.
3. PUEBLOS' CURVEY I-25 SECTION, IS A SURE BET FOR A ROLLOVER. BETWEEN PUEBLO AND WALSENBURG, THE WIND WILL CREATE MANY A SUPRISE FOR YOUR DRIVERS, JUST ASK THOSE WHO TRAVEL HERE ON A REGULAR BASIS, I SEE MANY SEMI'S ON THEIR SIDES.
4. TRINIDAD PRESENTS ANOTHER VERY CURVEY AND ANTIQUATED HIGHWAY AND GOOD LUCK ON RATON PASS.
5. I HAVE SEEN MASSIVE ICE SLICKS FROM RATON TO SANTA FE...AND MANY AN ACCIDENT HERE FROM ONE PACE OF LIFE MEETING ANOTHER.
6. LA BAJADA HILL IS WHERE YOU'LL GET YOUR NEXT THRILL...ICE, SNOW, WIND, ALL MAKE THIS ONE OF YOUR BIG OVERSIGHTS...
7. THE I-25 / I-40 INTERSECTION WILL BE GREAT FUN FOR YOU IN YOUR HOME...NOT TO MENTION THE TRAFFIC AND ORANGE BARREL FACTORS.

5

THE LIST GOES ON AND ON...AND WORSE YET **MILLIONS AND MILLIONS OF PEOPLE** LIVE ALONG THE AREA DESCRIBED ABOVE... ITS CLEAR THAT YOU ARE MAKING A MISTAKE!! **FIND ANOTHER ROUTE OR FIND ANOTHER WAY!!** PLEASE DON'T ENDANGER THE LIVES OF MY FAMILY AND YOUR FAMILY! FIND A BETTER WAY TO DO YOUR JOB AND STOP THE INSANE NEED TO CREATE YOUR JOB...STOP MAKING THE PRODUCT THAT CREATES THE WASTE!!!

6

IF YOU ARE UNABLE TO DO THIS THEN LET SOMEONE ELSE TRY, YOU HAVE NO RIGHT TO IMPOSE THIS UPON US AGAINST OUR WILL!

SINCERELY,

SCOTT W. ESTEP
SOUTHWEST WIRELESS INC.
PO 4344
PUEBLO, CO
81003

## Comment C-112

Author: "Dennis R. Floyd" <drfloyd@ix.netcom.com> at ~internet
Date: 2/23/97 7:35 PM
Priority: Normal
BCC: ^WIPPSEIS at ~Battelle_Abq
TO: Letters@denver-rmn.com at ~INTERNET
Subject: Responsible Disposition of Rocky Flats Waste
---------- Message Contents ----------

February 23, 1997

Letters@denver-rmn.com

How "responsible" is it for the president of the Colorado chapter of Physicians for Social Responsibility to be more concerned about people living 240,000 years from now than for the people living in the shadow of Rocky Flats today? In his Speakout column Feb. 21, Dr. John Shepherd urges us Coloradoans to tell the Department of Energy to keep Rocky Flats plutonium waste here rather than sending it for long term disposal in salt caverns in New Mexico. His basis is that the DOE can't guarantee the safety of the site for 240,000 years. In taking this "responsible" position, has he asked how safe it is to leave the waste at Rocky Flats? Since his title implies some familiarity with science, why doesn't he cite some statistical bases for his position, such as the relative likelihood of cancer deaths between the two choices he is asking us to make? Could it be that his commitment to the mission he states for his organization, "the elimination of weapons of mass destruction", ma!
y have clouded his judgment as a
scientist and compromised his objectivity regarding the best environmental interests of Coloradoans?

1

Dennis R. Floyd
3265 Fenton St.
Denver, CO 80212
237-0577
drfloyd@ix.netcom.com

## Comment C-113

Author: VHOLM@aol.com at ~internet
Date: 2/24/97 12:03 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WHIPP SEIS-II comments
---------- Message Contents ----------

DOE, SIES-II
WHIPPSIES@battelle.org
February 24, 1997

1 After carefully reading The Waste Isolation Pilot Plant Study by the National Research Council and looking over the Draft EIS I have concluded that WIPP represents the best solution to the Transuranic Waste problem. As a citizen of the Denver area one way to examine the problem is to look at the alternatives from our standpoint. Any alternative except storing the waste at Rocky Flats (an unacceptable alternative to most Denver residents) would involve transportation. For us then this aspect can be considered a wash. While we naturally want to insure that it is done in the safest manner possible we are agreed that it will have to be moved. As to where to put it; basically two alternatives could be considered, storage or disposal. Storage
2 would have the disadvantage that it would probably require further transportation in the future. This extra step could only be justified if we felt we would have the technology to better dispose of it in the future or no safe alternative existed for the waste at the present. In the case of TRU waste, I do not believe either of these factors are present. We not only don't know of any technology to make TRU waste safe; but, we don't even have a theoretical basis to develop such a technology. I believe we do have a
1 safe alternative in WIPP to dispose of this waste. I strongly advocate that WIPP be opened for accepting of waste at the earliest date possible.

Victor Holm

## Comment C-114

Cecil Caldwell

DOE, SEIS-II
Albuquerque, NM 02-24-97

FAX 505.224.8030

1 Please register my objection to the planned interment of the Rocky Flats (CO) Plutonium trash in the Carlsbsd (NM) WIPP facility. This same class of garbage now stored in WA and ID should be treated in the same manner as that recommended for CO. . . Secured above-ground storage at the point of generation.

Like several thousand others, I feel this entire plan is an ill-conceived invitation to a civil disaster.

Sincerely,

/s/ Cecil Caldwell

Cecil Caldwell
6425 South Jay Way
Littleton, CO 80123

Comment C-115, 1 of 3

1101 W. Ural Dr.
Carlsbad, NM 88220
(505)885-4140
February 24, 1997

Mr. Harold Johnson
U S. Department of Energy
Carlsbad Area Office
c/o Battelle
P.O Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson.

1 I am a resident of Carlsbad, NM, and support the Waste Isolation Pilot Plant (WIPP) project wholeheartedly. However, as a taxpayer and concerned citizen, I urge you to re-evaluate the project's apparent total commitment to trucks as the sole mode of transportation to the WIPP site.

2 Since eight of the 10 major generator-storage sites and the WIPP site itself are served by rail, a multi-modal approach using both truck and rail as presented in Action Alternative 1,2, and Action Alternative 3 (Table S-4, pg. S-17-18) seems to be the most logical and cost-effective approach.

3 It is clear from reading Appendix E in the Draft WIPP SEIS-II, that not enough investigation of the rail alternative has been undertaken. For example, I think that you will find that rail transit (especially dedicated service) is not slower than truck transit, particularly during periods of adverse weather and highway conditions. Certainly the 60 day truck shipping limit could be met by the railroad companies. Unfortunately, as cited in Appendix E pg. E-60, "Discussions between DOE, the NRC, and railroad industry personnel have not taken place." My question is why? As the rail industry continues to consolidate through mergers, it becomes increasingly easier to discuss shipping options with an ever decreasing number of rail companies. Additionally, a negotiated contract for rail shipment of TRU waste can provide DOE with a realistic rate comparison with trucking costs and create a baseline for shipping costs to be evaluated accurately. Such cost information has not been requested from the railroads. I think you will find that the costs of leasing a fleet of trucks and replacing the tractors every three years and 300,000 miles (WIPP brochure dated Aug '96), combined with the continued deterioration of public roadways (which are already in need of major reconstruction) will far exceed the cost of using rail transport

Comment C-115, 2 of 3

4 In Appendix E you also stated that "In the event of an accident, a rail line could be disabled during the accident investigation, with the possibility of no alternative routing for both WIPP and non-WIPP related rail shipments" (E-60). Are highways immune to such interruptions or inconvenience to shippers? I think not. A flat tire, mechanical failures, or traffic accidents on the roadways used to carry TRU waste would not impact the traveling public any less than a train derailment or accident. I believe it is a relatively simple data search to show that (1) there are far more truck-auto accidents, and (2) a greater number of fatalities involve trucks rather than trains. Therefore, the statement that "...a commercial train is just as likely to be in an accident whether it hauls TRU waste or not" (E-60) is simply incorrect

5 There is a public concern for exposure to radiation during the time any mode of transportation is stopped for any reason (accident, repair, weather, or traffic delays, etc.) The Draft SEIS-II states that ". dedicated rail service would have a stop time exposure about eight times lower than for regular rail, and the estimated dose from rail stops would be 64 times lower than the estimated dose from the truck stops" (E-62). From a public psychological standpoint, it makes sense to consider dedicated rail shipment.

6 It is stated in the Draft WIPP SEIS-II that emergency response teams in towns along highway routes for TRU waste shipments have been offered emergency response training and presumably many towns have already taken advantage of the opportunity. Why can't the same ER training be planned for towns along potential rail routes? On page E-58 the concept is simply noted as "Similar training or planning has not been accomplished for rail." Why cannot the same ER training be applied for rail shipped waste? Is it merely an oversight or is there something unique to rail shipments?

7 An additional indicator of the lack of serious inquiry into rail shipment alternatives is the unrealistic assumption that dedicated trains carrying TRU waste would have "only three rail cars and that each rail car would be carrying TRU waste" (E-60). Without consultation with railroad companies regarding the characteristics of dedicated TRU waste trains a short three-car train is at best conjectural and at worst wildly unrealistic. The creation of unit trains carrying coal or TOFC (trailer on flat car) "hot shot" trains were not based upon conjecture They were developed through discussions between shippers and the railroads. Discussions about the physical characteristics of TRU waste redball (express) trains should be undertaken before assumptions that may be very unrealistic are printed in the SEIS. The public deserves a complete inquiry into the capabilities and interests of the railroads regarding TRU waste shipments. Anything less does not contribute to the understanding and support of taxpayers who ultimately will fund the shipping costs

8 Finally, a consideration of economic distance does not seem to have been considered. Although transportation technology has changed considerably over the last generation, the relative economics of transport modes have not Trucks are still competitive in short to moderate haul distances of less than 200 miles. However, the higher capacity (in terms of tonnage) rail transit is the most cost effective mode in the 200-500 mile range. On a cents per ton-mile comparison, multi-car rail shipments reflect an over-the-road cost of about 1/2 cent while trucks

Comment C-115, 3 of 3

8 are about one cent per ton mile (R Morrill, The Spatial Organization of Society, 2nd ed., pp. 130-132 ) Dedicated trains have the potential to lower the over-the-road costs even further and that possibility should be investigated With the exception of the Los Alamos National Laboratory (which is not served by rail), all the major waste generation sites are over 500 miles from the WIPP site

While it is important to deal with the enormous problem of transuranic waste disposal, it is equally important to develop an efficient and economic transportation strategy. It seems to be an American mind set to equate transportation with rubber-tired vehicles for all situations. In the interest of transportation cost control and minimal adverse impacts upon the motoring public, I ask you to thoroughly study a multi-modal approach for transporting transuranic waste to the WIPP site. The American taxpayers deserve your best efforts in examining the safest, most cost-effective means of transportation. To do less is to ignore your responsibility to all our citizens. I hope that you take my comments in the spirit in which they were offered - helpful rather than hindering.

Thank you for the opportunity to respond to the SEIS-II.

Sincerely,

Melvin M Vuk

Melvin M Vuk

3

Comment C-116

SHURGARD STORAGE CENTERS

4401 South Tamarac Parkway
Denver, Colorado 80237
(303) 770-3211

Feb 22, 1997

Dear Sir or Madam:

1 I am writing this letter in response to your plan of transporting Nuclear Waste from Rocky Flats to W.I.P.P. near Carlsbad, N.M. I oppose this plan Rigorously. I think the best option at present is to keep the waste in safe, above ground Storage at the point of generation.

Sincerely,

Lauren O'Neal

LAUREN O'NEAL
ON-SITE MANAGER

## Comment C-117

To: HAZEL O'LEARY
SECRETARY OF ENERGY
DEPARTMENT OF ENERGY
1000 INDEPENDENCE AVE. S.W.
WASHINGTON, D.C. 20585

FROM: JEFF MOYERS
RPM2 BUILDING SERVICES LTD.
1122 PORTLAND PLACE #206
BOULDER, CO. 80304

RPM 2
& ASSOCIATES

DEAR HAZEL O'LEARY;

SHIPPING ALL THAT NUCLEAR WASTE TO THE WASTE ISOLATION PILOT PROJECT FOR BURIAL IN CARLSBAD, NM. IS REALLY A BAD IDEA. IT IS A MUCH BETTER IDEA TO KEEP IT ON SITE AND STORE IT IN A WAY AS TO BE ACCESSABLE AND MONITORABLE WITHOUT RISKING CONTAMINATION OF MAJOR WATERWAYS, SOURCES OF DRINKING WATER AND MAJOR BODIES OF WATER SUCH AS THE GULF OF MEXICO.

I LIVE IN BOULDER, COLORADO. 25,000 SHIPMENTS OF WASTE FROM ROCKY FLATS, JUST OUTSIDE OF BOULDER, ARE SLATED FOR WIPP. WHAT HAPPENS IF ONE OR TWO OF THESE TRUCKS IS INVOLVED IN AN ACCIDENT? WHAT HAPPENS IF THESE ACCIDENTS ARE IN POPULATED AREAS OF DENVER OR GOLDEN? NO MORE COORS BEER! THIS WOULD BE THE LEAST OF OUR TROUBLE, OF COURSE! WHAT HAPPENS IF SOME OF THE SHIPMENTS ARE HIJACKED AND USED FOR BLACK-MAIL? WHAT SECURITY MEASURES ARE IN PLACE TO ASSURE SAFE PASSAGE OF THE WASTES? ARE THEY REASONABLE? (IN THE SENSE THAT THE PROBABILITIES THAT A CATASTROPHIC FAILURE COULD BE AVOIDED). THE ODDS OF A CATASTROPHIC FAILURE FOR THE SPACE SHUTTLE WERE SET AT ABOUT 1 IN A MILLION. IT TURNED OUT TO BE MORE LIKE ONE IN TEN! YOUR RESPONSE?

OTHER ISSUES ARE INVOLVED WHICH DEFIE SIMPLE ENGINEERING AND SCIENCE:
(HOW DO YOU RESPOND TO THESE ISSUES?)

1. STATES HAVE A CERTAIN AMOUNT OF AUTONOMY. WHY SHOULD COLORADO ALLOW THE SHIPMENT OF OTHER STATE'S WASTE THRU OUR BEAUTIFUL STATE WHEN IT COULD BE STORED ON THE SITE WHERE IT WAS GENERATED? ARE WE PAID FOR THIS? HOW MUCH? WHAT ABOUT INSURANCE FOR ACCIDENT COVERAGE; WHO PAYS FOR IT? IS THIS INSURABLE? (PROBABLY NOT SINCE GENERATING WAS NOT INSURABLE!)
2. IF WE BURY THE WASTE AT WIPP HOW WILL THE CITIZENS OF THIS NATION MONITOR IT? WHAT WILL PREVENT PARTS OF IT DISAPPEARING? IS WESTINGHOUSE AND THE DOE THAT GOOD? (WESTINGHOUSE HAS A DREADFUL RECORD AS A CORPORATE POLLUTER). WHY WERE THEY CHOSEN FOR THE JOB OF BURIAL?

OBVIOUSLY, I COULD GO ON AND ON WITH THE PROBLEMS. AND THERE ARE PROBLEMS WITH STORING ON SITE. BUT WIPP'S PROBLEMS AND POTENTIAL FOR CATASTROPHY ARE MUCH GREATER! PLEASE CONCIDER THIS WITH THE UTMOST CARE AND CONTEMPLATION.

THANK YOU FOR YOUR TIME!

SINCERELY, JEFF MOYERS

## Comment C-118, Page 1 of 2

Author: David Proctor <sts@rmci.net> at ~internet
Date: 2/25/97 2:02 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: X-Sender: sts@rmci.net
---------- Message Contents ----------

February 25, 1997

Harold Johnson
NEPA Compliance Office=20
Atten: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119=20

Mr. Johnson,=20

1 I would like to join the chorus of voices who are unalterably opposed to opening the Waste Isolation Pilot Project.=20

2 Like many others who have already testified, I do not believe the transportation system can safely handle shipping plutonium-contaminated materials around the country. I also feel the buried waste at INEEL -- such as Pit 9 -- is a much more pressing problem than the above-ground waste that would go to WIPP. The whole project would be an enormous waste of money =96= my

1 money and yours. It would be far cheaper to leave the above-ground waste where it is than move it to a highly questionable and suspect underground location.

This summer I called New Mexico and talked to several of the people involved in the WIPP debate. One of the most impressive was Lokesh Chaturvedi, one of the scientists who have studied WIPP for 18 years. He told me that there remain serious unanswered scientific questions about the viability of the site and its ability to contain the waste safely for more

3 than 10,000 years,=20
Much scientific work remains to be done at WIPP, including measuring the gas that will be generated within the drums, the water leaks and the problems posed by the extraordinary amount of drilling done in the area.=20

Dr. Chaturvedi spelled out his concerns in a column run in the Albuquerque Journal on June 25, 1996. If they haven=92t been already, please make those remarks part of the record.=20

I repeat: I am strongly opposed to WIPP opening for reasons that are

4 as abundant as they are logical. The United States needs a thorough, rational, scientific nuclear waste policy, not some political legislation passed in haste to appease the nuclear industry and some of our temporary employees in Congress. What we don=92t need is another nuclear waste dump= that
will cost taxpayers billions and solve nothing.=20

Yours truly,=20

David Proctor=20
6627 Ashland Drive
Boise, ID 83709
208/322-8413

e-MAIL US
*The Journal op-ed page e-mail address is opinion@abqjournal.com*

Op-Ed Page

# Decision To Open WIPP Needs Scientific Support

BY LOKESH CHATURVEDI
*WIPP Observer*

The decision to put a large quantity of radioactive and chemically hazardous substances in an underground repository with no chance of retrieval or monitoring, forever, is a decision that should not be made lightly.

The Waste Isolation Pilot Plant (WIPP) has been constructed to be a repository in bedded salt deposits, 2,150 feet below ground, 25 miles east of Carlsbad in southeastern New Mexico, for the permanent disposal of radioactive waste generated in the process of making nuclear bombs.

The plan is to dispose 850,000 55-gallon drums of "contact-handled" and seven canisters of "remote-handled" (containing higher levels of penetrating radiation and requiring remotely operated machines to handle) transuranic waste.

Only a small quantity of the total amount of the defense transuranic waste is carefully stored at present in the government facilities, and this waste will be brought to WIPP. Most of the older, pre-1970 waste, is stored under a few feet of dirt at several national laboratories, including some at Los Alamos. This older waste will not be shipped to WIPP because digging up this waste is a hazardous operation and no decisions have been made to dispose it.

Transuranic waste contains radioactive elements heavier than uranium, which is the heaviest naturally occurring element. By the U.S. Department of Energy (DOE) definition, the "transuranic" waste contains more than 100 nanocuries per gram of radioactivity; waste below that level is defined as "low-level" waste.

WIPP is not a low-level waste facility as is often incorrectly stated. For long-term considerations, transuranic waste is more like the high-level waste; the same environmental standards apply to both.

The geological disposal is being considered due to the very long periods of hazard to human health and the environment. For example, the WIPP repository will contain about nine metric tons of plutonium-239 with a half-life of 24,000 years. But, geological disposal is an irreversible action.

Of course it is better to put the waste 2,150 feet underground rather than leave it on the surface, but only if the decision is made carefully through a scientific process, without haste or political pressure. The waste destined for WIPP is stored safely at present and can stay there as long as current institutional controls can be maintained.

So what is involved in making a decision to start filling the WIPP repository with waste, and why is WIPP not open yet? The decision for permanent geologic isolation has to be based on projections of the repository's integrity and ability to contain waste for a period much longer than the history of human civilization.

The U.S. Environmental Protection Agency (EPA) standards for such a repository require "performance assessment" for an arbitrarily chosen 10,000 years in the future; a length of time that was considered to be long enough to distinguish a bad site from a good one, but short enough to be able to reasonably project geologic changes.

The waste will, however, remain hazardous for much longer than 10,000 years. The EPA standards specify probabilistic limits of release of radionuclides to the environment for 10,000 years.

Demonstration of compliance with these release limits involves a thorough understanding of the geological and hydrological setting of the site, the characteristics of the waste, projections of scenarios for breach of the repository for 10,000 years, and complex calculations to project the probabilities and amounts of radionuclides escaping from the repository to the environment.

While much of the work on site characterization has been in progress since 1974, the DOE did not focus on the scientific work necessary to assess WIPP as a permanent geologic repository until 1994.

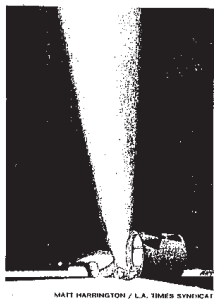
The reason for this is evident in the name of the project itself. The facility was presented as a "pilot plant" in the late 1970s with focus on placing some waste underground for "research and development", but no one could think of the specific "research" that could be done with the waste.

In 1987, measurement of gas expected to be produced in the waste drums was identified as a justification to put 25,000 drums underground. This effort was finally abandoned by the DOE in 1993 when the extent of the engineering problems in trying to measure gas in the waste drums, in the WIPP repository, were identified.

After abandoning the plans to conduct experiments with waste, the DOE announced an accelerated plan to assess WIPP's compliance with the EPA standard. Another year was wasted, however, in trying to prioritize the experiments to be conducted to resolve longstanding issues through an elaborate "systems prioritization" exercise.

Thus, many critical experiments identified years ago did not begin until 1995, and some have not yet been conducted. In July 1995, the DOE published a draft application to the EPA for certification of WIPP.

Both the EPA and the Environmental Evaluation Group found major gaps in the application. It is clear to all who have reviewed the WIPP project status recently that much additional work remains to be done and many issues of the long-term as well as operational safety have yet to be resolved before the repository can open to start emplacing waste for permanent disposal.



MATT HARRINGTON / L.A. TIMES SYNDICAT

One of the problems that has emerged sinc 1991 is that the WIPP is now surrounded by per haps the highest rate of drilling for any 4-square mile piece of real estate anywhere, for oil, ga and potash exploration and production. The con sequences of potential breach of the repositor through primary and secondary oil, gas- an potash exploration and exploitation processe have not been analyzed.

Water levels in several WIPP exploration well have been unexpectedly rising since 1988, an one potential cause is a nearby salt water dispos al well that may be leaking. Could water fro such activities flood the WIPP repository? I appears likely, but such a scenario has not ye been analyzed.

After all these years of study, there is still a insufficient understanding of the hydrology o the WIPP area, and the mode and rate of trans port of radionuclides, if injected in the aquifer overlying the repository, remains unclear. T some extent, this is due to the nature of the prob lem. But certain experiments that should hav been conducted a long time ago, have not been conducted, and thus the questions remain unan swered.

The only rational way to proceed on the WIPI project is to allow the scientific process to reacl a consensus among reasonable people about the integrity of the repository. If the integrity cannot be assured for untreated waste emplacement i ordinary 55-gallon drums, more robust contain ers and waste treatment may be needed. It would be unwise to try to make the decision to oper WIPP without a thorough scientific process.

Dr. Lokesh Chaturvedi has worked with the Environmental Evaluation Group, a federally funded scientific review group for the WIPP project, since 1979. He has been the deputy director of the group since 1988. These comments are written by him in his personal capacity.



```
Author:  David Proctor <sts@rmci.net> at ~internet
Date:    2/25/97  1:46 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: X-Sender: sts@rmci.net
---------------------------------- Message Contents ----------------------------
February 25, 1997

Harold Johnson
NEPA Compliance Office=20
Atten: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119=20

Mr. Johnson,=20
 I would like to join the chorus of voices who are unalterably opposed to
opening the Waste Isolation Pilot Project.=20
 Like many others who have already testified, I do not believe the
transportation system can safely handle shipping plutonium-contaminated
materials around the country. I also feel the buried waste at INEEL is a
much more pressing problem than the above-ground waste that would go to
WIPP. The whole project would be an enormous waste of money =96 my money. It
would be far cheaper to leave the above-ground waste where it is than move
it to a highly questionable and suspect underground location.
This summer I called New Mexico and talked to several of the people involved
in the WIPP debate. One of the most impressive was Lokesh Chaturvedi, one of
the scientists who have studied WIPP for 18 years. He told me that there
remain serious unanswered scientific questions about the viability of the
site and its ability to contain the waste safely for more than 10,000 years,=
=20
Much scientific work remains to be done at WIPP, including measuring the gas
that will be generated within the drums, the water leaks and the problems
posed by the extraordinary amount of drilling done in the area.=20
Dr. Chaturvedi spelled out his concerns in a column runin the Albuquerque
Journal on June 25, 1996. If they haven=92t been already, please make those
remarks part of the record.=20
I repeat: I am strongly opposed to WIPP opening for reasons that are as
abundant as they are logical. The United States needs a thorough, rational,
scientific nuclear waste policy, not some political legislation passed in
haste to appease the nuclear industry and some of our temporary employees in
Congress. What we don=92t need is another nuclear waste dump that will cost
taxpayers billions and solve nothing.=20


Yours truly,=20


David Proctor=20
```

## Comment C-120

Author: DSENOJ@aol.com at ~internet
Date: 2/25/97 6:29 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: FEB27 MTG RE NUCLEAR WASTE DISPOSAL, RM NEWS 21FEB97
---------- Message Contents ----------

I,m a retired mechanical engineer, univ of colo 1946. Although nuclear fission was not my specialty, I have done considerable reading on the subject including the news letter "access to Energy", box 1250, Cave Junction, Or, 97523. Further, having spent some 50 years in product development, I'm committed to objectivity and, in my opinion, the subject editorial is a study in scare tactics and deception. Witness "DOE admits that it cannot guarantee the safety of--", "--shipments will careen down I/25--", "--accidents will occur--even DOE admits that fact", "--may be enough to cause cancer--", "hospitals--likely to be unprepared--", "first responders--likely to be ill prepared--", "we are gambling--",. Note all the references to a lack of guarantees and the possibilities of problems. How fortunate we are that society now enjoys guarantees of safety and a lack of problems re, say, air and land travel, natural disasters, war, terrorism, etc! Implementation of the WIPP facility has been stalled by this and other anti-progress organizations. The WIPP facility is the best, safest storage facility for the material in question. It is certainly better that the "--safe, above ground storage at the point of generation--".

1

It is my fervent hope that real science and reason will prevail in the discussion but I doubt that such will be the case, especially considering your new boss!

## Comment C-121, Page 1 of 3

The attached file contains an article published in the Idaho Statesman's Speakers Corner on 2/18/97. I am submitting this article as my personal comments on WIPP as a citizen participating in the National Environmental Protection Act as it concerns the WIPP SEIS.

[Bob McEnaney (SRA)]

To: Idaho Statesman Editorials

From: Steve Hopkins, Western Idaho Coordinator, Snake River Alliance

4710 N. Maple Grove Rd., Boise, ID 83704. 376-4923 hm., 344-9161 wk.

Topic: Guest Opinion

1 Plutonium is the most hazardous substance known to man, and if the Department of Energy (DOE) has its way, 16,844 shipments of plutonium contaminated nuclear waste will pass through the Boise area over the next 35 years. All total, Idaho will be subjected to 25,762 of these potentially deadly shipments. This amounts to 2 per day traveling on accident riddled highways like I-84 en route from Hanford, Washington to Carlsbad, New Mexico. For 20 years, the DOE has been intent on burying plutonium-contaminated nuclear waste, generated during the cold-war, 2,150 feet beneath the surface near Carlsbad.

2 If this facility, termed the Waste Isolation Pilot Plant, is allowed to go ahead as planned, it would become the world's first nuclear waste repository. As a result WIPP would become a tremendous waste of tax payer dollars, a threat to the health and safety of those living in Idaho and the West in general, and a tremendous step backward in developing a rational, national nuclear waste policy. The facility should be opposed by everyone regardless of geography, even if it means resigning ourselves to keep some waste instead of making it someone else's problem.

3 Currently, the DOE estimates that 9 deaths would result from the total 38,089 shipments en route to WIPP, but one is too many, and it is impossible to rule out the possibility of wide-scale, very long-term contamination in densely populated areas like Denver, Albuquerque or Boise. In New Mexico, 80% of the public opposes the facility

4 not only because of the enormous number of shipments that could pass through the state, but because of the DOE's inability to demonstrate to the Environmental Protection Agency that the facility itself is safe. WIPP has many unresolved health and safety problems, foremost among them is the DOE's inability to demonstrate that radiation releases would result in fewer than 1,000 deaths over 10,000 years. Still, politicians are pushing for it to open.



Opposing WIPP may seem like a sacrifice in that Idahoans would be resigned to keeping 8,918 of these shipments at the Idaho National Engineering and Environmental Laboratory (INEEL); however, this is where one must examine all of WIPP's problems. The type of policy inherent in WIPP is itself hazardous in that it creates the illusion that we are solving the nuclear waste by moving it somewhere else. Here in Idaho it means moving the safely stored, above ground waste, at the expense of ignoring the far more perilous 60,000 cubic meters (conservative estimate) of waste buried above the Snake River Plain Aquifer. And this is not even a cheap-fix illusion. The estimated life-cycle

5 cost of the facility is $19 billion compared to $2.7 to store it where it currently resides. The savings could go along way toward cleaning up contamination throughout the DOE weapons complex as well as retrieving waste from the ground above our precious aquifer.

The net result should WIPP open would be the creation of yet another nuclear waste dump, and we would still be without a rational waste policy. In Idaho, it would mean moving out approximately 500,000 curies of radioactivity, about 1/6 the radioactivity of a single nuclear navy shipment coming into the state for storage, at the expense of further endangerment to our health and safety from 25,762 shipments passing through. The political expediency that foments NIMBYism (Not in My Back Yard) is always a bad basis for responsible public policy. Moving a problem does not solve it. Stop WIPP, and stop the shipments.

The DOE is accepting written comments until February 27. Contact: Harold Johnson, NEPA Document Manager, Attn: SEIS Comments, Box 9800, Albuquerque, NM 87119. E-mail: WIPPSEIS@battelle.org. Make your voice heard.

## Comment C-122

Author: murlock1@NM-US.CAMPUS.MCI.net (R. Lockridge) at ~internet
Date: 2/26/97 2:37 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: SEIS-II on WIPP
---------- Message Contents ----------

Concerned Citizens of Cerrillos, POB 245, Cerrillos, NM 87010

SEIS-II on WIPP
P.O. Box 9800
Albuquerque, NM 87119

Feb. 25, 1997

Re: Comments from Concerned Citizens of Cerrillos: SEIS-II on WIPP

1 AFTER REVIEWING the SEIS II on the WIPP, and after having followed this issue for years, we are under the opinion that none of the proposed six alternatives (SEIS-II) are now apropos.

2 The WIPP continues to be, instead of a solution to our N-waste problems, a tremendous waste of money. Since it has not been determined that opening WIPP will really help contribute to safely solving the N-waste problems, we think that this operation should be slowed down. Since the DOE puts no deadline of when N-waste production will end, future accumulation of waste would make the WIPP essentially of little value as a long term solution to a continuing problem.

3 The WIPP should probably never be opened. It continues to be geologically and hydrologically suspect. It has long appeared to be too connected with the biosphere via water and should not be, for that reason alone, considered for the long term storage of long lived nuclear waste.

2 Also the alternatives proposed in the SEIS II do not address the larger nuclear waste contamination problems at DOE sites, nor the accumulations of TRU waste. As has repeatedly been the case, the proposed solutions appear short sighted. The time frame under consideration of 35 years of future waste production does not consider the continuing of waste production beyond this time period.

Nuclear waste transport too becomes suspect in light of these uncertainties.

4 We believe most nuclear waste should be put in long-term storage at the facilities in which they are generated. The people who live around these facilities and have the most to loose should have some choice in the care and security of these wastes while we continue as a people to research for a solution that is not so questionable and irreversible. DOE must make room for an option for stopping all N-waste production.

1 WIPP should not soon be opened because of the unresolved health and safety issues, the questionable geology and hydrology issues regarding the location and consequent design of the WIPP. It is therefore also not justifiable to transport waste through the biosphere to a site with so many uncertainties.

5 This site was chosen not for reasons of geologic suitability but for political expedience. It is our observation that the "site selection process" was flawed from the beginning. As an article in the Albuquerque Journal of April 9, 1978 expressed it: "Failing Potash Firm Started Push for Carlsbad Disposal Site".

Ross Lockridge, President

## Comment C-123

Author: Carol Merrill <MERRILL@apsicc.aps.edu> at ~internet
Date: 2/26/97 3:38 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP
---------- Message Contents ----------

Dear folks:
I am an ordinary concerned citizen who is alarmed at the thought of WIPP being fully operational ever, at all.

1 According to the studies I have read, it is possible to reverse the process of creating highly radioactive substances. The substances should be left where they are, not transported across public highways. They should be transformed back into relatively harmless materials (whatever the expense!) Then they should be put into the ground as harmless materials.
All of life cries out to be rid of this ridiculous toxic material.

2 The solution is not to bury it in salt beds.
The salt beds will not be stable with radioactive hot substances there changing the character of the salt beds.
There is an aquifer that goes into Texas and Mexico. That could be poisoned for many people for aeons. There is no reason to this insanity.

3 NO WIPP NOW OR EVER.

Think about it. Would you want to live there?

Carol Merril
POB 1746
Corrales, NM 87048

(505) 898-8507
work (505) 877-6444

## Comment C-124



26 February, 1997

U. S. Department of Energy
P.O. Box 9800
Albuquerque, N.M. 87119

Comments on Waste Isolation Pilot Plant SEIS -II

There are at least four major flaws in the logic and rationale for siting WIPP in bedded salt deposits:

1 | 1. Problems with salt for a repository are well known beginning with long-term studies at Lyons,Kansas in the 1960's where water migrated through salt and vanished.

2 | 2. The presence of pressurized brines in the beds below the proposed repository and the tendency of salt to decrepitate giving off large amounts of water means that any canisters emplaced in the salt will soon be surrounded with a corrosive slurry. The dissolving of the canisters makes the future mobility rather than containment of highly corrosive radioactive brines extremely likely.

3 | 3. There is a very high probability of future drilling into these radioactive brine pockets in the future given the oil and gas deposits in areas surrounding the proposed site.

4 | 4. Those very characteristics which the DOE promotes for salt (that it deforms plasticly and that the repository becomes self-sealing) are in fact the very reasons to decide against it: The salt will deform and flow quite readily with thermal loading from the waste, under pressure, allowing emplaced waste to migrateinto one large brine-filled cavity, with no separation.

5 | Such rapid deformation after emplacement of the waste means that there will be no retrievability and that mistakes as well as waste migration and canister corrosion cannot be mitigated or corrected. In fact the repository will become unusable within a few years if permitted to go forward and then we will be treated to an uncontrolled experiment with radioactive waste brines with the contamination possibly reaching the Rio Grand valley.

6 | We now have, in Nevada, a repository design in a welded tuff, a far superior medium for long-term containment. There is no reason not to immediately recognize the flaws of WIPP and to abandon this wasteful, expensive, unnecessary experiment. Because and experiment is all that this has ever been and to add high level radwaste to this equation will lead very quickly to disaster.

Roy Young

NATURE'S OWN Roy Young
P.O. BOX 1260
5 EAST FIRST ST.
NEDERLAND, CO 80466
1-303-258-3846

## Comment C-125, Page 1 of 5

The Rio Grande Chapter of the Sierra Club
621 Old Santa Fe Trail Suite 10 Santa Fe, New Mexico 87501

February 26, 1997

By FAX to (505) 224-8030

SEIS-II
P.O. Box 9800
Albuquerque, NM 87119

Re: Public Comment on SEIS-II for WIPP

We are concerned that the Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS-II) does not meet the requirements of NEPA with regard to assessing environmental impacts of significant federal actions.

1 | The environmental impact statement is designed to be a full disclosure document, which gives decisionmakers relevant information on the environmental consequences of a major federal action before a decision on that action is made. According to 40 CFR 1500.1(b): "The information [in the EIS] must be of high quality, . . .accurate scientific analyses, expert agency comments, and public scrutiny are essential to implementing NEPA."

It has not been demonstrated that the SEIS-II meets this criterion.

**Accurate Scientific Analyses**
The Conceptual Models Peer Review Team, assigned to review WIPP conceptual modeling, has voiced concern over two of the Department of Energy's (DOE's) conceptual models: spallings, and chemically engineered backfill, which is one type of barrier designed to "significantly decresase the mobility of radionuclides. . ." (40 CFR 191.12)

2 | **Spallings.** "Spallings" refers to the entrainment of waste during the venting of high pressure gas from the repository in the event of a drilling intrusion. The spallings model is essential to the safe disposal of TRU waste. WIPP is surrounded by oil and gas wells as well as potash mines. Mining could, as the Environmental Protection Agency (EPA) has pointed out, alter the properties of certain rock formations above the underground repository. Changes to the rock formations above surface could cause alterations in the hydrogeology of the rock formations, specifically groundwater travel time. Human intrusion through oil and gas drilling into the repository through to the briny aquifer is also cause for concern.

SEIS-II
February 26, 1997
Page 2

3 The Environmental Evaluation Group (EEG), established in 1978 to perform an independent technical review of WIPP for the State of New Mexico, has told the EPA that there is insufficient basis for the selection of certain conceptual models, the spallings model being one of them. "EEG finds no justification for assuming only an 8% probability of intercepting a pressurized brine reservoir in the Castile Formation, 800 feet below the repository." EEG goes on to say that the repository has been relocated twice in response to encountering pressurized brine reservoirs. "The EEG position is that a brine reservoir, most likely the same [one] that was encountered by WIPP-12, should be assumed to extend under the [current] repository. . . "

4 **Barriers.** EEG found that DOE's engineered barriers are inconsistent with definitions used by other agencies, such as the Nuclear Regulatory Agency (NRC) definition at Yucca Mountain. The only barriers that DOE is planning to use are seals for the shafts leading to the underground repository. According to EEG, "The shaft and panel seals and borehole plugs are at best attempts to undo the damage done to the natural environment when the shafts were excavated and therefore cannot be considered to be engineered barriers as distinct and *complementary* to the natural barriers. " We agree with EEG that DOE's efforts at engineered barriers are minimal, and go against the common practice of multiple and redundant barriers to isolate nuclear waste.

5 **Other Areas of Incomplete Documentation.** In addition, the groundwater system at WIPP is not currently scientifically understood; the Dewey Lake rock formation (a layer of rock between the surface of the site and the repository) has not been fully characterized by the DOE, and must be examined as a potential pathway for the leaching of contaminants.

6 The Government Accounting Office (GAO) found that "about 41 percent of the waste is expected to be too heavy for efficient transport in the existing type of container. DOE plans to procure new containers for this waste. DOE has not decided how it will transport the remaining amount of contact-handled [CH-TRU] waste." (Page 16, Nuclear Waste Uncertainties about Opening WIPP) The SEIS-II does not address GAO's concerns.

7 GAO has also found that over 60% of DOE's stored TRU waste contains hazardous waste, requiring DOE to dispose of these wastes as defined under the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs). The LDRs prohibit the disposal of untreated hazardous wastes unless the Agency makes a "no migration" determination. The SEIS-II does not clearly lay out DOE's determination that no migration of hazardous waste will occur as long as the waste remains hazardous.

**Alternatives**
We are also concerned that the Alternatives section does not meet the requirements of NEPA. In particular, we wonder if the alternatives presented meet the court test of "reasonableness." According to 40 CFR 1502.14, "Alternatives including the proposed action":
"This section is theheart of the environmental impact atatement. . .[and should]
"(a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were elimimated from detailed study, briefly discuss the reasons for their having been eliminated."



SEIS-II
February 26, 1997
Page 3

8 **Reasonable Alternatives.** The courts have stated that agencies do not need to consider all alternatives, only reasonable ones. But at least two of the alternatives discussed by DOE are not even legal under the enabling law, the WIPP Land Withdrawal Act (LWA). Under the LWA, only defense-related transuranic (TRU) waste may be emplaced at WIPP. Alternatives #1 and #3 call for emplacing non-defense-related waste. Alternative #2 exceeds the limits of RH-TRU (remote handled) waste allowed to be emplaced under the New Mexico/DOE Compliance and Certification Agreement (C&C Agreement). These alternatives therefore do not seem to meet the reasonableness requirement of NEPA. Reasonable alternatives would seem to include the different treatment options discussed, but on the legally allowable Basic Inventory, rather than on the Additional Inventory (which includes non-defense-related waste). Another reasonable alternative would be alternate transportation scenarios. Please see the Transportation section below.

9 **Misleading Characterization of the No Action Alternative 2.** The No Action Alternative 2, leaving waste at the generator sites, seems to be mischaracterized in the SEIS-II. The August 1995 DOE Draft Waste Management Programmatic Environmental Impact Statement provides calculations that indicate leaving the waste at the generator sites indefinitely rather than disposing of it at WIPP would result in fewer cancer fatalities, a smaller collective radiation dose, and a cheaper cost. Yet, the discussion in Summary of Impacts suggests that many more people would be in danger from continuing to store waste at the generator sites: "If the waste were released, either by loss of institutional control or by natural disaster, estimated deaths would total 2,325 over 10,000 years, given current population densities and distribution. Future increases in population densities near TRU waste storage sites could increase the number of estimated deaths. . ."

10 This is misleading.

Under the Proposed Action, most TRU waste will continue to be stored at the generator sites because at least 50% of waste in the Overall Inventory is non-defense-related, and therefore ineligible for emplacement at WIPP. Thus, a program to deal with the waste still stored at generator sites will have to be undertaken. WIPP does not solve the problem of potential radiation releases at the generator sites. It does not protect the people around the generator sites—it just endangers people all around the country who are not currently in danger from nuclear waste.

If there is a danger of radiation release due to "loss of institutional control or natural disaster," that danger continues to exist whether or not WIPP opens.

11 **Alternatives Eliminated From Detailed Study.** It is unclear why the alternative of future technology "to neutralize or change the natural rate of radioactive decay" was not seriously considered. Physicists in New Mexico have testified that such technologies should be explored, and the government has programs to develop new technologies in all areas. Why is this one not considered to be be viable? What doesn't seem viable is continuing to produce nuclear waste when we have no safe and reliable way to dispose of it.

**Transportation**
There are several transportation issues.

12 **Rail Transit.** It is unclear why rail transit, which the SEIS-II acknowledges is 10 times safer than truck transit, has not been taken seriously as an alternative. Regular rail transit is also less expensive. Dedicated rail shipments, arguably safer, are certainly more costly. But is the government saying that money is more important than the lives of its citizens? That seems to be the bottom line. We are not talking here about the Flycatcher or the Snaildarter. We are talking about

13 human beings, who will, according to the SEIS-II, die from exposure to radiation from the transportation of nuclear waste, whether there is an accident or not. If money is the issue, then leaving the waste at the generator sites should be the preferred alternative.

14 It is important to remember that TRU waste is **not** "low-level waste." It includes 141 radioactive elements, 47 organic and 13 non-organic contaminants of concern. An individual exposed for one hour to organic and inorganic contaminants at concentrations meeting emergency response 3 (ERG3) guidelines would develop or experience a life-threatening effects. The SEIS-II considers exposure time for its accident scenarios to be less than 30 minutes. How that time is arrived at, when DOE's satellite tracking alert system requires from one to five hours for regionalizedstaff to arrive at an accident scene, is unclear. A safer transportation system would seem to be the most important alternative to consider.

15 **Transport along St. Francis Drive.** The SEIS-II does not consider the consequences of transport along St. Francis Drive in Santa Fe. It says that the route will be the Relief Route. But WIPP is being readied for opening in November, long before the relief route can be completed. The New Mexico State Highway and Transportation Department recorded 366 accidents in 1995 on St. Francis Drive alone, all involving a moving vehicle and damages of $500 or more. Since no evacuation plan or altenate routing exists for WIPP trucks on St. Francis, the probability of a WIPP truck being stopped in traffic on St. Francis is significant, increasing the exposure to cancer -causing radiation for many Santa Fe residents and tourists. The probability of an accident involvding a WIPP truck is also greater on St. Francis Drive than on the relief route. But that has not been taken into consideration in the SEIS-II.

**Other Impacts Not Considered**

16 **Socioeconomic Impacts.** In **People Against Nuclear Energy v. U.S. Nuclear Regulatory Commission** (1982) 678 F2d 222, a case involving the re-opening of the Three Mile Island nuclear power plant, the plaintiffs suggested that ". . .communities [would be] severely damaged. . .because fear of nuclear accidents will diminish citizen confidence in local institutions, cause local businesses and residents to leave the area, and discourage potential newcomers who perceive the area as an undesirable location." (678 F2d at 230) The Court agreed that this was a "classic 'socio-economic' issue" which needed to be consideed in an EIS. "Deterioration of a community's economic base or social stability. . .is a cognizable 'seconday effect' important under NEPA. . ." and must be evaluated. (678 F2d at 230) Socioeconomic considerations, including considerations of environmental justice, have been discussed in the SEIS-II with regard to the area surrounding WIPP. But they have not been considered for areas such as Santa Fe which stand to face significant socioeconomic impacts. The City of Santa Fe is on record as saying that it does not want WIPP trucks going through the city. Santa Fe businesses experienced a dramatic drop in tourism due to

17 the perception of danger from the Hanta Virus, which was detected in Farmington, not Santa Fe. A WIPP-related accident in or near Santa Fe could have a much more devastating impact.







18 **Psychological Impacts. PANE v. NRC** also discussed the need to evaluate potential psychological effects from the proposed action. The Court said that Congress meant "health and safety" to include mental health. The fear of radiation exposure from WIPP trucks will certainly have an effect on the communities along the transportation routes. It needs to be evaluated.

**Cumulative Impacts**

19 "[I]t is well settled that cumulative impacts of a proposed federal action must be analyzed in an EIS." **(Town of Huntington v. Marsh** [2dCir 1988] 859 F2d 1134,1142)

The SEIS-II does not in fact take into account cumulative impacts of radiation exposure on the people of New Mexico, nor does it address the synergistic effects of exposure to multiple chemicals AND radiation. Remember, 60% of the waste to be emplaced at WIPP also contains hazardous waste as defined by RCRA.

**Conclusion**

20 WIPP is merely a device to allow the continued production of nuclear waste from unneeded nuclear weapons research. Much of the waste which is to be emplaced at WIPP has not yet been generated—62,000 cubic meters of TRU waste is currently stored. That Basic Inventory is estimated to rise to 135,000 cubic meters by 2033. If, indeed, WIPP were a solution to our nuclear waste problem, there would be much less opposition to it. But it is not. Nuclear waste will continue to endanger people around the generator sites, it will continue to endanger people along the transportation routes to WIPP, and it will continue to endanger people around the WIPP site. And there is no suggestion that, when WIPP is full, the goverment will stop producing even more nuclear waste.

We need a solution to the nuclear waste problem. WIPP, however, is not that solution.

Sincerely,

Barbara H. Johnson
For the Executive Committee
Rio Grande Chapter, Sierra Club

## Comment C-126

Richard Dant ☎ 505 471-2425 2/26/97 3:33 PM 2/2

# FACSIMILIE TRANSMISSION

**DATE:** 2/26/97

**TO:** SEIS-II

**FROM:** RICHARD DANT
**ADDRESS:** RT. 2, BOX 310 R.D., SANTA FE, NM 87505
**RE:** Comments on SEIS-II

1 Our family is **against** opening WIPP in 1998. We feel there are too many unresolved questions about health and safety, transportation, waste from the treatment process, geology and hydrology, and the WIPP design.

2 We strongly feel that facilities that generate any kind of nuclear waste (past, present, or future) should be responsible for its storage, and/or teatment, and that generation of nuclear waste at all sites shoud be terminated, until an absolutely safe and finite solution can be achieved, that is acceptable to all parties. Without clear-cut determination of when waste production will end, future accumulation of waste at generator facilities would render WIPP's usefulness is negligble.

SINCERELY, RICHARD DANT, JACK DANT, CHRISTI SCHACKEL

## Comment C-127

February 22, 1997

SEIS-II
P.O. Box 9800
Albuquerque, N.M. 87119

Comments on SEIS for WIPP Disposal Phase

I am concerned about plans to begin disposing plutonium-contaminated waste from the U.S. nuclear weapons complex at the WIPP site in New Mexico.

1 I think there are serious questions about the environmental impact of storing wastes at WIPP that have not been satisfactorily answered. I understand that, in some areas of WIPP, the storage rooms are "collapsing" much sooner than anticipated. What does this say about all the projections for the long-term configuration of WIPP? Does this "early collapse" call into question other projections for the site?

2 As you are well aware, a layer of groundwater--the Rustler Aquifer--sits just above WIPP. This aquifer feeds the Pecos River. Below the WIPP site is a brine reservoir with millions of gallons of water. The government's claim is that the WIPP wastes will not impact these bodies of water. But, is this a judgment that represents a consensus of scientific and technical thought, or is it another government assurance in support of a project which the government wants very much?

3 I think that disposal of plutonium wastes should not begin at WIPP until both the State of New Mexico and public environmental organizations in New Mexico are satisfied that all environmental and health concerns about the site have been answered satisfactorily.

4 Finally, I am concerned about the shipment of wastes through so many states, including Colorado, if current plans for WIPP are carried out. I understand that 28,000 shipments through Colorado are projected. If that many shipments occur, and if accidents happen--and it seems very unlikely to me that so many shipments, of such long distances, could happen without some accidents--are states and major municipalities ready to respond to such accidents? I know that the municipalities surrounding the Rocky Flats Nuclear Weapons Plant do not have the medical facilities to care for a substantial number of radiation-contaminated people if such a group would need care because of radiation contamination from Rocky Flats. Is the situation different in all the states through which these shipments will pass? I urge that no shipments head for WIPP until citizens of all the states on the route can be assured that adequate resources are available for responding to accidents however serious.

I appreciate the opportunity to offer my comments.

Thomas M. Rauch
675 So. Newport St.
Denver, Colorado 80224 (303) 388-4954

## Comment C-128

MARY FRAN O'CONNOR
7613 S. Madison Circle
Littleton, Colorado 80122

February 21, 1997

Department of Energy
SEIS-II
P.O. Box 9800
Albuquerque, N. M. 87119

Re: WIPP

Dear DOE,

1 This letter is written to urge you to abandon your plans for the Waste Isolation Pilot Plant near Carlsbad, New Mexico.

2 You have acknowledged that this particular nuclear waste burial could contaminate the fresh water aquifier above WIPP. You know that there is a brine reservoir underneath WIPP. You are aware that the WIPP location is a mineral rich reserve where mining and exploration may well occur in later years. Do you think a "keep out" sign, a fence, and a prayer for no leakage is really any protection for future generations?

1 Much of the nuclear waste is in my backyard, Rocky Flats. I implore you to contain the waste right here at its point of origination and not to further tamper with or transport it. All waste, anywhere, should be contained at points of generation.

3 Have you taken a drive down Highway 1-25 south of Denver recently? Traffic is furiously bumper to bumper due to our swelling population. Locally, this stretch of highway has become know as "the corridor of death". Fatal accidents occur between Denver and Castle Rock with regularity. Now you propose sending **25,000 shipments of nuclear waste** down this path. You don't need a statistician to tell you that it would be only a matter of days or months before an accident were to occur.

1 You may have convinced a few people that WIPP is a solution, but the truth of the matter is that people are simply uninformed. If you took a vote of all those in the state of Colorado, you would not find too many individuals in support of WIPP. Then again you should be taking a international vote, because plutonium waste and radionuclides know no borders.

You are gambling with millions of lives and a living and viable planet.

Please rethink your WIPP proposal. Our children are counting on it.

Sincerely,

Mary Fran O'Connor

## Comment C-129, Page 1 of 5

Coalition 21
PO Box 51232
Idaho Falls, Idaho 83405

February 26, 1997

Mr. Harold Johnson
NEPA Compliance Officer
Attn: SEIS Comments,
PO Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

To meet the WIPP February 27 deadline for public comments, enclosed are our written comments on WIPP SEIS-2.

Very truly yours,

Richard A Kenney /gaf

Richard A. Kenney
President
(202) 528-2161
FAX: (208) 528-2199

Coalition 21 Comments on WIPP SEIS-II

The Snake River Alliance (SRA) has submitted its January 1997 Bulletin Volume II, Number 1 as a statement on the Draft WIPP SEIS-II. The SRA Bulletin has many undocumented, inaccurate and fallacious statements. Therefore, the WIPP SEIS-II Public Response document should refute these statements in the strongest possible terms.

1

1. The SRA says that WIPP is a bad idea. The SEIS-II should list the various organizations such as the National Academy of Science (NAS), U.S. Geological Survey, the U.S. Congress, and its own analyses and comprehensive Environmental Impact Statements developed over a period of 20 years that have supported WIPP and agreed that it should be opened for operation.

2

2. The SRA says that WIPP will not solve a significant part of the nuclear waste problem. The SEIS-II should list the other states, in addition to Idaho, that have TRU waste stored in temporary storage facilities. Those states disagree with the SRA position that their problem is "insignificant." WIPP helps to solve a potentially significant problem, by completing the process that stopped the burial of TRU waste. This process was initiated in 1970 when TRU waste was stored above ground for future disposal at a TRU waste repository. TRU waste, if released to the environment, would be a hazard. In fact, Aggregate Population Impacts of leaving the TRU waste at its present locations (over 10,000 years) have been very conservatively estimated to cause 2,300 Latent Cancer Fatalities.

3

3. The SRA says WIPP will take only 32% of existing TRU waste, a volume of approximately 65,000 cubic meters. WIPP can take 175,000 cubic meters. The SEIS-II should state the amount of volume reduction required for WIPP to accept all of this nation's foreseeable TRU waste. It should also explain (when the WIPP becomes operational) how much its capacity would need to be expanded to take all of this nation's TRU waste without treatment, including any TRU waste generated during the next 35 years. In that case, an amendment to the Public Law 104-201 1997 WIPP Land Withdrawal Act would be required. However, the current SEIS should cover this expansion. The Record of Decision (ROD), by means of a hybrid alternative, could select this expanded case as the proposed action.

4



4. The SRA says that TRU waste is not dangerous because it has less curie content than commercial irradiated nuclear fuel, called spent nuclear fuel (SNF). Yet other organizations and individuals (Ref. Mathews* & Rickards**) keep stating that "deadly" plutonium, "gram for gram", is the most poisonous element in the world. Pu is hazardous if it is inhaled into the lung. TRU waste stored indefinitely above-ground or in shallow burial is obviously more of a hazard than it is in deep burial in undisturbed geological salt deposits.

5

5. The SRA says WIPP has unresolved health and safety problems; however, the SRA does not specify what those problems are. The SEIS-II should either directly or by reference answer the various allegations the project has previously countered during the more than 20 years of evaluation and analysis, studies which have shown the WIPP to be a safe permanent repository for TRU waste. Good science has produced a world-class nuclear waste repository. As an example, the most prestigious U.S. scientific body, the National Academy of Science, has concurred that WIPP has geological formations stable enough to contain wastes for thousands of years without releasing them.

6

6. The SRA says that WIPP has been unable to show that radiation releases would result in fewer than 1,000 deaths in 10,000 years. The SEIS-II should dispute this criterion unless the WIPP Project has a basis for it. The performance of WIPP was evaluated in SEIS-II for the first 10,000 years following the decommissioning of the WIPP Site, with no impact on human health as long as the repository remains undisturbed by human activity.

7

7. The SRA says that future mining at WIPP could allow TRU to escape into the groundwater or to the surface. The SEIS-II should state that future mining at WIPP was investigated, and cite the references which found the risk of migration of nuclear waste to the surface to be minimal.

8

* "2-pronged solution to plutonium problem," Commentary by Jessica Mathews, senior fellow at Council on Foreign Relations; Washington Post, reprinted in the Twin Falls, Idaho, Times News on 12/18/96.

** "A leopard can't change its spots," letter to the editor by Peter Rickards, Twin Falls, Idaho in the Times News on 2/6/97.

## Comment C-129, Page 4 of 5

9 8. The SRA says that experts don't understand the groundwater systems at WIPP. This statement should not go unchallenged. The SEIS-II should demonstrate how the groundwater systems at WIPP have been extensively investigated, and explain how well they are understood. There is practically no risk of underground water systems bringing waste to the surface. The salt deposits in which the waste will reside have been water-free for millions of years.

10 9. The SRA says that small boreholes would not remain sealed for more than 200 years. The SEIS II should explain that this escape path for radio nuclides was dismissed because salt beds tend to be self-healing. For example, cracks and holes in salt deposits naturally fill in with salt.

11 10. Are people endangered by TRU waste at current storage sites? The SRA says "yes." However, the SEIS should state that the correct answer is "No, not currently" because these wastes are carefully stored. However, it was never intended to leave TRU waste stored indefinitely at its numerous locations around the nation. Therefore, we should not continue to waste money on improvements to temporary storage sites. Fatalities expected over time due to leaving the TRU waste in its current locations would be unacceptable. Permanent disposal in a centralized safe repository such as WIPP is clearly the preferred action.

12 11. The SRA says that treating INEL's TRU-contaminated waste will increase its volume. The SEIS-II should state that this is incorrect, and should explain what volume reduction the available treatments are expected to produce. A volume reduction of 90% is possible.

13 12. According to the SRA, DOE-ID intends to incinerate all TRU waste, while DOE-NM says that treatment is not necessary. The SEIS-II should explain that all INEL TRU waste which meets the WIPP Acceptance Criteria could be shipped to WIPP untreated. The only waste which must be treated in the Advanced Mixed Waste Treatment Facility will be TRU-contaminated waste which does not meet the WIPP acceptance criteria. After treatment, the waste will meet the WIPP acceptance criteria, and will be eligible for direct shipment to WIPP. The SEIS-II should explain the various options as suggested in comment 3 above.

14 13. The SRA says that it is cheaper to leave the TRU waste where it is rather than send it to WIPP. This only is true for No-action Alternative 2, where costs are estimated through the year 2033, and no new facilities are constructed. No-action Alternative 2 cost figures only include

## Comment C-129, Page 5 of 5

14 storage as-is for 35 years. The SEIS-II should point out that, because this alternative is not acceptable for any of the sites where this waste is currently stored, a true cost comparison does not result.

15 14. The SRA says that the Proposed WIPP Transportation System is not safe because of the estimated deaths and injuries. The transportation accident analysis was based upon ultra-conservative accident conditions and some assumed radiation exposures. This conservatism should be explained, since the most likely number of fatalities due to transportation radiation exposure is zero.

16 The SEIS-II should emphasize the high standards for safety that the current WIPP's TRU waste transportation system has set. The system includes: (1) WIPP trucks, operated by highly trained drivers, (2) NRC-certified containers, (3) transportation monitoring by a satellite tracking system, (4) trucks meeting the highest classification of federal transportation standards, (5) rigorous procedures for dealing with inclement weather, safe parking, and notification of incidents to the state, local, and tribal responders, and (6) WIPP-specific training of appropriate response personnel where needed.

17 Also, train transportation should be considered wherever possible. The SEIS-II has already done the train transportation analysis for Alternative Actions 1 & 2; therefore, the ROD can choose train transportation to become effective at such time as it is practical.

**LOC INC**
**Oak Ridge Reservation**
**Local Oversight Committee**

February 26, 1997

Mr. Harold Johnson
NEPA Compliance Officer
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear Mr. Johnson:

The Oak Ridge Reservation (ORR) Local Oversight Committee (LOC) appreciates the opportunity to comment on the Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement (hereafter referred to as the "WIPP SEIS"), dated November 1996, and the Proposed Action.

The Local Oversight Committee is a non-profit regional organization funded by the State of Tennessee and established to provide local government and citizen input into the environmental management and operation of the DOE ORR. The Board of Directors of the LOC is composed of the County Executives of Anderson, Knox, Loudon, Meigs, Rhea, and Roane Counties; the Mayor of the City of Oak Ridge; and the Chairs of the Roane County Environmental Review Board (RCERB), the City of Oak Ridge Environmental Quality Review Board (EQAB), and the LOC Citizens Advisory Panel (CAP). The CAP currently has 16 members with diverse backgrounds representing the region impacted by the ORR.

Disposal of transuranic (TRU) waste, stored on the ORR and potentially accepted from other sites, is a great concern of the region's governments and stakeholders. Following are several key conditions that the LOC requests be addressed with respect to ORNL-generated (and any other shipped to ORR) TRU waste:

1 • East Tennessee's climate and geology is unsuitable for disposal of TRU waste; therefore, the LOC supports the opening and operation of WIPP and finds the No Action Alternatives unacceptable;

2 • WIPP must accept all ORNL-generated TRU waste as well as all TRU waste shipped to Oak Ridge from other locations;

• Acceptance by WIPP of ORNL-generated waste must be given a high priority;

3 • The decision to ship TRU waste generated at locations other than ORNL to Oak Ridge for interim storage and/or processing must be negotiated with DOE Oak Ridge Operations and

***Anderson • Meigs • Rhea • Roane • City of Oak Ridge • Knox • Loudon***

136 S. Illinois Avenue, Suite 208 • Oak Ridge, Tennessee 37830 • Phone (423) 483-1333 • Fax (423) 482-6572





3 Tennessee regulators, with disposal schedule and storage/treatment costs for all TRU waste brought to and resident at ORR clearly understood and equity issues addressed;

4 • Long-term on-site storage of TRU waste, such as proposed in Action Alternative 1, needs further assessment, including impacts on planning for ORR mission change and budgets, and potential risks to health and the environment; and

5 • Costs must be adequately assessed and compared; as presented this is not possible. Costs for the Proposed Action cover only 35 years of storage for waste not accepted at WIPP, neglecting that portion of waste that Oak Ridge must manage indefinitely. Additionally, long-term storage costs for the Action Alternatives are not presented in a consistent manner.

The above general comments are applied specifically to the alternatives, as summarized below. The LOC finds that either the Proposed Action or Action Alternative 1, although unacceptable in their current forms, could be modified into acceptable plans.

1. Proposed Action (PA). Under this option, ORNL receives contact-handled (CH) TRU waste from six other sites, 580 cubic meters ($m^3$) of remote-handled (RH) TRU waste from Battelle Columbus Laboratories (BCL), and 9 $m^3$ of RH-TRU waste from Bettis Atomic Power Laboratory. All ORNL "Basic Inventory" (defense-related, post-1970 TRU waste in retrievable storage and TRU waste to be generated through 2033) CH-TRU is to be disposed at WIPP. This part of the PA is acceptable.

6 Under the PA, RH-TRU waste disposal will be limited to only 21% (1,100 $m^3$ of the estimated post-treatment 5,300 $m^3$) of combined ORNL-BCL-Bettis RH-TRU waste. This means no more than 25% (should the treated ORNL waste be preferentially accepted), and potentially as little as 6% (should the treated BCL-Bettis waste be preferentially and entirely accepted), of the 3,100 $m^3$ of ORNL-generated RH-TRU will be disposed of at WIPP. Either way, the end result is that Oak Ridge must indefinitely manage 4,200 $m^3$ of RH-TRU waste. This is a change from previous WIPP plans, in which all ORNL RH-TRU was destined for disposal at WIPP. This appears to be the result of large increases in Hanford RH-TRU volume. Oak Ridge, with climate and geology unsuitable for disposal of TRU waste, should not be penalized for Hanford's previous inaccurate estimates. Additionally, the cost of this long-term TRU waste management is not evaluated in the SEIS.

7 In order for the PA to be acceptable to the LOC, all ORNL-generated RH-TRU, plus all BCL-Bettis RH-TRU sent to ORNL, must be accepted at WIPP. Further, transportation options must include shipment by rail, a lower-risk option than truck transportation alone.

2. Action Alternative 1 (AA1). Under this option, ORNL receives CH-TRU from one additional site, and RH-TRU from two additional sites: 80 $m^3$ from Knolls Atomic Power Laboratory and 1,700 $m^3$ from West Valley Demonstration Project (WVDP). This includes DOE-owned or controlled wastes in addition to Basic Inventory wastes. The total post-treatment RH-TRU is estimated at 8,000 $m^3$, to be shipped to WIPP over a period of 160 years, until 2158.

The impact of long-term on-site storage at the ORR has not been adequately assessed for our region. The LOC is concerned about the potential risks related to the occasional anomalous climatic event, such as record rainfall, flooding, or tornado. The east Tennessee region is also subject to frequent low-magnitude seismicity, which has not been adequately assessed regarding the potential for a large earthquake.

8

The LOC finds AA1 to be correctable, and would consider it to be an acceptable alternative if the length of time for Oak Ridge waste disposal is shortened, risk analyses are performed for ORNL waste storage, and appropriate storage safeguards put in place. AA1 would be more acceptable if WVDP waste shipments to ORNL were limited or eliminated, unless equitable off-site management of other ORR waste streams is granted.

3. Action Alternative 2 (AA2). All three variations of this option include PCB-contaminated TRU waste as well as the waste included in AA1, which will be thermally treated on the ORR, to decrease TRU waste volumes and to meet RCRA Land Disposal Restrictions (LDRs) for TRU mixed waste [Note: under the September 23, 1996, National Defense Authorization Act, LDRs are no longer applicable to wastes for disposal at WIPP]. The LOC frowns upon this alternative without consideration for equitable management of other ORR waste streams. Vocal opposition by some citizens to the use of thermal methods to treat high-hazard off-site wastes is of concern to local officials. Comments regarding long-term on-site storage due to long shipment schedules, as noted for AA1, also apply.

9

4. Action Alternative 3 (AA3). This alternative covers the same waste as AA1, but it is treated by a shred-and-grout process. This is unacceptable to the LOC because of the large increase in post-treatment volume and the physical hazards to workers involved in waste-processing operations. Concerns regarding long-term on-site storage due to long shipment schedules, as noted for AA1, also apply.

10

5. No Action Alternative 1 (NAA1). WIPP is closed and ORNL receives and treats the same wastes as specified in AA2. The LOC finds this option to be unacceptable, due to the inappropriate climate and geology for TRU waste disposal in east Tennessee.

11

6. No Action Alternative 2 (NAA2). WIPP is closed and ORNL keeps its own TRU waste. The LOC finds this option to be unacceptable, due to the inappropriate climate and geology for TRU waste disposal in east Tennessee.

The LOC concludes that either the Proposed Action or Action Alternative 1, although unacceptable in their current forms, could be modified into acceptable plans. The LOC strongly desires that WIPP become operable as soon as practicable, and that ORNL's TRU wastes, plus any other TRU wastes accepted by DOE at the ORR for storage and/or treatment, be disposed of on a high priority basis, due to inappropriate local conditions for disposal or long-term storage.

Sincerely,

Susan L. Gawarecki, Ph.D., P.G.
Executive Director





cc: David O. Bolling, Anderson County Executive
Roy G. Cardwell, Alternate Representative for Loudon County
Gail Corbett, Vice-Chair, CAP
Kenneth Dungan, Alternate Representative for Roane County
John Evans, Knox County Director of Solid Waste Management
John Ewing, Alternate Representative for Meigs County
Amy Fitzgerald, Assistant Oak Ridge City Manager for Public Affairs
Don Hunsaker, Chair, RCERB
Steve Kopp, Chair, LOC CAP
Garland Lankford, Meigs County Executive
Earl Leming, Director, TDEC DOE-O
George Miller, Loudon County Executive
Kathleen D. Moore, Mayor, City of Oak Ridge
Billy Ray Patton, Rhea County Executive
Jay Pride, EQAB
Tom Schumpert, Knox County Executive
Frank Sewell, Anderson County Director of Solid Waste Management
Ed Strain, RCERB
Billy Ray Thurman, Alternate Representative for Rhea County
Gerald Palau, Chair, EQAB
Kenneth Yager, Roane County Executive

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87106 505-262-1862 FAX: 505-262-1864

February 27, 1997

WIPPSEIS-II
P.O. Box 9800
Albuquerque, NM 87119 By fax (w/o attachments) & U.S. Mail

Comments by Southwest Research and Information Center (SRIC) on Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement (D-SEIS-II)

These comments are in addition to statements made by SRIC at the public hearings in Albuquerque on January 6, Santa Fe on January 8, and Oak Ridge on January 21. In addition, the Final SEIS-II must fully respond to all questions and issues raised during the question-and-answer sessions at the hearings by SRIC representatives and others.

1 In summary, SRIC believes that the Department of Energy (DOE) is fundamentally violating the major requirements of the National Environmental Policy Act (NEPA). To adequately remedy those deficiencies DOE must reverse several actions already taken -- including withdrawing the Compliance Certification Application (CCA) and the Resource Conservation and Recovery Act (RCRA) application, and terminating the CAST Transportation trucking contract and the contract with BNFL for the mixed waste treatment facility at the Idaho National Engineering Laboratory (INEL). After taking such actions, DOE must fundamentally revise the D-SEIS-II and re-issue it for public comment and public hearings.

Alternatively, if DOE continues with its present plans to finalize the final SEIS-II during the summer of 1997 and issue its Record of Decision (ROD) soon thereafter, it will be proceeding in gross violation of NEPA.

Furthermore, DOE must recognize the strong public opposition to WIPP. That opposition is evidenced by the significant number of people who testified against WIPP and TRU waste transportation, not only in New Mexico, but also at the Colorado and Idaho hearings; by the significant written comments being submitted by leading citizen groups in several states, including New Mexico, Colorado, Tennessee, and Texas; and by the united opposition to WIPP from leading citizen groups at all of the major storage





sites as reflected in the comments of the Military Production Network. Conversely, little evident strong support was shown for WIPP at the public hearings in Colorado, Washington, Tennessee, and South Carolina.

Major Comments

1. The Department of Energy (DOE) is fundamentally violating the National Environmental Policy Act (NEPA) because it has already made the major decisions that the D-SEIS-II covers.

The Council on Environmental Quality (CEQ) implementing regulations for NEPA clearly state:

> NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. 40 CFR 1500.1(b).

2 However, DOE has already effectively made the decision to proceed with the proposed action of opening WIPP in 1997 or 1998 and has taken actions to support that decision. Such actions include submitting to the Environmental Protection Agency (EPA) the Department's Compliance Certification Application (CCA) on October 29, 1996 (prior to the release of the D-SEIS-II). If DOE had not decided to use WIPP for disposal it would not have submitted the application. Moreover, the DOE Manager of the Carlsbad Area Office has stated: "Current and future generations will be better off once we have transuranic waste safely disposed of in the WIPP. It is the right thing to do -- for ourselves and our children's children." Citizens' Guide to the Waste Isolation Pilot Plant Compliance Certification Application to the EPA, DOE/CAO-96-1207, inside front cover.

DOE has also submitted a RCRA permit application to the New Mexico Environment Department for disposal of hazardous wastes at WIPP. If no decision had been made to dispose of wastes at WIPP such an application would not have been submitted.

3 Those actions reconfirm what DOE decided in its original WIPP Record of Decision (ROD) of 1981:

> The WIPP facility will dispose of defense transuranic (TRU) waste stored retrievably at the Idaho National Engineering Laboratory (INEL). By approximately 1990 all existing waste stored at INEL will have been removed to WIPP, and the WIPP facility would be in a position to receive and dispose of TRU waste from other defense waste generating facilities. 46 Federal Register 9162.

4 Not only is the most fundamental decision already made, but the other two basic decisions that are to be made by the SEIS-II (p. 3-1) have also been made -- transportation methods and treatment methods -- and actions have been taken in support of the decisions.

5 DOE has decided to use truck transportation. It made that decision at least as early as 1988, when it awarded a $9.5 million contract to Dawn Trucking Company. It is worth noting that decision was made despite the assumption in the 1980 FEIS was that 75% of the waste would be shipped by train (FEIS, p. 6-19). That decision to ship by truck was reaffirmed in 1993 when the Dawn contract was extended until November 1994 and in November 1994 when a new trucking contract was signed with TAD Trucking, and again with the decision to enter into a third trucking contract -- with CAST Transportation, Inc. In all, DOE has spent more than $11 million on trucking companies as compared with no contracts with railroad companies. (The D-SEIS-II does not include an adequate discussion of those contracts and the current trucking contract requirements.) When asked on the record at the D-SEIS-II hearing on January 6, 1997, DOE officials stated that railroad transportation could not be in place in time to meet the currently planned schedule for opening WIPP in 1997 or 1998.

6 As for waste treatment, once again DOE has already made the fundamental decision -- to decide about the particular treatment facility at INEL. That decision was confirmed by DOE's announcement on December 20, 1996 that it had signed a $1.18 billion contract with BNFL, Inc. to treat mixed waste at INEL. That contract is certainly not included in the D-SEIS-II, nor does it seem to be considered in any other NEPA document.

4 The effect of making these decisions without complying with NEPA is what courts have held to be an irretrievable commitment of resources. WIPP is a clear case of such unlawful activity.

4 Thus, the purpose of the SEIS-II is to justify decisions already made, contrary to the requirements of NEPA. If DOE wants to maintain that the decisions have not been made and there has been no irretrievable commitment of resources, it should take action to prove such a claim, including:

* withdrawing the 1981 WIPP ROD
* withdrawing the CCA
* withdrawing the RCRA permit application
* terminating the CAST Transportation contract
* terminating the BNFL waste treatment contract





2. The Department of Energy (DOE) is fundamentally violating NEPA because the D-SEIS-II does not include all reasonable alternatives.

7 The alternatives section "is the heart of the environmental impact statement." 40 CFR 1502.14. Agencies must "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." 40 CFR 1502.14(a). See Calvert Cliffs' Coordinating Comm., Inc. v. United States Atomic Energy Comm'n, 449 F.2d 1109, 1114 (D.C.Cir 1971) and Natural Resources Defense Council v. Callaway, 524 F.2d 79,92 (2d Cir. 1975).

8 In the D-SEIS-II, DOE has failed to provide any analysis of at least three reasonable alternatives. One is to not use WIPP and to instead consider other alternative disposal sites, including emplacing INEL TRU waste in the first high-level waste repository, the preferred alternative in the FEIS (FEIS, p. 3-16). This alternative should include consideration of both existing wastes and those from future generation. A second reasonable alternative is to continue to store wastes at current locations, but to upgrade storage facilities to improve safety and environmental protection. Such an alternative is not included in the No Action Alternative 2 of the D-SEIS-II. The third alternative is to consider WIPP only for contact-handled (CH) waste because not enough information is known about remote-handled (RH) wastes and because RH wastes will not be ready for emplacement at WIPP for many more years.

9 Not only does the D-SEIS-II not consider all reasonable alternatives, but it does include unreasonable alternatives. The D-SEIS-II three action alternatives are not reasonable in that they do not provide comparable environmental impact information to the proposed action. Further, they are not reasonable in that they require that the WIPP surface and underground facilities function for more than 190 years when they have not been designed for such a mission, and the D-SEIS-II contains no adequate technical basis in support of the notion that the facilities have that capability. Clearly the surface buildings would dramatically deteriorate, and salt creep and other problems with the subsurface facilities would make them very dangerous to workers and the public -- issues which are not addressed in the D-SEIS-II. There is also no description of how the up to 75 panels (p. 3-28) would be laid out including whether they could be constructed within the boundaries of the WIPP site, how they would be positioned in relation to other panels, brine reservoirs, and oil, gas, potash, and other mineral reserves, how surface buildings and shafts would have to be modified to handle

10

11

such a configuration, among other issues. The D-SEIS-II also contains no adequate analysis of the environmental impacts of continued operations of the storage/generator facilities over the timeframes included in the action alternatives.

SRIC believes that all three action alternatives must be eliminated from the final SEIS-II because they are not reasonable alternatives and they cannot be comparatively analyzed with the proposed action and no action alternatives, as required by NEPA.

Further, the D-SEIS-II contains no analysis of what would happen to TRU waste generated in the future. If the D-SEIS-II is going to consider any time period, it must describe all the TRU wastes that exist or would be produced during that time period, the alternative storage and disposal sites, and the environmental impacts of all alternatives.

DOE must issue a new, revised D-SEIS-II for public comment fully considering all reasonable alternatives before it can proceed to issue a final SEIS-II.

3. The Department of Energy (DOE) is fundamentally violating NEPA because the D-SEIS-II does not adequately analyze the environmental impacts of all of the alternatives.

The Supreme Court has summarized this requirement:

> [NEPA] ensures that the agency, in reaching its decision, will have available and will carefully consider detailed information concerning significant environmental impacts; it also guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 348 (1989).

Numerous environmental impacts are understated -- at WIPP, along transportation routes, and at the storage sites. Thus, the D-SEIS-II is not adequate and must be revised and re-issued for future public comment and hearings before a final SEIS-II can be issued.

In addition, the D-SEIS-II includes no consideration of the environmental impacts of other decisions that DOE has now made under the Stockpile Stewardship and Management PEIS and the Storage and Disposition of Weapons-Usable Fissile Materials PEIS. The D-SEIS-II should be revised and re-issued for public comment to consider the transuranic wastes that would be generated. Such wastes would be generated through different processes, would have different characteristics and volumes, and would create much





larger volumes of waste for storage, treatment, and transportation that are analyzed in the D-SEIS-II. In addition, some of the sites would be much larger generators of wastes.

Another inadequacy of the D-SEIS-II and DOE's waste storage program relates to the draft Waste Management (WM) PEIS. The D-SEIS-II identification of alternative treatment sites and types of treatment are wholly dependent upon the draft WM PEIS even though that document has no programmatic or legal validity. The D-SEIS-II further states that the draft WM PEIS analyses "form the basis of the SEIS-II analyses of generator-storage site impacts." (p. 1-4). Other possible alternative storage or treatment sites are not included in the D-SEIS-II. Despite its dependence on the draft WM PEIS, the D-SEIS-II states, incredibly, that "the potential actions analyzed in the SEIS-II are not connected to the potential actions analyzed in the Draft WM PEIS." (p. 1-10). That statement is clearly false since, among other examples, if there is a final WM PEIS, and if it selects particular treatment sites, those sites would define the actual locations and transportation corridors for any shipments to WIPP. Such actions cannot credibly be said to be "not connected" to potential actions for WIPP.

The inconsistent discussions about the WM PEIS in relation to the SEIS-II appear to indicate an additional legal deficiency: illegal segmentation. It appears that DOE is attempting to avoid full discussion of all relevant activities by including some in the WM PEIS and others in the SEIS-II. The effect is that some alternatives are foreclosed and an irretrievable commitment of resources is made, which courts have found to be illegal. All actions involved with WIPP -- storage, treatment, transportation, and disposal -- must be included in the SEIS-II for the document to be legally adequate.

In short, the D-SEIS-II should carefully analyze the environmental impacts of all TRU wastes at existing sites and all wastes that would be generated from other decisions that DOE has made related to TRU wastes. That analysis should be contained in a revised and re-issued D-SEIS-II for additional public comment and hearings prior to the issuance of the F-SEIS-II.

Regarding the WIPP site, the D-SEIS-II does not adequately consider fundamental issues related to the site performance and compliance with regulatory standards. The most severe scenario considered in the D-SEIS-II is a single borehole (p. 5-44). An adequate document must consider the impacts of multiple boreholes penetrating the repository and hitting a brine reservoir (and it should assume that any borehole through the waste disposal area will hit a brine reservoir). It should consider the effects of

22 shaft seal failure, especially since it assumes that boreholes can fail in 200 years. It should analyze the effects of water injection for secondary recovery of oil outside the WIPP boundaries causing large amounts of brine to invade the
23 repository horizon through flow through Marker Beds 138 and/or 139, completely flooding the repository and transporting brine and waste to the accessible environment through the marker beds, through leaks in boreholes or shafts, and through release to the surface through boreholes, including by active drilling.

24 The D-SEIS-II does not contain an adequate analysis of the environmental and worker impacts of using Panel 1. There are severe problems with that panel (see, for example, EEG-63) which are not considered in the D-SEIS-II. Such impacts must be considered in an adequate SEIS.

25 The D-SEIS-II contains no information about the "derived wastes" that DOE intends to dispose of at WIPP that are created at WIPP and not at any of the 25 storage sites. Such wastes cannot be stored or disposed at WIPP without an adequate NEPA analysis.

26 Related to transportation, the D-SEIS-II must analyze the environmental effects of escorted highway shipments and analyze whether they would improve safety as well as their cost. Escorted shipments with trained emergency responders would have fewer accidents, would provide faster emergency response since responders would be immediately on the scene, and could even be cheaper because a much smaller number of responders would need to be trained and equipped compared with continuously training and equipping thousands of emergency responders along highway routes throughout the 35 to 215 year timeframes (until 2310) contemplated. The D-SEIS-II should contain realistic cost estimates of the various modes of transportation.

27 The D-SEIS-II should also fully consider the economic and social effects of a nuclear waste transportation accident. Businesses along the routes could suffer long-term damage due to actual contamination or the public perception of risk or contamination.

28 Further, the D-SEIS-II should provide some adequate basis for the change in highway routes from those included in the SEIS-I. Such environmental analysis should compare the risks and costs of each potential transportation corridor and an explanation of why the preferred routes were chosen and the basis for that decision. The final SEIS-II should also discuss whether other routes can be used, under what circumstances, and what notification, training, and equipment measures will be taken to prepare officials along such other routes.





29 The D-SEIS-II merely states that designated DOE, DOD, or state sites would be used safe parking areas (p. 3-9). An adequate D-SEIS-II must identify such parking areas, discuss what contingencies are in place in case those parking areas could not be reached in case of bad weather, accidents, etc. The document, among other matters, must describe the environmental impacts of using such facilities including highways off the designated WIPP routes that would be used to reach such facilities.

30 The D-SEIS-II contains no discussion of evacuation plans and practice evacuation drills related to any transportation accidents. Such an analysis must be included. Additional
31 analyses of the impacts of terrorist actions related to waste shipments must be included.

32 The D-SEIS-II uses various numbers of shipments for the same alternatives in the text and appendices D and E. DOE should decide and justify the actual number of projected shipments and use those numbers consistently throughout the SEIS-II.

33 A major obstacle to adequately discussing environmental impacts at WIPP and the storage sites is the inadequate waste characterization information. Without such understanding adequate analyses of actual risks to human health as well as long term repository performance cannot reliably be made. The D-SEIS-II inadequately discusses the great gaps in knowledge about some of the characteristics of existing wastes and the fact that quality assurance requirements are still not in place. The document also does not adequately discuss the limitations of the real time radiography that is being used, including how much the system depends on the judgment of the operator, the limitations to adequately characterizing containers filled with liquids and pressurized containers, identifying free liquids and particulates, and verifying content codes. It also does not
34 adequately discuss what measures would be taken to ensure that future wastes generated conform to prescribed waste acceptance criteria.

35 Regarding remote-handled (RH) wastes, DOE analyses are seriously flawed regarding all aspects of the wastes. Very little information is known about their current characteristics, including radioactivity and hazardous chemical composition. For the Battelle-Columbus RH wastes, the D-SEIS-II admits that "no information was available" (p. A-31). Consequently, the analysis of continued storage is flawed. Similarly, the environmental effects of transportation and disposal are also not adequately known. Thus, the D-SEIS-II should be revised and re-issued with such necessary information included. The D-SEIS-II correctly states (p. 2-3) that RH wastes with an external dose rate greater

than 1,000 rem per hour cannot be disposed at WIPP because of the Land Withdrawal Act prohibition. However, the final SEIS-II
36 should discuss how much of such RH-TRU waste exists, in what locations, how that waste is stored and will be disposed, and the environmental impacts of storage, treatment, and disposal.

Given the hundreds of workers involved with WIPP and included in the socioeconomic analysis, the SEIS-II must provide a much more
37 detailed basis for the relatively small populations of "involved workers" considered susceptible to accidents analyzed in Chapter 5.

The D-SEIS-II provides no adequate analysis of the effectiveness of active or passive institutional controls (p. 3-13), so the
38 document cannot assume that such measures will be effective. Thus, it must analyze the environmental impacts of a massive failure of the active institutional controls and it should not assume that passive institutional controls can effectively deter human intrusion.

39 As with previous WIPP EISs, the socioeconomic analyses are not adequate (see, for example, previous comments enclosed) and in some case no source for various statements is provided (see, for example, p. 4-29).

The Supreme Court in Robertson v. Methow Valley Citizens Council required NEPA documents to adequately provide the basis for on-
40 going evaluation of the implementation of the agency action by decisionmakers and the public. Thus, an adequate WIPP SEIS would fully describe anticipated environmental impacts at both storage sites and WIPP if waste emplacement begins. The D-SEIS-II totally fails to meet that standard.

Additional comments

George Dials, Carlsbad Area Office Manager, frequently states that 61 million people are at risk from potential releases from
41, TRU waste storage sites and that such risk would be eliminated if
42 the waste were shipped to WIPP. The SEIS-II Fact Sheet entitled "Why is the Waste Isolation Pilot Plant important to the nation?" contains a similar statement. The D-SEIS-II contains no such information. If the Manager and the WIPP Project Office are going to continue making such statements, they should be
41 substantiated in the final SEIS-II. If such an analysis is done, it must also consider the risk to those populations of storage and other activities related all wastes, not just TRU wastes, at those sites, as the other wastes can pose a larger threat to surrounding populations which would not be reduced by removing TRU wastes to WIPP or other sites. Further, any such analysis
42 should compare the risks to the many more millions of people endangered by transportation to WIPP.







Because many of the voluminous joint comments that SRIC and others submitted on the D-SEIS-I were not adequately considered and most of them are still relevant to the D-SEIS-II, SRIC is resubmitting those comments, which should be fully considered in the SEIS-II. SRIC notes that the Department of Interior (DOI) does not have the same NEPA requirements as discussed regarding the D-SEIS-I. However, the SEIS-II will not serve to fulfill EPA's NEPA responsibilities.

More detailed comments could have been prepared except for the fact that the comment period is too short, the comment period overlapped with the public comment period on the CCA, and the comment period included the Christmas/New Years holiday time.
43 SRIC again protests the inadequate notice for public hearings and the inadequately short comment period. Attached is the May 29, 1996 letter from SRIC and two other organizations related to the public comment process. The proper remedy for such problems, as already stated, is to revise and re-issue the D-SEIS-II for additional public comment, with additional public hearings scheduled in New Mexico and in other states affected by WIPP, including states where no hearings have yet been held.

Thank you for your consideration.

Sincerely,

Don Hancock

JOINT COMMENTS ON THE DRAFT SUPPLEMENT
ENVIRONMENTAL IMPACT STATEMENT
WASTE ISOLATION PILOT PLANT
DOE/EIS-0026-DS

JULY 20, 1989

SUBMITTED BY:

CCNS
Concerned Citizens for Nuclear Safety

ENVIRONMENTAL
DEFENSE FUND

NRDC
Natural Resources
Defense Council

SOUTHWEST RESEARCH
AND
INFORMATION CENTER

THE ATTORNEY GENERAL
OF TEXAS



JOINT COMMENTS ON THE DRAFT SUPPLEMENT
ENVIRONMENTAL IMPACT STATEMENT
WASTE ISOLATION PILOT PLANT
DOE/EIS-0026-DS

JULY 20, 1989

SUBMITTED BY:

CONCERNED CITIZENS FOR NUCLEAR SAFETY
711 Calle Grillo
Santa Fe, New Mexico 87501
(505) 986-1973

ENVIRONMENTAL DEFENSE FUND
1405 Arapahoe Avenue
Boulder, Colorado 80302
(303) 440-4901

NATURAL RESOURCES DEFENSE COUNCIL
1350 New York Avenue, N.W., Suite 300
Washington, D.C. 20005
(202) 783-7800

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524
Albuquerque, New Mexico 87106
(505) 262-1862

STATE OF TEXAS
The Attorney General of Texas
P.O. Box 12548
Austin, TX 78711-2548
(512) 463-2012

**EXECUTIVE SUMMARY**

Concerned Citizens for Nuclear Safety, the Environmental Defense Fund, the Natural Resources Defense Council, Southwest Research and Information Center and the State of Texas have compiled their comments on DOE's Draft Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant. The criticisms set forth in these comments clearly demonstrate that DOE is not ready to open WIPP now, or in the near future. There are both technical and legal problems which DOE must first overcome before WIPP could become the nation's first nuclear waste repository.

The comments begin, in Part II, with an overview of the legal requirements for WIPP under the National Environmental Policy Act, the Hazardous Materials Transportation Act, the Atomic Energy Act, the Federal Land Management and Policy Act, the Resource Conservation and Recovery Act, the EPA radioactive waste disposal standards enacted under the Nuclear Waste Policy Act and the Safe Drinking Water Act. The commentors have attempted to set out brief explanations of what remains to be done before DOE will have negotiated all of the legal hurdles still lying in WIPP's path.

Focusing then on NEPA, the law which requires DOE to issue an Environmental Impact Statement, the commentors discuss how the D-SEIS fails to comply with both the procedural and substantive requirements of that Act. The procedural failings of this NEPA process, that DOE established an Inadequate Public Comment Period and Failed to Give Sufficient Notice for the D-SEIS Hearings, and that Critical References to Support the D-SEIS are unavailable, are detailed in Part III. Part IV explains the substantive failings of the D-SEIS: that it fails to demonstrate the need for WIPP, to analyse all reasonable alternatives to DOE's preferred action (opening WIPP through the artifice of a five year Experimental Plan), to analyse in sufficient detail the No Federal Action Alternative, to analyse the full range of environmental issues at WIPP, or to consider all available, relevant information about the WIPP.

In Part V, the commentors have attempted to list some of the more frequently repeated unsupported and unrealistic assumptions which DOE has used throughout the D-SEIS in a manner that seriously detracts from the document's scientific integrity.

The heart of a NEPA analysis is the federal agency's analysis of the environmental impacts of its proposed action. Part VI of the joint comments explains how DOE failed to analyse the direct environmental impacts which could occur were operations ever to begin at WIPP. Thus, the comments address how





DOE's health risk assessment model underestimates potential adverse health effects from WIPP operations, how DOE has ignored or inadequately addressed a whole slew of technical problems at the WIPP site, all of which indicate a strong potential for long-term releases of radioactivity and/or toxic materials to the biosphere from WIPP, and how DOE has underestimated the consequences in general of waste emplacement at WIPP.

NEPA also requires federal agencies to consider and analyse the indirect environmental effects of proposed actions. Such indirect effects have been defined to include the socioeconomic impacts of a project. In Part VII, the comments explain why the D-SEIS analysis of socioeconomic impacts is inadequate and how DOE has not even used the best available methods to compile the socioeconomic data that it did collect. Moreover, the comments criticize DOE's failure to consider any negative economic data. Finally, the comments point out that the D-SEIS fails to satisfy NEPA because DOE did not consider any socioeconomic impacts outside WIPP's environs.

Shipments of plutonium contaminated waste bound for WIPP will traverse 23 states. As a result, more citizens will be exposed to the risks of radioactive releases from the transportation of waste to WIPP than through any other mechanism. Yet, as detailed in Part VIII, the D-SEIS analysis, from its underlying assumptions, to its risk modeling, to its failure to address in a straight forward manner the insufficient preparation of potential emergency responders along the route, is woefully inadequate.

DOE is not the only federal agency involved in the opening of WIPP whose actions are governed by NEPA. Pursuant to FLPMA, the Bureau of Land Management must determine whether it is appropriate under that law to withdraw the federal lands on which WIPP is located from all other uses and to allow the WIPP site to be used exclusively for radioactive hazardous waste disposal. Part IX explains how the D-SEIS fails to inform the BLM decision makers because it does not include some important pieces of information, using as one glaring example DOE's failure to justify a six fold increase in the size of the exclusive use area for which it is applying. In addition, the commentors remind DOE in this part that, unless and until DOE obtrains a permanent land withdrawal from Congress, BLM has a role in approving the test phase plan, an action which the D-SEIS totally ignores.

The technical/legal requirement for WIPP that has perhaps received the most public attention is the need for WIPP to comply with EPA's Radioactive Waste Disposal Regulations. In Part X, the commentors set forth the legal framework of those regulations in some detail, including the arguments for why DOE must demonstrate compliance with all of the EPA standards before waste

emplacement occurs at WIPP. In addition, the commentors briefly describe how all of the site problems and inadequate analyses addressed elsewhere in the comments virtually ensure that the WIPP project, as described in the D-SEIS, will not comply with the EPA standards.

Part XI focuses on the inadequacies of the D-SEIS regarding WIPP's compliance with the nation's hazardous waste management law, RCRA. The flaws in DOE's D-SEIS include a misleading discussion of waste characterization, a mischaracterization of the history of RCRA's applicability to mixed radioactive-hazardous wastes, inadequately consideration of waste treatment alternatives, and the use of technically invalid model assumptions that result in an underestimatation of projected doses.

In Part XII, the joint commentors have included a brief but important discussion of the relationship between WIPP and the Safe Drinking Water Act. Having establsihed the context, the comments set forth how the D-SEIS has failed to present all of the information necessary to determine whether WIPP can comply with the SDWA.

Finally, the commentors address in Part XIII the D-SEIS' totally inadequate consideration of mitigation measures, both from the standpoint of honestly setting forth the impacts and from the view of whether the proposed measures will eliminate or reduce those impacts.





TABLE OF CONTENTS


I. Introduction I- 1

II. Overview of Legal Requirements for the WIPP

A. NEPA II- 1

B. HMTA II- 4

C. NRC Certification Requirements II- 5

D. FLPMA II- 6

E. RCRA II- 8

F. EPA standards II- 9

G. Safe Drinking Water Act II-11

III. NEPA Compliance - Failure in Process

A. DOE established an Inadequate Public Comment Period and Failed to Give Sufficient Notice for the D-SEIS Hearings. III- 1

B. Critical References to Support the D-SEIS are unavailable. III- 2

IV. NEPA Compliance - Failures in Substantive Requirements

A. The D-SEIS Fails to Demonstrate the Need for WIPP. IV- 1

B. The D-SEIS Fails to Analyse all Reasonable Alternatives to DOE's Preferred Action. IV- 2

C. The D-SEIS Inadequately Analyses the No Federal Action Alternative. IV- 4

D. The Scope of the D-SEIS Fails to Satisfy NEPA. IV- 5

E. The D-SEIS Fails to Consider All Available, Relevant Information. IV- 6

V. Unsupported and Unrealistic Assumptions in the D-SEIS V- 1

VI. Inadequate Analysis of the Direct Environmental Effects of WIPP.

A. The D-SEIS Health Risk Assessment Model Underestimates Health Effects. VI- 1

B. The D-SEIS Ignores or Inadequately Addresses Numerous Problems with the WIPP site which show the Strong Potential for Long-term Releases of Radioactivity and Toxic Materials. VI- 4

C. The D-SEIS Underestimates the Consequences of Waste Emplacement. VI-10

VII Indirect Effects - Socioeconomic Impacts

A. The D-SEIS must address Socioeconomic Impacts. VII- 1

B. The D-SEIS Analysis is Inadequate and Does Not Use the Best Available Research Methods. VII- 5

C. The D-SEIS Fails to Consider Negative Economic Data. VII- 8

D. The D-SEIS Fails to Consider Any Socioeconomic Impacts Outside WIPP's Environs. VII-10

VIII. Transportation Assessment - Inadequacies

A. Shipping Containers VIII- 1

B. RADTRAN VIII- 4

C. Routine Operations VIII-10

D. Maximum Credible Transport Accident Release VIII-10

E. Transport Modes VIII-13

F. Inconsistencies with Other DOE Documents VIII-13

G. The Trucking Contract VIII-15

H. Tracking System VIII-16

I. Emergency Response VIII-17

J. Routing VIII-18

K. The Implications of Mixed Waste Transport VIII-20





L. Double Shipments VIII-20

M. Economic Impacts VIII-21

IX. FLPMA - D-SEIS' Failure to Inform BLM decision makers

A. Exclusive use Area IX- 1

B. BLM's Role in Approving the Test Phase Plan IX- 2

X. Inadequacies in the D-SEIS regarding the EPA Radioactive Waste Regulations

A. Subpart A Applies to All Waste Management and Storage Activities at WIPP X- 1

B. DOE Must Demonstrate Compliance with Subpart B Prior to Any Emplacement of Wastes at WIPP. X- 2

C. DOE Must Demonstrate Compliance With the Repromulgated Subpart B Standards Prior to Waste Emplacement. X- 4

D. The D-SEIS does not properly assess the likelihood of non-compliance with repromulgated EPA standards. X- 5

E. Neither the D-SEIS nor the draft Test Phase Plan describe experiments that will produce reliable data for an adequate performance assessment. X- 6

F. The D-SEIS does not adequately discuss how DOE will demonstrate compliance with 40 CFR 191, Subpart A, or the assurance requirements of Subpart B. X- 7

G. A Note on the Implications of 10,000 years X- 8

XI. Inadequacies in the D-SEIS regarding RCRA

A. The D-SEIS Presents a Misleading Discussion of Waste Characterization. XI- 1

B. The D-SEIS Mischaracterizes the History of RCRA's Applicability to Mixed Wastes. XI- 2

C. The D-SEIS Does Not Adequately Consider Waste Treatment Alternatives. XI- 2

D. The D-SEIS Uses Technically Invalid Model Assumptions that Underestimate Projected Doses. XI- 6

XII. D-SEIS' Failure to Present Information Necessary for Deciding If WIPP can Comply with the SDWA XII- 1

XIII. D-SEIS' Failure to Consider Adequate Mitigation

A. Impacts XIII- 1

B. Mitigation XIII- 2

XIV. Conclusion

Appendix A List of Contributors
Appendix B CCNS' page-by-page comments on D-SEIS
Appendix C SRIC's previous unaddressed comments on WIPP
Appendix D Selected documents from PUC v. Harmon, #8821524
Appendix E 7/5/89 Letter from Joint Commentors to Sec. Watkins
Appendix F 3/21/89 Letter from Joint Commentors to Sec. Watkins





## I. INTRODUCTION

The National Environmental Policy Act (NEPA) requires a federal agency contemplating a major action to complete an Environmental Impact Statement (EIS) assessing all direct and indirect environmental impacts from its proposed action, as well as comparing the anticipated impacts from that action to those impacts which might occur from all reasonable alternatives to such action, including the alternative of taking no federal action. An agency must supplement an EIS upon receipt of significant new information, or if there are significant changes to the project which will result in changes to the environmental impacts associated therewith. It is within this context that Concerned Citizens for Nuclear Safety, the Environmental Defense Fund, the Natural Resources Defense Council, Southwest Research and Information Center and the State of Texas (hereinafter referred to as joint commentors) submit the following comments regarding DOE's Draft Supplement to the Environmental Impact Statement, Waste Isolation Pilot Project (D-SEIS).

The D-SEIS is fatally flawed. Although DOE and its contractor have almost completed construction at the Waste Isolation Pilot Plant (WIPP), DOE is nowhere near ready to commence the permanent disposal of transuranic (TRU) waste at the facility. DOE's lack of readiness translates in the D-SEIS into a continual reliance upon future studies to address existing problems and upon unsubstantiated assumptions in formulating crucial calculations and conclusions which purport to justify the project's allegedly trivial environmental impacts. The D-SEIS fails entirely to describe the potential range of environmental impacts associated with the project, to justify emplacement of radioactive waste for the proposed five year test period, or to justify continuing reliance on WIPP as a permanent solution for transuranic waste disposal. Many of the D-SEIS references ignore the full range of interpretations of scientific and technical concerns at WIPP. Worse, the D-SEIS is a paean to DOE's historic position -- savings over safety.

Even though the federal government has expended almost $800 million dollars on WIPP during the past 15 years, DOE may not compromise its NEPA duty to consider all reasonable alternatives to its preferred action, which is to emplace a portion of the wastes eventually bound for WIPP underground prior to establishing compliance with all applicable environmental, health and safety standards. The D-SEIS is particularly inadequate in meeting this core NEPA requirement. Not only are there alternatives to DOE's preferred action which might eventually allow DOE to emplace waste at the WIPP, but there are reasonable alternatives for long term waste storage or treatment that could obviate entirely the need to emplace waste in WIPP.

Given the serious technical problems with the existing facility, DOE's failure to consider other reasonable alternatives to TRU waste disposal at WIPP, and in particular to consider long-term above-ground storage of such wastes, is in contravention of NEPA. In addition to having ignored entire alternative solutions to transuranic waste management, DOE consistently fails in this D-SEIS to explain its choice of more environmentally destructive or more risky alternative actions. Although the document itself demonstrates that a rail based transportation system would be safer, DOE's preferred action relies solely on truck transport.

The D-SEIS is also entirely deficient in explaining how compliance, or noncompliance with, other statutory and regulatory requirements may change the environmental impacts of the project. DOE is apparently reluct to see an interconnection between its NEPA duties and its obligations under other laws. The D-SEIS is the appropriate forum for consideration of how DOE intends to comply with these other requirements including the Resource Conservation and Recovery Act and the Environmental Protection Agency's radioactive waste standards, and what the impacts will be if it cannot do so.

Similarly, DOE cannot make a cognizable impact under NEPA evaporate by pretending it does not exist and eliminating any discussion of such impact from the D-SEIS, as DOE has attempted with several issues, notably socioeconomic impacts. Nor can DOE circumvent the legal requirements for the transport, handling, treatment, storage, or disposal of the hazardous wastes bound for WIPP by reliance on it's proposed "Test Phase." The current crisis of DOE's nuclear weapons production complex stems in large part from the Department's longstanding and intense resistance to compliance with federal environmental and safety requirements. For years, DOE has sought to avoid laws and regulations that private industry has been asked to meet. As the first major new facility in the complex in the past quarter century, the Waste Isolation Pilot Plant (WIPP) presents DOE with the opportunity to avoid the mistakes of the past.

In the relatively short period of time between the release of the Final Environmental Impact Statement (FEIS, 1980) and the printing of the Draft Supplement Environmental Impact Statement (SEIS), important new discoveries have been made concerning the moisture content, brine inflow, transmissivity, and convergence (or "salt creep") at the WIPP site. DOE has recognized that these discoveries highlight the uncertainty which enshrouds the possible environmental effects of the WIPP project. Although the "Test Phase" is purportedly designed to show that WIPP will comply with the laws and perform the functions DOE has planned it to accomplish, the D-SEIS has not actually addressed the possible





adverse impacts to human health and the environment posed by the test plan and its various possible results.

Finally, DOE has failed miserably with the substantive requirements of NEPA. Aside from the Department's failure to demonstrate a need for the project, DOE has also conducted the public comment and review process in a manner which will not ensure meaningful public input. The joint commentors urge DOE to begin immediately a substantial revision of the D-SEIS, incorporating the changes and additions suggested below. This process should culminate in the rerelease of a draft WIPP SEIS for public review and comment; moreover, such a revised D-SEIS might be able to withstand the scrutiny of the scientific community, the relevant oversight and cooperating agencies and the informed public, something which this D-SEIS cannot do.

## II. OVERVIEW OF LEGAL DEFICIENCIES IN D-SEIS

### A. NEPA

The National Environmental Policy Act (NEPA) was passed in 1969 to require federal agencies contemplating major actions to examine the environmental impacts thereof. The heart of the NEPA process is an agency's comparison of alternatives which the agency must make available for public review and comment. Earlier this year, the United States Supreme Court explained the purpose of NEPA and the process by which such purpose is accomplished as follows:

> ... NEPA promotes its sweeping commitment to 'prevent or eliminate damage to environment or biosphere' by focusing government and public attention on the environmental effects of proposed agency action. 42 U.S.C. sec. 4321. By so focusing agency attention, NEPA ensures that the agency will not act on incomplete information, only to regret its decision after it is too late to correct. [Citation omitted.] Similarly, the broad dissemination of information mandated by NEPA permits the public and other government agencies to react to the effects of a proposed action at a meaningful time.

Marsh v. Oregon Natural Resources Council, 109 S.Ct. 1851, 1858 (1989). In the Marsh opinion, which the Court uses to establish standards by which to judge when a federal agency must prepare a supplemental environmental impact statement ("SEIS"), the Court describes the preparation of an SEIS as "at times necessary to satisfy the Act's 'action-forcing' purpose." Id., at 1857.

To comply with NEPA, if the action at issue is a major one, the federal agency must analyse its proposal and all reasonable alternatives thereto to determine the environmental consequences of each. 42 U.S.C.A. 4332 (2)(C) (West 1982); Committee for Nuclear Responsibility, Inc., et al. v. Shlesinger, Chairman of Atomic Energy Commission, 404 U.S. 917 (1971). The Council on Environmental Quality has defined the scope of environmental consequences as broad indeed, encompassing both direct and indirect effects. 40 C.F.R. 1502.16. Moreover, if the agency ultimately chooses to implement an alternative other than the one which has the fewest adverse environmental effects, then the agency must mitigate the effects of the alternative which it does select. 40 C.F.R. 1502.14.

The CEQ regulations do not allow a federal agency to ignore reasonable alternatives to its preferred action. 40 C.F.R. 1502.14. Thus, DOE cannot streamline the WIPP SEIS by simply not





considering those reasonable alternatives which it wants neither to implement nor even to recognize as existing, such as a long-term, above-ground transuranic waste storage facility which could be built expressly for such purpose.

Nor does NEPA jurisprudence allow the agency to ignore entirely views or information with which it disagrees. Although the agency need not set forth such opposing views "at full length," the agency must provide meaningful references that at least identify the controversy. Citizens for Mass Transit v. Adams, 492 F.Supp. 304 (D.C. La. 1980), aff'd 630 F.2d 309. In the context of the WIPP SEIS, this decision means that DOE cannot completely exclude from the record, and thus from its analysis of technical issues in the SEIS, those opinions which have been expressed by the Environmental Evaluation Group ("EEG") and other independent scientists, such as the Scientists Review Panel.

One of the reasons that Congress passed NEPA was to give interested public citizens and organizations a role in the federal agency decision-making process, a process in which consideration of environmental impacts had often occurred, if at all, behind closed doors. Latham v. Volpe, 350 F. Supp. 262 (D.C. Wash. 1972). DOE, like all federal agencies, must provide the public with the opportunity to review and comment upon its environmental impact statements. This process must be meaningful, not hollow; merely setting a hearing to allow for public testimony and allowing the public to submit written comments does not per se satisfy NEPA requirements. Citizens Against Toxic Sprays, Inc. v. Bergland, 428 F. Supp. 908 (D.C. Or. 1977). There is every indication in the instant situation, that DOE is attempting to limit public input and to proceed through the NEPA process in a manner which virtually ensures that public comment will be ignored.

Finally, of import here is the CEQ's guidance for agencies faced with making decisions based on incomplete information. 40 C.F.R. 1502.22. Although an agency no longer needs to examine a "worst case scenario" in this situation, Robertson v. Methow Valley Association, 109 S.Ct. 45 (1989), it may not avoid consideration of the potential environmental impacts entirely simply by deferring any real analysis of the environmental impacts such that the harm which its preferred alternative would cause has occurred. DOE's approach in the WIPP SEIS does not conform to this standard.

DOE attempts to shirk its duty to examine certain environmental consequences of waste implacement at the WIPP on the grounds that "the timing of the SEIS is such that certain regulatory compliance issues for the WIPP project are unresolved ... it is not the purpose of this SEIS to resolve these issues or

to demonstrate compliance with regulatory requirements." D-SEIS, p. 1-6. Obviously, DOE cannot resolve regulatory compliance issues over which it does not have authority, but that is no justification for DOE's failing to consider adverse environmental effects of the WIPP project which must also be examined in the context of regulatory compliance. The fact, for example, that DOE may have incomplete information as to how the Environmental Protection Agency may judge its "no migration" petition under the Resource Conservation and Recovery Act (see infra, parts I.E and XI), does not allow DOE to refuse to analyze alternatives for the potential that waste may migrate, the environmental consequences of such migration, and the possible mitigation measures appropriate to decrease or eliminate such migration. Moreover, DOE cannot avoid an analysis because there is incomplete information as a result of DOE's refusing to compile or develop the information. If such information could have been obtained by or for DOE, then DOE must obtain it for use in the NEPA process.

The D-SEIS is strewn with instances where DOE attempts to defer a discussion of a part of the WIPP project's environmental impacts to a later date and a different NEPA process. Such a ploy is akin to the practice of illegal segmentation, whereby an agency avoids issuing an EIS altogether by splitting the proposed action into its smallest, and thus "minor" parts. See, e.g., City of Rochester v. U.S. Postal Service, 541 F.2d 967 (C.A.N.Y. 1976). Here, DOE is using essentially the same tactic not to avoid issuing an SEIS, but to underreport the potential impacts of its proposed action. This tack effectively ensures that the decision-makers will act on incomplete information, thereby violating both the spirit of NEPA and the plain regulatory language. Appalachian Mountain Club v. Brinegar, 394 F. Supp. 105 (D.C.N.H. 1975).

When a major federal action involves decisions from more than one federal agency, NEPA and the CEQ Guidelines have set up a special process. One agency, DOE in this case, becomes the "lead" agency, primarily responsible for publication of the EIS. The other decision making agencies become "cooperating" agencies. Although such cooperating agencies do not have primary responsibility for the contents of the EIS, they must ensure that the EIS presents all necessary information and analyses to inform the public and their decision-makers regarding the proposed action's environmental impacts. For WIPP, the Bureau of Land Management (BLM) is a cooperating agency because DOE has asked BLM for an administrative land withdrawal of the WIPP site. The D-SEIS is clearly insufficient to satisfy NEPA vis-a-vis the BLM's obligations. See infra, parts II.D and IX.





B. Hazardous Materials Transportation Act

Although DOE drivers need not comply with the Hazardous Materials Transportation Act (HMTA) and pendant regulations, private drivers hauling hazardous materials, including radioactive materials, pursuant to a contract with DOE are not exempt from compliance with the Act and implementing regulations. See, Colorado Public Utilities Commission v. Harmon, D. Colo (Weinshenk, J.), Case No. 88-Z-1524 (June 23, 1989) ("CPUC v. Harmon"). The HMTA does not, at the present time, extend to rail transport; however, given DOE's current plan to have a contractor haul all TRU waste to WIPP via truck, the HMTA does govern the WIPP shipping campaign.

The regulations with which DOE's contractor must comply include those found at 49 C.F.R. 171 and 177 (commonly referred to by their docket number, HM-164, and also referred to hereinafter as HMR, for the Hazardous Materials Regulations), and in particular section 177.825 which is directed at carriers of radioactive materials. The HMR directs carriers to limit travel to designated routes, consisting of the federal interstate highway system, the most direct secondary road from the terminal to a federal highway and any alternate road that a state has specifically designated. 49 C.F.R. 171.8. Because New Mexico has never designated any such alternate routes, at the present time, truckers bound for WIPP would be limited to travel through the state on the Interstates (40 and 25) and the shortest spur to the WIPP. This means that all of the D-SEIS' proposed routes through New Mexico are invalid.

The HM-164 also has incorporated by reference certain regulations promulgated by the Nuclear Regulatory Commission (NRC). It incorporates requirements for sabotage prevention and for prenotification to jurisdictions through which shipments will pass, as well as the NRC's requirements for packaging of highway route controlled radioactive materials (see infra, part II.C).

In the D-SEIS, DOE states that its contractors will comply with all relevant federal transportation regulations of the Department of Transportation, i.e., HM-164, and the NRC. This commitment is seriously deficient for reasons of which DOE is clearly aware. The HMTA allows states to regulate the transport of hazardous, including nuclear, materials so long as such regulations are not inconsistent with the HMTA or HMR. 49 U.S.C. app. Sec 1811 (1982). That the states have broad latitude to regulate the transportation of highway route controlled quantities of radioactive materials has been reaffirmed by the federal courts again and again. City of New York v. United States Department of Transportation, 539 F. Supp. 1237 (S.D.N.Y. 1982), National Tank Truck Carriers v. City of New York, 677 F.2d 270 (2nd Cir. 1982); attached hereto in Appendix D is EDF's

amicus brief in CPUC v. Harmon. Most recently, the U.S. District Court for Colorado affirmed Colorado's Nuclear Materials Transportation Regulations. A copy of the Court's order and the state's regulations are attached hereto in Appendix D. Thus, DOE's WIPP campaign trucking contractor has a legal obligation to comply with all state, tribal and local regulations and ordinances which have not been determined to be inconsistent with the HMTA or HMR. A revised and rereleased D-SEIS should clarify this point and address any increases in costs or changes in environmental impact which may result from such compliance.

C. Nuclear Regulatory Commission Packaging Certification

The Nuclear Regulatory Commission (NRC) has the responsibility pursuant to the Atomic Energy Act to certify the safety of packaging for the transportation of highway route controlled quantities of radioactive materials. TRU waste shipments all have a high enough radioactivity to qualify as such. Although DOE may have been able to self-certify to the Department of Transportation that the containers bound for WIPP met NRC standards, on June 3, 1987 DOE reaffirmed a commitment initially made in the FEIS to have its contractors use only containers which had received certification from NRC for shipping wastes to the WIPP. Until NRC has certified the containers, they cannot be used in commerce on the public roads.

To date, DOE has received no NRC certifications. When Pacific Nuclear Corporation, designer of the TRUPACT-II, first submitted its application to NRC for certification of that container, the TRUPACT-II had not passed all of the tests required for NRC certification. Although DOE claims that it has now given NRC the data which would complete its application, NRC has yet to rule. The TRUPACT-II configuration for which DOE is seeking certification is that which would be used in truck transport. DOE has not submitted an application for a TRUPACT-II with the appropriate tie down configuration for trains.

As for the RH-TRU waste shipping container, there is not even a final design available. Therefore, there has been no container testing. DOE is far from the date when it will be ready to submit an application to NRC for that packaging's certification.

DOE admits that it does not yet have NRC certification for either container. In the D-SEIS, DOE simply states that it will obtain such certification before using the containers in commerce on the public roads. Such commitment is laudable; however, the joint commentors object to how DOE then uses the anticipated NRC certification in the D-SEIS as a foundation for its erroneous assumption that by virtue of such certification, all containers





on all 34,144 shipments will behave up to the standards for certification. As discussed below in part VIII, as thorough as NRC's review for certification may be, a design certification does not ensure perfection in container construction, operation or maintenance. DOE has no legal or technical basis to assert otherwise.

D. FLPMA

The WIPP site is public land, managed by the Bureau of Land Management (BLM) pursuant to the Federal Land Policy and Management Act, 43 U.S.C. sec. 170 et seq. (FLPMA). BLM issued Public Land Order (PLO) 6403 (48 Fed Reg 31038, July 6, 1983) which withdrew 8,960 acres of federal land (an additional 1,280 acres that was formerly New Mexico State land have subsequently been included) from operation of the public land laws, including the mining laws, for eight years. This order went into effect June 29, 1983. That administrative land withdrawal will remain in effect until June 1991 unless terminated by the Secretary of Interior or by Congressional Act.

PLO 6403, section 5, expressly "does not authorize the use or occupancy of the land hereby withdrawn for the transportation, storage, or burial of any radioactive materials, except as to radiological instruments normally used for non-destructive testing and geophysical logging." Thus, no wastes can be transported to WIPP for the Test Phase or for permanent disposal under the provisions of the existing withdrawal.

Moreover, Congress has not enacted legislation which would allow for the transportation of nuclear wastes to or disposal of such wastes at WIPP.

FLPMA's congressional declaration of policy (section 102, 43 U.S.C. 1701) states inter alia:

> (4) that Congress exercise its constitutional authority to withdraw or otherwise designate or dedicate Federal lands for specified purposes and that Congress delineate the extent to which the Executive may withdraw lands without legislative action."
>
> (7) that management be on the basis of multiple use and sustained yield unless otherwise specified by law"
>
> (8) that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values...."

43 U.S.C. 1701(a); FLPMA section 102(a).

In exercising the federal government's constitutional authority to withdraw public lands from the normal multiple use and sustained yield requirements, FLPMA explicitly requires agencies to withdraw at least 5,000 acres of land and to limit such withdrawals for periods of time not to exceed twenty years. FLPMA section 204(c); 43 U.S.C. sec. 1714(c).

The statute allows the Secretary of Interior "to make, modify, extend, or revoke withdrawals but only in accordance with the provisions and limitations" of the Act. One clearly stated limitation is that, "The Secretary [of Interior] shall not make, modify, or revoke any withdrawal created by Act of Congress; [or] make a withdrawal which can be made only by Act of Congress...." FLPMA, section 204(j); 43 U.S.C. sec. 1714(j).

Because nuclear waste disposal would be a single, permanent use of the WIPP site, such use of the site must be authorized by congressional legislation. No FLPMA-based administrative land withdrawal can be sufficient. The fact that Congress has considered, but not approved, proposed land withdrawal bills (H.R. 2504 and S.1272 in the 100th Congress) also clearly indicates that Congress recognizes that its own action is necessary before DOE can open and accept wastes at WIPP.

From our reading of the law and from our interpretation of Congress' actions to date, the joint commentors believe that the WIPP site cannot be used for transportation, storage or disposal of wastes until Congress so authorizes. Furthermore, the record indicates that the BLM and DOI have long held the same position. If DOI is now changing this established legal and policy position opposing an administrative withdrawal for waste transportation, storage or disposal, it should issue a legal opinion describing the basis for such a change.

If DOE believes that there is a legal basis for approving its current application, it should make such a legal opinion available to BLM and to the public. Conversely, if DOE does not have such an opinion, it should withdraw its application for land withdrawal filed with the BLM on April 7, 1989, 54 Fed. Reg. 15814, (April 19, 1989), because such application cannot comply with the requirements of FLPMA. As will be discussed below (see infra, part IX), the D-SEIS neither supports the grant of an administrative land withdrawal nor does it provide adequate information to meet BLM's NEPA responsibilities as a cooperating agency.





E. Resource Conservation and Recovery Act Requirements

DOE generates massive quantities of wastes subject to regulation under the Resource Conservation and Recovery Act, a federal law that governs the management of hazardous wastes from "cradle to grave." Wastes containing both radioactive and toxic chemical constituents ("mixed wastes") are subject to RCRA regulation to the extent RCRA requirements are not inconsistent with applicable requirements of the Atomic Energy Act of 1954. 52 Fed. Reg. 15937 (May 1, 1987).

The Environmental Protection Agency's RCRA regulations for generators of mixed waste are codified at 40 CFR Part 262, as well as in analogous state regulations. Among the requirements applicable to DOE is 40 CFR 262.20(b), which specifies that DOE must designate the facility receiving any offsite waste shipment from its facilities on the Uniform Hazardous Waste Manifest accompanying the shipment. Significantly, 40 CFR section 262.20(b) stipulates that the facility designated on the manifest be "permitted" to receive the generated waste.

EPA has defined the term "designated facility" as used in this context in 40 CFR section 260.10. According to this provision, a designated disposal facility is a facility operating under an EPA RCRA permit, under interim status, or under a RCRA permit issued by an authorized state. The WIPP facility has not received a RCRA permit from EPA nor has it obtained interim status. WIPP has not received a RCRA permit from New Mexico because the state is not yet authorized by EPA to regulate mixed wastes. Consequently, since WIPP is currently not subject to appropriate RCRA regulation, it cannot be considered a "designated facility", and the shipment of mixed wastes generated at DOE facilities to WIPP would constitute a violation of 40 CFR 262.20 and analogous state requirements.

As a generator of hazardous wastes, DOE must also comply with the land disposal prohibitions of RCRA. See 40 CFR 268.1(b). Under these prohibitions, wastes must be treated prior to disposal in a manner that substantially reduces the toxicity or mobility of the wastes. See Section 3004(m) of RCRA. The prohibitions are phased in according to a schedule developed by EPA and the Congress. See RCRA 3004(d)-(g); 40 CFR 268 Subpart B.

Because WIPP is a "salt dome formation, salt bed formation, underground mine or cave", the placement of wastes in WIPP constitutes "land disposal" as defined in Section 3004(k) of RCRA. Accordingly, in the absence of an exemption or variance from the land disposal prohibitions, DOE wastes for which the prohibitions are already in effect (i.e., solvent wastes and the so-called "California wastes" as specified in 40 CFR 268 Subpart

C) must meet applicable treatment standards prior to emplacement in WIPP. Indeed, pursuant to 40 CFR 268.7, DOE officials must certify that wastes shipped to WIPP for disposal meet applicable treatment standards. The submission of a false certification can result in a fine or imprisonment. Without a valid certification, DOE cannot ship waste presently subject to the land disposal prohibitions to the WIPP for disposal. DOE cannot properly certify that the RFP-generated wastes presently subject to the land disposal prohibitions meet applicable treatment standards because the Department either has not performed adequate testing to make such determinations or it possesses insufficient knowledge of the wastes to make such determinations.

DOE recently applied for a variance from the land disposal prohibitions for mixed wastes destined for disposal at the WIPP. Before such a variance can be granted, DOE must demonstrate "to a reasonable degree of certainty" that during the time in which the wastes remain hazardous "there will be no migration . . . from the disposal unit or injection zone." 40 CFR 268.6(a) (emphasis added).

F. EPA Radioactive Waste Regulations

EPA issued regulations governing the management, storage and disposal of highly radioactive wastes in August, 1985, 17 months beyond the date set by the Nuclear Waste Policy Act, 42 U.S.C. 10101 et seq, and after NRDC filed suit to enforce the statutory deadline. The regulations, entitled "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Radioactive Wastes," 40 CFR 191 (1986), establish health and safety standards for both NRC-licensed and DOE nuclear waste facilities, including WIPP. Subpart A, "Environmental Standards for Management and Storage," 40 CFR 191.01-.05, limits human exposure to radiation from the management, storage and preparation of wastes for disposal. Subpart B, Environmental Standards for Disposal, 40 CFR 191.11-.18, is designed to limit radiation releases after the wastes have been disposed.

In November 1985, NRDC, along with the states of Maine, Vermont, and two other environmental organizations, challenged the adequacy of EPA's high level radioactive waste (HLW) regulations in the First Circuit Court of Appeals in Boston. Minnesota and Texas also petitioned for review of the standards in their respective Courts of Appeals and the cases were transferred to the First Circuit. In July, 1987, the First Circuit determined that two standards in Subpart B setting limits on the exposure of individuals and contamination of ground water were inadequate. The Court remanded the EPA radioactive waste standards in their entirety to EPA. In September, the Court,





upon EPA's motion and without objection from any party reinstated Subpart A.

Subpart B, the portion of the standards on remand to EPA, is composed of four different types of environmental standards: general containment standards (191.13), assurance requirements (191.14), individual protection requirements (191.15) and groundwater protection requirements (191.16). The general containment requirements are design standards which specify that nuclear waste disposal systems be designed to provide a reasonable expectation -- based on a performance assessment using computer modelling and other predictive techniques -- that the cumulative releases of radiation to the "accessible environment" for 10,000 years after disposal shall not exceed certain specific limits.

The six qualitative assurance requirements are designed to insure that the quantitative limits in the containment standards are achieved in the face of "major uncertainties and gaps in our knowledge of the expected behavior of disposal systems over many thousands of years." 50 Fed. Reg. 38072. One of the assurance requirements, for example, states that agencies should avoid developing disposal facilities in areas where there is a reasonable expectation of exploration for scarce or easily accessible resources. 40 CFR 191.14(e). The assurance requirements are applicable only to disposal facilities not regulated by the NRC, such as WIPP, 40 CFR 191.14, since similar standards governing NRC-licensed facilities already exist. See 10 CFR part 60.

The individual protection requirements and the ground water protection requirements are designed to address the possibility that individuals in the vicinity of a repository will be exposed to harmful levels of radiation even where the overall releases are within the levels set by the containment requirements. The individual protection standard requires that disposal systems be designed to provide a reasonable expectation that the annual radiation exposure to any member of the public will not exceed 25 millirems to the whole body or 75 millirems to any organ for 1,000 years after disposal. 40 CFR 191.15. It also requires that performance assessments take into account all potential "pathways" of radiation releases from the repository, particularly contamination of drinking water sources. The ground water protection requirement limits releases of radiation to ground waters near a disposal facility which currently supply drinking water for "thousands of persons" and are "irreplaceable in that no reasonable alternative source of drinking water is available to that population". 40 CFR 191.16. The radiation limits apply for the first 1,000 years after disposal.

In the judicial challenge to the EPA radioactive waste regulations, NRDC argued and the First Circuit found that deep geologic disposal of radioactive wastes constitutes "underground injection" as regulated under Part C of the Safe Drinking Water Act (SDWA), 42 U.S.C. 300f et seq. NRDC et al. v. EPA, 824 F.2d 1258 (1st Cir. 1987). The Court held that the individual and groundwater protection standards in Subpart B allowed contamination of ground waters by underground injection of radioactive wastes at levels greater than those permitted under the "no endangerment" provision of Part C of the SDWA. "The HLW regulations under review not only do not 'assure' the non-endangerment of underground sources of drinking water, but sanction disposal facilities allowing certain levels of endangerment as that term is used in the SDWA." 824 F.2d at 1272.

G. Safe Drinking Water Act Requirements

The Safe Drinking Water Act (SDWA) regulates, among other things, the disposal of wastes by injection into the ground. Underground injection is defined by the SDWA as the "subsurface emplacement of fluids by well injection." 42 U.S.C. sec. 300h(d)(1). The EPA-promulgated regulations which define "well injection" as "the subsurface emplacement of fluids through a bored, drilled, or driven well; or through a dug well, where the depth of the dug well is greater then the largest surface dimension." 40 CFR Part 146. The term "well" means a bored, drilled or driven shaft, or a dug hole, whose depth is greater than the largest surface dimension." 40 CFR 146.1. The regulations define fluids expansively as: "[any] material or substance which flows or moves whether in a semisolid, liquid, sludge, gas or any other form or state." 40 CFR 146.3.

Pursuant to 40 CFR 146, a disposal system constitutes underground injection if:

(a) the waste disposed of is a material or substance in a semisolid, liquid, sludge, gas or any other form or state;

(b) the waste is emplaced underground through a bored, drilled or driven shaft, or a dug hole whose depth is greater than the largest surface dimension; and

(c) the waste flows or moves.

Disposal of radioactive waste by emplacement in a deep geological repository, as envisioned by the Nuclear Waste Policy Act (42 U.S.C. sec. 10101, et seq.) and proposed in WIPP, meets each one of these requirements. The emplacement of radioactive sludge, gaseous wastes, and other waste streams in the salt





formation beneath the New Mexico desert constitutes underground injection. The emplacement, whether for "storage" or "disposal," through the well shafts at the WIPP site is of wastes that exist in solid, liquid and gaseous form. The wastes at issue, therefore, are clearly "material(s) or substance(s)" in a "semisolid, liquid, sludge, gas or any other form or state." The emplacement will be through a shaft which is "bored, drilled or driven . . . or . . . dug." The waste can also "flow or move."

Prior to emplacement, the wastes will exist in a variety of states which flow easily. This waste can and most likely will move. Not only does DOE take no responsibility for the ability of the waste boxes and drums to keep the wastes from migrating and flowing, but the presence of brine in the disposal area at much higher levels than first anticipated will cause the containers to corrode quickly, allowing the waste to escape into the surrounding formation.

The EPA has developed models of this type of movement of wastes. In the "Basic Model" EPA assumes that the radioactive wastes:

> after being released from the repository into the ground water will be transported upward through the host formation to the upper aquifer. The [wastes] are then slowly transported horizontally through the upper aquifer to a body of water on the earth's surface, such as a lake or river, where they become available to people.

(Population Risks from Disposal of High-Level Radioactive Wastes in Geologic Repositories, Draft Report, at 34 (December, 1982).) It is beyond dispute that the wastes which will be emplaced in the salt formation below the New Mexico desert will "flow or move." The D-SEIS fails to address the impacts which may result from such movement or the mitigation which DOE might undertake in response thereto.

## III. NEPA COMPLIANCE -- FAILURE IN PROCESS

### A. DOE established an Inadequate Public Comment Period and Failed to Give Sufficient Notice for the D-SEIS Hearings

#### 1. Comment Period

When DOE published its draft EIS for the WIPP in 1980, the Department initially established a 90 day public comment period. Eventually, however, that period was extended to a total of 141 days. Given the voluminous nature of both the EIS itself and the supporting documents, this was an appropriate time frame to allow the public to review the materials and present DOE with meaningful public comment.

In April 1989, when DOE released the D-SEIS -- a document of over 1000 pages -- DOE established a 60 day comment period. Initially, DOE maintained that such a short comment period was necessary because the Department needed to proceed expeditiously with completing the NEPA process to show Governors Andrus (Idaho) and Romer (Colorado) its good faith efforts to get WIPP open as soon as possible. Eventually, faced with mounting public pressure, DOE extended the comment period for 30 days and added three hearings, including ones in the States of Texas and Utah. However, for several reasons, DOE has still effectively denied the public an opportunity to complete a meaningful public review of the SEIS or provide meaningful public comment. Moreover, in view of Secretary Watkins June 27, 1989 decision to postpone the opening of WIPP indefinitely pending additional documentation of the plant's safety and ability to meet environmental, public health and safety regulations, at this time, DOE should suspend the NEPA process entirely and issue a new D-SEIS when it has completed the necessary information and analyses to support the opening of a safe WIPP. See Appendix E, a letter from the joint commentors to Secretary Watkins on the relationship between his June 27th comments and the impropriety of using the D-SEIS as a decision-making document.

#### 2. Hearings

DOE also held public hearings on the D-SEIS. Although there was adequate notice for the initially scheduled set of hearings (in the States of Idaho, Colorado, Oregon, and Georgia and the Cities of Santa Fe and Albuquerque), the same cannot be said of the three hearings which DOE added to its list in June. For example, there was almost no notice given for the Odessa Texas hearing. To our knowledge, DOE failed to notify any Texas state or U.S. representative of the Odessa hearing. DOE also failed to notify Texas state agencies and citizen groups that have expressed a strong interest in the WIPP, such as the Texas Department of Agriculture, the League of Women Voters, NWTF





(Nuclear Waste Task Force), STAND (Serious Texans Against Nuclear Dumping), and POWER (People Opposed to Wasted Energy Repository). Moreover, DOE ran the Santa Fe hearings in a manner which defies comprehension. Literally making the hearings into a three ring circus (which necessitated putting on the hearing panels DOE employees who were totally unassociated with and informed about the WIPP), scheduling individual citizens, including children and the elderly, for testimony late into the night, announcing only a week in advance that it would schedule persons who had preregistered for the scheduled Thursday-Friday hearings for Saturday testimony, DOE's conduct of the city's hearings was outrageous and certainly defied the spirit, if not the letter, of NEPA regulations.

### B. Critical References to support the D-SEIS are unavailable.

Not only is even a 90-day period obviously too short to perform a meaningful review of the D-SEIS -- which is a 1000+ page document -- but DOE has, once again, put itself into a "cart-before-the-horse" position vis a vis the supporting documentation for the D-SEIS. Although again DOE has released numerous and voluminous supporting documents for the D-SEIS, several documents are not available at this time. Notable among them is the Final Safety Analysis Report (FSAR) for the WIPP. DOE has made the latest draft of this report available to the public in various public reading rooms, but DOE has not yet finalized the FSAR. Thus, the FSAR is unavailable.

The FSAR is one of the critical documents necessary for DOE's demonstration that the WIPP will isolate TRU wastes from the environment. Without a final version of the FSAR, it is impossible to know whether the D-SEIS accurately describes the environmental impacts associated with the WIPP. And the changes which others (e.g., EEG and the NAS) believe DOE must make to the FSAR for it to be acceptable are both numerous and significant, judging, for example, from EEG's "Review of the Final Safety Analysis Report (draft), DOE Waste Isolation Pilot Plant, December 1988" EEG-40 (May 1989). Thus, at the very least, the absence of the final FSAR must delay the public review and comment period for the D-SEIS until such time as that document becomes available.

Secretary Watkins' recent announcement delaying indefinitely WIPP's opening bolsters the joint commentors' position. Even DOE's executive officer apparently concedes that there is insufficient information to determine whether WIPP can operate safely in compliance with all relevant regulations. Given his command to delay the plant's opening until Department personnel and contractors have collected additional information for analysis by DOE and independent scientists, the DOE office should

similarly defer the NEPA compliance process so that the public and all cooperating agencies can also review and comment upon the new information which Secretary Watkins has directed DOE to gather.





**IV. NEPA COMPLIANCE -- FAILURES IN SUBSTANTIVE REQUIREMENTS**

A. The D-SEIS fails to demonstrate the need for WIPP.

NEPA requires the federal agency proposing a major federal action first to establish the need for such action. 42 U.S.C. sec. 4332(-). The D-SEIS fails to do so.

1. According to the D-SEIS, WIPP would have a detrimental effect on public health and safety as compared to leaving the wastes in place.

The D-SEIS has not identified any immediate health and safety or environmental problems at its existing facilities that would be resolved by WIPP. The D-SEIS, like the FEIS, states: "no environmental reasons have been found why TRU waste could not be left at the Idaho National Engineering Laboratory stored as it is for several decades or even a century." D-SEIS pp. S-19, 5-173. The D-SEIS offers no different assessment for any other facility.

On the other hand, the D-SEIS acknowledges that opening WIPP will increase risks to public health and safety. The D-SEIS calculates that there will be 8.3 deaths and 106 injuries in trucking waste to WIPP. D-SEIS, pp. 5-15 and 5-35. The document does not explain why that number, or any number, of deaths and injuries is acceptable to DOE or why it should be acceptable to the public. The D-SEIS must disclose how many deaths and injuries are acceptable to DOE at any site, along any transportation route, or at WIPP.

Moreover, DOE is arguing that it needs at least five years to demonstrate WIPP's compliance with EPA's radioactive waste disposal standards, 40 CFR 191. DOE has also indirectly acknowledged that the site does not now even meet the standards that were ruled invalid in 1987 by the First Circuit Court of Appeals. For example, in two of the four long-term release scenarios analyzed in the D-SEIS, radioactive releases could exceed the invalid EPA repository standard. D-SEIS, p. 5-167. Thus it is clearly possible that major long-term health and safety problems could result from waste emplacement at WIPP.

2. DOE should address the full range of TRU waste problems and all reasonable alternatives for management, storage, transportation, and disposal in a comprehensive programmatic environmental impact statement before proceeding with WIPP.

Neither the D-SEIS nor any other DOE NEPA document addresses the full range of TRU wastes, including the buried wastes which constitute the largest volume of those wastes. According to DOE's Integrated Data Base For 1988, those wastes buried at Hanford, INEL, Los Alamos, Oak Ridge, Savannah River, and Sandia

National Laboratories total 190,837 cubic meters. In addition, those buried wastes have contaminated from 139,100 cubic meters to 287,100 cubic meters of soil at five sites. In the IDB for 1988, DOE estimates that existing stored wastes total 58,748.7 cubic meters. Taking the low estimate for the amount of contaminated soil, plus the amount of buried wastes shows that the TRU wastes coming to WIPP account for only 15 percent of the existing inventory. Taking the highest estimate, WIPP accounts for only 11 percent of that total.

In its June 1983 Defense Waste Management Plan (DWMP) , DOE's "reference plan" for buried wastes was to monitor the wastes, take necessary remedial action, and reevaluate safety issues every ten years. In 1986, the General Accounting Office report, Department of Energy's Transuranic Waste Disposal Plan Needs Revision, criticized the DWMP for various reasons, including for not addressing plans and costs for management of the buried wastes and other TRU wastes not coming to WIPP. DOE responded with two documents in 1987 -- Defense Waste Management Plan for Buried Transuranic-Contaminated Waste, Transuranic-Contaminated soil and Difficult to Certify Transportation Waste, and Comprehensive Implementation Plan for the DOE Defense Buried TRU-Contaminated Waste Program. While those two 1987 documents discussed "planning alternatives" including continued monitoring, improving confinement, and exhuming and processing wastes for disposal in a repository, DOE never selected an alternative nor produced any NEPA documentation on plans for all the stored and buried TRU wastes.

Therefore, the joint commentors request that DOE prepare a programmatic EIS evaluating existing and projected future inventories of TRU wastes, current disposal and alternative on-site disposal and storage options and off-site storage and alternatives (together with transportation requirements) prior to proceeding with WIPP. Without such a programmatic EIS, DOE, Congress and the public cannot fully evaluate the need for WIPP, the priority for handling stored wastes versus buried wastes, or whether on-site storage, WIPP, the high-level waste repository, or some other disposal option provide the best method for long-term management.

B. The D-SEIS fails to Analyze all Reasonable Alternatives to DOE's Preferred Alternative.

In its 1980 Final EIS DOE examined four alternatives:

1. No Action (leave all transuranic (TRU) waste at its present storage sites, e.g., INEL);





2. Authorized WIPP (build an underground repository, and emplace TRU waste in it for permanent disposal);

3. Preferred Alternative (delay the authorized WIPP activities and combine them with the first available high level nuclear waste repository); and

4. Choose and build a deep geologic repository for TRU waste after considering other sites (e.g., tuff at Nevada, basalt at Hanford, salt domes in the Gulf interior region).

Ultimately, DOE chose to proceed with Alternative 2 for the permanent disposal of TRU waste and for experimentation with high level waste. In 1988, during Congressional consideration of a permanent land withdrawal bill for the WIPP site, DOE abandoned the project component involving high level waste experiments. On April 21, 1989 DOE announced in the Federal Register the release of its draft SEIS for the facility. The D-SEIS examines the following alternatives:

1. No Action (same as the no action alternative analysed in the FEIS);

2. Preferred Alternative (open WIPP and commence emplacement of waste concurrent with a test phase designed to demonstrate compliance with EPA's standards for the long term underground disposal of nuclear waste); and

3. Alternative Action (demonstrate compliance with EPA's standards at WIPP through modeling and above-ground experiments with TRU waste, but delay waste emplacement until compliance is proved).

Essentially, DOE has examined only two alternatives in each EIS: no action and deep geologic disposal of waste. What DOE has not done has been to include an alternative action based on long-term, above-ground storage and/or disposal of TRU waste. Such action would be different from the "no action" alternative in that it would require construction of an above-ground facility designed for long term storage. The above-ground facilities where waste is presently stored, e.g., at INEL, have been designed for short term or temporary storage. Because NEPA requires DOE to consider all "reasonable" alternatives to its preferred action, DOE's failure to consider long term above-ground storage is a fatal flaw in the NEPA process for WIPP.

DOE has conceded that above-ground long term storage of TRU waste is a reasonable alternative. In February 1989, DOE held a contractor meeting to discuss the parameters for private companies to bid on the construction of such a facility. More

recently, DOE has refused to announce where it will construct an interim storage facility for contact handled transuranic waste from the Rocky Flats Plant pending the commencement of operations at the WIPP, inter alia because it is considering the various contractor proposals for such a facility. In light of DOE's own actions clearly indicating that the Department recognizes the reasonableness of above-ground storage, there is no excuse for DOE's failure to have included such an option in its alternatives analysis in the D-SEIS.

C. The D-SEIS does not adequately analyze the No Action Alternative.

The D-SEIS defines the no action alternative as continuing all operations and current practices at four existing generator sites (INEL, RFP, Hanford, and SRP). In the brief discussion of this alternative, D-SEIS, pp. 5-168 to 5-176, no adverse impacts related to biology, land use, air quality, cultural resources, water quality, and transportation are identified at any site. Radiological impacts of continued storage at INEL, SRP and Hanford are calculated and are considered acceptable. The only negative impact of the no action alternative which DOE projects in the D-SEIS is a loss of WIPP-related spending in Carlsbad. The D-SEIS makes no comparable calculations of the increased spending at the generator sites or the economic benefits in those areas, nor does the D-SEIS discuss the positive impact on the federal taxpayers from not spending those WIPP-related dollars.

The D-SEIS contains no explanation about why the no action alternative was not chosen since its impacts to public health and safety are calculated as being much less than proceeding with WIPP. Curiously, there is never any comparison of the impacts of 8.3 deaths and 106 injuries associated with the preferred action with the assumed negative economic impacts to Carlsbad. Is it DOE's position that those economic impacts are more important than the deaths and injuries? The D-SEIS merely concludes that the no action alternative "would result in the potential for long-term degradation of the environment and potential public health consequences at TRU waste generator and storage facilities and may have adverse impacts on nuclear weapons programs and maintenance." D-SEIS, pp. 3-30 and 5-7. The D-SEIS itself does not justify such a conclusion nor is any document cited in support thereof. On the contrary, the potential for environmental and public health consequences also exists at WIPP.

As regards the generator sites, for the last 45 years their operations have not been dependent upon WIPP and there is no reason to believe that they will be so dependent in the future. In a December 1988 DOE report to Congress, United States Department of Energy Nuclear Weapons Complex Modernization





Report, WIPP certainly was not identified as an essential element to the production of nuclear materials for the next 20 years. If there are any 'national security' requirements related to WIPP, they have not been discussed in the D-SEIS or in any other public DOE or congressional document. Without such a public discussion, no basis exists for alleging such concerns.

Moreover, the no action alternative should be more fully analyzed because if WIPP does not comply with the EPA disposal standards, it could become the only possible alternative, at least until NRC licenses a permanent nuclear waste repository. Further, money saved from not transporting wastes to WIPP and not operating the facility might be better used in the cleanup of existing DOE storage facilities, which by DOE's own estimates will be tens of billions of dollars. The D-SEIS must consider these issues.

An adequate D-SEIS also must discuss a no action alternative with mitigation measures, including expanded on-site storage and compaction or processing of stored wastes to determine the environmental impacts of such measures and to compare them to the impacts of DOE's proposed action of proceeding with WIPP. Indeed, in other DOE documents there are "planning alternatives" which would leave the wastes stored at existing facilities, but take some action to upgrade those storage facilities. For example, in its June 1987 Defense Waste Management Plan for Buried Transuranic-Contaminated Waste, Transuranic-Contaminated Soil and Difficult to Certify Transuranic Wastes, DOE identified two alternatives that would leave wastes at the existing storage facilities. One alternative was to leave the waste in place with continued monitoring and surveillance until closure and, the second was to leave the waste in place but to improve confinement. If those measures are reasonable alternatives for buried wastes they also must be analyzed for stored wastes. Since DOE obviously considers those two planning alternatives to be reasonable they must be included and analyzed as part of the no action alternative for WIPP.

D. The Scope of the D-SEIS Fails to Satisfy NEPA.

In addition to the reasons stated in part C, the D-SEIS is deficient in scope for several other reasons. This is obvious from the repeated references in the D-SEIS that certain WIPP-related matters will be addressed in other, future NEPA documentation. Assuming that all facets of the WIPP project are integral thereto, DOE cannot make a decision to go forward with its chosen alternative -- or any alternative -- until it has examined the whole range of environmental impacts. Yes, DOE is covered by a rule of reason as to what it must cover in an EIS; but, as DOE itself has recognized, many WIPP-related issues

properly subject to NEPA are not addressed in this D-SEIS. Failure to do so in this context is, as explained in part I.A above, essentially akin to the illegal segmentation of a project by which an agency attempts to avoid producing an EIS altogether.

Two examples should serve to illustrate. The D-SEIS concedes that additional NEPA documentation will be necessary to address the retrieval and processing of waste from the six facilities whose TRU waste handling, retrieval and processing have not already been the subject of NEPA documents. D-SEIS, p. 1.5. Because retrieval and processing of wastes will affect the waste form received at the WIPP, these topics must be addressed in the WIPP NEPA process. DOE cannot assume, absent any evidence, that the wastes from these six facilities can be retrieved and processed such that they meet the WIPP WAC and are within the radiation and hazardous waste ranges set forth in the D-SEIS. Similarly, the D-SEIS states on p. 5-13 that retrieval, processing, packaging and shipping facilities for TRU waste at INEL will be addressed in forthcoming NEPA documents, a delay which DOE justifies because such wastes are not to be shipped until 1992. The majority of the existing wastes scheduled for emplacement at WIPP are presently stored at INEL. It is unconscionable for DOE to ignore the potential impacts of that facility's retrieval, processing, and packaging of its wastes, or to assume that these functions can be performed in a manner which will comply with the law and be consistent with the assumptions in the D-SEIS.

E. The D-SEIS Fails to Consider All Available, Relevant Information.

For the reader who is not familiar with the history of information available regarding WIPP, the length of the D-SEIS and the number of references cited would be impressive. However, the joint commentors, who have followed WIPP for many years, are appalled by the lack of use of much relevant information. Ignoring such information is particularly striking given the fact that it is readily available to DOE, in some cases it was even paid for by DOE, and in some cases it has even been relied upon by DOE. While more detail is included in Appendix C to these comments (to which comments the joint commentors expect DOE to respond in its final SEIS), here we discuss information from four sources which must be included in the revised and reissued D-SEIS. Those sources are the Environmental Evaluation Group, the State of New Mexico, the National Academy of Sciences' WIPP Panel, Congress, and the Scientists Review Panel on WIPP.

1. Environmental Evaluation Group (EEG)

EEG was formed more than a decade ago under a contract between DOE and the State of New Mexico. During its history, DOE





has provided more than $5 million to EEG, providing all funding for that agency. DOE officials and its contractors meet formally with EEG at least once a quarter and there have been literally hundreds of meetings and thousands of pages of correspondence between EEG and DOE. Further, at the time of the preparation of the D-SEIS, EEG had published 38 reports regarding WIPP. However, in Volume 1 of the D-SEIS only two EEG reports (EEG-11 and EEG-32, referenced in Chapter 4) and one technical paper (Chaturvedi, et. al. from Waste Management '88, referenced in Chapter 5) are referenced at all.

DOE has not even used the few EEG documents which it chose to cite correctly. Typically, DOE has extracted information quite selectively from those EEG reports which it did not entirely ignore. For example, EEG-32 calculated (page 56) that ground water travel time to the Pecos River could be 114 years and to a well could be 15 years. Those calculations and discussion of their probabilities are never included in the D-SEIS.

Most EEG reports with direct application to issues discussed in the D-SEIS are completely ignored as are many of the issues these reports raised. Just a handful of examples in three different substantive areas are: (a) EEG-24 and EEG-33 on transportation issues, (b) EEG-16, EEG-22, EEG-23, EEG-25, EEG-31, EEG-34, EEG-35, and EEG-39 on geology and hydrology issues, and (c) EEG-37 and EEG-38 on facility operational safety issues. Several of those reports are also not mentioned in the D-SEIS Appendix J Bibliography of "most writings" about WIPP, which purports to be a to list that includes WIPP related documents neither referenced nor used in the D-SEIS.

The joint commentors believe that DOE should include a discussion of EEG's views on the three above-mentioned topic areas, and on all other major issues, as well as DOE's responses to EEG's views and concerns in the revised and reissued D-SEIS. More appropriately, DOE should publish a comprehensive review of EEG's reports and DOE's responses to the issues raised thereby before it reissues a D-SEIS.

2. State of New Mexico

The D-SEIS does not include citations to or discussions of the history of interactions with the State of New Mexico during the past 17 years. The many glaring examples, individually and together demonstrate how DOE's first attempted NEPA documentation this decade ignores major state concerns regarding direct and indirect environmental impacts. Below, we will illustrate by highlighting only two -- transportation and socioeconomics.

a. Transportation. DOE is well aware of the December 1982 Supplemental Stipulated Agreement it signed with New Mexico. In that document, DOE agreed to seek almost $58 million for upgrading highways used for WIPP shipments, to provide emergency response training and equipment, and to allow state monitoring of shipments. Nonetheless, neither the agreement nor those issues are adequately discussed in the D-SEIS. In the July 1987 Modification of the Consultation and Cooperation Agreement, DOE agreed to support the State's efforts to obtain $200 million for bypasses around New Mexico cities. Again, neither the agreement nor the need for such bypasses are discussed in the D-SEIS, despite the fact that DOE assumes, for purposes of its transportation analysis, that the bypasses will exist by the time the shipping campaign begins.

b. Socioeconomics. DOE is also well aware of the State's long-standing concerns about socioeconomic issues, especially related to the need for compensation to the State for lost mineral revenues and royalties and the need to provide funding for the transportation issues just discussed. Because the State was not satisfied with the discussion of socioeconomic impacts in the DEIS and FEIS, the New Mexico Energy and Minerals Department contracted with the University of New Mexico (using mostly DOE funds) to conduct its own socioeconomic impacts study. That report, The Proposed Waste Isolation Pilot Plant Project (WIPP) and Impacts in the State of New Mexico: A Socio-Economic Analysis, was the basic source for much of the information and cost estimates subsequently used in the Supplemental Stipulated Agreement. The report also discussed the importance of risk perception and the statewide impacts of WIPP. Neither the report nor its findings are discussed in the D-SEIS. In fact, as the joint commentors explain elsewhere, DOE has ignored negative economic data and impacts for the entire country outside Eddy County.

The joint commentors believe that the revised and reissued D-SEIS also must discuss the various agreements with the State of New Mexico, including transportation and socioeconomic issues. More appropriately, DOE should issue a comprehensive report describing the State's concerns, the various C&C Agreements, and how DOE has and intends to comply with those agreements prior to issuing a revised D-SEIS.

3. National Academy of Sciences (NAS)

For more than three decades NAS panels related to the Board on Radioactive Waste Management have issued reports relevant to WIPP. The D-SEIS ignores those reports, of which DOE is well aware if for no other reason than DOE funded most of them. For example, in 1983 the National Academy Press published A Study of the Isolation System for Geologic Disposal of Radioactive Wastes





and in 1984, the Academy published Social and Economic Aspects of Radioactive Waste Disposal. Those reports are not referenced in the D-SEIS, not even in Appendix J. At a minimum, the revised D-SEIS should discuss why those documents are not relevant, if that is DOE's position. More appropriately, the revised D-SEIS should discuss the relevant issues raised in those reports in relation to WIPP.

Even more incredible than DOE's having overlooked these NAS reports, the D-SEIS virtually ignores the NAS WIPP Panel, which has had regular meetings and discussed various aspects of WIPP since 1978. The Panel has issued both formal reports and letters and had discussions with DOE personnel. The Panel has raised various concerns, especially regarding additional testing and safety standards, during the past few years, most of which are not adequately discussed in the D-SEIS. The revised and re-issued D-SEIS should discuss NAS concerns and recommendations and how DOE has and will address those issues.

4. Congress

During the past two years several congressional committees have held hearings on WIPP. DOE is aware of such hearings because DOE officials have testified at each one. DOE has not discussed many of the issues raised at the hearings of the Senate Energy Committee and the House Committees on Interior and Insular Affairs, Energy and Commerce, Armed Services, and Government Operations in the D-SEIS, even though these issues are of great concern to federal elected decision-makers and despite the fact that their articulation has substantially influenced DOE's activities at WIPP. The revised and reissued D-SEIS must include a discussion of the issues raised in all congressional hearings related to WIPP and to land withdrawal legislation.

For example, the congressional concern about compliance with EPA waste disposal standards at WIPP apparently was the source of the alternative action described in the D-SEIS. Yet, those concerns and various legislative proposals to require compliance with the disposal standards are not included. Congressional concern about funding highway upgrading, bypass construction, emergency response training and equipment, and loss of mineral revenues are not included in the D-SEIS.

Issues raised about WIPP's readiness, operational safety, quality assurance, and compliance with the EPA disposal standards and RCRA dominated the House Government Operations Subcommittee hearing on September 13, 1988. Nonetheless, DOE does not address these issues in the D-SEIS. In the revised and re-issued D-SEIS, DOE must evaluate the direct and indirect environmental implications of each of these issues, relative to the various alternatives under consideration. DOE must do the same, as well,

for those issues raised in the June 12, 1989 House Government Operations Subcommittee hearing, so that the issues relevant to federal, non-DOE decision-makers are discussed and evaluated in the NEPA process.

5. Scientists Review Panel on WIPP (SRP)

SRP has issued reports on brine seepage, brine reservoirs, and two reports on the test phase plan, none of which is recognized to exist, much less evaluated in the D-SEIS. Congressional committees have heard testimony from the SRP, as has the NAS WIPP Panel, attesting to both the credibility of the group and the relevance of the issues that they have researched. To ensure that DOE no longer ignores those reports, they are included in Appendix C so that the revised and re-issued D-SEIS both considers them and responds fully to the issues raised therein.





## V. UNSUPPORTED AND UNREALISTIC ASSUMPTIONS IN THE D-SEIS

The assumptions made in the D-SEIS unrealistically underestimate the risks involved in WIPP operations. For example, accident scenarios that are supposed to represent the "worst case" postulate optimistically low releases and "assume that management and control systems operate as designed." D-SEIS, p. 5-55. Such assumptions made in evaluating risks invalidate any conclusions reached in these scenarios. Following are some undocumented assumptions that are not credible, rendering the conclusions reached in the D-SEIS invalid.

Worst case accident scenarios assume that the filters in the Waste Handling Building operate at 99.9999% efficiency. D-SEIS, p. 5-47. No exposures are calculated in the event of filter failure, whereby the amount of radioactivity released into the atmosphere would be greater than the DOE estimates by a factor of one million. The EEG has in fact determined that the filter switching mechanism is unreliable. Moreover, as DOE has been forced to confront elsewhere where the Department has attempted to rely on banks of HEPA filters, (e.g., Rocky Flats, Lawrence Livermore), the filters themselves are fragile -- require delicate handling -- and are easily combustible.

No calculations are made for radiation exposures to workers, because "workers are assumed to respond as trained and immediately leave the scene of any accidents." D-SEIS, App. F, p. 19. In fact, in EEG tests, the air monitors made so much noise it was impossible for workers to hear emergency instructions over the PA system, and several workers entered accident areas without any protective devices whatsoever. No exposures were calculated for workers who might be disabled in the event of an accident and unable to leave the accident area.

The D-SEIS bases many calculations and resulting waste containment scenarios on unsubstantiated assumptions and simplistic conceptual models of hydrologic and geologic features of the site. See, e.g., D-SEIS, p. 4-13. The hydrology of the region has consistently proven to be more complex, more variable and more unpredictable than the uniform and homogeneous qualities ascribed by DOE for purposes of numerical modeling and predictions. Assuming constant properties when making predictions over a 10,000 year control period is neither realistic nor valid.

Accident scenarios involving waste drums opening assume that only 1% of the radioactive contents are spilled in such an event. In one hypothetical, a pallet of drums is hit by a forklift, but only one drum is assumed to fall off and breach. D-SEIS, p. 5-53. The only impacts from a borehole breach of the disposal

area are assumed to be to the geologist examining the drill cuttings and possible contamination of a stock well. D-SEIS, p. 5-115. In fact, such a breach could bring large quantities of radioactive slurry to the surface.

The D-SEIS assumes that, "Most of the accidents during the WIPP's operating lifetime will not result in releases of radioactive material." D-SEIS, p. 5-56. This statement makes no sense whatsoever in light of the fact that the D-SEIS admits that even normal operating conditions will result in routine releases of radioactive material to the atmosphere. DOE must explain why would there be less chance of release under accident conditions than under normal conditions?

The D-SEIS relies upon data of questionable integrity for many critical evaluations. Given that assumptions and estimates in the FEIS have proven to be inaccurate by factors of up to 10,000, D-SEIS at 4-20, how can DOE now assume that its current figures are correct? Even DOE appears to concede the imperfection of its methodologies, at least in some places in the D-SEIS. For example, the D-SEIS states that "an attempt to estimate thermodynamic data" was made by "extrapolating and "arbitrarily changing" data on WIPP brine. D-SEIS, p. 5-126. It goes on to say, "Unfortunately, these procedures result in order-of-magnitude uncertainties." Id. Nonetheless, DOE has proceed to perform calculations regarding brine flow, but without using the most conservative ranges available, e.g., findings of independent researchers such as EEG personnel or SRP members. The hazards of radioactive waste and the potential risks to the environment and public health are far too great to make a decision on WIPP, given data that even DOE admits is unreliable.

The D-SEIS continually defers decision on critical safety issues to some unspecified time in the future thereby clearly indicating the WIPP is in fact not ready to open now. There are continual references throughout the document such as "further detailed characterization of brine inflow are needed," D-SEIS at 4-20, "the DOE is currently developing a detailed plan for the Test Phase," id., at 3-21, and "will enable the DOE in the future to ascertain whether the repository can meet the standards, id., at 3-26." Statements such as these are symptomatic of ongoing problems throughout the D-SEIS; many of the factors affecting WIPP's long-term effects are as yet unquantified or open to question, review and change. The containers for transporting RH-TRU waste have not yet been designed; nonetheless, DOE predicts that "fabrication and testing of this packaging are expected to be completed in the early 1990s." D-SEIS, p. 3-14. Emplacement of permanent tunnel and shaft seals to isolate the radioactivity from the environment remains "open to study and future decision." D-SEIS, p. 6-7.





Deferment of critical studies and decisions, and acknowledgment of inadequate scientific data at the present time is not acceptable in an SEIS issued only months before DOE plans to open the WIPP. Although NEPA does not require an agency to have certainty on all issues associated with a project at the time it issues its EIS, an agency may not create the inadequacies itself by failing to perform tests which independent scientists and informed individuals have repeatedly told the agency are necessary. A revised, rereleased D-SEIS is the proper time for DOE to address all of the WIPP's environmental impacts and that means making a good faith effort to fill the information gaps.

**VI. INADEQUATE ANALYSIS OF THE DIRECT ENVIRONMENTAL EFFECTS OF WIPP.**

A. The D-SEIS health risk assessment model underestimates health effects.

DOE has not considered the Petkau Effect in its BEIR III health risk assessment model. This failure invalidates all DOE health risk assessments that rely on BEIR III modeling and ICRP standards. The result is that the D-SEIS' health risk assessments may be up to 1,000 times too low.

At the request of the Canadian Atomic Energy Commission, Dr. Petkau did research to establish the effect of low dose/long term exposure to radionuclides. His results, as reported in March, 1972 in Health Physics, suggest an entirely different mode of operation for the damaging effects of low dose/long term exposure. Through the creation of free radicals, especially of the oxygen molecule, low dose/long term radionuclide exposure leads to the dissolution of the cell membrane and the eventual death of cells involved. This wreaks havoc in the immune system and potentiates all kinds of possible immuno-deficiency diseases. Current research in the field is corroborating Dr. Petkau's original findings. Hence we have a health risk from low dose/long term radionuclide exposure that is 1,000 times more dangerous than is currently accepted by the DOE or any standard-setting body. Without considering the Petkau effect the health risk of the routine releases of radiation during the normal operation of WIPP are grossly underestimated. At a minimum, if DOE disagrees with alternative health risk assessment models, including the Petkau effect, it must discuss those theories and why DOE chooses not to use them.

As stated by DOE, direct comparisons between doses and risks reported in the FEIS and those reported in the D-SEIS cannot be made due to differences both in the assessment methodologies and in the methods of expressing dose. D-SEIS, p. 5-15. Because a NEPA analysis requires the federal agency to make its alternative analysis understandable, the law essentially requires that the public be able to compare important values, which values certainly include projected doses and risk levels. Without direct comparisons, neither the public nor independent scientists can confirm or endorse the methodology changes DOE has effected in the last decade.

The D-SEIS' health risk assessment for all phases of TRU-waste transportation (e.g., packaging, loading and unloading, waste emplacement, and possible waste retrieval) also does not factor in human error. As a result, the D-SEIS analysis of radiological and hazardous chemical release and exposure to workers and the public is fatally flawed, underestimating the





risk to the environment and citizens. The D-SEIS only covers accidents involving equipment failure, despite the fact that most nuclear facilities incidents have occurred due to operator error. Chernobyl, Three Mile Island and the recent Exxon oil spill each exemplify how human operators can bring abnout unexpected and uncalculated disasters. The classic fault tree risk analysis predicts that a Chernobyl-like accident would occur once every 10,000,000 reactor years; the accident actually happened after 300 reactor years. Similarly, a Three Mile Island-type accident was predicted to occur once in 3,000,000 reactor years; yet it happened after a mere 500 reactor years. The maximum credible accident predicted for the Valdez tanker spills was between one and two orders of magnitude lower than the actual 11,000,000 gallons of oil. The failure to factor human error into a model leads to projections which are three to five orders of magnitude (1,000-100,000 times) less likely than the real world has consistently shown will occur.

DOE does not realistically choose its worst case accident scenarios (bounding cases). Many of the possible accidents creating health risks are simply dismissed as unlikely and are not assessed. Therefore DOE's predictions of radiological and/or hazardous chemical exposure to workers and the general public are grossly underestimated and unrealistically low. The D-SEIS worst case accident scenarios assume ridiculously low environmental releases, e.g., the 0.02% release of the radioactive contents of a TRUPACT-II in the bounding transportation accident. DOE assumes in the D-SEIS that all of the HEPA air filters used in the Waste Handling Building will function at 99.9999% removal efficiency at all times. Again, DOE fails to address the possibility and consequences of operator error. More realistic scenarios -- assuming a 10% or more release in the event of a shipping accident, allowing for HEPA filter system malfunctions, expecting that a critical operator error is made - would better represent a bounding case scenario. Such an approach would truthfully reveal that the WIPP workers, the truck drivers, and the general public would be exposed to far greater doses of radiation and hazardous chemicals under possible accident conditions than the totally unrealistic cases presented in the D-SEIS.

The D-SEIS fails to analyze the health risk for retrieving and returning the waste to other locations in the event that WIPP does not work. Nor does the D-SEIS reveal where this retrieved waste would be stored. DOE's preferred action during the Test Phase is to determine if the site can meet EPA standards. If the site cannot, the DOE will need to retrieve the waste emplaced and ship it elsewhere. DOE has neither outlined this process in any detail nor assessed the health risks of such action.

The D-SEIS is also silent as to the risks associated with decontaminating and dismantling surface structures, which activities will be associated with decommissioning the WIPP whether or not it is ever used as a permanent nuclear or hazardous waste repository.

The DOE's analysis of the health risks of mixed hazardous waste exposure to humans over the 10,000 year period required by EPA is wholly deficient and chock full of unsupportable assumptions. As the D-SEIS states, "a key purpose of geological disposal is to delay the appearance of contaminants in the accessible environment for very long times." D-SEIS, p. 5-157. Delay, not prevent. Even then, geological disposal can delay "for very long times" only if the facility works precisely as intended. Yet, the D-SEIS does not and cannot substantiate the assertion that "no radionuclides will reach the Culebra aquifer or the surface in 10,000 years" in Cases IA and IB.

There are many crucial assumptions and unknown processes in DOE's rosy worst case scenarios; any of these could radically alter the outcomes predicted in the D-SEIS for closure rates, gas generation or migration, aquifer pressure, hydrologic flow patterns, and brine seepage quantities and flow. That D-SEIS Cases IIB and IIC (the "worst case scenarios" presented) would produce only doses on the same order of magnitude as background radiation in the United States is a red herring, if for no other reason than EPA has estimated that hundreds of people in the United States die yearly from "background" radiation. Words like "more likely assumptions in Cases IIA and IID," D-SEIS at 5-160, have no basis in reality. The D-SEIS notes that total integrated releases over a 10,000 year period have only been done by "bounding" the releases over time out to 10,000 years using simplified analyses. D-SEIS, p. 5-161. Such techniques may provide some insight, in the absence of defensible, probabilistic performance assessment evaluations, as to WIPP's prospects for compliance with the long term release criteria in the EPA standards. However, the sheer quantity of modifiers expressed for this technique, i.e., "simplified," "may provide some insight," "absence of defensible, probabilistic assessment evaluations," D-SEIS at 5-161, serve as a telling reminder of the tenuous data base DOE is using to demonstrate that WIPP can comply with the EPA standards.

The EPA requires the WIPP site to safely isolate waste from the accessible environment for 10,000 years. How accurately can health risks be predicted for years 101-10,000, a mere 24 generations, when the waste will be deadly for nearly 3,400 generations. How realistically can DOE, or anyone, predict what will happen in 1,000 years, let alone in 10,000? We have seen the accuracy of the Chernobyl, TMI and Exxon predictions and how quickly these promises of protection proved false.





The D-SEIS glosses over many issues affecting long-term health risks. Predictions assume (1) that there will be no future increases in population in or around the WIPP site, (2) that released contamination will be confined to one mythical stock well and a handful of cattle; (3) that a borehole breaching the repository would expose only a geologist examining the cuttings of material brought to the surface; (4) that surface water will never act as a transport medium for radionuclides; (5) that local climate and moisture will remain constant, and on and on. Such assumptions falsely limit human exposure and health risks.

B. The D-SEIS ignores or inadequately addresses numerous problems with the WIPP site which show the strong potential for long-term releases of radioactivity and toxic materials.

Many questions remain unresolved as to the suitability of the selected WIPP site to effectively isolate radioactive materials from the biosphere for even a fraction of their dangerous lifetimes. New findings and interpretations are nearly all unfavorable to the effectiveness of the site. Since the "Final" Environmental Impact Statement (FEIS) was released by DOE in 1980, much scientific evidence has come to light which indicates serious potential for both breach (human intrusion) and gradual releases into the environment. Despite the ambiguous text and incomprehensible charts which constitute the geology and hydrology chapters in the SEIS (4.2 and 4.3), it is surprisingly easy even for the layperson to find in them innumerable instances of bad scientific process -- assumptions, averaging, reliance on limited data and references to inconclusive experiments or equipment failure in testing.

The D-SEIS analysis of new data is inadequate, suppressing unfavorable data, especially from independent experts, and relying on non-conservative assumptions to justify the proposed action of opening WIPP without demonstrating compliance with EPA disposal standards. The fact that DOE cannot show that the site meets those EPA standards is the clearest measure of the severe geotechnical problems with the site. Despite more than a decade of investigations at the site, the unanswered technical questions are more numerous and more severe than ever. Issues that DOE declared resolved with the end of the Site and Preliminary Design Validation (SPDV) Program now are known to be unresolved.

Despite the certainty expressed in DOE's official SPDV Program evaluation, Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program, WIPP-DOE-161, March 1983, that the site was "qualified" for each and every one of the 21 site qualification criteria, the fact is

that the site does not meet the only valid site suitability criteria -- the EPA disposal standards. Six years after DOE and Sandia declared the WIPP site "qualified," much is still unknown about the hydrogeology of the region -- and much of what was declared to be known six years ago has now been shown to be in error.

For example, the 1983 report declared that "not only are karst channels unlikely at WIPP, they would be of no consequence to site acceptability even if they existed" (p. 21). Subsequently, the EEG concluded that "geological and hydrological characterization of the Rustler Formation has not yet been completed to a desired level of detail for a realistic modeling of breach and transport scenarios through this Formation. The published models and scenarios... are based on insufficient information about the Rustler and may therefore not be "bounding" or "worst-case" (EEG-32, p. iii). That same EEG report stated that using conservative values "one gets a water travel time from the WIPP site to the Pecos river [sic] of 114 years. Travel time to a well located 2 miles from the point of injection would be 15 years" (p. 56). What was known for a certainty in 1983 is now clearly in error -- where is the D-SEIS analysis of this major problem? Such an analysis must include the potential for contamination of the Pecos River continuing for many years and the potential impacts on downstream water users in New Mexico and Texas.

Another example from the 1983 SPDV report is its "conclusion that brine reservoirs are not likely to occur under the WIPP facility now or in the near geologic future. If they should occur.... the consequences of this (unlikely) occurrence are not unacceptable" (p. 23). In fact, even DOE's own data show that a large multi-million barrel pressurized brine reservoir directly underlies at least the majority of the waste emplacement area. The Scientists Review Panel evaluation of the brine reservoir (included in Appendix C) concluded: "with a connection to the underlying brine reservoir, the radiation dose reaching the biosphere can be expected to [be] several times greater" [than the limits set by the EPA disposal standards]. Once again, what was a certainty in 1983 is now known to be false -- but the D-SEIS fails to adequately analyze this issue.

The 1983 SPDV report also reported that "the facility interval contains less than 1% water and less than 5% nonhalite minerals" and that the interbeds do "not present a thermal barrier or water release concern." D-SEIS, p. 23. In fact, brine seepage in the Salado formation is a major problem -- so much so that that SRP, EEG, and NAS all concluded and DOE finally agreed that much more study is needed of the brine seepage problem, which is included as a part of the draft Test Phase Plan. Further, the interbeds, which in 1983 were considered to pose





no site suitability problem, have now been shown to be a source of water, to crack to such an extent as to require rock bolting (an issue never mentioned in the 1983 report), and to be a major potential release point for wastes and gas. Once again, what was certainly not a site suitability issue in 1983, is now clearly a major shortcoming of the WIPP site which creates a virtual certainty that the site cannot meet the EPA disposal standards as currently designed. In its revised and reissued D-SEIS, DOE should review all oral and written comments on the 1983 SPDV report, discuss all new and changed information since that report, and evaluate the reasons for the inaccuracies in the SPDV program.

In the D-SEIS, DOE repeatedly bases long series of calculations and resulting release scenarios on unsubstantiated assumptions and simplistic conceptual models of hydrologic or geologic features. The hydrology of the region has consistently proven to be more complex, variable and unpredictable than the uniform, consistent qualities ascribed by DOE "for purposes of numerical modeling."

Features about which uncertainties still exist and assumptions have been made include: brine inflow -- at least one independent reviewer postulates larger amounts of brine seepage than DOE currently estimates based on DOE's own data (see SRP brine seepage report in Appendix C); gas generation; permeability and gas dissipation potential; variability in porosity; far-field qualities; brine compositions; flow directions; flow rates; boundaries of differing transmissivity zones; extent of fracture zones; potential for future fracturing; fluid-pressure differentials; cause and extent of formation dissolution; aquifer recharge rates; hydraulic conductivity between adjacent formations; variations in fluid density; degree of anisotropy; mineral distribution; variability of stratigraphic thicknesses; volume, origin and age of brines; rate of salt closure; nature of seismic activity in the region; cracks and fractures in the surrounding marker beds 138 and 139 and clay seams, synergistic effects of toxic and radioactive materials given the pressures, geochemical regime, and brine levels possible. Given these large uncertainties, the maximum and minimum calculations of releases in the four scenarios (about one order of magnitude in three of the four scenarios) are not credible. The maximum levels must be higher than calculated -- even in those two of four scenarios in which the levels exceed those allowed under the invalid EPA disposal standards.

Pressurized Brine Reservoir Underlying Disposal Area: A large (likely more than 15 million gallon) brine pocket, pressurized at 2000 psi, exists in the Castile Formation beneath the site. Breach of a similar brine pocket under the original WIPP site a few miles away resulted in millions of gallons of

brine flowing to the surface. Of course, upflowing brine coming through the disposal area could bring with it volumes of decomposed waste. The SEIS refers to the brine pocket as a "potential" or "assumed" presence although evidence of it is much more ironclad than features on which they base calculations.

Brine Inflow: Another major concern affecting long-term performance is brine seepage into the disposal area, originally thought to be "bone-dry." DOE now acknowledges that significant inflow is occurring but says it is "unlikely" that a radioactive slurry will form as the brine mingles with the radioactive and chemical materials and decomposing organic wastes buried at WIPP. Independent scientists have characterized this slurry formation as very likely. The SEIS states, " Steady-state flow conditions may be determinable only from many years of observation." D-SEIS, p. 4-14. It also acknowledges that at the present time, ventilation systems are drying up much of the brine seepage. After the site is closed, the accumulation will therefore accelerate. Both brine inflow studies cited evaluate inflow at ambient temperatures. Neither addresses the possibility of rising temperatures from decomposition and gas generation; salt is a hydrophilic medium in which rising temperatures attract moisture, accelerating container and waste breakdown and slurry formation/migration. Salt is a questionable disposal medium for this reason alone. Note: the "current understanding" of the source of the seepage is intergranular brine, not even recognized in the 1980 FEIS. The Salado Formation (where the facility is located) is "probably hydrologically saturated." Thus, the D-SEIS analysis should assume that brine inflow will occur and should calculate potential release scenarios based on that conservative assumption. D-SEIS, p. 4-16.

Gas Generation and Dissipation: The decomposing mixed hazardous wastes to be buried at WIPP, including organic material, will generate gases. These gases will probably build up to greater than "lithostatic" or surrounding rock pressures, increasing fracturing tendencies in the rock and possibly serving as a driving mechanism for contaminated brine to leave the site. This potential is greatly enhanced by the fact that the gas-permeability of the Salado Formation (the layer the disposal area is in) is 1000 to 10,000 times lower than originally thought. Current gas generation estimates are based upon the unreliable brine inflow estimates used in the SEIS. Far-field conditions have been estimated based on an admittedly "limited data base."

The Rustler Aquifer: This important groundwater source is directly above the disposal area. The Culebra Dolomite layer of this aquifer is the the likeliest potential pathway for release. The SEIS admits that flow directions cannot be accurately defined; that the testing procedures have several limitations;





that "hydraulic conductivity" between the Salado (where the facility is located) and Rustler Formations is difficult to define. This is a euphemistic way of admitting flow between the formation in which the facility is located and the formation known to bear the most water and risk of off-site migration.

Karst is a condition of interlacing channels which greatly speed groundwater progress time. The SEIS never mentions karst, although WIPP is located in one of the most prominent karstlands in the United States. The SEIS does not mention the word, or condition, of karst even once, although the Environmental Evaluation Group (New Mexico's official WIPP watchdog agency) has extensively researched and reported on the phenomenon. Larry Barrows' definitive study of karst and his correspondence with EEG are not referenced, except for one listing in Appendix J, p. 20 and a second garbled citation at J-38.

Salt Dissolution could play a role in breach of the facility. The SEIS makes many assumptions about this eventuality. The potential result of local evaporite dissolution is "continuing formation of small caves and sinkholes," D-SEIS at 4-33, a statement supported with no analysis and accompanied by no additional predictions.

Aquifer Recharge Rates could play an important role in determining how long it would take contamination to reach the Pecos River. DOE claims they are extremely slow, yet concedes that "Rustler hydrology is transient on a 10,000-year time scale," D-SEIS at 4-16, which means conditions could change well within the control period.

Disturbed Rock Zone: Excavation of the WIPP site itself has resulted in unpredicted fracturing around the facility. Studies done to determine the extent of the disturbed rock zone have been inconclusive and the SEIS states that "Studies...will continue throughout the WIPP operational phase." D-SEIS, p. 4-18. These fractures obviously provide potential pathways for off-site migration of radioactive material.

Marker Bed 139 is a thin anhydrite layer immediately (three feet) below the floor of the WIPP disposal facility. It is intensely prone to fracturing, has high rates of brine inflow and provides a very likely pathway for contaminated brines to enter the WIPP shafts. The D-SEIS states that it may be necessary to remove or grout sections of MB139 at the time of facility closure, but the brief discussion in Chapter 6 fails to adequately describe how such sealing could be effectively accomplished or the costs and hazards of this technique.

Further, Marker Bed 138, a similar interbed which lies just above the roof of the waste emplacement rooms, poses similar

cracking problems and could also be a release pathway. Yet the D-SEIS contains no discussion of MB 138 and does not describe what measures will be taken to seal or grout that interbed. Such an analysis will be necessary for the performance assessment required to demonstrate compliance with the EPA disposal standards and must be included in the D-SEIS.

Salt Creep or closure is postulated to seal in the wastes and isolate them from the environment, yet rates of salt creep are still disputed. The rates now appear to be up to five times faster than initially thought, which may make retrieval of the wastes impossible or extremely hazardous if non-compliance with federal standards necessitates it. Moreover, the dominant process of the salt creep-- uniform or fractured--is still not known.

Drillholes which abound in the area, from both previous oil or mineral exploration and WIPP testing, could provide release pathways for off-site radioactive migration. Some older boreholes may not appear on current DOE maps.

In summary, the SEIS document does not prove that the WIPP site is safe. Important bodies of hydrological and geological research have been entirely omitted from the SEIS. DOE fails to reference those EEG reports which contradict Sandia Labs reports more favorable to proceeding with WIPP; nor is evidence of the seismic complexity of the region addressed. Many characteristics of the site area necessary to predict long-term performance of the facility are still not clearly defined, and DOE is still depending on old data, assumptions, simplistic computer modeling and vague or overly favorable interpretations of inconclusive data to promote the "preferred action" -- opening WIPP without the remaining information or compliance with existing federal health and safety standards.

There are also major uncertainties about the reliability of the data used in calculating waste characteristics. First, even the D-SEIS admits that there is not adequate data on the composition of toxic contaminates in mixed wastes. Second, the data used throughout is Rocky Flats "average" wastes. Given the existing FBI investigations at Rocky Flats, DOE should not rely on existing data until they can be verified using adequate quality assurance procedures. Just as RFP "average" wastes do not correlate with an adequate evaluation of transportation risks (see Part VIII), neither are they truly representative of the total inventory of wastes going to WIPP. Thus, the highest known existing concentrations of both radioactive and toxic materials should be used in calculating potential releases. Third, about two-thirds of the wastes ultimately destined for WIPP have not yet been produced, so DOE has no basis for saying that waste characteristics in the future will be the same as existing





wastes. Clearly, the exact characteristics of wastes depend upon the processes and materials used -- which have changed many times over the years at existing facilities. In the future those facilities will again have further changes in their processes and materials. Moreover, as new facilities are built, using new technologies (for example, the SIS facility), characteristics of wastes will certainly be different than existing wastes. Thus, the revised and re-issued D-SEIS must assume that some significant fraction of the wastes emplaced at WIPP will have significantly higher concentrations of radionuclides and toxic materials than those assumed.

C. The D-SEIS underestimates the consequences of waste emplacement.

An adequate analysis of the consequences of waste emplacement must include both short-term and long-term issues. In the short term, the consequences relate to the general public during transportation (which are discussed in part VIII), the public that could be subject to exposures during operations, the workers at the generating and storage sites, involved with waste shipments, and at WIPP, and possible impacts on the general environment. Long-term issues relate to compliance with EPA disposal standards, and especially to releases to the accessible environment after facility closure.

The release scenarios which DOE uses in the D-SEIS are all based upon this web of uncertainties regarding the site itself. Needless to say, the success of the site at containing waste will have far-reaching effects on the environment and on human and other life. Instances where DOE cites further study and written analysis to be done in the future represent an inappropriate deferral of critical information gathering designed to ensure that DOE decision makers have in the EIS enough information so that their deicision takes into account the full potential environmental impacts of the project.

There are other critical flaws in the D-SEIS release scenarios. The document never analyzes scenarios that include release of RH-TRU wastes because it assumes there are no releases for many years after closure -- the earliest maximum calculated dose occurs at about 1,500 years after closure (p. 5-157) -- and because of the emplacement of individual RH-TRU canisters in the storage room walls (p. 5-109). However, the D-SEIS must use conservative assumptions for release scenarios. At a minimum, DOE must use its own assumption that a release could occur 250 years after closure (Radiological Consequences of Brine Release by Human Intrusion Into WIPP [TME 3151], 1982, p. 1) or describe why that assumption is no longer valid. Given the fact that institutional controls cannot be assumed beyond 100 years, that

the FEIS admitted that human intrusion could occur 100 years after closure (p. 15-32), and that there are possible scenarios for early releases (including those discussed by Dr. Bob Watt at the D-SEIS public hearing on June 16), the revised and reissued D-SEIS must calculate releases starting no later than 100 years after closure, so that potential contributions of beta and gamma emitters in RH-TRU wastes and toxic materials in mixed wastes are included in the calculations.

The D-SEIS should calculate more realistic release scenarios including above-ground and subsurface fires. While fires are not supposed to occur at WIPP, they have occurred at Rocky Flats on several occasions during the past 20 years, and, of course, WIPP will be handling some similar materials. Exposures to the workers and the public should include both radioactive materials and toxic chemicals being released. The release scenarios should also include the possibility of the HEPA filters failing totally or in part. There is no valid experience to justify the assumption that HEPA filters will work in an accident situation at 99.9999 percent efficiency. Such optimistic assumptions are unwarranted in view of the EEG's criticisms of the problems with the operational system and that group's suggestions during the past several years about the necessity for re-design and operational improvements.

In addition, DOE's long term risk assessment, used in the model to predict various occurrences which might lead to a release of radiation from the site is outdated because it assumes that the WIPP site need only meet the invalid EPA disposal standards that were rejected by the First Circuit Court of Appeals in 1987. Given that court's opinion, and as previously explained in part II.G hereinabove, DOE should assume instead that WIPP must comply with the Safe Drinking Water Act.

Long-term radioactive releases from WIPP and subsequent environmental impacts cannot be accurately predicted from the information DOE has compiled to date on the site. As should be clear from the inadequacies of the D-SEIS to characterize the site itself, as explained in part VI.B, above, DOE's long-term release scenarios are based on a chain of assumptions that cannot be considered credible. Different interpretations of the same data or use of slightly different but equally plausible models reveal the potential for massive contamination of groundwater, air and soils from the facility, and resulting negative health effects on humans, plants and animals.

DOE's proposed use of "permanent monuments" on the surface of the WIPP site warning of the dangers below will provide no long-term assurance that the repository will not be breached by future generations searching for minerals or water. There are no existing metals or materials to make monuments which can





future, people will be aware of the toxic material lurking beneath the landscape of the WIPP site.

DOE selectively analyzes possible release paths for radioactivity from WIPP and randomly dismisses some while down-playing the significance of others. DOE says that airborne releases during the operational phase will be cut by 99.9999 percent by filters on the ventilation system, and assumes that this filter system will never fail. Filtration systems have been a weak point at many other DOE facilities. It says that surface water releases aren't analyzed because there are no major surface streams at the present time. It makes this assumption in spite of the fact mankind is now altering global weather patterns, and that the Pecos River--only 15 miles from the site--is fed by the same aquifers which overlie WIPP. It says that migration through aquifers will not present significant radioactive releases within the 10,000 year control period, yet it also clearly states that aquifer flow rates and direction have yet to be quantified or determined.

The D-SEIS states that "a probable release period is assumed for ... a fire underground in a single drum." D-SEIS, at M-5. Given this assumption, it is unclear how DOE can also state on the same page that, "no particulate release is expected during these periods due to the nature of the waste." The radioactive particulates generated during a fire from contaminated airborne carbon should be considered in the exposure scenario.

Exposure models used in the SEIS assume steady-state climate, population figures and land use patterns. The deliberate exclusion of possible changes in social or environmental factors provides DOE with a "best case" premise for all its exposure calculations. Even in its "worst case scenarios," the SEIS says exposure near the site will occur to only one cattle pond and one family eating meat from these cattle. What if the region becomes a major farming belt or a large urban area? What about the effects on human drinking water?

Scenarios portraying the potential release of radionuclides from WIPP make huge, important and unsubstantiated assumptions that falsely limit possible releases. Assumptions and unknowns include: brine seepage rates into the repository; the gas generation rates of the waste material; closure rate of the rooms and shafts; effectiveness of shaft sealing/plugging technology; behavior of fracture zones; the underlying 15 million gallon pressurized brine pocket and the rock matrix; formation of a radioactive slurry; and aquifer flow rates and direction.

The D-SEIS reveals that in two possible release scenarios of radionuclides from WIPP, the maximum possible releases will

exceed EPA standards by 2.5 times and almost 5 times. It says "modifications to the waste, and/or backfill material, should be able to improve performance enough to give a high confidence of compliance." Does this make you confident?

Radioactive releases during the facility's "decommissioning" activities are not calculated or adequately addressed. The SEIS admits that surface facilities will become "contaminated" during routine operations, but it provides no thorough assessment of the threat this poses to workers, the public or the general environment when these structures are torn down after the 25 year "operational phase." It simply notes that "shielding" will provide some protection to the workers involved.

The D-SEIS consistently uses terms such as "not credible," "unlikely," "more likely," "simplified," "may provide some insight," and "likelihood" to present what it says is a defensible, objective summation of the facts supporting its contention that WIPP is suited to contain radioactive wastes active for 240,000 years. Such terms have no place in such a document and provide no scientific rationale for proceeding with the project.

"In summary, no environmental reasons have been found why TRU waste (the waste slated for WIPP) could not be left at the Idaho National Engineering Laboratory stored as it is for several decades or even a century," says the SEIS. In light of this, why all the rush to open WIPP without safety documentation?

Analysis of the environmental and economic impacts of the "No Action" alternative (leaving the wastes where they are) that the SEIS is supposed to analyze thoroughly is a farce. The SEIS reviews the pros and cons of "No Action" in nine pages! It notes the "downside" of the loss of income to Carlsbad from "No Action," but does not evaluate the economic losses in agriculture, water quality, air quality, land use, and human radiological exposure from a failure of the site itself-- because it says such a failure is "unlikely." Nor does it adequately address the negative environmental, economic and health impacts from a shipping accident. See infra, Part VII.

A more credible hypothetical worst case should be addressed in the D-SEIS than the optimistic scenarios used by DOE to promote a fast-track opening of WIPP.

Finally, the nature and characteristics of RH-TRU wastes are not adequately described in the D-SEIS. In the First Modification of the Consultation and Cooperation Agreement with the State of New Mexico at p. 3, DOE insisted on being able to emplace RH-TRU wastes with "activity levels and characteristics which exceed the transuranic waste characteristics used in the





WIPP FEIS." Those wastes were described as having a maximum surface dose rate of up to 1,000 rem per hour. Those wastes, which DOE claimed in 1984 already existed, are not explicitly discussed in the D-SEIS in regards to their characteristics, specific activity levels, or how they will be transported and emplaced. Indeed, the D-SEIS states that the surface dose rates for RH-TRU wastes assumed now are lower than those used in the FEIS (p. 3-6). This discrepancy must be discussed. Clearly, the potential impacts on public health and safety and the environment are not discussed in the D-SEIS.

**VII. INDIRECT EFFECTS - SOCIOECONOMIC IMPACTS**

A. Need to address Socioeconomic Impacts in the D-SEIS

1. Law and Guidelines

DOE must consider socioeconomic impacts of any proposed major federal action pursuant to the Council on Environmental Quality's (CEQ) Guidelines on federal agencies' implementation of NEPA, 40 C.F.R. Part 1500 (1986) and to established case law.

Section 1502.16 of the CEQ Guidelines lists those project facets which must be evaluated to form "the scientific and analytic basis for the comparisons under sec. 1502.14" [analysis of alternatives] which is the heart of NEPA. Section 1502.16 describes this section of an EIS as one which "shall include discussions of ... (b) Indirect effects and their significance (sec. 1508.8)," and "(g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures."

Section 1508.8 of the CEQ Guidelines defines the scope of indirect effects as follows:

> Effects include:
>
> ...
>
> (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
>
> Effects and impacts as used in these regulations are synonymous. Effects includes [sic] ecological (such as the effects on natural resources and on the components, structures and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social or health, whether direct indirect or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

Case law also affirms that a socioeconomic impact analysis is critical for complete NEPA documentation. Thus, in Stop 3-H





v. Lewis, the District Court found that the federal agency must take a hard look at the socioeconomic impacts of a project in the EIS. 538 F. Supp. 149 (D. Hawaii 1982). An appellate court decision growing out of the same controversy held that an EIS must analyze the relationship of the project to affected local land use plans and discuss how the project would conform or conflict with the objectives and specific terms of such plans, policies and controls. Stop 3-H Association v. Dole, 740 F.2d 1442 (9th Cir. 1984). While in Stop 3-H the issue was consistency with local land use plans, the fact that the Court focused on whether the major federal action was consistent with affected plans and policies means that in the context of WIPP, DOE must examine whether and how the entire WIPP project, including the shipping campaign, conflicts or conforms to all affected communities plans, policies and controls. Although an EIS need not substitute for necessary community planning devices, it must at least disclose the economic impacts of a project. Concerned About Trident v. Rumsfeld, 555 F.2d 817 (D.C. Cir. 1977). And, such impacts must be "carefully discussed." Rankin v. Coleman, 394 F. Supp. 647 (E.D.N.D. 1975).

See. also, North Slope Borough v. Andrus, 642 F.2d 589 (D.C. 1980) (consideration of economic plusses and minuses of lease sale for oil drilling sufficient to satisfy NEPA); Sierra Club v. Marsh, 769 F.2d 868 (1st Cir. 1985) (omission of secondary impacts, such as industrial growth, a serious omission); Fritiofson v. Alexander, 772 F.2d 1225 (5th Cir. 1985) (must discuss cumulative impacts, defined as those impacts being perhaps individually insignificant, but cumulatively significant); EDF v. Marsh, 651 F.2d 983 (5th Cir. 1981) (EIS must contain info regarding cost/benefits); NRDC v. NRC, 685 F. 2d 459 (D.C. 1982) (EIS inadequate because it omitted description of health, socio-economic and cumulative effects of the project); McDowell v. Schlesinger, 404 F. Supp 221 (W.D. Missouri 1975) (where transfer of an Air Force unit from one community to another would result in significant impacts, including economic impacts, to both areas, NEPA mandates consideration in EIS of effects on both communities.)

2. What the FEIS and D-SEIS actually consider

The FEIS considered "how the authorized WIPP project would affect the social and cultural environment around the Los Medanos site in New Mexico. The analysis deals primarily with Eddy and Lea Counties, which would receive most of the impacts." FEIS, p. 9-44. The several criticisms of that failure to consider statewide impacts in the DEIS were not adequately responded in the FEIS or in the D-SEIS.

The FEIS, section 9.4, examined the impacts on the immediate area as follows:

1. Project Description, Setting and General Impacts, focusing mostly on the influx of jobs during the three year construction phase.

   1.1. General Economic Impacts. How much money would be spent for the construction, preconstruction and post construction operational phases.

   1.2. Other Events with Economic Impact. Relation of WIPP to other local jobs projects and plant openings/closings.

   1.3. Employment. Job prospects, and resulting fluxes in population.

   1.4. Personal Income. Estimation of the multiplier effect of its direct WIPP expenditures.

   1.5. Statewide Economic Impact. DOE's New Mexico-wide expenditures prior to WIPP construction ($76M), and the jobs already created, future state impacts, with two paragraphs and several sentences on jobs and money that might accrue to Albuquerque, but noting the weak economic link between the WIPP locale and Albuquerque.

2. Population.

   2.1. Population growth. Direct and indirect migration.

   2.2. Population within 10 and 50 miles. Same analysis.

3. Social Structure. DOE describes social structure as housing and public services. The agency notes that the only expected cultural impacts might be between the culture of the in-migrant transient workers and those already living in the counties.

   3.1. Sociocultural Impacts within the two counties.

   3.2. Unions.

   3.3. Social Services. No impact predicted.

   3.4. Churches and Other Community Organizations. Little impact because migrants would not join these organizations other than churches.





4. Private Sector. Description

   4.1. Industrial Activity. What will be bought locally (sand and gravel) and elsewhere (all sophisticated equipment).

   4.2. Trade and Services. Predicted to expand significantly during construction and operations phases.

   4.3. Tourism. WIPP's effects found unpredictable.

5. Housing and Land Use.

   5.1. Total Housing Requirements.

   5.2 to 5.4. Carlsbad, Loving and Hobbs housing and land use impacts.

6. Community Services and Facilities. (School districts, water supply systems, waste water and treatment facilities, electrical service, natural gas service, fire protection, police protection, health care, traffic and transportation (to the WIPP), communications services and facilities, recreation and solid-waste management (e.g., room in the landfill).

7. Government (increases in revenues and necessary expenditures, including school district finances).

8. End note on how socioeconomic impacts would change under changed circumstances.

The SEIS also includes an economic impact analysis in section 5.1.2. (SEIS, pp. 5-3 to 5.6.) First the SEIS refers to three sections of the FEIS: 6.6, a one paragraph summary entitled, "Cost of Transporting Contact-Handled TRU Waste to the WIPP" (FEIS, p. 6-19); 6.12, a six paragraph expose on "Financial Responsibility for Accidents" which generally explains the limitations on liability for nuclear accidents set by the Price Anderson Act (FEIS, pp. 6-42 to 6.43), and 9.4 (see above).

Again, the SEIS focuses on Eddy and Lea Counties. It mentions these factors: inflow of federal money, jobs, multiplier effect increases in personal income, the award of the TRUPACT-II assembly contract to a Carlsbad firm, the Dawn Trucking contract, expected new jobs and federal funding, local and state taxes and revenues, and the impacts of decommissioning.

What the D-SEIS does not do is look beyond the Eddy and Lea county area. Nor does the D-SEIS address certain adverse impacts which might occur within that area. A revised and rereleased D-SEIS must do so. Such an analysis would include at a minimum

the same type of evaluations done for the two county area immediately adjacent to the WIPP. For example, this analysis would look at the effects on:

- increases in employment in Santa Fe (both in terms of the bypass and in terms of any chilling effect which letting the trucks roll down St. Francis Drive might have);

- population growth (i.e., avoidance of growth along the transport corridor);

- social structure (i.e., will trucks rolling through town have an effect on any individuals or sociocultural groups locating their businesses in Santa Fe?);

- tourism. Hundreds of "Another Business Against WIPP" signs in Santa Fe and the testimony of numerous people at both the Albuquerque and Santa Fe public hearings are a clear indication that many businesspeople and citizens believe that WIPP transportation and problems with the site could damage tourism, especially in Santa Fe and Albuquerque. Thus, the revised and reissued D-SEIS must acknowledge that such impacts will occur or have an independent scientific study as the basis to show that such effects will not occur.

- housing and land use (i.e., depressed prices or less growth along corridor);

- community services and facilities (i.e., the additional burdens on hospitals and other health care providers to be ready in the event of an accident; other emergency response costs);

- government (more limited increases or even decreases in revenues as a result of being on the route; increased expenditures for emergency response preparedness).

- tribal governments and pueblos along the route were totally ignored in the D-SEIS even though there economies and cultural traditions require a clean environment. Transportation accidents could severely damage tribal life and tourist-based economic activity. The revised and reissued D-SEIS must consider such impacts.

B. The D-SEIS' analysis is inadequate and does not use the best available research methods.

The input-output (I/O) model used by DOE in the DEIS, FEIS, and D-SEIS has been roundly criticized (for example, DEIS and FEIS comments of Southwest Research and Information Center, State of New Mexico DEIS comments, and the New Mexico EMD's study





The Proposed Waste Isolation Pilot Project (WIPP) and Impacts in the State of New Mexico: A Socio-Economic Analysis). DOE's continuing reliance on the I/O model is inexcusable, especially given that its predictions from the early 1980's about direct and indirect employment and economic benefits calculated by that model in the FEIS have been demonstrated to be false in the intervening years. The projected employment peak of "just fewer than 1,300" (FEIS, p. 9-48) never occurred, nor can any number near the projected peak of 1,215 indirect jobs be documented.

The D-SEIS admits that there was an economic decline since the publication of the FEIS (p. 4-2). The I/O model did not predict and cannot evaluate such a decline. Inherently, the I/O model assumes the existing economy is at full capacity, when, in fact, there is substantial "excess capacity" in the Carlsbad local economy which was built up in the "good times" of the late 1970s, but which still exists in an era of higher unemployment. For example, there is available housing stock in Carlsbad, which means that the new revenues from new housing predicted by the I/O model will not occur. Another example: according to the New Mexico Department of Taxation and Revenue, retail trade gross receipts in Carlsbad in 1981 (the year WIPP construction began) were $151,193,000. In 1987, the retail trade gross receipts in Carlsbad were $141,580,000, a drop of more than 6 percent. (Is that the "stabilizing effect on the local economy" mentioned in the D-SEIS (p. 5-3)?)

Looking at the actual economic picture instead of the I/O predictions, then, it is clear that the existing retail businesses in Carlsbad have the capacity to expand to meet any new activities from WIPP operations without the development of new enterprises; the predicted multiplier effects reported in the D-SEIS and based on the I/O model are simply not going to occur. For additional fallacies in the I/O model, DOE should review the comments of Dr. Ronald Cummings, attached in Appendix C, and the oral and written comments of Lee Reynis, Ph.D., given at the June 14 D-SEIS public hearing. Together, this evidence shows that virtually none of the supposed "indirect and induced" economic benefits listed on p. 5-5 of the D-SEIS can be substantiated.

If DOE were really interested in having accurate calculations of actual economic impacts in Eddy and Lea counties, it would have collected data on workers and their spending patterns during the past 8 years of construction. For instance, real data could have been collected on in-migration of temporary and long-term workers (did they bring their families, buy or rent housing, make purchases locally or send money to their previous home communities, participate in social and community organizations, use existing community services, etc.?). Instead, DOE refused to collect such data and conduct such studies, so

the socioeconomic documents referenced in Chapter 5 do not have the data necessary to calculate actual direct economic benefits or to calculate realistic indirect benefits using "real world" multiplier effects. Thus, one finds yet another instance of where DOE has created the very information gap that weakens its NEPA analysis by its own inaction, contravening the spirit of NEPA in a way unimagined by the drafters.

Besides not collecting actual data on the supposed economic benefits of WIPP to Carlsbad, DOE also has not done surveys to determine whether WIPP has caused economic detriments to the local community. For example, has WIPP been a reason that hundreds of people have moved out of Carlsbad over the last eight years? No surveys have been taken to determine whether tourists have foregone visits to the area because of concerns about WIPP, or whether retirees have decided to settle elsewhere because of concerns about WIPP. Further, DOE has not researched whether tourism may be curtailed in the future or whether retirees may forego staying in or moving to Carlsbad once WIPP opens because of concerns about the site and waste transportation. The D-SEIS does not mention these issues, yet, as the joint commentors have already noted several times, ignoring them does not make them go away.

A further serious problem with the socioeconomic analysis in the D-SEIS is that it totally ignores technical developments in the field during the past eight years. Was this glaring omission caused by incompetence, ignorance or malice? In any case it is hard to explain, given that DOE's Office of Civilian Radioactive Waste Management has been very much involved in funding some of those studies. Because of the obvious interest and importance of socioeconomic impacts of nuclear waste disposal, in 1980 DOE funded the National Academy of Sciences Panel on Social and Economic Aspects of Radioactive Waste Management to study major issues related to repository siting and transportation and to describe the status of expertise in the field. The NAS study was published in 1984 -- Social and Economic Aspects of Radioactive Waste Disposal -- a seminal report never referenced in the D-SEIS and apparently one of which the D-SEIS authors are totally unaware. As a first step, DOE must read that report and develop an entirely new approach to conducting socioeconomic research and analysis related to WIPP.

DOE could find further guidance in how to structure a new and meaningful socioeconomic analysis for WIPP from the socioeconomic impact work being done regarding the proposed Yucca Mountain high-level waste repository site by the State of Nevada's Nuclear Waste Project Office. Attached in Appendix C is a list of 20 socioeconomic reports published by that office, several of which are relevant to WIPP and should be considered in the revised and reissued D-SEIS. In addition, DOE also should





review a paper presented at the 1989 AAAS Annual Meeting in San Francisco, California, entitled "Forecasting the Adverse Economic Consequences of a Nuclear Waste Repository in Nevada," by Howard Kunreuther and Paul Slovic. (That paper is also available from the Nevada Nuclear Waste Project Office.) That paper focuses on quantifying and evaluating perceived risks of a repository, potential impacts of perceived risk on tourism in Nevada, and includes the results of surveys done in Phoenix, Arizona and of corporate executives nationally in April, May, and June, 1988. The surveys found that the most common images associated with an "underground nuclear waste storage facility" were "dangerous, "death," "negative," and "pollution." Such negative images have very significant implications regarding the potential for people to stay away from locations having such a repository. In surveys of convention planners discussed in the Kunreuther and Slovic paper, such images and any transportation accidents were shown to substantially reduce the number of conventions that would be held in Las Vegas.

DOE must admit now that negatives images also could apply to WIPP, that the D-SEIS must address the impacts of such negative images and any transportation accidents which could substantially reduce tourism in Santa Fe or other parts of New Mexico. Further evidence of the validity of people's negative images and concerns about WIPP, including impacts on tourism, were the statements of many people testifying at the public hearings in Albuquerque and Santa Fe. The revised and reissued D-SEIS must analyze such negative images and the potential negative impacts of WIPP and waste shipments, both in the local area and statewide throughout New Mexico.

Additional relevant socioeconomic impact analyses that must be considered and applied to WIPP include the studies done by the Texas Department of Agriculture in 1985 through 1987. Those reports include Panhandle Residents' Views of High-level Nuclear Waste Storage, Economic Effects of a High-level Nuclear Waste Repository: A Survey of Businesses in Deaf Smith, Oldham, and Swisher Counties, Agricultural Brief: The Texas Panhandle and the Proposed High-level Nuclear Waste Repository, and Effects of a High-level Nuclear Waste Repository on Local Communities: A Survey of Texas Panhandle Residents. Dr. Cummings' letter in Appendix C also mentions some new developments.

C. The D-SEIS fails to consider negative economic data.

The SEIS speaks in glowing terms about the economic benefits that will accrue to the Carlsbad area of southern New Mexico. Not surprisingly, the DOE did not include negative economic data as required (except that which would result "should WIPP not open"), DOE has ignored its responsibility to analyze and present alternative data, negative though it may be.

A major radiological release would have far-reaching consequences. Although perhaps difficult to estimate, the D-SEIS should have included some analysis or estimate of this type of impact. A model for such estimates does exist; NRC used it for estimating the financial consequences of an accident during the course of spent nuclear fuel transportation in 1977.

If cancer cases result from long-term/low-dose exposure to radiation, as the Petkau Effect discussed above in part VI.A suggests, what will the costs be? Treatment for a typical cancer case costs about $100,000 to $150,000. Just a hundred such cases would then cost $10 million to treat. Long-term/low-dose exposure also results in immunodeficiency, manifest as multiple health and hormonal disorders and chronic fatigue syndrome. What are the potential costs to individuals, families and the work force?

The SEIS makes no reference to potential costs of mitigation or retrieval techniques should WIPP fail to meet its mandate of effectively isolating radionuclides from the environment. Costs of certain operational measures which may ultimately be required (for example, removing or grouting badly fractured sections of Marker Bed 139, the layer 3 feet below the disposal area, identified as a likely brine migration pathway) are neither estimated nor mentioned.

Fear of a nuclear spill can damage the social fabric of a community, adding an additional burden on the societal infra-structure. Additionally, victims of radiological and toxic contamination must live in constant fear for their future health. The costs--financial, psychological and other--to our society of upcoming generations of young people growing up in constant fear, pessimism and distrust are inestimable. A belief in the ability of our environment to sustain healthy life is a crucial requisite for a solid society with a future.

The D-SEIS fails to evaluate the negative economic impact of a significant release of radioactivity from the site--the value of the potential loss of farming, residential, urban or industrial lands, both in the immediate region and as far away as the Pecos/Rio Grande valleys of Texas; the economic loss posed by contaminated aquifers and local soils; and the economic impact of contminated air in the WIPP site region. These factors represent a much more realistic economic "downside" than any presented in the SEIS, which the document should evaluate, but does not.

The D-SEIS analysis even ignores economic data that does not support its proposed action from the Congressional Budget Office (CBO) -- which DOE knows about. On August 8, 1988, the CBO submitted a budget estimate for a 5-year delay in WIPP's opening until compliance with EPA standards is demonstrated. That





analysis showed that such a delay would "reduce planned expenditures by about $80 million over the 1989-1993 period" (H. Rept. 100-867, Part 1, p. 35). The revised D-SEIS must include such savings to taxpayers in its analysis of socioeconomic impacts.

D. The D-SEIS fails to consider any socioeconomic impacts outside WIPP's environs.

There will be no actual or perceived economic benefit to communities in the 23 states along the WIPP route except for the money spent by truck drivers buying food and gas. (Since DOE anticipates that Dawn Trucking's drivers will work in teams and the cabs will be equipped with sleepers, there will be no generation of income from drivers purchasing lodging except when trucks are taken out of commission.) By contrast, there may be significant adverse economic impacts.

For example, most communities in central and northern New Mexico, especially Santa Fe, are heavily dependent on the tourism industry, estimated to exceed $2.5 billion statewide. Tourism is the lifeblood of New Mexico. A WIPP truck accident, with or without a spill, at any location in New Mexico may have an immediate and devastating effect on the financial security of all New Mexicans, due largely to negative international publicity which may keep tourists away. (Tourism is projected to be off 40% in Alaska as a direct result of the Exxon-Valdez oil spill.)

Proximity to the WIPP route may result in a decline of investor interest, economic development and a decline of a communities municipal bond rating (Santa Fe is A+ at this time), thus damaging the ability of a city to meet medium and long-term financial obligations.

Property values along a WIPP route may suffer due to buyers preference for non-adjacent properties. The Santa Fe Board of Realtors now recommends a WIPP disclosure statement to potential sellers. This possible decline in property values may have a damaging effect of the value of real estate loan portfolios held by regional banks and savings and loan associations.

The D-SEIS predicts there will be 8.3 deaths and 106 injuries resulting from the truck transportation of wastes to WIPP. What will the costs be to society, the work force and the affected families? What will the increase in health care and health insurance costs be to individuals or populations along the WIPP route? The D-SEIS does not even ask these questions.

Given that taxpayers foot the bill for all DOE activities -- both making messes and cleaning them up -- all of the costs

listed hereinabove must be assessed in a proper NEPA evaluation of DOE's proposed TRU waste disposal system.

E. The discussion of socioeconomic impacts of the No Action alternative is inaccurate and inadequate.

The improper analysis just discussed is once again manifest in section 5.5.2, regarding socioeconomics of the No Action Alternative. In addition to the unsubstantiated and overblown "guestimates" about positive local economic benefits, the D-SEIS erroneously states that there is decreased activity in potash mining. In fact, in 1988 and 1989, both employment and production in the potash industry have been increasing substantially. The free trade agreement with Canada makes it likely that the recession of the mid-1980s in the potash industry will not recur in the next few years.

The subsection fails to calculate the savings to the taxpayers if the No Action Alternative is selected. Such savings would certainly be greater than the $960 million total personal income calculated to be lost to the local economy. Savings would include both costs at the facility and from eliminating transportation costs. Immediate savings would include, for example, not paying the 5-year $10-million contract to Dawn Trucking, unless DOE has agreed in the contract to pay for services not rendered. Also, limiting the number of TRUPACTs manufactured -- if they are certified by the NRC -- to only those needed to transport wastes from Rocky Flats to INEL (if that continues to be DOE's policy) would create additional savings.

The D-SEIS admits that there is no estimate of the costs at other facilities of not using WIPP (p. 5-169), so DOE has not calculated either the savings to the federal taxpayers (and the multiplier effects of such increased consumer income) or the potential economic benefits to the local economies at the ten facilities from some increased spending related to on-site storage. And, of course, DOE has not calculated any economic costs or benefits for the unmentioned reasonable alternative of constructing a surface storage facility.

In summary, section 5.5.2 is incomplete and grossly inaccurate in its discussion of the socioeconomics of the No Action Alternative, both related to the local economy and regarding the economic impacts at existing or alternative sites, as well as disregarding benefits to the federal taxpayers.





**VIII. Inadequacies in the Transportation Assessment**

The D-SEIS states that there will be over 34,000 shipments to the WIPP from 10 generator or storage facilities. About 8600 will start at Rocky Flats (averaging to 430 per year); an additional 11,200 (560 per year) would travel through Colorado on I-25 on their way to the WIPP from either the Hanford Reservation in the State of Washington or from INEL. Thus, Colorado's I-25 corridor through Denver, Colorado Springs and Pueblo will see an average of 990 shipments annually for the next two decades. This compares with zero shipments of TRU waste along this highway now.

A. Shipping Containers

1. CH-TRU Waste

Earlier this year, DOE submitted an application for certification of its CH TRU container (the TRUPACT II) to the Nuclear Regulatory Commission (NRC). To obtain certification, DOE must demonstrate to NRC that TRUPACT-II is built to certain design specifications and that it is capable of withstanding four severe accidents. The four accidents are (1) impact -- a 30 foot drop onto an unyielding surface, (2) puncture -- a 40 inch drop onto a pin six inches in diameter, (3) thermal -- a 30 minute all-engulfing fire at 1475 degrees, and (4) immersion -- an eight hour submersion under three feet of water.

DOE's application was based on doing several sets of three of these tests (except immersion) on actual, full-scale TRUPACT-IIs. After several redesigns, in late April 1989, DOE sent to NRC what it claims are final test results showing that the TRUPACT-II now meets all NRC standards. It will take NRC several months to verify DOE's claims.

The problem is that, in the D-SEIS, DOE finally concedes a point which environmentalists have been arguing for years, that "the dominant accident effect [for truck shipments] is crush rather than impact." Draft SEIS, page D-65; emphasis added. What this admission means is that, despite the fact that DOE has done all that it needs to do for NRC certification, DOE has not tested the container for the critical type of accident which TRUPACT is likely to encounter in shipping. These joint commentors submit that unless and until DOE performs crush tests on the TRUPACT-II that it has not demonstrated the container's safety nor assessed the full environmental impacts of its WIPP transport program. A revised and released SEIS should report on the results of such tests. In addition, DOE should explain why other possible accident tests (propone engulfment, multiple drop or contusion) and why testing with simulated, gas generating wastes have not been performed.

The joint commentors also understand that DOE has only completed tests on one TRUPACT-II prototype, the version that will handle 14 55-gallon drums. The other TRUPACT-II prototype -- for shipping boxes -- has not yet been tested. Even though the outside design, including both containment levels will not change based on what form of waste containers there are inside the TRUPACT, for the purpose of establishing whether those internal packages will break open and whether wastes inside will be broken or pulverized, DOE must perform tests with each of the waste container types it plans to ship in TRUPACT-IIs. The draft SEIS does not mention testing for this second version of the TRUPACT-II, nor does the draft SEIS discuss how DOE intends to move the old boxes presently stored at INEL to the WIPP, given that the those boxes will not fit into a TRUPACT thereby requiring either that DOE repackage that waste into new boxes or build a third TRUPACT-II version to carry them. A revised and released D-SEIS should discuss DOE's plans for receiving certification and constructing all of the different TRUPACT-II designs, in addition to addressing the need to repackage wastes for transport.

Examination of the TRUPACT-II Safety Analysis Report (SAR) does show very detailed quality assurance and quality control (QA/QC) procedures for the container, which procedures DOE assumes will catch any mistakes during the loading or testing of TRUPACTs. But, the QA/QC procedures are more complex and entail more human involvement than those typically seen even from spent fuel containers. These joint commentors seriously question the likelihood that so many steps in packaging will be followed for the hundreds of containers to be manufactured or the thousands of shipments needed to move the waste. Surveys of spent fuel and plutonium packaging have found human errors, some of them potentially quite serious, so their implications should be examined here as well.

The TRUPACT-II SAR, while exemplary in its thoroughness and level of analyses, reveals a container design requiring very careful handling, and a waste categorization process with many requirements for perfect human judgment and flawless record-keeping. DOE has not demonstrated the necessary organizational acumen for handling a waste disposal process of this magnitude, and simply maintaining oversight will be an ordeal. Particularly in light of recent information revealed by the FBI in the Rocky Flats affidavit, it was hard to take seriously DOE's assertion that its "adherence to federal environmental regulations" would guarantee that the non-radiologic hazardous wastes would be properly handled and recorded.

2. RH-TRU Waste

Three percent by volume of the waste bound for WIPP has been categorized as remote handled (RH) TRU waste, which means that





the waste contains more significant quantities of radionuclides that emit beta and gamma radiation and thereby pose different problems for waste handlers. Personnel involved in moving RH-TRU waste must be shielded from the waste and are expected to "handle" such waste by robotics under remote control. Most RH-TRU wastes are produced at the Oak Ridge National Laboratory in Tennessee. Despite the low volume percentage of RH-TRU wastes, because the shipping containers will each carry a much smaller amount of waste in a single shipment, from all sources, RH-TRU shipments will account for 8000, or more than one fifth, of the expected 34000 truck shipments to WIPP.

Although the SEIS deals with both CH and RH wastes, TRUPACT-II is only designed to ship CH wastes, so there are no QA-QC procedures to examine for handling the RH waste and therefore no way to judge their effectiveness. In fact, DOE has yet to build or test an RH-TRU waste shipping container, much less to submit an application to NRC for its certification. Nonetheless, in the draft SEIS, DOE projects the radiologic risks associated with RH-TRU waste transport, assuming that any RH-TRU waste container will perform perfectly according to design standards. Obviously, in the view of the joint commentors, DOE has again put the cart before the horse and is simply not ready to make the environmental assessment that it has for this component of waste transport. Prior to completion of the final SEIS, DOE should build and test an RH-TRU container; otherwise, DOE will have to do another EIS supplement when it is ready to begin shipping RH-TRU waste, despite the illegal segmentation of environmental impact assessment which that scenario may entail. Recognizing that DOE is unlikely to hold up the opening of WIPP until it has a certified container on hand, (and without endorsing or approving of DOE's legal right to proceed in that fashion) at the very least, DOE should include in a revised and rereleased SEIS, a realistic risk assessment of shipping accidents involving an RH-TRU container, which assessment accounts for the probability of human error in container construction, maintenance and operation.

The RH-TRU waste shipments are particularly important for the Interstate 40 (I-40) corridor from Oak Ridge through Tennessee, Arkansas, Oklahoma and Texas. In fact for that route, more than 93% of all the projected 7,261 shipments will be RH-TRU. The D-SEIS is grossly deficient in not calculating route specific data, especially in Texas, and for not calculating bounding case accidents for accidents with RH-TRU wastes for Oklahoma City or Amarillo.

B. RADTRAN -- general analysis of transportation impacts

To assess the radiologic and nonradiologic risks associated with the transport of nuclear waste by truck, DOE has long used a computer model entitled RADTRAN. Although the model, developed at the Sandia National Laboratory in the mid 1970s, has been modified to respond to certain criticisms, there are still ways in which a RADTRAN analysis does not accurately inform the public about the risks associated with nuclear waste shipping. Each of the problems mentioned below should be corrected prior to releasing a revised D-SEIS

1. The probability of a radiation release from a TRUPACT accident is relatively low. The containers are built to withstand severe accidents and they will most likely not breach except under catastrophic conditions or in the event of serious human error. Because RADTRAN calculates radiation doses by multiplying a series of fractions, including the likelihood of an accident with a release occurring, the model results essentially mask the consequences of such an accident. See, e.g., SEIS p. D-57. While the "answers" which RADTRAN produces are correct in way, DOE should include in its discussion a more complete description of what these answers really mean.

Think of the Valdez oil spill. One accident in 9,000 tanker trips over 12 years sounds, or only one in 28,000 barrels of oil spilled, like a great safety record. But is that statistic meaningful in the context of what that one accident was? Yet, 11 million gallons in one massive dose, suggests a different environmental impact than the reality of 11 million gallons at one time.

2. One of the inputs into the RADTRAN model is the population density along the corridor route. This figure is an estimate for the number of people who would potentially be exposed to an airborne plume of radioactivity in the event of a severe accident. (SEIS, p. D-43) RADTRAN divides the world into three levels of population along the shipping corridor -- urban, suburban and rural. To qualify as an urban area, the population must equal or exceed 3861 people per square kilometer (pers/km). Anything less than that density -- i.e., 3850 people per square kilometer -- qualifies as suburban. Thus, only two percent (through Denver) of the 874 mile route between Rocky Flats and WIPP qualifies as urban; the remainder RADTRAN calculates on the basis of the suburban population (719 pers/km) while anything less than that number is rural (six pers/km).

Does this truly reflect the I-25 corridor? More importantly, does it reflect the I-25 corridor as the population grows over the next two decades? The answer is no; the use of the lower figures obviously underestimates the radiation dose





expected from WIPP shipments. To compensate in a revised and rereleased D-SEIS, DOE should modify its RADTRAN runs to reflect increases in population density, correlated with accident rates, along the shipping corridors as projected in state forecasts for the next 25-30 years. The Department should at least revise the key to Table D.3.6 so that rural population is defined as from 0 to 718 pers/km, suburban is 719 to 3860 pers/km and urban is equal of greater than 3861 pers/km. Better, however, would be for DOE to revamp the manner in which it inputs population density, preferably to use actual data, or at least data which more accurately reflects conditions in metropolitan areas.

44

The urban population density which DOE has used is roughly 10,000 persons per square mile. In NRC's 1977 analysis, the Commission used a figure of 40,000 inhabitants per square mile. DOE should explain why it rejected that figure, particularly given that TRUPACT-II shipments from Lawrence Livermore Laboratory will pass through Los Angeles.

3. The effects of human error on a probabilistic risk assessment like RADTRAN are almost impossible to predict. This is because one can do an experiment to determine how much pressure it will take to break a piece of metal, but there is no firm number as to how often a human being will make a mistake. Moreover, there is a possibility of human error at virtually every point along the chain of events leading to an accident. Thus, there could be an error in TRUPACT manufacture (e.g., someone forgets to screw in a bolt), and/or an error in TRUPACT maintenance (e.g., someone fails to lubricate a seal or notice a crack in an O-ring) and/or an error in TRUPACT operation (e.g., someone improperly fastens the TRUPACT to the truck bed or incorrectly closes the lid).

Nonetheless, for the purposes of the RADTRAN analysis done for this D-SEIS, DOE assumes that TRUPACT has been perfectly built, operated and maintained such that it would only fail in the event of an accident exceeding design criteria. For details regarding the potential for human error in TRUPACT-II manufacture or operations, see infra. While it is true that some human errors will be detected through, e.g., loading procedures, DOE must use the SEIS to postulate the full range of such vulnerabilities and consider the consequences of those that could compromise container integrity. Ideally, were DOE to do so, it would discern alterations to design and/or procedures that could eliminate the need to assume the possibility of such errors.

As it stands, however, the results, which essentially factor human error in as zero, simply ignore life in the real world. Not only is there a long history of error in the construction and maintenance of spent nuclear fuel containers, despite the fact that no accidents have occurred, but a risk assessment which

ignores human error is likely to underestimate risk by several orders of magnitude. For example, a rough calculation of the chances of a Chernobyl-type accident occurring estimate that one such accident would occur during 10 million reactor years of operation. The Chernobyl accident, where human error compounded human error, actually occurred after 300 reactor years.

If it is truly impossible to perform a meaningful risk assessment that reflects the probability of human error occurring in construction (half of the NAC-1 spent fuel containers had valves installed incorrectly -- is that representative of Type B container construction?), maintenance or operations, then DOE must at least address the issue in the text of a revised and rereleased SEIS, explaining that the radiation doses that RADTRAN does project are likely to underestimate actual doses. Even though the D-SEIS is a definite improvement over its predecessor document, as is the TRUPACT-II design much better than its forebear, neither measures up against the demands of a reality in which people are fallible, and it is human, not mechanical, error that has been shown to be the most likely avenue for a serious radiological release.

4. A particularly troubling opportunity for human error involves the content of the waste package. While care appears to have been taken to define possible combinations of waste that could lead to internal cask damage or dangerous chemical reactions, a loophole of sorts exists with respect to sealed containers of liquids. In general, both the SEIS and the SAR discuss the impact of residual fluid in the waste drums or boxes, assuming it will be held to levels small enough to exert no consequences on the pressure, temperature or containment of the TRUPACT-II. Yet, sealed containers of one gallon or less are allowed as part of the waste. SAR, section 1.2.3.2.2. There is no limit on the liquid materials allowed in sealed containers, the materials used for sealed containers, or the number of such containers which a single drum or box may contain. An inspector checking on the volatile materials content of a drum by air sampling could easily certify the shipment without realizing that a sealed container exists that, if broken, could cause a chemical reaction or release of materials previously bound by solidification. While it is true that DOE intends to x-ray the drums, such examination will only show if a sealed container exists and not what the contents of such container are. If it is a gallon or less, there is no requirement that the x-ray examiner order its removal from the drum for inspection.

If there were no mechanism for damage to the sealed container, this point would be irrelevant. However, full scale tests of the TRUPACT found releases of broken concrete to the cask interior from simulated waste, indicating that it had received an appreciable shock in the drop tests. Glass





containers could not be expected to fare much better. Even if no accident occurred, decay heat could break down such containers, because the SAR shows that a temperature of 334 degrees Farenheit could be reached in the center of a drum, causing some sealed containers to burst or melt. The release of gallons of volatile and/or corrosive materials could have impacts on containment not foreseen by the SAR or the SEIS.

Similar errors could occur in determining incompatabilities of wastes if record-keeping or labeling became careless. In sum, the general implication is that cask integrity has not been shown to occur in all scenarios where potential human error could compromise the stability of container content.

5. Fabrication errors also hold an opportunity for complicating accident consequences. For example, an examination of the QA/QC procedures set forth in the SAR did not find any procedure to verify that the insulation was constant throughout the entire outer containment vessel. Since the temperature of the drums depends on insulating them during a fire, failure to assure continuity of insulation could seriously affect the assumptions of low pressure and lack of combustion on the contents, either of which could affect containment.

6. Although DOE labels as a bounding case the accident described for purposes of what is essentially a worst case scenario analysis, D-SEIS, p. 5-24, in fact it is not, given that DOE assumes the contents of the shipment are an average Rocky Flats generated load. First, there be CH-TRU waste loads which have much higher Curie contents than an average Rocky Flats shipment; thus, for example, the curie content of Hanford's CH-TRU waste is projected to be up to four times higher than Rocky Flats waste. The D-SEIS also projects that the CH-TRU wastes from Savannah River Plant will be 12 times as radioactive as average Rocky Flats wastes (p. B-9), so shipments along the I-20 corridor must be analyzed for both routine and accident conditions with those higher curie wastes. Moreover, DOE must include in a revised and rereleased D-SEIS a bounding case accident for Savannah River wastes.

In addition, the RH TRU wastes are also more highly radioactive and as such an accident which breached one of those casks would be likely to result in more severe radiological consequences. A revised and rereleased D-SEIS should also include an assessment of the potential radiologic release of a Category VIII accident on a TRUPACT-II containing the maximum possible curie load consistent with the WIPP WAC.

7. RADTRAN incorporates the use of eight accident levels described in the draft SEIS as being based on increasing crush forces and length/intensity of fire. Given that the

TRUPACT-II has not been tested for crush, how did DOE determine the likely radiation releases from the container in the event of a crush, as opposed to an impact accident? DOE should explain its methodology in a revised and rerelased D-SEIS.

8. The D-SEIS fails to explain clearly how DOE derived the release fractions it assumed for those accident categories which might result in a release. (SEIS, p. D-68.) For the D-SEIS DOE apparently modified the process used in the TAGR (in which DOE estimated a fractional value of total curie contents released in a category 3 accident and then increased that fraction by an order of magnitude for each accident severity category above category 3) to account for TRUPACT-II's double containment. However, DOE does not explain or reference the explanation for how the additional security of double containment was calculated. What assumptions did DOE make in deriving the fractions? What literature and test data did DOE analyse? These facts should be reported in a manner which would allow for public comment, prior to the issuance of the final SEIS.

Moreover, it would appear that two of the assumptions DOE made in estimating release fractions were incorrect. Not only does DOE assume that a major breach of the Type B packaging system is not credible, but the assumption than a loss of packaging containment would result in a 100 % release to the environment of airborne particulates and aerosols present in the packaging cavity is not conservative given how little what DOE assumes will be released to the cavity in the first place, and their concern only for 10 micron size particles.

DOE appears to have based the values used in the fractions FMAI, FMC and FMAT on only one source of data, namely NUREG/CR-2651, a document that was not subject to peer review and may not be appropriate for use with the type of materials, i.e., mixed hazardous radioactive wastes, being shipped to WIPP. DOE should verify and have independent scientists verify, the applicability of this reference, and/or reference other data sources which confirm these numbers.

Finally, the D-SEIS only examines the respirable fraction released, as though larger particles had no impact whatsoever. While it is theoretically possible that ideal and immediate medical care may be possible near an accident, it is unlikely, particularly with RH-TRU waste, that it will actually occur. Many people inhaling or coming into contact with larger particles may not even know it and therefore not seek treatment. Does DOE plan to round up an entire community and forcibly administer naseopharyngeal examinations and lung washings?

45 | 9. Has DOE ever published a sensitivity analysis for the version of RADTRAN which it used to do the risk assessment in





45 | the draft SEIS? If not, DOE should make such an analysis part of a revised and rereleased D-SEIS.

10. DOE asserts that the probability of an accident exceeding design criteria is less than 0.5 %. What data base did DOE use to derive that figure -- the total number of reported accidents in the United States? the total number of accidents involving trucks in the United States? the total number of accidents involving loaded semi-tractor trailers? an extrapolation from previous accidents with nuclear materials?

11. DOE relies upon a Transport Index (TI), D-SEIS, p. D-45, for the source term used in RADTRAN's calculation of radiation exposures to persons in proximity to TRUPACT-II shipments. How DOE derived the TI for each generator/storage site is not well explained in the draft SEIS. For example, DOE states that the TI depends, inter alia on waste self shielding; does this take into account the steel of steel drums in which the waste is packaged? Elsewhere, DOE avers that it is not taking credit for any protection which the Type A package may contribute, but for the TI, there would obviously be a difference between the TI for the same waste stream were it packaged in a steel drum versus being packaged in a wood box.

Second, there would appear to be variables that are not presented in Appendix D for DOE to have calculated the TI's used. For example, if one looks at the Curie content of Hanford's wastes and compare the TIs, there does not appear to be any obvious reason why the TIs are so different.

Average Curies (Grams) in Trailer Load of TRU waste

| Radionuclide | CH | RH |
|---|---|---|
| PU-238 | 8.1 ( 0.46) | 0.63 ( 0.03) |
| PU-239 | 35.1 (561.60) | 3.85 (61.60) |
| PU-240 | 12.5 ( 55.00) | 1.96 ( 8.62) |
| PU-241 | 636.0 ( 5.59) | to be determined |
| PU-242 | -- | 0.06 (15.60) |
| Transport Index | 0.7 | 16.00 |

12. DOE makes excessive use of averaging to smooth out curves in plotted data. By overdependence on averages, moving averages and moving weighted averages to smooth out data curves, DOE effectively hides the possible impact raw data would have on the D-SEIS findings. It is well known that averages can be deceptive, be used to present data that is misleading in a form designed to support a predetermined goal.

13. Here, as elsewhere in the D-SEIS, DOE makes excessive use of assumptions that have little or no basis in fact. For example, "the population at risk ... is assumed to be that which resides within about 0.50 mile on either side of the transportation route" and "in about a 1000 sq. km in the downwind dispersion pattern." D-SEIS, p. 5-19. Dispersion, however, is a function of volume, wind direction and velocity, as well as numerous other factors. It cannot be assumed that one half mile represents a boundary limit when dispersion could, in fact be up to 50 miles or more on the windy, semi-arid mesas of the inter-mountain west or the western plains.

C. Routine Operations

DOE admits that there will be radiation exposure to the public through the TRUPACT-II transportation container, even during routine operations. D-SEIS, p. 5-9. However, "direct radiation exposures to [TRUPACT-II] truck drivers, to members of the public driving alongside a waste shipment, to the roadside population and to people in the parking lots where stops are made are estimated" are not calculated. Why has DOE not made the necessary calculations for the SEIS? DOE cannot hide behind a lack of existing information and use its own, unsubstantiated estimates when its personnel or contractors could calculate the likely exposure levels during routine transportation operations. In light of the fact that mounting scientific evidence exists for the proposition that there is no "threshold" level below which health effects will not occur, it is all the more important to fix what these "insignificant" doses are. In addition, given that there will be exposure to these different populations, DOE is required by the CEQ guidelines to examine the availability of mitigation procedures, something it has failed to do in the D-SEIS. Finally, the D-SEIS does not explain the discrepancies regarding incident-free nonoccupational risk as calculated on pages D-59 and D-83. Why are incident-free person-rem exposures higher than for accident exposures?

D. Maximum Credible Transport Accident Release

As part of its assessment of the risks from WIPP shipments, DOE examines the potential environmental impact of the worst accident it can conjure up, which in this case involves TRUPACT colliding with two oil trucks in an urban area under unfavorable atmospheric conditions. However, what sounds like it could produce a horrendous situation turns out, under DOE's assumptions to be relatively benign. In addition to the assumption regarding the absence of human error (which leads to an assumption that the TRUPACT has been perfectly built, maintained and operated and





will perform as designed), DOE also makes another suspect assumption that effectively limits the scope of the "worst" accident.

According to the draft SEIS, this worst, or "bounding", accident results, in a release of only 0.02% of the radioactive contents of a TRUPACT. DOE defends this absurdly low number using two assumptions. First, DOE assumes that the largest credible breach in the container would be a puncture hole so small that not enough oxygen could enter the TRUPACT to sustain a fire (and a fire is necessary to volatilize the plutonium thereby putting it into a respirable and thus dangerous form). Second, DOE assumes that with an all-engulfing fire, not enough oxygen could enter the TRUPACT because all oxygen around the container would be used in the outside fire. With no oxygen inside, there would be no fire inside and no volatilization of the plutonium and thus, no significant release of radioactivity. In its revised and rereleased D-SEIS, DOE should include a bounding accident scenario where the container fails as a result of faulty construction, maintenance or operation.

The D-SEIS assume that 0.02% of the respirable radioactive contents will be released under the worst case scenario, almost all of which is due to the impact event. There are two typographical errors in the D-SEIS which confuse the calculations; more seriously, however, DOE has erred in its derivation of several of the factors used to develop the release fraction.

The typographical errors exist on pages D-69 and D-71. The first involves the formula for the thermal release fraction. It should read:

46

Thermal release fraction = FAT ((FMC x FMAC0 + FMAT x FMRPT))

The second error involves the accident severity for categories five through eight, as shown under the values for the parameter, FMPRI. The number "0.0" is shown, but the proper number (which appears to have been used in the actual calculations) is "1.0" as may be seen on page D-73, Table D.3.19.

47

With regard to the derivation of the fraction of accidents involving a thermal event (FAT), DOE has forgotten that it is supposed to be examining a bounding scenario. Given that context, the rate of accidents involving a fire cannot be averaged over all accident categories (yielding 1/7 x 10E-2) but rather should be 1.0 for category VIII accidents. That is, DOE must assume a full fire occurs in this scenario, instead of assuming that 1.7 x 10E-2 fires would occur. By itself, this change does not materially affect the 0.02% fraction, since it is heavily dominated by the impact, rather than the thermal event.

In addition, the fraction of material consumed by combustion (FMC) would be considerably higher if any gallon containers (as postulated above in subpart 5) were to burst -- due either to decay heating or to a puncture-instigated leak -- and be ignited by the thermal event. Once again, however, even altering both of these fractions would not double the total respirable release.

There is a third avenue of release, on the other hand, which could materially influence the fraction of release for respirable, and larger, particles. The leakage of a volatile organic, such as xylene or methanol, from a sealed container could create an explosive mixture with the air in the inner cavity, which could be ignited by a surface made hot due to decay heat. The resulting explosion could perform several functions ignored by the SEIS analysis:

- breach the container at its seal due to overpressurization, thereby opening a much greater avenue for release to the environment;

- rupture many of the drums or boxes, exposing a much greater surface area to dispersal by rapid depressurization;

- ignite much of the exposed contents, thereby releasing particles via combustion.

There is a need to examine the potential for such an event. Similarly, DOE did not analyze the potential for volatilizing organic compounds from sledges, due to decay heating, which could also lead to formation of an explosive vapor mixture. Compounds such as xylene would undoubtedly find their way out of a slurry if heated above 300 degrees Farenheit. DOE must consider these possibilities and adjust the SEIS accordingly.

Two other major components of the bounding accident scenario which remains wholly unexplained in the SEIS are the emergency response assumptions which DOE used and the costs for clean up of such an accident. (In fact, the draft SEIS is silent as to the costs generally of the transport system. See, infra.) Even if DOE were correct in its calculations that no fatalities would result from the bounding accident, the costs of decontamination could still be enormous. Other analyses, notably NUREG/CR-0743 have established the importance of this aspect of risk assessment; the D-SEIS is deficient without it. Given that traditional NEPA analysis requires the agency to consider indirect impacts, including the costs of an action, this information should be included in a revised and rereleased D-SEIS, but only after DOE has made its cost figures available for public comment and review.





E. Transport Modes

DOE's own calculations show that fewer fatalities and less of a radiation release would result were DOE to maximize shipments by rail. See, e.g., SEIS, pp. D-58 and 59. In the 1980 EIS, DOE was preparing to send 75% of the wastes to WIPP via rail and DOE did in fact built a rail spur into the WIPP site. Then, however, DOE changed course; the Department now intends to send all shipments by truck because there are two generator sites without rail access and because DOE would have more "control" over the transport system if it were truck based. Draft SEIS, p. 3-14. The obvious question raised is how is DOE balancing safety with "control" to reach a decision that "control" is more important than safety?

DOE must also explain why it chose to use antiquated and irrelevant truck accident data compiled by the NRC in 1977, well over a decade ago. Given that DOE's switch from train to truck transportation is one of the two most significant changes in its WIPP transportation analysis, DOE cannot base critical assumptions on outdated sources. DOE's contention that "recent national estimates of truck accident rates are not available," D-SEIS, p. 5-35, is simply not credible. There are a variety of data bases available to DOE, including insurance company statistics, the various transport and motor carrier associations and current data from individual states. It represents an attempt to sidestep their responsibility to use fully modern information system accessible to anyone. DOE must compile from these existing sources and use in the SEIS reliable, impartial and independent truck accident statistics for the late 1980s.

This approach would also appear to be inconsistent with DOE's preferred transportation scenario for the WIPP's sister repository, the spent fuel and high level waste disposal facility which DOE wants to build at Yucca Mountain Nevada. There, DOE has said that it would like to move all wastes to Nevada by dedicated train. If dedicated train is the best plan for those wastes, why is it not here? A revised and rereleased D-SEIS should set forth the calculated risks and exposures for dedicated trains, should discuss DOE's change of modal mix in more detail, should explain why DOE has chosen a less safe mode, rejecting almost without comment the use of dedicated trains, and should detail what mitigation DOE has included, given the choice of a modal mix other than the least risk alternative.

F. Inconsistencies with Other DOE Documents

The results of RADTRAN are based on many different input parameters, but clearly critical to the calculations are the number and radioactive content of shipments. The SEIS contains

new numbers in both categories from those which were published in the 1987 revised TAGR or in the many view graphs which DOE has used in presentations to the Southern States Energy Board,the Western Interstate Energy Board, the Rocky Flats Environmental Monitoring Council and other groups over the last two years. Even worse, the D-SEIS in internally inconsistent.

Combining both CH-TRU and RH-TRU wastes, the D-SEIS estimates that a total of 14,509 train shipments would occur over WIPP's 25 year life. D-SEIS, p. S-15. Yet, the D-SEIS also reports a figure of 18,506 train shipments at pp. 5-17, 5-18 and D-47, as well as a figure of 18,505 at p. D-90. A difference of 4,000 shipments is significant. The revised and rereleased D-SEIS should use the correct number throughout.

As for the numbers reported in the D-SEIS versus those reported elsewhere, several examples follow. As recently as 1987, DOE predicted that there would be over 500 shipments annually from Rocky Flats to WIPP. Then, DOE decided to install a supercompactor for wastes at the Plant to achieve volume reductions so that the number of annual shipments would drop to approximately 120 during an average year. Additionally, DOE has recently informed the citizens of Colorado that the Plant has instituted other measures to reduce waste volumes by at least one third in an effort to minimize the volume of new wastes for continued shipment to Idaho prior to the commencement of operations at WIPP. Yet, the number of shipments set out in the draft SEIS is 430 average per year. Given that various reduction plans may have a direct impact on the average radioactive content of Rocky Flats shipments, DOE must clarify in a revised and rereleased D-SEIS how it has estimated Rocky Flats volumes over the course of the next 20 years.

An important corollary discussion would examine what effect these waste reduction scenarios has on the expected average Curie content for loads from Rocky Flats. DOE must also explain why it has chosen to pursue installation of a supercompactor at Rocky Flats, but not at INEL, given that the waste there is the same type of waste (most of it having been generated at Rocky Flats) and given that, at least with respect to the boxes stored there, DOE currently anticipates having to repackage them so that they fit into a TRUPACT-II. As long as the packages will be reopened there is no reason not to employ supercompaction technology.

Another problem which DOE has created for the public by the methods it used to prepare the D-SEIS is that "direct comparisons of doses and risks reported in the FEIS to those reported in this SEIS cannot be made because of the differences in the assessment methodologies and the method of expressing dose. D-SEIS, p. 5-15. In updating an FEIS, DOE must provide for meaningful public participation in the review of the Supplemental EIS.





Where DOE has used a more accurate or sophisticated method for estimating doses and risks in the D-SEIS than was available in the FEIS, DOE should correlate the two methodologies by offering a correcting factor or at least an explanation. Otherwise, DOE cannot comply with the NEPA-based requirement of providing a meaningful opportunity for public review and comment.

G. The Trucking Contract

DOE has awarded a contract to Dawn Trucking, a small New Mexico company, to haul all WIPP-bound wastes during the first five years of WIPP operations. Dawn Trucking has never handled hazardous materials in commerce. The company's qualifications for the contract appear to have been that they are a New Mexico business, that they submitted the low bid, that they promised to bring their operations into conformance with the contract requirements (e.g., by obtaining for the first time the requisite level of bonding), and they had experience with something radioactive, namely they moved uranium mill tailings on open flat bed trucks between their original site and a permanent disposal site over a private road. There is, however, virtually no relationship between the uranium tailings job and hauling plutonium contaminated wastes in TRUPACT-IIs along the interstates.

The first five year contract was also signed prior to DOE's determination that its preferred action would involve a five year test phase. (SEIS, p. D-4.) Has DOE revised or does DOE intend to revise that contract based on the limited number of shipments (3% or less of the waste by volume) during that period?

The D-SEIS asserts, at p. 3-16, that the trucks will have governors, but does not say what the speed limit will be. Absent the imposition of penalties for tampering with the governors, how can DOE assume that the governors will remain in place for the life of the shipping campaign?

In the draft SEIS, DOE explains that Dawn must meet all applicable federal regulatory requirements for the transport of nuclear materials on the highways. (SEIS, p. D-4.) However, the draft SEIS is silent regarding DOE's agreement with Dawn over compliance with state regulations or local ordinances, even as to those rules which have been upheld either by the Department of Transportation or the federal courts as consistent with the Hazardous Materials Transportation Act. DOE should address this point in a revised and rereleased D-SEIS by affirming that it will direct Dawn (and its successors and assigns) to comply with all state regulations and local ordinances that have not been found to be inconsistent with the Hazardous Materials Transportation Act. In addition, DOE should set forth what

penalties Dawn and/or individual drivers will receive in the event that they do not follow assigned routes or other local routing regulations.

It is the joint commentors' understanding that Dawn Trucking does not employ union drivers. Such firms tend to have significantly less protection for their employees in the event that an employee or employees seek to object to poor working conditions, or working conditions which are inconsistent with their contract. The D-SEIS does not address the issue of safeguards for whistle blowers working for Dawn Trucking employees. A revised and rereleased D-SEIS should correct this oversight and explain how DOE intends to ensure that Dawn drivers will be able to raise safety issues in a timely manner so that such issues may be resolved before they lead to an accident.

Although DOE reports in the D-SEIS that its contract with Dawn requires that TRUPACT trailer drivers must have two years of experience driving large trucks (D-SEIS, p. D-7), there is no requirement that the drivers have any experience hauling hazardous or route-controlled quantities of radioactive materials. The contract should be modified to add this requirement prior to issuance of the final SEIS.

H. Tracking System

DOE is proud of the satellite tracking system it intends to use to follow trucks in transit to WIPP. With such a system, DOE claims, there is no need for on-the-ground escort because DOE will know at all times where the trucks are, whether they are moving and whether they are on course. The problem with the system lies in the fact that DOE personnel are not going to be the first emergency responders in the event of an accident. How does DOE intend to notify first responders in a timely fashion in the event of an accident? Moreover, given DOE's historic reluctance to make accident information public, what independent mechanism exists to ensure that DOE in fact notify the appropriate state and local agencies in a timely manner when an accident occurs?

DOE has indicated that it will make its tracking system available to the states, but this offer is chimeric unless a state is willing to buy a dedicated computer line to monitor the system; otherwise, the state must rely on DOE notification of an unusual occurrence. DOE should address in its revised and rereleased D-SEIS what assistance it intends to give the states so that each corridor state can afford to purchase a dedicated line for the LORANS-TRANSCOM system over the 25 year life of the project.





48

What arrangements has DOE made, or does DOE intend to make, to deal with a failure in the tracking system, whether it ceases to function due to technical, satellite or other problems? Under such circumstances, would DOE halt all shipments, and if not, how will DOE notify states about shipments en route and how would DOE be able to respond to accidents or incidents? What documentation exists for the statement on page 3-16 that tests have been conducted to verify the effectiveness of TRANSCOM? If such tests have already been successfully conducted, why are such tests also necessary for the operational demonstration tests proposed during the first five years?

I. Emergency Response

1. Training

The problem with the WIPP transportation system is how to keep the thousands of potential first responders all along the shipping routes ready, trained and equipped over the course of the 20 year project, especially when there are likely to be very few accidents. DOE has committed to doing continuous training for the life of the project, but only in New Mexico. D-SEIS, p. C-2. Yet, according to GAO testimony given at a June 12, 1989 house oversight subcommittee hearing, most emergency response offices surveyed did not feel prepared. Furthermore, even the commitment DOE has made includes no provision regarding DOE's supplying New Mexican emergency responders with the equipment necessary to detect radiation leaks or to protect themselves in the event of an accident. Also, DOE has made no effort to train hospital staffs in communities along the WIPP route to ensure that they are equipped or otherwise ready to respond to the emergency urgent care needs of potential victims of radiation exposure resulting from a radioactive release. So far, there has been one set of training sessions conducted along the Rocky Mountain corridor and those were in the spring of 1988. That is simply not enough. Finally, to the extent that all training is based upon DOE's bounding accident scenario, such training is per so inadequate due to the unrealistically optimistic assumptions about radiation releases which DOE has made (as described above).

According to the Amarillo Daily News of May 24, 1989, emergency response personnel along I-40 received training that there would be a total of 3,000 shipments and that 97 percent of those shipments would be alpha-emitting wastes. In fact, the D-SEIS says that there would be more than 7,200 shipments and more than 93 percent of those shipments would be RH-TRU emitting beta and gamma rays. DOE should discuss these serious discrepancies and describe what sanctions will be imposed for their contractors performing inaccurate emergency response training and what safeguards will be put in place to assure that future training is more realistic and accurate.

2. Evacuation Plans

In the D-SEIS, there is no indication that DOE has formulated, or has helped the states, tribes or local governments formulate evacuation plans in the event there is a significant radioactive release from a WIPP-bound shipment. The WIPP transportation route includes many miles through both large and small communities, often by roads in close proximity to community centers, schools, retirement centers and hospitals. DOE has failed to provide for the eventuality of emergency evacuation and chosen instead to rely upon existing, or in most cases, non-existent civil defense plans. DOE must provide evacuation assistance, funding and planning to every community along the WIPP route; the SEIS should explain how DOE intends to accomplish this goal.

J. Routing

Although DOE describes the routes which the draft SEIS used in assessing the risks associated with transportation of TRU wastes to the WIPP, as the Department correctly notes, route selection is traditionally the choice of the carrier, so long as the choice fits within DOT's and the states' regulatory restrictions. From the description of DOE's contract with Dawn Trucking, it does not appear that DOE has altered this allocation of responsibility for the WIPP shipping campaign. D-SEIS, p. D-4. If that reading is accurate, DOE should explain in its revised and rereleased D-SEIS why the contract does not include a clause obligating Dawn Trucking to choose the routes which DOE describes in the D-SEIS.

Similarly, the draft SEIS does not describe what, if any, agreement DOE reached with Dawn regarding where the carrier drivers may stop for food and refueling. Will drivers be limited to stopping at truck stops or other facilities with direct highway access where it is unnecessary to traverse neighborhoods? The SEIS should address this concern, because, particularly in the north Denver residential area bisected by I-25, citizens have a right to know whether trucks they see in their neighborhoods are acting legally and according to their contract.

49 The draft SEIS mentions that WIPP-bound trucks will stop primarily, if not only in CCC designated parking areas, in the event that they are temporarily pulled out of service or unable to proceed due to weather or other unavoidable conditions. (SEIS, p. D-8). Where are the CCC parking areas? A revised and rereleased SEIS should include a map indicating the location of all such designated areas.





The C & C Agreement notwithstanding, New Mexico has yet to designate Route 285 as an alternate route for transport of highway route controlled quantities of radioactive material. (SEIS, p. D-13). How does DOE intend to instruct Dawn to proceed in the event that New Mexico does not formally designate the route prior to the time that the WIPP begins receiving waste? A revised and released SEIS should discuss DOE's anticipated solution.

The D-SEIS does not address the route between Los Alamos and the WIPP because of the possibility that an interstate bypass will be built to avoid sending trucks through Santa Fe. Has DOE committed not to shipping any TRU wastes to the WIPP until such time as a bypass is built? If so, the final SEIS should specify where DOE has made that commitment; if not, the final SEIS should address shipments from Los Alamos to the WIPP over existing roads as well as discuss the schedule for construction not only of the Los Alamos - Santa Fe bypass, but also of those bypasses promised around Roswell, Hobbs, Artesia and Carlsbad.

The D-SEIS states that the routes discussed are only "general proposed routes," p. D-13, and assumes a wide range of shipping distances, p. 3-22. Given these concessions, how can DOE assume that the specific routes shown on p. 3-20 will be used? In fact, the routes described on pp. D-34 to D-36 are frequently different from those shown on the maps. For example, the description always assumes wastes coming on I-40 will use US 54 in New Mexico, whereas the map never shows that highway being used. Which is correct? The D-SEIS p. D-36 states that no wastes will come from Lawrence Livermore during the 5 year test phase, but the draft Test Phase Plan, p 3-5 asserts that such wastes will arrive at WIPP during those first five years? Again, which is right? Did the D-SEIS calculate Lawrence Livermore wastes coming during the first 5 years for the purposes of analyzing transportation risks during the test phase? The traffic segment analyses for Savannah River, Argonne and Oak Ridge contain no data for Texas, alleging instead that it is "to be determined". D-SEIS, pp. D-104, D-105 and D-113. A revised and rereleased D-SEIS must analyze Texas-specific data.

Since December 1982, DOE has agreed to upgrade highways in New Mexico, and since July 1987 DOE has agreed to support funding for bypasses around several New Mexico cities. A revised and rereleased D-SEIS must analyze potential differences in the number of accidents and predicted radiation releases if the bypasses are built. Such document should also discuss why DOE agreed to construct a bypass around Hobbs, New Mexico, a city which is not on any of the transportation routes shown on the map on page 3-20 or the routes described on pages D-34 to D-36. The joint commentors suspect that the Hobbs bypass is included in clear anticipation of wastes coming through Texas on US 62-180.

The D-SEIS must discuss what safeguards Texans have that that highway will not be used. A revised and released D-SEIS must also discuss why DOE will use neither I-27 nor US-60 as alternative routes.

A revised and reissued D-SEIS must also discuss what alternative routes are available if the routes specified on page 3-20 are unavailable because of construction, bad weather or other problems. If those routes are unavailable, will all waste shipments to WIPP on those routes be stopped? If not, what routes will be used? Who will decide when and which alternative routes can be used? When does DOE expect to publish a comparative analysis of the risks and accident data for potential alternative routes?

K. The Implications of Mixed Waste Transport

At least 60% of the waste destined for WIPP is transuranic waste mixed with hazardous materials, including chemicals, solvents, heavy metals and decomposing organic materials. In the D-SEIS, DOE has failed to show how they intend to comply with federal requirements for transportation and disposal of these dangerous mixed wastes under RCRA. Not only must DOE shippers obtain and carry the proper manifests, which of course can only be given if and when WIPP becomes a designated facility under RCRA, but DOE must placard the wastes in a manner which will allow emergency responders to know what materials, in addition to radionuclides might be present in the event of a release during transport.

The D-SEIS reports contradictory figures as to the quantities of mixed wastes destined for WIPP. Page 5-60 shows that between 75 mg/kg and 150,000 mg/kg of trichloroethylene are in Rocky Flats wastes, yet page 3-10 shows no trichloroethylene. A revised and rereleased D-SEIS must correct these discrepancies.

L. Double Shipments

The D-SEIS ignores the transportation risks associated with the possibility that WIPP may fail to meet the EPA's long term isolation requirements in 40 C.F.R. 191, subpart B, either because DOE is allowed to emplace waste prior to demonstrating full compliance with the EPA standards in advance, or because DOE finds that WIPP will meet the standards in advance of waste emplacement but such assurance turns out to be in error. Due to the decomposition of waste which will occur during emplacement or "experiments," the risks of shipping the wastes back to generator, storage or new, above-ground holding facilities will be equal to, if not greater than the initial risks of transportation, given that possible dose rate commitments to the





public could be double the initial estimates. In any event, returning wastes in the event of a failure at WIPP must be considered in a revised and rereleased D-SEIS.

M. Economic Impacts

The D-SEIS ignores the potential adverse economic impacts to communities along the WIPP route, affected by WIPP only as a result of transportation through their borders. Clearly, there will be few, if any, economic benefits to these communities. In addition, certain stretches of the WIPP transport corridors are heavily dependent on tourism; for example, the industry in New Mexico is estimated to bring $2.5 billion to the state annually. A WIPP truck accident, with or without a spill, at any location in New Mexico, may have an immediate and devastating effect on the financial security of all New Mexicans, due largely to negative international publicity. (According to figures widely reported in the media, tourism in Alaska is expected to fall by 40% this year as a result of the Exxon Valdez oil spill.)

Even absent a spill, mere proximity to the WIPP route, with the inherent possibility that a release could occur, may result in a decline of investor interest, economic development and slippage in a community's bond rating, thus damaging the ability of a city to meet medium and long-term obligations. In addition, property values along a WIPP route may suffer due to buyers preference for non-adjacent locales. (Already the Santa Fe Board of Realtors has recommended to agents that they disclose proximity to the WIPP route to prospective buyers.) Such a decline in property values may have a damaging effect on the value of real estate loan portfolios held by regional banks and savings and loan associations.

**IX. FLPMA**

The D-SEIS states that the BLM is a cooperating agency and that BLM will consider all comments received. D-SEIS, p. 1-8. However, the D-SEIS does not detail what actions BLM is supposed to take in its role except mentioning that DOE has filed for an "administrative withdrawal of the WIPP site acreage." D-SEIS p. 10-7. Apparently, the action requested by DOE is that BLM approve the administrative withdrawal. Because the totality of these comments clearly show the gross inadequacy of the document for a permanent land withdrawal, we will not discuss that issue further herein.

In part II.D, the joint commentors described why we believe that, as a legal matter, the requested administrative withdrawal cannot be approved and why only an act of Congress can allow waste emplacement at WIPP. Below, we turn to the technical inadequacies of the D-SEIS, should BLM decide nevertheless to consider DOE's application. Specifically, these comments address two issues: the expansion of DOE's exclusive use area and BLM's role in approving the test phase plan.

A. Exclusive Use Area

Public Land Order 6403 set aside 640 acres for DOE's exclusive use. DOE is requesting now that BLM more than double that area, to 1453.9 acres. 54 Fed. Reg. 15815 (April 19, 1989). Neither the D-SEIS summary, nor the purpose and need for the supplement, pp. 1-4 to 1-5, even mention this expansion as a major change from the FEIS appropriate for discussion in the SEIS. The D-SEIS merely states that, "DOE has proposed to expand this exclusive use area to include 1454 acres." D-SEIS, p. 2-3.

The D-SEIS provides no adequate explanation for the proposed expansion, so on its face the document does not provide an adequate basis to support such a significant change. In the land use discussion, p. 4-3, the D-SEIS states that only one section (the Exclusive Use Area) has been substantially changed. Yet, the D-SEIS provides no discussion of the environmental impacts of this expansion on vegetation, wildlife, air quality, cultural resources or recreational uses. The only direct references to adverse impacts are one sentence on p. 5-6 and brief discussions pp. 7-1 to 7-3 and p. 9-2. Apparently, DOE wants to expand the fenced area at WIPP from the current 250 acres to 1454 acres, but there is no explanation of why such an enlargement is necessary. Nor has DOE explained why WIPP security reguries a six-fold increase in the fenced area. Nor has DOE illuminated for the public or for BLM what additional buildings or activities would take place within such an enlarged secured area. All of those issues must be addressed in a D-SEIS to provide an adequate basis for BLM to consider an administrative withdrawal.





Thus, the proposed expansion has not been justified for the current operations, for any Test Phase, or for permanent disposal. The impacts of such an expansion have not been assessed, mitigation measures have not been analyzed, nor have any alternative arrangements for the existing 640 Exclusive Use Area been considered. Therefore, no expansion of the Exclusive Use Area can be approved based on the analysis in the D-SEIS.

B. BLM's Role in Approving the Test Phase Plan

DOE's administrative land withdrawal application requests that the existing withdrawal be extended through June 29, 1997 "to conduct an operations and experimental program, and for retrieval of the waste, if necessary." 54 Fed. Reg. 15815. The D-SEIS does not contain a schedule of activities consistent with that request. The D-SEIS briefly describes a test phase of "approximately 5 years" emplacing up to "10 percent of the TRU waste by volume." D-SEIS, p. 3-21. In its brief discussion of waste retrieval, pp. 2-14 to 2-15, the D-SEIS does not discuss how long retrieval may take. The FEIS stated that retrieval would take five to ten years after a decision to retrieve was made. FEIS, p. 8-49. Thus, BLM has no basis to approve an administrative land withdrawal lasting until 1997, since it is not clear that the Test Phase experiments and waste retrieval could be completed within that time frame.

Moreover, there is no discussion of how BLM could effectively play any role during the Test Phase. The D-SEIS does not analyze how BLM could oversee the Test Plan, let alone enforce requirements it might set on activities during that period. There is no indication in either the D-SEIS or the draft Test Phase Plan that BLM even has any role in evaluating the adequacy of the plan. Yet, as manager of the land, BLM must retain such a role.

There are other questions that DOE must address in a revised and rereleased D-SEIS. How should BLM decide if the Test Phase is successful? How can BLM ensure that retrievability can occur at all, let alone during the period of time DOE has requested for administrative withdrawal? What authority does BLM have to require Idaho and Colorado to accept waste retrieved from WIPP? If wastes could not be returned to the generating facilities, what BLM (or other) land could be used for storage? What is BLM's expertise in monitoring nuclear waste transportation? By its failure to have addressed any of these issues, the D-SEIS implicitly assumes that BLM has no management or oversight role in the Test Phase. Such an assumption is consistent with the need for a congressional land withdrawal through which DOE would obtain exclusive control over the land, but it is inconsistent with an administrative land withdrawal in which BLM would retain jurisdiction over the site.

If DOE in fact agrees with the joint commentors that congressional land withdrawal is the only type of withdrawal that can permit emplacement of waste, DOE should withdraw its application to BLM and stop wasting that agency's time and resources. If, on the other hand, DOE insists on pursuing an administrative withdrawal, then DOE must both answer those questions and present BLM with all reasonable alternatives for consideration in order for BLM to decide whether to grant an administrative withdrawal. Such alternatives should include, at a minimum: (1) instigation of a two-year test phase consistent with the existing administrative withdrawal, and (2) no waste emplacement at WIPP without a congressional land withdrawal. Absent those corrections to a revised and rereleased D-SEIS, BLM does not have an adequate basis on which to approve the requested withdrawal extension for six years.





**X. INADEQUACIES IN THE D-SEIS REGARDING THE EPA RADIOACTIVE WASTE REGULATIONS**

There are three important issues which the D-SEIS fails to address adequately regarding the application of the EPA radioactive waste standards to WIPP. First, what are DOE's obligations under Subpart A? Second, when must DOE demonstrate compliance with Subpart B? Third, what are the applicable Subpart B standards in light of the First Circuit decision? Moreover, there are major technical deficiencies in the D- SEIS discussion of compliance with EPA standards, as presented in Chapter 5. Finally, there are also concerns about the 10,000-year control period that should be addressed in the D-SEIS.

A. Subpart A Applies to All Waste Management and Storage Activities at WIPP

In the D-SEIS, DOE states that "[b]ecause the WIPP will not be a disposal facility during the Test Phase, Subpart A technically does not apply to the Test Phase." D-SEIS at 10-9. DOE has voluntarily committed itself to complying with Subpart A upon receipt of waste at WIPP. However, the Department's position that it is not obligated to do so is flawed and raises the possibility that DOE will withdraw its commitment in the future.

The Department's position reflects an interpretation advanced in 1987 by Sheldon Meyers, then Director of the EPA Office of Radiation Programs. In testimony on October 12, 1987 before the Subcommittee on Public Lands, National Parks and Forests of the Senate Energy and Natural Resources Committee, Mr. Meyers stated that Subpart A does not apply until "DOE's decision to convert [WIPP] to a disposal facility."

Under this view, DOE could manage and store an unlimited amount of wastes at WIPP without compliance with Subpart A until the Department decides that emplacement of wastes at the facility constitutes "disposal" under 40 CFR 191. DOE's interpretation is contrary to both the letter and spirit of the regulations. Under 40 CFR 191, Subpart A applies to "management" of wastes, meaning "any activity, operation, or process ... conducted to prepare ... waste for storage or disposal ... ." 40 CFR 191.02(m) (emphasis added). This language indicates that even if, as DOE may contend, initial emplacement of transuranic (TRU) wastes at WIPP constitutes "storage," rather than "disposal", any activities involving the waste prior to emplacement constitute "management" subject to Subpart A. When DOE is managing or storing wastes at a geologic repository, Subpart A applies regardless of whether the repository is actually being used for disposal at a particular time.

Subpart A is designed to protect the public from radiation doses above specified levels resulting from the management and storage of high-level and transuranic radioactive wastes. Mr.

Meyer's interpretation, if adopted, would subvert this intent by allowing unlimited exposure of the public, pursuant to Subpart A, to radioactive wastes stored at WIPP until some unspecified point in the future when DOE makes the subjective determination that WIPP is a disposal facility. The public must be protected from radiation exposure from management and storage of radioactive wastes at WIPP whether or not waste is actually being emplaced at a given time and whether or not such emplacement constitutes "disposal."

B. DOE Must Demonstrate Compliance with Subpart B Prior to Any Emplacement of Wastes at WIPP.

It is clear from the D-SEIS that DOE interprets the EPA radioactive waste standards to allow it to emplace large quantities of wastes in the WIPP facility prior to demonstrating compliance with Subpart B. See, e.g., D-SEIS at 10-10. DOE's view reflects an interpretation advanced by Mr. Meyers of EPA (see above), who stated in a July 24, 1986 letter to Mr. Robert H. Neill, Director of the State of New Mexico Environmental Evaluation Group (EEG), that DOE's use of WIPP as an experimental facility constitutes "storage" rather than "disposal" under the EPA standards. According to this view, DOE would have to demonstrate compliance with the Subpart B disposal standards only when the Department "declares its intention to use the facility for disposal, without any intention of recovery ... ." This is likely to occur in the mid-1990's or later when a substantial amount of wastes will already be emplaced in the repository.

This position, that waste can be emplaced prior to demonstrating compliance with Subpart B, is simply incorrect. According to EPA, Subpart B "must be implemented in the design phase for [a] ... disposal system[ ] because active surveillance cannot be relied on" in the future. 50 Fed. Reg. 38070 (September 19, 1985). Thus the agency has stated that Subpart B is "needed for modeling repository performance which would generate information relevant and appropriate to the decisions that will be made by the implementing agencies," i.e. whether to allow waste emplacement. The performance of the repository must be analyzed to "provide a reasonable expectation" that the facility as designed will meet the quantitative release and exposure limits in Subpart B. 40 CFR 191.13(a). This is demonstrated through a "performance assessment," -- essentially a computer model "which estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events." 40 CFR 191.12(q). The repository must also be judged against "assurance requirements" in Subpart B which provide a qualitative backup to the numerical limits. These analyses must be accomplished before waste emplacement occurs in order to ensure that the goal of the





standards -- minimizing adverse effects on human health and the environment -- is achieved.

The fact that DOE holds out the possibility of retrieving TRU wastes from WIPP at some time in the future does not change the fact that the objective intent of WIPP is the permanent disposal of wastes. Retrieval of emplaced TRU wastes would occur only if WIPP fails to contain the wastes or other problems develop. This is identical to the situation at DOE's planned geologic repository for commercial and defense high-level wastes, where compliance with Subpart B will be demonstrated prior to any waste emplacement. As at WIPP, DOE will monitor the performance of the NRC-regulated commercial repository following waste emplacement and remove the wastes if problems develop. In fact, the Nuclear Regulatory Commission's licensing regulations require that the repository be engineered so that wastes are readily retrievable for fifty years. 10 CFR 60.111(b).

WIPP is described under the original authorizing legislation as a "research and development facility to demonstrate the safe disposal of radioactive wastes," P.L. 96-164. However, the only "experiment" DOE is really conducting with TRU wastes is actual emplacement with no intention of recovery unless problems develop. The emplacement of the first gram of TRU waste at WIPP will be done with the intent of permanent disposal. This intention might not be realized if problems develop, but it is DOE's intention nonetheless. The fact that DOE may later make the extremely unlikely decision to retrieve the emplaced wastes does not change the objective fact that the purpose of waste emplacement from the start is disposal and not storage. Demonstrating compliance with Subpart B prior to any waste emplacement is therefore required and in fact will reduce the chances that the wastes will have to be retrieved after disposal by insuring that DOE has developed a safe and environmentally sound facility.

Disposal of TRU waste at WIPP is distinct from a secondary activity DOE had originally intended to carry out, and which would be properly described as experimental. Under DOE's original plans, "[i]n addition [to disposal of TRU waste], WIPP [was to] include an experimental facility for conducting experiments on defense wastes, including small volumes of defense high-level waste. The high-level waste used for experiments [was to] be retrieved and removed from the site prior to decommissioning of the WIPP facility." 46 Fed. Reg. 9162 (January 28, 1981) (emphasis added).

Subpart B is the only independent regulatory check on the safety of the WIPP site for the disposal of radioactive wastes, especially since WIPP is exempt from Nuclear Regulatory Commission oversight. Emplacement of waste in WIPP before demonstrated

compliance with Subpart B will subject present and future generations to the very risks the standards were intended to prevent. The fact that DOE may at some point in the future apply Subpart B to WIPP does not change the fact that in the interim large quantities of dangerous wastes could be emplaced in a system never judged to be safe under any objective set of criteria. Moreover, if the repository is ultimately determined not to meet the Subpart B standards, modifying it while wastes are emplaced or attempting to remove the wastes may be technically infeasible or prohibitively expensive.

C. DOE Must Demonstrate Compliance With the Repromulgated Subpart B Standards Prior to Waste Emplacement.

Since DOE must demonstrate compliance with Subpart B prior to waste emplacement, the critical question is: what are the applicable standards in light of the First Circuit decision? In the second modification of its Agreement on Consultation and Cooperation with New Mexico, DOE committed to continue planning for a performance assessment of WIPP "as though the provisions of 40 CFR 191 effective November 19, 1985 remain applicable." D-SEIS at 10-10. However, DOE must ultimately comply with the repromulgated Subpart B prior to any waste emplacement.

Subpart B is intended to limit human exposure to and contamination of the environment from radiation resulting from disposal of radioactive wastes. The First Circuit found that Subpart B failed to protect human health and the environment as stringently as mandated under the Safe Drinking Water Act. It simply cannot be the case that while the EPA is attempting to bring the standards into compliance with the more protective requirements of the SDWA, the DOE can emplace wastes under the weaker standards found to be invalid by the First Circuit. Demonstrating only that WIPP complies with the vacated standards would permit contamination of ground water and exposure of individuals to radiation at levels greater than allowed under the Safe Drinking Water Act.

Mr. Meyers of EPA, in his July 24, 1986 letter to the New Mexico Environmental Evaluation Group, implied that while the EPA radioactive waste standards are being repromulgated DOE can emplace wastes without demonstrating compliance with any standards. This is a disturbing conclusion. Subpart B was vacated and remanded for failure to comport with SDWA's stricter standards. Where the repromulgated regulations are required to be stricter than the ones they replace, it cannot be that the Court intended the interim period to be a "free-for-all" for parties and projects otherwise subject to the regulations.





D. The D-SEIS does not properly assess the likelihood of non-compliance with repromulgated EPA standards.

Chapter 5 discusses two basic long-term release scenarios which "are expected to bound potential impacts" (p. 5-109). Two cases purport to evaluate the long-term performance of an undisturbed repository, and four cases purport to evaluate the hypothetical intrusion of a borehole. The D-SEIS analysis shows that in two of the four intrusion scenarios the invalidated EPA standards would be exceeded. In Case IIB, the EPA standards are exceeded by 2.5 times even when "potential treatments/engineering modifications are postulated" (p. 5-109). Thus, DOE's assumption in the D-SEIS should be that in order to meet newly promulgated EPA standards, treatment and engineered barriers will certainly be required and even with such modifications the site may not meet the standards.

Given such an assumption, the revised and reissued D-SEIS must have a detailed discussion of what treatment technologies in addition to compaction and what engineered barriers in addition to the bentonite backfill might be required. As is described in part XI.C. various waste treatment technologies should also be analyzed for their ability to reduce uncertainties and improve confidence of compliance with EPA disposal standards.

As already discussed in Part VI.C., there are various additional release scenarios that must be considered. Examples of such scenarios include the one described by Dr. Bob Watt at the June 16 hearing, the two borehole intrusion scenario postulated by the EEG (in EEG-11), and intrusion scenarios beginning with the presumed loss of institutional control 100 years after closure. It appears that some of those scenarios, even without changes in other parameters and assumptions, will result in release rates significantly higher than those calculated in the D-SEIS. The revised and reissued D-SEIS must include consideration of those scenarios.

The "slurry hypothesis is hastily dismissed because it is "not considered credible." (p. 5-124). Such a dismissal is inappropriate in light of the Scientists Review Panel evaluation of data regarding brine (see Appendix C), the NAS WIPP Panel's suggestions for further tests on brine inflow, and the fact that even DOE's own Draft Test Phase Plan includes experiments on brine inflow. Thus, the brine inflow parameters are clearly not conservative. The revised and reissued D-SEIS should calculate the amount of brine inflow that would be required in order to create a slurry that could lead to releases in excess of the limits set by the Safe Drinking Water Act, describe experiments that will be done to better quantify the amount of brine inflow, and discuss possible treatment, backfill, or engineered barriers that could be used to reduce those releases.

Gas generation estimates cannot be considered conservative in light of the large orders of magnitude uncertainties about the various processes and amounts of gas that will be generated. No scenario with a significant buildup of gas, which could result in a large, more explosive release, is considered. DOE has at times suggested the use of "gas getters," but the specific type, their effectiveness, and their synergistic effects with brine are not mentioned in the D-SEIS. In the revised and re-issued D-SEIS, such factors must be included in possible release calculations.

The characteristics of the Rustler aquifer -- including flow rates and fracture frequency -- are highly uncertain and the values assumed in the D-SEIS are not conservative. For example, the values assumed for Culebra flow in EEG-32 are higher than those used in the D-SEIS. The revised and reissued D-SEIS must use the highest possible values for the Culebra, so that the fastest possible ground water travel time is assumed. Finally, the D-SEIS itself admits that the calculations are not a "defensible, probabilistic-performance assessment" as required by 40 CFR 191 (p. 5-162). Also, some of the analysis of the scenarios is missing and garbled. See, pp. 5-138 to 5-140.

E. Neither the D-SEIS nor the draft Test Phase Plan describe experiments that will produce reliable data for an adequate performance assessment.

The D-SEIS has virtually no concrete discussion of the specific activities that will be included in the five-year test plan. There is also inadequate discussion of what information will be developed, how such data will be used in performance assessment calculations, what kind of quality assurance program will be in place to validate data, and what period of time will be necessary to gather and adequately interpret data. Since no test plan existed at the time of preparation of the D-SEIS, it comes as no surprise that such necessary details are not included -- as they must be -- in the D-SEIS. The amount of wastes that DOE has maintained that it needs for the test phase plan has ranged from 15 percent of WIPP's capacity to less than one percent for performance assessment purposes. The fact that DOE has maintained for more than two years that it needs to emplace wastes at WIPP for experimental purposes, but still has been unable to develop a consistent, justifiable test program is itself testimony to the fact that the program is nothing more than a ruse to get WIPP open.

Although the D-SEIS states that "any waste brought to the WIPP ... would remain fully retrievable" (p. 3-21), there is no support for this statement. And given the fact that two rooms at WIPP have been closed after having been mined less than five





years ago, it is certainly conceivable that retrieval cannot or will not be carried out because of worker exposure and costs. The D-SEIS must include a discussion of these issues.

If a test plan with waste emplacement is implemented, and if the determination after 5 years is that the site does not comply with the repromulgated EPA standards, the D-SEIS says that three options will then be considered (p. 2-15). Each of these options is premised on some "fix" in order to use WIPP as a permanent repository rather than admitting that the site may not meet the revised EPA standards.

The D-SEIS suggests that the wastes at WIPP during the test phase can be stored there for more than the five years (p. 2-15). The D-SEIS does not calculate worker exposures, exposures to the general public, or costs associated with such "storage."

The draft Test Phase Plan released on April 26 and supplemented on June 16 with an addendum, also does not provide the discussion and analysis necessary to determine whether in fact data essential for the performance assessment will be developed. The draft test plan itself admits that the "detailed plans" necessary to implement the plan still have not been developed (p. ES-1).

The draft test plan will not result in useful, reliable data on gas generation, which is the specific factor that DOE maintains requires in-situ experiments. It is not possible to use an open, operating repository for three to five years to approximate a closed repository's performance for 10,000 years. The WIPP ventilation system, atmospheric changes and operational activities will combine to prevent collection of valid data. Inadequate room seals, continuing creep and fracturing of the surrounding marker beds and clay seams will result in continuing dissipation of gas during the test phase, so no useful data on gas generation can be collected through such in-situ experiments (see also Appendix C and statement of Dr. Bob Watt at the June 16 public hearing).

F. The D-SEIS does not adequately discuss how DOE will demonstrate compliance with 40 CFR 191, Subpart A, or the assurance requirements of Subpart B.

The D-SEIS does not include an analysis of how DOE will demonstrate compliance with Subpart A and the assurance requirements of Subpart B. Such an analysis also does not exist in any other DOE document. Even though the Second Modification of the Consultation and Cooperation Agreement between the State of New Mexico and DOE required DOE to prepare a detailed plan to show compliance with Subpart A and the assurance requirements of

Subpart B, such a plan does not exist and the steps to show such compliance are not included in the D-SEIS.

Compliance with Subpart A should also be included in the Final Safety Analysis Report but the draft FSAR version referenced in the D-SEIS does not contain such a demonstration. Given DOE's past agreements with the State of New Mexico and its own position that it does not need to emplace any wastes to show compliance with Subpart A or the assurance requirements of Subpart B, such a demonstration should be completed prior to the release of the revised D-SEIS so that such compliance can be analyzed in that document.

G. Some Implications of a 10,000-year control period for WIPP.

A ten thousand year control period, stipulated by the Environmental Protection Agency, has been the yardstick against which WIPP's long-term performance has been discussed and evaluated in all DOE documentation to date. While some critics have suggested that this is too brief a control period (after all, the plutonium at WIPP will still retain some 60% of its radioactivity after 10,000 years of decay) others question the validity of attempting to predict how any human endeavor -- experimental or otherwise -- will fare over such an immense span of time.

In essence, DOE's plans and documents for WIPP have simplistically assumed an unrealistic continuity for many factors which will decisively affect the viability of the project, e.g. local hydrology, geology, seismic activity, population levels, land and water use, and climate. Moreover, the documents completely fail to assess cultural shifts which will doubtless occur and which might play an equally crucial role in the fate of the site and its deadly contents--politics, national borders, governmental systems and bodies, technology, resource levels and uses, language and record-keeping, etc.

In all fairness, a thorough analysis of potential hydrogeologic shifts in the WIPP area over the next 10,000 years would be a lengthy and complex undertaking, and indeed many of the affecting factors would be difficult or impossible to predict with any accuracy. The fact that no attempt has been made to analyze these shifts, however, invalidates the D-SEIS as the full evaluation of environmental impacts which it must be under NEPA.

The ongoing hydrologic events of dissolution, collapse, brecciation, cave and sinkhole formation and fracturing may reasonably be expected to accelerate over time, particularly where influenced by the excavation itself or by waste





decomposition and resulting higher temperatures and gas movement. Seismic activity in the area should be characterized and predicted with much more seriousness than the few words it receives in the D-SEIS.

Aquifer recharge rates and groundwater flow rates and directions may be expected to change quite a bit, particularly if climatic changes (constantly occurring in nature) continue to be unpredictably altered by human activity.

Since at this time much is still not known about the extent of the disturbed rock zone, the nature of the rock matrix, the mechanism and rate of salt creep, the permeability of the formations, hydraulic continuity between formations, variability of direction, speed and pressure in the aquifer channels, (as well as the behavior of the waste itself and of various repository features such as shaft seals over time) the future characteristics of the region's hydrology seem very important if meaningful predictions are to be made concerning WIPP's ability to contain nuclear waste.

The 1980 FEIS and 1989 D-SEIS assume no change in population levels in the area over the 10,000-year period. How realistic is this? Should not a "worst-case" release scenario consider the effects of waste migration on a potentially larger area population? Would population growth in the area and changing land use affect water use or the search for precious resources--including water--leading to higher chances of human intrusion into the site?

Is it realistic to assume that technology (energy sources, waste disposal methods, agricultural techniques, mineral exploration, which minerals are considered valuable, etc.) will not develop in unforeseen ways? The D-SEIS assumes no changes in technology.

What about political or governmental changes over the 10,000-year control period? DOE seems to think that our current nation and system of government--barely two centuries old--will endure unaltered. It scarcely needs to be mentioned here that no state or government or system of government in human history has ever survived even a fraction of this period.

The fact that no century has ever passed without major nations of the world changing borders is not considered. We may not expect the Carlsbad area to become part of Mexico through war or land trade; similarly, the inhabitants of many Polish and German towns did not anticipate finding themselves within the Soviet Union, nor did Armenians, Tibetans or Palestinians anticipate the dissolution of their traditional lands.

If the Carlsbad area were to become part of Mexico at some distant, indeterminate time, have any provisions been made to have Spanish- language records of the facility and its boundaries placed in Mexican libraries (since DOE points to library records as a preventive measure against human intrusion at WIPP)? Have the FEIS, D-SEIS and other crucial WIPP documents been issued in Spanish? The answer is no.

And what of linguistic changes? Every human language is a constantly evolving and organic form. Over a few centuries the English language has been completely transformed; speakers of modern English must study Old English virtually as a foreign language. How will DOE documents be understandable to readers centuries hence (if indeed the records survive that long)?

How can the so-called "permanent" markers placed at the WIPP site hope to keep future generations away from the area? Have markers been designed, produced and tested that can stand up to the long+term ravages of sun, wind, erosion, acid rain and vandalism? The D-SEIS does not specify the materials and methods by which such "permanent" markers could be made; nor at what intervals they would be placed, how many there would be in all, or what techniques would be used to secure them. Whether or not the markers can be inscribed with a message--verbal or pictorial--whose meaning will be clearly understandable to people of the distant future is unclear.

And finally, a related question is the contrast between the 10,000-year control period and the paltry 100 years EPA says we can rely on institutional (government agency) prevention of human intrusion into the WIPP site. Indeed, EPA predicts 4.2 human intrusion-induced boreholes through the repository (in the course of mineral exploration) during the control period. Each of these boreholes, penetrating the disposal area and the underlying pressurized brine pocket, would bring to the surface far more than the 15 cubic meters of waste-contaminated liquid which would be sufficient to exceed EPA waste disposal standards. Something is gravely amiss when we can only rely on governmental prevention of such an ecological disaster for a mere 1% of the "control" period.

In summary, though we are dealing with substances that remain deadly for varying lengths of time up to periods which far outlast the control period, serious doubts remain as to whether the WIPP program can realistically hope to meet even a fraction of its 10,000-year mandate.

The arrogance and irresponsibility of a government agency pretending to predict human and natural events for 10,000 years, while conveniently ignoring a plethora of factors sure to play significant roles in the project's performance, bespeak a





disregard for future consequences that is highly inappropriate in the context of long-lived radioactive materials.

The value and importance of precious resources and a clean environment can only increase as we move into the future. If it is to be reasonably responsible, long-term planning must not gloss over the realities of change, upheaval and evolution in the natural world and in human culture. If DOE intends to demonstrate WIPP's viability for a 10,000-year control period, much research and analysis remain to be done before accurate conclusions can be reached. By failing to fully address or even mention many crucial factors affecting long-term performance, the D-SEIS clearly embodies a policy which values expediency above responsibility.

## XI. INADEQUACIES IN THE D-SEIS REGARDING RCRA

DOE's consideration of RCRA in the D-SEIS is inadequate. First, the D-SEIS presents a misleading discussion of waste characterization. Second, misrepresents the history of the applicability of RCRA to mixed wastes. Third, the D-SEIS does not adequately consider the use of waste treatment alternatives. Finally, the D-SEIS uses technically invalid model assumptions that underestimate projected doses. As a result, the SEIS provides an incomplete record on which to base a decision regarding the environmental impacts of the disposal of these wastes at WIPP.

### A. The D-SEIS Presents a Misleading Discussion of Waste Characterization.

DOE's discussion of waste characterization in the D-SEIS is misleading. DOE correctly acknowledges that anyone who stores or disposes of hazardous waste must obtain a "detailed chemical and physical analysis of a representative sample of the waste." Yet DOE misleadingly suggests that it can rely on "knowledge of process" rather than actual analysis for its "old" wastes pursuant to 40 CFR 262.11(c)(2). However, that regulation only allows reliance on knowledge of process when a "waste is not listed as a hazardous waste in Subpart D of 40 CFR 261...." In the case of WIPP, the hazardous constituents of TRU mixed wastes listed in D-SEIS Table 3.4 are specifically included under 40 CFR 261.

In the D-SEIS, DOE states that "[a]lthough it may be less detailed, the characterization of old waste through knowledge of process is preferred by the DOE because opening great numbers of stored containers to collect and analyze 'representative samples' of TRU waste would pose a radiological risk to workers." D-SEIS at 10-6. It is not self-evident why opening containers and sampling their contents would, necessarily, pose a significant risk to workers. Remote analysis of radioactive materials and wastes -- some of far greater activity than the WIPP TRU wastes -- is routine in the nuclear weapons complex and in the commercial nuclear industry. Furthermore, the level of risk related to the sampling and analysis of mixed wastes is not necessarily greater than that associated with toxic non-radioactive wastes. The engineered health and safety controls are the only difference (e.g., remote grappling arms or robotic samplers for radioactive wastes versus non-sparking drum openers for non-radioactive wastes). The commercial sector has not received an exemption from the RCRA characterization requirements because of such risks, nor should DOE. DOE can and must pursue sampling techniques that both provide the required information and protect workers.





In the D-SEIS, DOE states that "the sampling of old waste for characterization purposes also would generate substantial amounts of additional waste for each barrel sampled." D-SEIS at 10-6. While it may be true that additional waste will be generated by sampling each barrel, the problems potentially created by such new waste must be considered in light of the additional information obtained. Furthermore, based on the information provided in the D-SEIS it is impossible to determine whether this amount of waste is "substantial", as DOE claims. The SEIS should substantiate this claim quantitatively, by including the additional percentage of overall WIPP TRU wastes that the sampling wastes would represent.

On page 10-6, DOE states that it "may examine the desirability of performing tests with TRU wastes not covered by land-disposal restriction standards." It is not self-evident how waste analysis that relies on generalized "process knowledge" could establish that specific wastes do not contain constituents covered by the land disposal restrictions.

### B. The D-SEIS Mischaracterizes the History of RCRA's Applicability to Mixed Wastes.

The D-SEIS states that "[w]hen the FEIS was prepared, it was believed that the RCRA .... did not apply to "mixed waste" radioactive waste contaminated with RCRA-regulated hazardous chemicals." D-SEIS at 10-1. The D-SEIS continues: "On July 3, 1986 .... the EPA published a notice of its determination that wastes containing hazardous and radioactive constituents were subject to regulation under RCRA." Id. These statements fail to acknowledge that while DOE and EPA may have believed that mixed wastes were not covered by RCRA until 1986, this has certainly not been a universal view. NRDC, other citizen organizations and several states have long believed that RCRA, since its enactment, has applied to all DOE wastes containing RCRA-regulated hazardous chemicals whether or not they are also contaminated with radioactivity. In fact, DOE's contention that it was exempt from RCRA for all of its wastes led NRDC and the Legal Environmental Assistance Foundation to file suit at the Department's Y-12 facility in Tennessee. The Tennessee federal district court ruled in 1984 that DOE must comply with RCRA. LEAF v. Hodel, 586 F. Supp. 1163 (E.D. Tenn., 1984). The Department did not appeal the case.

### C. The D-SEIS Does Not Adequately Consider Waste Treatme t Alternatives.

Although obtaining a "no-migration variance" may lead to compliance with RCRA, this legal option should not limit DOE from

pursuing reasonable waste treatment technologies to reduce the solubility and mobility of the waste. DOE's failure to consider adequately such treatment alternatives is particularly disturbing given DOE's statement in the D-SEIS that "all exposures shall be kept as low as reasonably achievable." D-SEIS at I-11.

There are three factors that affect risk: contamination source characteristics, contamination fate/transport in the environment, and receptor location and characteristics. DOE can only effectively exert control over the source of contamination. And because the waste quantity is essentially fixed, the only source characteristic that can be controlled is the chemical characteristics of the wastes -- especially solubility. Given the uncertainty regarding the ground water regime at the WIPP site and the potential for migration over the long period of time the WIPP wastes will remain dangerous, DOE's failure to consider treatment alternatives to control source contaminants is technically indefensible.

Treatment of waste using a solidification technique such as vitrification in boro-silicate glass or an organic polymer would not only help reduce the mobility of the source contaminants, but could also lend structural integrity to the waste as it is crushed by the salt formation, thereby reducing the surface area and, in turn, leachability. The D-SEIS gives only passing mention to these technologies. Furthermore, while the D-SEIS acknowledges that in the time since the FEIS was prepared, "several waste treatment technologies have been developed and implemented at various DOE facilities," D-SEIS at 6-10, and notes that an update is necessary because of "advances in immobilization technologies" (p. 6-13), the discussion of these waste treatment technologies is virtually identical to the discussion in the FEIS. FEIS at F-3,4. In fact, three of the treatment technologies discussed in the FEIS were dropped in the D-SEIS without explanation (ceramic, metal matrix and slag).

To the extent that the D-SEIS does provide a "qualitative discussion" of waste treatment alternatives, D-SEIS at 6-10, it is skewed towards incineration. The description of each immobilization technology is generally only a short paragraph, while far more space is devoted to incineration, including cost estimates and a quantification of volume reduction benefits. The D-SEIS arbitrarily designates incineration as a separate technology and organizes it in a separate subsection rather than classifying it as a "Volume Reduction Technique" along with compaction.

DOE further emphasizes incineration over other treatment technologies by citing a nationwide network of six existing or planned incinerators (Los Alamos, Lawrence Livermore, INEL, Savannah River, Pantex, and Oak Ridge) prepared to handle





WIPP-bound wastes. But, the D-SEIS fails to consider the additional risks resulting from use of these incinerators. The D-SEIS implicitly suggests that burning DOE mixed waste in these incinerators may reduce the risks at WIPP. D-SEIS at 6-16. However, it is unlikely that using incinerators would produce a lower overall risk than the use of some other form of waste treatment.

DOE's real interest in incineration seems to be to reduce the volume of the waste to provide more disposal space, rather than to reduce the total aggregate risk. D-SEIS at 6-15. While reducing waste volume might result in some benefits, such as a lower probability of penetration and elimination of void space, the D-SEIS fails to consider the problems resulting from incineration. For example, in addition to the air exposure and soil deposition risks of incinerator emissions, burning waste increases the surface area of the residue which would greatly increase the leachability of the ash without effective immobilization. Moreover, if DOE is suggesting a nationwide network of incinerators to reduce the volume of WIPP-bound waste, then it should include this plan in its D-SEIS to avoid potential illegal NEPA segmentation. If DOE is proposing such a plan, it must also consider regulatory requirements such as RCRA Subpart O and Section 112 of the Clean Air Act.

The D-SEIS inadequately addresses the potential environmental impacts of incinerators and dismisses their potential environmental impacts by simply noting that incinerators "...have found acceptance in industry." D-SEIS at 6-16. Less than a year ago, however, DOE cited evidence of "public opposition" to incinerators to support its argument that adequate incineration capacity is not available and, therefore, EPA should defer imposition of its Land Disposal Regulations. Raymond Pelletier, Director, DOE Environmental Guidance Division, Comments to proposed regulation: Land Disposal Restrictions for First Third Waste Wastes, Federal Register - May 17, 1988 (Docket no.F-88- LDR8-FFFFF), July 29, 1988. DOE should consider potential public health and environmental impacts of incinerators rather than simply cite sources of support or opposition.

The D-SEIS fails to account adequately for the potential importance of the six existing or planned incinerators in its long-term WIPP plans. Moreover, the D-SEIS does not acknowledge the strong likelihood that still more incinerators may be built at other facilities. The D-SEIS is inadequate because it fails to disclose the full scope of DOE's incinerator plans that are integral to operating WIPP. In fact, only five of the ten facilities identified as contributing waste to WIPP have public plans for constructing incinerators (the DOE Pantex facility is included on the D-SEIS list of facilities with incinerators, although it is not among the facilities contributing to WIPP).

The other five facilities contributing waste to WIPP, but not having yet publicly disclosed their plans to construct incinerators for TRU waste are the Rocky Flats Plant, Argonne National Laboratory/East, Nevada Test Site, Mound, and Hanford.

The failure to discuss additional potential incinerators suggests one of three possibilities. First, DOE may have not yet finalized plans at other facilities where it will eventually build incinerators. Another possibilty is that WIPP-bound waste will be transported from one facility to another to be incinerated. In this case, the D-SEIS should have also included an assessment of the potential transportation impacts. The third possibility is that WIPP-bound waste from the five facilities without incinerators will simply be sent to WIPP without incineration. In light of the competition for the use of available space in WIPP, it is highly unlikely that half of the facilities could send their waste to WIPP without incineration, while the other five facilities must overcome the financial, political and technical hurdles to construct and operate incinerators to burn plutonium-contaminated waste. Nonetheless, if this is DOE's strategy, then the D-SEIS should discuss the differences in impacts between incinerated and unincinerated waste, specifically identifying which waste streams will and will not be incinerated.

The emphasis in the D-SEIS of incineration over stabilization technologies is especially baffling in light of DOE's repeated comments to EPA on the need to consider the unique characteristics of radioactive mixed wastes in the Land Disposal Restriction regulations at 40 CFR 268. For example, in response to EPA's proposed Second Third waste rule, DOE presented "a number of comments advocating the use of stabilization technologies for inorganic and metal-containing wastes", and "support[ed] EPA in the development of appropriate treatment standards and technologies for mixed wastes." Raymond Pelletier, Director, DOE Environmental Guidance Division, Comments to EPA on Land Disposal Restrictions for Second Third Scheduled Wastes Proposed Rule (54 Fed. Reg. 1056), February 27, 1989.

It is duplicitous for DOE to support waste treatment technologies in comments on land disposal restriction regulations, but to downplay the need for thorough consideration of alternative treatment technologies when a particular waste facility is under consideration.

The D-SEIS states that "[i]f during or at the conclusion of the Test Phase it was determined that additional processing would be beneficial, one or more of these technologies could be used to enhance long-term performance." It is unclear, however, how DOE will determine if "additional processing will be beneficial." No experiments are identified in the Draft Test Plan (DOE/WIPP 89-





011, April 1989) to evaluate the benefits of using the treatment technologies discussed in the D-SEIS.

D. The D-SEIS Uses Technically Invalid Model Assumptions That Underestimate Projected Doses.

The information provided in the D-SEIS is inadequate to determine whether WIPP will present a threat to ground water. First, the section on radiation exposure pathways does not indicate what assumptions are used for determining the effective dose rates found in well water. D-SEIS at Table I.1.3.7, p.I-19. (The text in Volume 1 at p.5-110 erroneously directs the reader to "Appendix 1, section I.14", which does not exist; the reference should read "Appendix I, section I.1.4.") Without information concerning groundwater pH and postulated transport mechanisms, it is impossible to assess the adequacy of the analysis for radiation exposure.

Second, to the extent that the assumptions used for analyzing non-radioactive chemical exposure pathways are also applied to the analysis of radiation pathways, the D-SEIS analysis is further flawed. In particular, the D-SEIS assumptions related to the mobility of non-radioactive chemical constituents in ground water would be inappropriate for use in analyzing radionuclides. For example, the D-SEIS considers only the solubilized or insoluble/adsorbed states of lead as an indicator parameter for chemical pathways analysis. Applying this transport model to radionuclides such as plutonium would be incorrect in light of recent research demonstrating that colloidal transport of suspended precipitates is also an important mechanism. Without this mechanism the long distance transport of plutonium observed in the field cannot be explained. Mccarthy, J.F and J.M. Zachara, "Subsurface Transport of Contaminants", Environmental Science and Technology, 23(5): 496-502, May 1989.

Third, the soil and groundwater pH assumed for modelling the transport of lead is inappropriately assumed to be between 7 and 8. Soil and ground water pH is an important determinant in estimating the mobility of plutonium. Mahara, Y. and H. Matsuzuru, "Mobile and Immobile Plutonium in a Groundwater Environment", Water Resources, 23(1):43-50, 1989. The failure to consider different pH levels is particularly disturbing given the widely known property of lead to increase its solubility in a low pH environment. A similar flaw in the radiation pathway analysis would result significantly underestimate the radiation exposure.

**XII. SDWA - D-SEIS FAILURE TO PRESENT INFORMATION NECESSARY FOR DECIDING IF WIPP WOULD COMPLY**

The disposal of radioactive wastes by emplacement through the WIPP project falls within the definition of underground injection provided by the SDWA and its implementing regulations. This form of underground injection differs from the types associated with the pumping of purely liquid wastes into underground geologic formations, it is clear that Congress intended the definition of underground injection to be construed expansively: "The definition of underground injection is intended to be broad enough to cover any contaminant which may be put below ground level and which flows or moves, whether the contaminant is in semi-solid, liquid, sludge or any other form or state." (H.R. Rep. No. 1185, 93rd Cong., 1st Sess., reprinted in 1974 Code and Cong. and Ad. News 6454, 6483 (emphasis added)).

Congress's intent in enacting the SDWA underground injection provisions was to protect underground sources of drinking water from contamination by subsurface disposal of wastes. As long as this disposal occurs through a shaft or deep hole and the wastes might move, the statute, regulations, and legislative history indicate that Congress intended the disposal technology to be regulated. The U.S. Court of Appeals for the First Circuit found that the emplacement of solidified high-level waste housed in canisters in a geologic media (such as salt) should be considered as an underground injection of waste. The court held that the applicable part of the SDWA was intended to protect current and future supplies of drinking water against contamination, and it found no reason to distinguish between methods of possible pollution of ground waters: "Unusable ground water is unusable ground water no matter whether the original source of the pollution arrived in a loose, free form manner, or in containers injected into the ground." NRDC et al. v. EPA, 824 F.2d 1258 (1st Cir. 1987).

The D-SEIS does not discuss SDWA issues or the need to secure a UIC permit for the emplacement of hazardous and mixed wastes. Discussion of the legal requirements of SDWA, as presented earlier in these comments (see Part II. G.), shows the need for DOE to comply with the Safe Drinking Water Act Underground Injection Control permit program. At a minimum, the D-SEIS should discuss these legal requirements, show evidence of DOE's intentions to comply with SDWA, discuss the precautions to be taken at WIPP to ensure that there will never be contamination of an Underground Source of Drinking Water (USDW), present alternative actions which would have less impact on USDWs, and explain why the chosen option was chosen despite the relatively safer alternative actions.





The D-SEIS not only ignores the need to discuss the application for a UIC permit, whether Class 5 or other, it does not even mention why the subject is not discussed in detail. It is expected that the hazardous and mixed wastes to be disposed of at WIPP will escape the confinement area at some future date. The environmental consequences of such releases to USDWs must be considered in the D-SEIS, and DOE must be able to explain why it has chosen not to comply with the applicable statutes and regulations despite the great probability that the interred wastes will contaminate the possible drinking water sources which the SDWA is intended to protect. The standards for the protection of USDWs are high. They are higher, in fact, than the former Subpart B standards vacated by the First Circuit. It is therefore essential that DOE discuss the applicability of the SDWA and its implementing regulations and show how WIPP procedures and methods will be designed to comply with these requirements.

**XIII. THE D-SEIS DISCUSSION OF ADVERSE IMPACTS AND MITIGATION IS GROSSLY INADEQUATE.**

As the D-SEIS admits (p. 6-1) CEQ regulations require mitigation of adverse impacts. Thus, a federal agency must clearly define the adverse impacts of a project, then discuss the varying alternative mitigation methods. The D-SEIS fails to either adequately define adverse impacts or adequately discuss required mitigation measures.

A. Impacts

There are three types of impacts that must be considered: impacts at the generating and storage sites, impacts caused by transportation, and impacts at the WIPP site. The D-SEIS has not adequately discussed any of those impacts.

IMPACTS AT EXISTING DOE SITES. The D-SEIS does not adequately discuss impacts of removing wastes to WIPP or not removing wastes to WIPP for any of the facilities. Given the D-SEIS admission that the TRU wastes can stay at INEL "for several decades or even a century" without any significant impact (p. 5-173), there appears to be no impact from not removing wastes to WIPP. If there are such adverse impacts, the revised and reissued D-SEIS must describe those impacts in detail. Vague, undefined sentences about "long term volcanic action" are not an adequate discussion of long-term impacts. The revised and reissued D-SEIS also must analyze the socioeconomic impacts of removing and not removing wastes from INEL. It must also analyze the public health and safety impacts and the socioeconomic impacts of leaving about one-half of the existing stored TRU wastes at INEL, as D-SEIS suggests on page 5-7. Similarly, the revised and reissued D-SEIS must analyze the environmental and public health and safety impacts of removing or not removing TRU wastes at each of the other DOE generator and storage sites and the socioeconomic impacts of removing or not removing such wastes. The revised and reissued D-SEIS also must discuss the impacts of developing a long-term surface storage facility. Alternatively, those impacts could be discussed and evaluated in a draft and final programmatic EIS prior to revising and reissuing a new draft WIPP D-SEIS.

IMPACTS CAUSED BY TRANSPORTATION. The D-SEIS states that 8.3 fatalities and 106 injuries will be caused by transportation accidents associated with the proposed action. The D-SEIS does not analyze the impacts of all reasonable accidents, including those in which radioactive and toxic wastes are released into the environment (see Part VIII). The revised and reissued D-SEIS must analyze the impacts of such releases on the environment.





IMPACTS AT THE WIPP SITE. The discussion in Parts VI and VII of the inadequacies of the analysis of direct and indirect impacts describes many changes that must be made in a revised and reissued D-SEIS. Suffice it to note here that the long-term impacts of WIPP, especially regarding releases even in excess of those allowed by the EPA disposal standards could have serious effects on the environment and the health and safety of hundreds of future generations.

B. Mitigation

The D-SEIS discussion of mitigation is found primarily in Chapter 6. The entire chapter is full of phrases such as "conceptual measures that could be applied," "engineering modifications that could become the standard operating procedure," "could identify the need for other treatments," "potential mitigations... would be determined during the Test Phase," "current plans," "is being considered," "if... it was determined," "proposed," "might be expected," and "long-term benefits are also unknown." Obviously, such qualifications and promises of future analysis are not an adequate discussion of required mitigation measures. In essence, the D-SEIS maintains that DOE will determine what mitigation measures, if any, it will use in the future without adequately describing what those measures are so that the public can effectively comment. Such a DOE position is inconsistent with the spirit and letter of NEPA.

What the revised and reissued D-SEIS must do is to propose and analyze specific mitigation measures that will be used to eliminate or lessen the impacts. Regarding existing DOE facilities, which are never discussed in Chapter 6, the new D-SEIS must analyze specific mitigation measures for the environmental, public health and safety, and socioeconomic impacts identified. The D-SEIS should analyze mitigating any impacts of long-term on-site storage at each facility. The document must also analyze measures to mitigate direct or indirect impacts at any long-term surface storage facility. Alternatively, those issues must be addressed in a programmatic EIS prior to revising and reissuing the WIPP D-SEIS.

Regarding transportation, the discussion of mitigation is limited to emergency response training and education programs, TRUPACT shipping containers, the Dawn Trucking Company contract, and TRANSCOM (p. 6-3). The training and education program would continue "as requested by involved government agencies." In fact, all affected state governments have requested, and WIPP withdrawal legislation proposed in the 100th Congress required, continuing training and equipping of emergency responders throughout the operating lifetime of WIPP. Such a program must be discussed in the D-SEIS. There is no discussion of training, equipping, and providing medicine to hospitals and clinics in all

the affected states to treat accident victims. Such mitigation measures are necessary and must be discussed in the D-SEIS.

Regarding TRUPACT, there is no discussion of first using the TRUPACT to ship wastes from Rocky Flats to INEL, which DOE had previously proposed. The D-SEIS must discuss why an NRC-certified container should not be used for all future waste shipments from any DOE generating or storage facility. The revised and reissued D-SEIS should also discuss other mitigation measures, including stronger tiedowns for TRUPACTs, reducing the radionuclide and hazardous waste concentrations in each TRUPACT, developing a testing program and container redesign for accidents involving the TRUPACT being crushed, limiting the lifetime of TRUPACTs to lessen deterioration that will inevitably occur from each container being used so frequently, developing a quality assurance program to ensure proper manufacturing of the NRC-certified containers, developing a program to verify all aspects of TRUPACT handling to try to limit the consequences of human error, and having periodic federal and state inspections of TRUPACTs to ensure that they do not develop problems.

Regarding the Dawn Trucking contract, the D-SEIS must discuss penalties that would be imposed if the company violates any provisions of the contract or if it uses unauthorized shipping routes or disregards any federal and state transportation requirements, the measures that will be taken to ensure that individual drivers maintain their safe driving records, whether random drug testing of drivers will be done, and how adequate maintenance of equipment will be ensured.

Regarding TRANSCOM, the new D-SEIS must discuss what mitigation measures will be taken when the tracking system fails or is out of service for any reason, how DOE will provide computer equipment, software, and a dedicated phone line to affected state agencies to ensure that the system is available to all states along the transportation route, and what modifications of the system will be necessary to monitor railroad shipments.

The revised and reissued D-SEIS must also discuss mitigation measures regarding shipping routes, including constructing of bypasses and agreeing to not use certain routes until bypasses are constructed; agreeing to not use alternative routes; plans to stop shipments in case of accidents, bad weather or major construction; agreeing to abide by local ordinances limiting hours that shipments can pass through the jurisdiction and requiring other prenotification or information.

Very importantly, the revised D-SEIS must discuss mitigating the deaths and injuries projected by shipping wastes whenever possible by railroad or by dedicated trains. If DOE persists in its policy of using trucks, it must explain why shipping by rail





is not an appropriate mitigation method. Further, if DOE wants to use trucks, the D-SEIS must discuss mitigating accidents by requiring escort vehicles, and using a sequential shipping schedule so that all wastes from some generator sites would be sent in convoys over a short period of time rather than having a few shipments every week.

As for geologic and hydrologic issues, the D-SEIS frequently says that uncertainties will be resolved during the Test Phase, but no criteria for evaluating information from the Test Phase is described, no independent review procedures are discussed, no promise is made that the measures that provide maximum mitigation would be used, and no Test Phase Plan exists that describes how the proposed experiments will provide information that will be analyzed to develop mitigation measures.

While there is some discussion in Chapter 6 of trying to mitigate problems caused by cracking in Marker Bed 139 with various grouting and sealing measures, there is no discussion of the need for mitigation measures for similar cracking problems in Marker Bed 138.

All of the discussion of engineering modifications and waste treatment options are so general ("conceptual" is the word used in the D-SEIS) so as to be unusable in terms of really describing the options available and how each measure would specifically provide mitigation at WIPP. Given the fact that virtually all of the engineering concerns discussed were either dismissed as being nonexistent or not discussed in the Design Validation program that was completed six years ago, the revised and reissued D-SEIS must discuss both why the SPDV program did not identify and adequately address those issues and describe why such engineering "fixes" have not previously been analyzed in more detail. Much more specific information is needed about each of the proposed engineering modifications, including uses and composition of various types of backfill, because the current level of general information is not an adequate discussion for public review and comment or for the decisionmaker.

Regarding waste treatment, given the requirements of RCRA it seems certain that some kind of treatment must be for WIPP wastes. Thus, the statement (p. 6-10) that if "additional processing would be beneficial" it could be used seems nonsensical -- of course treatment would be useful. But the discussion does not focus on the specific benefits of the various treatment options, on who will decide what is "beneficial" and whether the treatment alternatives will be carried out at WIPP or at the generating or storage site.

Finally, the joint commentors believe that DOE's attempts to avoid discussing specific mitigation measures now is a violation

of the spirit and letter of NEPA. Before WIPP proceeds any farther, a complete discussion of mitigation requirements, including their costs, must be completed in order to provide the public and decisionmakers with an adequate analysis of the environmental, public health and safety, and economic alternatives related to opening WIPP, developing various treatment technologies, maintaining long-term on-site storage at existing facilities, or developing a long-term surface storage facility.





**XIV. CONCLUSION**

If DOE begins to effect the preferred action of the D-SEIS, then a significant amount of mixed and hazardous wastes would be emplaced in WIPP by the end of the five-year period. The likelihood that these wastes would subsequently be removed either for disposal at another facility or for retrofitting and re-disposal at WIPP is small. The difficulty of retrieving the wastes once emplaced, and the costs of retrieval, make the prospect of removing, retrofitting and re-emplacing the wastes very improbable. Furthermore, the fact that no other disposal facilities of the magnitude of WIPP currently exist, and obviously will not soon come into being, renders the probability that WIPP will not be this nation's permanent disposal facility for nuclear wastes remote, at best. Under the circumstances of both known problems and obvious uncertainties concerning the geologic formations at WIPP, DOE cannot risk the potentially disastrous consequences of permanent disposal of radioactive wastes under standards designed only for the temporary storage of such wastes. DOE must adhere to the proper standards at the time the wastes are emplaced underground, not five years after the fact when unnecessary exposure and harm to human health and the environment has already occurred.

In light of Secretary Watkins' recent expressions of an increased commitment to the protection of human health and the environment, determinations of impact on human health and safety, as well as the environment, should receive foremost consideration, especially in matters regarding the operation of a facility as daunting in scope and effect as WIPP. The Department's compliance with environmental, public health and safety laws cannot be delayed or suspended. DOE specifically intends WIPP to provide for the permanent disposal of exceedingly dangerous wastes. The fact that DOE holds out the possibility of retrieving TRU wastes from WIPP at some time in the future does not change the fact that the objective intent of WIPP is the permanent disposal of nuclear wastes. Clearly, the emplacement of the first gram of TRU waste at WIPP will be done with the intent of permanent disposal. The plainest, simplest, and most forthright goal of the laws and regulations governing the handling and disposal of such wastes is to provide assured protection of the health and safety of humans. Any attempt by DOE to dismiss full compliance with either the objectives or purposes of environmental laws confirms that rhetoric is the sole expression of change within the Department of Energy.

Recent revelations of safety and environmental problems at DOE facilities across the nation underscore the importance of complying with federal and state environmental laws and regulations in the operation of the nuclear weapons complex. WIPP presents DOE with a unique opportunity to avoid the mistakes of the past. Accordingly, the joint commentors intend to ensure that DOE complies fully with all relevant environmental, public health and safety regulations and will pursue litigation to this end, if necessary.

**APPENDIX A - CONTRIBUTORS**

Concerned Citizens for Nuclear Safety (CCNS)

Elizabeth Billups
Dan Gibson
William Gould
Richard Johnson
Jai Lakshman
Robert March
Michele Merola
Richard Miller
Robert Ott
Sasha Pyle

Concerned Citizens for Nuclear Safety (CCNS) is a nonpartisan, non-profit organization founded in New Mexico in the spring of 1988. the group's purpose is to increase public awareness and involvement in nuclear safety issues by compiling and disseminating information, and by pursuing legal and legislative actions to uphold health and safety standards. To date, CCNS' efforts have been largely focused on the Waste Isolation Pilot Plant, because it poses a direct threat to the health, safety and future of New Mexicans, and because its Pilot status guarantees that it will set a crucial precedent for future Department of Energy facilities and for nation nuclear waste disposal policy.

Environmental Defense Fund (EDF)

Melinda Kassen, Senior Attorney
Lindsay Audin, Mechanical Engineer & Transportation Consultant

EDF is a nonprofit organization with approximately 100,000 members nationwide, including lawyers, scientists, engineers, educators and other professionals and concerned citizens. Through advocacy in administrative, judicial and legislative forums, EDF promotes environmentally and economically sound solutions to the ecologic problems facing the world today. The Radiation Program, which now focuses on nuclear waste management issues, grew out of EDF's 20 year campaign to reduce the release of hazardous materials into the biosphere. Although EDF's historic interest in the nation's nuclear waste system has been in the transportation of radioactive materials, given the potential exposure to millions of individuals thereby, because of the Rocky Mountain Office' location at the geographic fulcrum of DOE's nuclear weapons production complex, our work also seeks to address the long term management of both radioactive and hazardous wastes.





Natural Resources Defense Council (NRDC)

Dan W. Reicher, Senior Project Attorney
James D. Werner, Project Engineer
Steven J. Lemon, Intern

NRDC is a national environmental organization with over 100,000 members and contributors and a staff of over 120 lawyers, scientists, resource specialists and support personnel at offices in New York, Washington, and San Francisco. NRDC pursues a broad range of environmental, energy, and defense issues. The organization has long been concerned about safety and environmental problems at Department of Energy (DOE) nuclear facilities. Over the past twelve years, the NRDC Nuclear Project has won a series of lawsuits to enforce federal environmental laws at DOE facilities including Hanford, Washington; Oak Ridge, Tennessee; and the Savannah River Plant, South Carolina.

Southwest Research and Information Center (SRIC)

Don Hancock, Nuclear Waste Project Director
Caroline Petti, Legislative Director and Washington, D.C. Field Office Representative.
Lynda Taylor, Radiation, Toxics, and Health Project Director

Ronald Cummings, Ph.D. is Chairman of the Department of Economics at the University of New Mexico. He served as principal investigator for the socioeconomic impact assessment report, The Proposed Waste Isolation Pilot Project (WIPP) and Impacts in the State of New Mexico, published by the New Mexico Energy and Minerals Department in 1981. He has also published numerous articles on socioeconomic impacts of nuclear waste repositories.

Scientists Review Panel on WIPP was formed by several New Mexico scientists and academics in 1988 to review technical issues related to the WIPP site. Members of the group include Ph.D.s from the disciplines of geology, engineering, mathematics, physics, hydrology, chemistry, and political science. The SRP has produced several reports and has testified before Congress on their findings.

SRIC is a private, nonprofit educational and scientific organization, incorporated in New Mexico with offices in Albuquerque and Espanola, and in Washington, D.C. SRIC provides information and technical assistance on a wide variety of energy, environmental, and natural resources issues to people in New Mexico and throughout the nation. The organization's active involvement with WIPP dates from the mid-1970s; it has participated actively in all aspects of the WIPP NEPA process, has testified before congressional and state legislative

committees, has produced various publications regarding all aspects of WIPP, and has provided the public with detailed information about all aspects of WIPP. SRIC also has been actively involved in research, technical assistance, and public information regarding DOE's high-level waste management program for a decade.

State of Texas

Jim Mattox, Attorney General
Renea Hicks, Assistant Attorney General
Nancy Olinger, Assistant Attorney General
Mary Ruth Holder, Assistant Attorney General





APPENDIX B

PAGE BY PAGE ANALYSIS OF THE

DRAFT SUPPLEMENT ENVIRONMENTAL IMPACT STATEMENT
WASTE ISOLATION PILOT PLANT (WIPP)

Prepared by

CONCERNED CITIZENS FOR NUCLEAR SAFETY (CCNS)

July 17, 1989

SECTION PAGE TABLE

Summary S-9 S-1 This table compares, inter alia, the radiological risk to the public, in terms of the number of excess latent cancer fatalities, from routine transport and under predicted transportation accident conditions. Under routine transport by truck, the number of deaths is predicted to be .016 and by rail .012. Under accident conditions, however, the number of cancer deaths by truck transport is estimated to be only .0027, and by rail only .0013. That DOE predicts a higher radiological risk from routine conditions rather than accident conditions is illogical and is probably a result of the indefensible multi-staged averaging DOE loads into its modelling.

SUMMARY S-15 Repeatedly, calculations for risks under the proposed action are estimated to be smaller than those under the alternative action of waiting for compliance with EPA standards, although the reason for this discrepancy is never explained and is certainly not apparent. Here, for example, the number of excess latent cancer fatalities under the proposed action are .016 by truck and .011 by rail. For the alternative action, these estimates are .017 by truck and .013 by rail. Why should the number of deaths possibly be any greater because the site did not open until EPA standards were met? If anything, risks under the alternative action should be lower.

Chapter One - Purpose and need for WIPP - Summary

To support the notion that a need exists for the WIPP, the DOE refers to earlier DOE documents - the 1980 FEIS and the DOE Record of Decision (publ. Jan 28, 1981). However, there is no independent justification for the WIPP; moreover, given that the description of the No Action Alternative suggests that it would be safer than WIPP, at least for several generations, DOE must bolster its case for the need for WIPP.

DOE also attempts to support its claim that WIPP is needed now because the governors of Colorado and Idaho have expressed concern over the continued interim storage of TRU waste at Rocky Flats Plant (RFP) and the Idaho National Engineering Laboratory (INEL). Given that WIPP is unlikely to open before Governor Andrus reinstitutes his ban on waste shipments from Rocky Flats, a move he is promising for September 1989, or even before DOE hits the TRU waste cap at Rocky Flats, both of which facts mean that WIPP cannot be a solution, at least for interim storage of RFP wastes. These interim problems are obviously no basis for choosing WIPP as the long term disposal solution.

The third way DOE attempts to justify a need for the WIPP is by stating that the delay of the WIPP project has the potential





to adversely affect the nation's production of nuclear weapons. We have been able to produce approximately 25,000 of these weapons without the WIPP. The D-SEIS fails to explain how delaying the WIPP now will adversely affect our ability to produce additional nuclear weapons.

Additionally, DOE proposed to conduct certain experimental and operational tests during a "test phase." However, no independent scientific body has been able to justify using the WIPP as a laboratory for these experiments or justify the need for using waste in drums for the operational tests.

In conclusion, the DOE fails to adequately establish a purpose and need for the WIPP.

1.1 1-1 DOE states that tests will not begin at WIPP until satisfaction of all applicable environmental requirements. Then let DOE show compliance with EPA standards (subparts A & B of 40 C.F.R. 191) before it starts testing. These standards were written to insure that the design of a disposal facility is adequate and, as such, were meant to be applied PRIOR to any waste disposal.

1.1 1-1 DOE states that storage of waste in aboveground facilities might pose problems if continued for the long term. What is meant be the long term? Does this mean their may be problems after 100 years? 200 years? What are the problems posed by the aboveground storage? How does this fit with DOE's assertion that the No Action alternative would be safe?

1.1 1-2 DOE states that the delay of the WIPP project has the potential to adversely affect the nation's production of nuclear weapons. However, we have been able to produce approximately 25,000 of these weapons without the WIPP project. How then is delaying the WIPP project now adversely affecting the production of additional nuclear weapons?

1.3 1-4 When discussing new information since the publication of the FEIS, the D-SEIS fails to mention the discovery of the large pressurized brine reservoir underlying the WIPP, and DOE's new position that it will NOT comply with the EPA standards before emplacing any waste at the facility.

1.4 1-6 The D-SEIS states that DOE would decide whether the WIPP complies with EPA's standards. Determination of compliance with EPA standards should not be left up to DOE.

Chapter Two - Background: WIPP Overview - Summary

Section 2 of the Draft SEIS is intended as an overview of WIPP facilities and operations, including discussions of waste makeup, waste acceptance criteria, construction and potential decommissioning of the plant, emergency preparedness and environmental monitoring programs. A mere 22 pages are devoted to this overview which attempts to justify DOE's Proposed Action of opening WIPP before compliance with applicable health and safety standards. The section -- composed primarily of vague generalities and inaccurate analysis -- fails to support DOE's plans or to address a wide variety of important and currently unresolved issues.

2.2 2-3 Description of the surface and underground facilities implies they are all complete and have passed pre-operational testing. In fact, EEG reports indicate many unfinished aspects of the facilities, or severe limitations such as offices being located within "hot" zones, important systems (electrical, fire control, radiation control, etc.) having been built without needed drawings done first, and problems with the design and construction of the waste handling and exhaust shafts.

2.3 2-7 In 1982, transuranic waste was redefined to allow up to ten times greater radiological content than the previous definition. Although this very critical development occurred subsequent to the release of the 1980 FEIS, the SEIS provides no analysis of the potential increases in risks and costs of handling waste which may now be significantly "hotter." It would also appear that it has been this redefinition which causes the expected inventory of TRU waste bound for WIPP to be significantly lower than it would have been under the superceded TRU waste definition; if this is true, DOE should confirm the link.

2.3.1 2-9 How does DOE intent to identify or characterize the physical/radiological and chemical composition of waste in light of the FBI probe at Rocky Flats Plant (a major source of WIPP waste) has raised questions about that facility's falsification of waste characterization documents?

2.3.1 2-9 to 10 "The WAC do not require detailed characterization of chemical constituents of the waste because waste sampling and analysis would result in increased radiological exposure of personnel." This statement is particularly disturbing when viewed in the context of a possible shipping accident in which emergency response personnel and the public would be denied knowledge of the exact contents of a breached container. If the chemical constituents of the waste are so dangerous that DOE cannot risk worker exposure to verify contents of the barrels, then the risks to first responders and





the public from these chemicals have clearly been downplayed by DOE throughout the remainder of the SEIS document and in all emergency training programs offered along the routes.

Given that the waste in boxes at INEL must be repackaged for shipment in TRUPACT-IIs, why can't DOE perform waste analyses to determine chemical composition at that time?

Since the WAC changed in 1986, how does DOE intend to assess the packages labeled before that date?

Gas Generation: How does DOE intend to insure that gasses will not build up in containers that were packaged before 1986? How will these gasses be vented?

Toxics and Corrosives: Changes to the WAC since 1980 added a requirement to report the quantities of these constituents. How does DOE intend to fulfil this requirement given its previous statement that to perform such waste sampling to determine such quantities is too dangerous and will not be performed.

Immobilization: While free liquids were specifically prohibited in the WAC as formulated in the 1980 FEIS, the WAC have subsequently been revised to allow for "minor liquid residues remaining in drained containers." In fact, the WAC allows one gallon containers to go unanalyzed. There could thus be up to one gallon of liquid in each one gallon container. The WAC allows one gallon containers to be made of glass, which would be subject to breakage in the event that a box or drum were dropped. If the contents of these containers is unknown, such breakage could result in the mixing of constituents which are not allowed to be stored or disposed of together.

2.3.1 2-11 "A unique radionuclide composition is associated with virtually every TRU waste generator and storage facility. By "normalizing" radionuclides to a common radio-toxic hazard index, radiological analyses can be conducted for the WIPP that are independent of these variations." This is a euphemistic way of admitting that DOE is averaging waste characteristics, a misleading practice in relation to the bounding case scenarios which would reflect higher severity levels if the waste were more completely characterized. In addition, the risks to the public and to emergency responders are conveniently downplayed. Moreover, given the great variability in the carcinogenic charateristics of different radionuclides, to the extent that this practice obviously leads to less specificity in the identification of individual radionuclides, DOE must justify this new practice which will result in waste handlers and emergency responders having LESS, rather than more information in the event of an incident or accident.

"...operational accident scenarios using the 1,000 PE-Ci limit were performed to support amendment 9 of the WIPP draft Final Safety Analysis Report (FSAR) (DOE, 1988-a)." Reference to a draft FSAR which has been unfavorably reviewed by independent groups including the EEG, SRP and GAO is inappropriate.

"These analyses demonstrate that the somewhat higher projected doses do not change the radiological consequences significantly ...." In light of twenty years of research indicating that there is no safe or "threshold" level of radiation and that exposure is cumulatively damaging at any dose level, this kind of sophistry is misleading and irresponsible. DOE needs to take into account current and independent understanding of radiation health risks.

The D-SEIS refers to a waste certification officer performing certain tasks at each generator facility. Is such an officer actually in the work force now? Has such officer been present since 1980 at each facility?

"An independent DOE Certification Committee conducts either an annual or a biennial audit of each facility's certification program ...." What is an independent DOE committee? Everywhere DOE has been allowed to monitor itself without benefit of truly independent review, the consequences to human health and environmental quality have been staggering.

2.3.2 2-12 Wastes containing pyrophoric metals "are being processed to reduce reactivity either by chemical reaction or immobilization." There is no description of how this is being done or how the efficacy of such techniques will be evaluated or confirmed. Specifically, from which facilities do these materials originate? There is no analysis of the potential environmental impact of these materials or techniques.

It would appear that this section includes a description only of those practicies which DOE facilities have already implemented. The D-SEIS should also at least list those additional processing techniques that DOE facilities may have to employ in the future to ensure compliance with environmental, public health and safety standards, e.g., waste reduction, supercompaction, and incineration.

2.4 2-13 "The HEPA filtration system acts as a secondary confinement barrier." The D-SEIS assumes in subsequent sections regarding potential release risks that the HEPA filters will operate at 99.9999% efficiency in a "worst-case" scenario; this is highly unrealistic. Failed filtration systems at other DOE facilities, notably Fernald, have resulted in unconscionable volumes of contamination released into populated areas.





Moreover, EEG has noted some problems with the WIPP filtration system which the D-SEIS has conveniently ignored.

2.4.1 2-13 "During the Test Phase under the Proposed Action, RH and CH-TRU waste would be received and emplaced at the WIPP in such a way as to maintain retrievability." This statement glosses over the fact that the rate of salt closure, intended to slowly seal in the WIPP wastes, is now known to be occurring at 4 to 5 times the previously estimated rate, which may dramatically hinder retrieval efforts. As the Test Phase is designed to study the effects of waste decomposition and gas generation, it scarcely need be mentioned that the waste and containers will presumably be in a markedly different condition after the Test Phase than prior to emplacement. The questionable retrievability of the waste has been one of the primary reasons that several independent review groups (including the National Academy of Sciences, the EEG and SRP, the GAO and the U.S. House of Representative Subcommittee on Energy, Environment and Natural Resources) have criticized DOE's proposed testing plan. In addition, this sentence suggests that DOE will be able to move RH-TRU wastes to the WIPP during the test period; yet DOE does not even have a design, let alone a certified container in which to transport such wastes to the facility. Given the lead time necessary for designing and testing an RH-TRU waste packaging system, it may not be realistic for DOE to have a certified shipping container available in time to emplace RH-TRU waste in the WIPP during the test phase.

"The TRUPACT-IIs, emptied of the waste packages, would be decontaminated, if necessary, for reuse and loaded onto transport vehicles leaving the plant." DOE fails to describe exactly how such decontamination would be effected, who would do it, how much it would cost and what additional risks to workers would be entailed.

2.4.2 2-14 DOE acknowledges that additional backfill materials may be required "to satisfy the goals of the tests in a manner that allows for waste retrieval." There is no analysis of the environmental impacts or costs of such techniques or materials, nor of the rooms closing faster than originally projected in the FEIS (or which DOE acknolwedges in the D-SEIS).

2.5 2-14 "Based upon the results of the Test Phase, the DOE would decide whether to retrieve the waste." Another case of DOE monitoring itself without outside, independent regulatory input.

"Retrieval of waste is essentially the reverse of waste emplacement ...." This is incorrect. The tests are in fact designed to observe the effects of waste decomposition and resulting gas generation, container breakdown and exposure to the

highly corrosive action of salt and brine. Not only would the handling of damaged containers be much more dangerous, but exposure to the decomposing waste and gases as well as to the unpredictably interacting chemical constituents, would pose far greater worker and public health risks.

"The retrieval process for CH TRU waste [includes these tasks] ... Decontaminate the floor...of the WIPP if necessary, by mechanical removal of contaminated salt." In section 4.3 of the D-SEIS, the effects of excavation and facility operation on Marker Bed 139 (a fragile, easily fractured anhydrite layer immediately underlying the disposal area a mere three feet below the floor) are discussed. Fractures to this formation will provide potential pathways for off-site migration of contamination. DOE must analyse the possible effects on MB139 of removal of whole sections of the WIPP floor?

2.5 2-15 The decision to retrieve waste during the Test Phase would be based upon "a determination of compliance with Subpart B of 40 CFR 191, the EPA disposal standards for TRU waste." This is an erroneous determination, because the part B standards do not currently exist, having been invalidated by a federal court in 1987. Only if DOE agrees to postpone the Test Phase until the new standards are promulgated and approved, can such determination be made.

Options cited by DOE in the event of non-compliance with Subpart B include: "Additional waste treatment at the WIPP or another DOE facility; additional engineering barriers and/or design modifications of the WIPP; interim storage of the waste at WIPP or another facility while options are evaluated." DOE does not describe or evaluate methods, costs and risks of additional treatment, barriers or modifications, even though NEPA requires such analysis. Interim storage of the waste at WIPP in the event of non-compliance raises a host of legal and regulatory questions regarding compliance with Subpart A, length of the interim term and ultimate destination; interim storage art another facility raises questions of which facilities are under consideration for this dubious honor and whether any agreements have been formalized with such facilities.

DOE notes the possibility that waste might be "moved to other subsurface storage areas within the WIPP" if engineering additions are proposed as a result of the test phase. What subsurface storage areas does DOE have in mind?

If waste is brought to the surface at WIPP for interim storage, "in an environmentally safe manner," how long will it stay on the surface? Does DOE intend to obtain a RCRA storage permit for the above-ground WIPP facility? Who will certify the environmental safety of such action?





"Finally, if wastes are required to be shipped from the WIPP to another facility for interim storage, they might not be sent back to the generator or storage facility of their origin because of the costs of double handling and the transportation impacts." Once again, where is the waste to go? Has any agreement been reached or any oversight body established to deal with such a contingency? The SEIS fails to analyze the potential costs and risks of re-shipping the wastes anywhere, although it claims its Proposed Action is economically feasible and beneficial in comparison with the two alternatives considered. DOE is creating a situation where the wastes might remain at WIPP forever despite non-compliance.

2.6 2-16 Under the entombment scenario, if equipment were not decontaminated but rather left underground, would this not constitute, in fact, radioactive waste burial, and should this not therefore be required to comply with EPA standards 40 CFR 191, Subpart B for permanent disposal? Why does the D-SEIS fail to address potential environmental impacts of such action?

"If waste is retrieved after the Test Phase, the closure plan would be amended in accordance with 40 CFR 264.112." If retrieval in fact turns out to be impossible, how does DOE plan to comply with RCRA?

2.7 2-17 Here DOE admits the possibility of an underground fire, radioactive spills and contamination at the site, although the "bounding case" accident scenarios deny these possibilities as does D-SEIS Appendix F.

In a Memorandum of Understanding, DOE has stated that the WIPP Emergency Action Team would respond to fires or accidents within a 60 square mile area. If the team were responding to an incident away from the site, who would then respond to a simultaneous fire or emergency at the WIPP site, how long would it take to respond, and what potential health and environmental consequences might arise from such a conflict?

2.8 2-18 DOE purports to have established interfaces, training and education programs with local, state and federal government agencies, Indian tribal governments and first responders along the WIPP shipping routes. In fact, such cooperation and training has been widely characterized as grossly inadequate; funding, training and equipment for (often voluntary) emergency response teams in localities along the routes have been laughably poor. No provisions have been made for DOE to update, upgrade or even continue safety training during the 25-year transportation program.

DOE's satellite tracking system is controlled and operated by DOE alone. Despite being promoted as a tool to enhance local emergency response capabilities, only communities that can afford the multi-thousand-dollar computer linkup can have access to this warning system. Surely these localities would have doubts about such a large investment when perhaps the funds would be better spent on adequate equipment for the emergency and hospital personnel, evacuation plans, and other necessities which DOE has failed to provide.

Only two New Mexico hospitals are included in the DOE Memorandum of Understanding. What about all the other hospitals along the routes--not only in New Mexico-- where accidents may conceivably occur?

DOE appears to take educational credit for "the public awareness tour [that] has been completed in five States and has received much positive media coverage." Has DOE done any surveys recently to confirm whether the "positive media coverage" at the time of the tour continues to have any value in the minds of the public or for emergency response personnel?

The D-SEIS discusses its transportation emergency plan, stating that accident response during shipping will "be handled by the waste shipper ...." In normal transportation parlance, the shipper is the generating or storage facility, whereas it is the carrier who is actually hauling the waste. Which did DOE mean in this context?

2.8 2-19 Has DOE in fact conducted the public awareness tour along the route from Savannah River, South Carolina to Carlsbad, NM during this year?

2.9.1 2-20 Regarding the Radiological Baseline Program (RBP), it is important to note that DOE's policy of routine releases at all of its facilities serve to raise the levels of so-called "background radiation." The D-SEIS should acknowledge this fact.

Ref. 2 2-23 DOE has relied upon two draft references in this chapter, its 1988 TRU W.A.C. (stated draft in errata enclosure) and the Final Safety Analysis Report.

Chapter Three -- Description of Alternatives -- Summary

Chapter 3 of the D-SEIS strikes the reader for it's lack of "rigorously exploring and objectively evaluating" the Alternatives to DOE's Preferred Action, something which CCNS postulates DOE could not do for fear of presenting too much evidence of the preferred action's inadequacy in complying with





environmental, health and safety standards. There is also no effort here to explain or to detail mitigation for the greater environmental impacts of truck shipment to the WIPP which the DOE admits as more dangerous than rail shipments. The greater cost the DOE mentions as one of their reasons does not address the cost accruing from more accidents by truck nor the fact that they have not factored in the road improvements and bypass costs which they have promised the State of New Mexico. Another reason given by the DOE, namely more control of the transportation and routes in mentioned but not explained. The third reason, greater accessibility to the site is also not explained as there is a railhead that moves up to the "front door" of WIPP.

Another striking feature of the third section is it's numerous usages of a type of "future orientation" to plans and events that affect the WIPP project. This prevents an accurate examination of WIPP's impacts in the D-SEIS, thereby leading the reader to conclude that DOE is trying to fast track the opening of WIPP. Examples will be given in the body of this report and will be referred to as faults of "future orientation."

Finally, the reader is stuck with the impression that although 33 pages are taken by this section, not much is said. There is a lot that is vague, unexplained or explained in too little detail. Overall, the DOE has not made a strong case for the Proposed Action.

3.1 3-1 What is the "validation to construction?"

3.1 3-1 The D-SEIS lacks an explanation of the Preliminary Site and Design Validation Program.

3.1.1 3-2 The impacts of the WIPP project clearly extend beyond the WIPP site itself to include waste packaging, hadling and loading at DOE's generator and storage sites. Here is an example of the D-SEIS' untenable future orientation? That DOE "may propose" shipping these wastes to the site (which is not really a "may" but rather a question of "when") at which time NEPA documentation "would be prepared" is simply not sufficient under NEPA. DOE must look at the entire TRU waste management system and address the environmental impacts of the system as a whole, including those impacts on the generator and storage sites in this D-SEIS. To act otherwise is to perform a type of illegal segmentation as that term has bene used in NEPA jurisprudence.

3.1.1 3-2 There is no explanation of "an improvement in record keeping" - sloppy in the past? An improvement in sampling is not explained. The D-SEIS does not explain the change in the definition of TRU waste; a one sentence comparison between the new and old WAC would be appropriate here. Also, DOE should include a discussion of how the more limited TRU waste

inventory may affect a retrievable and non-retrievable waste load. Which factor -- the amended definition or the improved record keeping affected the changes in CH versus RH waste (the latter change being by far the most dramatic). How is that the waste volumes decrease despite the fact that the new WAC includes high curie and high neutron waste yet the old WAC did not?

3.1.1 3-2 How does the DOE know that the WIPP design capacity is sufficient to encompass TRU waste generated from new or planned defense-related facilities? The D-SEIS should explain the sources for and amounts of planned additions to the TRU waste generating complex. Also, for those persons who do not follow DOE's every move, DOE should explain what the SIS is, how much TRU waste it might generate and that per current sentiment, it is not likely to be built.

3.1.1 3-3 3.1 This Table ignores the existence of and possible impacts which would be associated with the currently problematic non-retrievable TRU wastes at several of the DOE sites. In addition, given that the 1988 IDB, referenced in footnote a to the Table, is significantly different from the 1987 IDB, DOE must use the most recent data.

3.1.1 3-4 3.2 As with the previous table, why did DOE use the 1987 IDB?

3.1.1 3-5 Regarding the changes in TRU waste composition, why didn't the FEIS consider neutron dose? How did the change come about?

3.1.1 3-5 How accurate is the 60% estimate in the third paragraph? On what publicly available facts is this estimate based? What is the "small fraction" to which DOE refers?

3.1.1 3-5 Has there been a risk assessment for the transport of waste from and possibly back to Los Alamos National Laboratory? On what basis does DOE claim that the environmental impact of an accident in which a TRUPACT II falls off one of those mountain cliffs is covered by the one big single impact simulated in the drop test?

3.1.1 3-5 Yet another example of future orientation - TRUPACT II is uncertified. how can one accurately assess the safety, environmental impact and health consequences of an uncertified shipping cask?

3.1.1.1 3-6 In paragraph 3, the limitation "except for surface dose rates" appears to be either inaccurate or inconsistent according to the data on page 3-7.





3.1.1.1 3-7 3.3 Some numbers don't seem to make sense. What is the explanation for a decrease of 93% of the curie content for RH TRU waste between the FEIS and PSAR?

3.1.1.1 3-8 Where are the new Am-241 concentrations?

3.1.1.1 3.8 What is known about spontaneous fission? Does the fact that californium 252 decay by that means indicate that it has no half life?

3.1.1.1 3-8 Does it follow that having the same surface dose equivalent rate restrictions means no unique handling, storage procedures, or precautions are necessary? Does the neutron waste create any new transportation concerns?

3.1.1.1 3-8 If it was known that the WIPP waste would include a hazardous component, why didn't the FEIS examine this issue? Even though they considered it exempt fromm outside regulation, wouldn't it be vital to know how the hazardous constituents interact with radionuclides and how they might change fate and transport of radionuclides in various media?

3.1.1.1 3-8 "Until recently, few records were required." This is quite vague! What does DOE mean here? What kind of records are now required versus what used to be required? What implications does the previous lax record keeping have for waste characterization? The D-SEIS should set forth more specifics.

3.1.1.2 3-8 "Because of the complex waste matrices" DOE would not reopen previously packaged materials to ascertain the nature of hazardous constituents stored therein. Yet, DOE expects to open at least some of these packages to tranfer the wastes from old boxes to new boxes so that they will fit inside a TRUPACT II. Under such circumstances, DOE need not rely on "process knowledge" (i.e., employees trying to remember what solvents they used in 1972) to produce accurate information regarding the hazardous waste constituents. Certainly, the use of process knolwedge is not necessarily a reliable source on which emergency response personnel would have a clear or accurate idea about what might be spilled in an accident during transport or at the facility. In light of all of the disclosures about mismanagement in the weapons production complex, on what basis can DOE possibly calim that it has historically followed followed highly structured production and ressearch activities" which resulted in requirements for strict product quality and concern for safety in handling radioactive material.

3.1.1.2 3-9 What are the implications and consequences of operating WIPP as an "interim status facility?" What permits would DOE need to obtain and what has DOE done to procure such permits?

3.1.1.2 3-9 Has DOE determined that the concentrations and/or quantities of hazardous constituents from RFP and INEL form an upper bound for all facilities? What if anything has DOE determined regarding the differing interactions of waste streams, including differences in fate and transport mechanisms, between, for example, Rocky Flats, which may have relatively more hazardous waste and lower Curie contents, and Savannah River which has higher Curie content CH waste, but fewer hazardous chemicals?

3.1.1.2 3-9 How accurate can these estimates regarding RFP waste characteristics be, given their basis on limited sampling and/or guessing as to the process involved, as described in the last paragraph?

3.1.1.2 3-9 How accurate can estimates "based on process knowledge" be?

3.1.1.3 3-11 They test filing cabinets @1700 degrees Fahrenheit for 1 and 1/2 hours. Why not test to at least that level for the packaging which will be used to transport deadly long-lived radionuclides and hazardous wastes?

3.1.1.3 3-12 Is a breach expected in a crush accident? Has a crush accident been considered such as being crushed between a train and another truck? Between a train engine and other rail cars (in the event of rail transport)? Has the DOE considered a plane crashing into a WIPP truck?

3.1.1.3 3-14 DOE once again lapses into its impermissible future orientation as to the NRC certification of TRUPACT-II. Even more dangerous, as will be seen hereinafter, DOE then assumes that the receipt of such certification guarantees the perfection of all 50+ TRUPACT-IIs throughout the entire WIPP shipping campaign.

3.1.1.3 3-14 Given that in 1980, DOE anticipated transporting 75 % of WIPP bound wastes by rail, and given that DOE built a rail spur into WIPP's waste handling building, how is it that DOE has not fully evaluated the rail transport option?

3.1.1.3 3-14 Given that DOE has not yet developed an RH-TRU waste shipping container, although DOE can use the D-SEIS to proclaim that such container, once developed will meet the standards, the D-SEIS analyses should not assume that it will do so. For example, the FEIS declared that TRUPACT would meet all existing standards, when it was not built to do so. More importnatly however is the notion that even if such a container were built to meet NRC certification criteria, and even if such container were designed and constructed in a timeframe that was





consistent with DOE's plans for shipping RH-TRU waste to WIPP, DOE cannot assume, for the purposes of its transportation risk assessment that all RH TRU containers will always perform as designed.

3.1.1.3 3-14 Choosing 100% truck transport, which even DOE admits is the most dangerous shipping mode, should require DOE to mitigate the resulting increased adverse environmental impacts. Where does the DOE do this?

3.1.1.3 3-16 That "the requirements of the trucking contract ... are highly specific and demanding" does not mitigate DOE's having choosen an inexperienced, nonunion trucking firm for the first five years of WIPP shipments. How will the terms of the contract be enforced? What about the measures which have not been required by the trucking contract (like having emergency response plans in the truck cabs)?

3.1.1.3 3-16 The use of TRANSCOM can't "ensure" (insure or guarantee) safe and efficient transport of waste to WIPP. How easy is it to jam the TRANSCOM frequencies, or what would happen in the event that the satellite system were not working for some other reason?

3.1.1.3 3-16 DOE should report the nature and results of the tests which it performed using TRANSCOM and the TRUPACT containers in the D-SEIS. (Which TRUPACT did DOE use, a truck loaded with TRUPACT-IIs?)

3.1.1.3 3-19 On what basis does DOE make the claim that "rail transport costs more;" have road improvements and bypass costs been factored into the costs of trucking versus rail to WIPP? In what ways does DOE expect that using TRANSCOM with rail shipments will present difficulties not inherent with using it for monitoring trucks, such that "details not available at this time." As for the potential of TRUPACTs sitting idle on railroad sidings, is there a reason why DOE could not contract with a rail carrier to prevent such occurrences? Are there ways in which DOE might mitigate such possibilities? How do the increased risks of having TRUPACTs sit idle in rail yards compare to the risks of trucks being idled on the interstates due to weather? If the TRU waste is as safely packaged as the DOE claims, why is it a problem for it to spend extended periods of time in urban areas?

3.1.1.3 3-19 Have the reported segments of concern been factored into the overall analysis of potential accident statistics? Given that no states or other governmental units have designated or approved of DOE designated parking areas yet, the D-SEIS should explain further how this will be done, what criteria DOE will use to ensure that the areas are safe and what DOE means by "appropriate." Has DOE addressed the states'

concerns regarding who bears the liability for exposures which occur while a truck is sitting in a parking area?

3.1.1.4 3-21 There is no way to assess what "the DOE is currently developing." This glitch in the timing of the D-SEIS issuance and the Test Phase which is the focus of the D-SEIS highlights why it is that DOE is not ready to issue a draft, let alone a final EIS for the WIPP yet.

3.1.1.4 3-21 How can the DOE ensure (guarantee) full retrievability during the 5 year test phase? There is a question on the rate of salt creep between SRP and DOE. What is a "reasonable" period thereafter?

3.1.1.4 3-21 The IOD does not require DOE to emplace waste prior to the DOE meeting Supart A of 404 CFR 191, the applicable federal standards for permanent nuclear waste disposal facilities. Why then must DOE do so?

3.1.1.4 3-25 There are independent agencies, such as SRP and EEG, as well as DOE's Brookhaven National Laboratory, that do not think that DOE has taken a "thorough approach" in the construction and testing of WIPP prior to waste emplacement; whose characterization is this?

3.1.1.4 3-25 Why start tests with rates of emplacement that represent full-scale operations? What is so hard about moving 55 gallon drums around that DOE needs to experiment for five years with doing so? Why must these drums be filled with real waste? Does DOE really want to use its own and its contractors' workers as guinea pigs to determine what the ALARA levels of exposure (as Undersecretary Duffy suggested on May 4, 1989 at the League of Women Voter's Nuclear Waste seminar in Albuquerque)? Why can't DOE gain the same or at least all necessary information at the surface with CH and RH waste with considerably less harmful environmental impact?

3.1.1.4 3-26 Any agreement between them notwithstanding, DOE and the State of New Mexico are not at liberty to supersede Federal EPA and RCRA laws. DOE and New Mexico cannot, therefore, reinstate the vacated EPA standards that the Frist Circuit found to be illegal and inconsistent with the Safe Drinking Water Act.

3.1.1.4 3-26 Of what use is the D-SEIS if it does not contain sufficient information to assess the Test Plan, particularly given that DOE's initiation of such plan is the primary feature of the WIPP program that DOE has changed since the FEIS? Absent sufficient infomration, how can DOE or the public ascertain whether the Test Phase, which is the major federal action DOE intends to undertake in the next five years "will enable DOE in the future" to see whether WIPP meets the EPA





standards?

3.1.1.4 3-26 How can the DOE guarantee anything for 1,000 or 10,000 years?

3.1.1.4 3-26 CCNS believes that in fact the numerical models and computational methods which DOE is using do not factor in human error and therefore do not identify all processes or events that might affect the disposal system. Computer models that did not factor in human error told us that there was a chance of one accident in 10,000,000 reactor operating hours at Chernobyl; a chance for one accident in 3,000,000 reactor operating hours at Three Mile Island; a maximum credible accident spilling 200,000 gallons of oil from a Valdez-like tanker. Without factoring in human error we have seen our risk in reality be between 1,000 and 10,000 times greater than predicted. How does DOE explain its failure to factor human error into its accident predictions?

3.1.1.4 3-27 "Some of the events or processes estimated to have a greater probability may be deleted if there is a reasonable expectation that the remaining probability distribution would not be significantly changed by their omission." What is this mumbo jumbo?

3.1.1.4 3-27 Same comment as above, p. 3-26 (2nd set): What good is the D-SEIS if it can't substantiate the Test Plan and justify DOE's reliance on an as-of-yet unformulated performance assessment? How will DOE choose the 10 to 15 release scenarios; will DOE choose true worst case or average case or least damaging events? How can DOE assure the public that it will examine the entire range of possible release events?

3.1.1.4 3-27 What would the DOE do if the "deficiencies in their methodology" for consequence analysis were drastic? For example, the WIPP site blows up due to the generation of explosive gases as the temperature inside the drums got hotter. Such a scene might actually have happened in the Ural Mountains to the Soviets. Does it not behoove the DOE to take the time, spend the money, do all the testing they need to, get all the independent and unbiased scientific verification that would corroborate the safety of WIPP prior to the emplacement of full-scale operation amounts of waste?

3.1.1.4 3-27 Who will perform the external peer review of DOE's performance assessment? When will that occur in the process?

3.1.1.4 3-27 How realistic can you be in 1,000 and 10,000 year predictions, even of WIPP's undisturbed performance? In the past (e.g., radionuclide migration at the Hanford

Reservation), even DOE's short term predictions have been grossly in error.

3.1.1.4 3-28 What is degradation product contamination?

3.1.1.4 3-28 DOE's argument for performing room scale tests, given the uncertainty surrounding DOE's ability to obtain meaningful data from such tests and given the risks involved is simply not convincing enough.

3.1.1.4 3-28 This description contradicts an earlier statement that DOE would add only brine at the site.

3.1.1.4 3-28 How can DOE use a "representative" mix of wastes during the Test Phase given that DOE has committed not to bringing wastes from Los Alamos until the bypass is built, which could be beyond the Test Phase time frame, and DOE may not have an RH TRU waste container available until after the Test Phase emplacement is done?

3.1.1.4 3-29 Have the environmental consequences of noncompliance been considered? How will DOE determine what "number of options would be considered" and which options those will be if waste treatment proves necessary to ensure compliance with EPA standards or RCRA? Without an assessment of the environmental impacts of using each such potential treatment, how is this D-SEIS useful to the WIPP decision makers or the public?

3.2.1 3-29 to 30 This alternative has not been rigorously explored. The description of DOE's preferred action fills 29 pages, but the D-SEIS dismisses the no action alternative in five sentences. What are the potential long-term hazards to public health and the environment that would remain? What are the details on this? Where does DOE discuss, let alone rigorously explore or objectively evaluated the no action alternative? Where is the comparison of risks between this and DOE's preferred alternative?

3.2.2 3-30 Why can't the room-scale tests be practically or usefully performed elsewhere?

3.2.2 3-31 What are the impacts associated with this alternative?

3.3 3-31 Why has DOE failed to analyze alternative storage and/or disposal facilities? Given that DOE has even elicited the aid of contractors to search for a long term above ground storage facility for TRU waste, why is that alternative not considered in detail? Does DOE really believe that the alternative and no federal actions discussed in the D-SEIS were considered "in detail?"





SECTION PAGE TABLE

4.2 SUMMARY Section 4.2 purports to address significant aspects of regional geology as they relate to WIPP's potential performance. In general, it merely rehashes the limited and in some cases incorrect characterizations found in the 1980 FEIS. Since the geology analysis in the FEIS was so misleading and incomplete that some geologists suggested during the document's public review process that it be invalidated as a future reference for any discussion of WIPP, it seems especially inappropriate to encounter such reliance on the FEIS nine years later when more is known about the area geology and the limitations of the FEIS itself.

The text is obscure and uninformative; the diagrams are incomprehensible and do not clarify the text.

Studies done subsequent to the FEIS have uncovered much conflicting and ambiguous data which require additional interpretation. DOE continues to gloss over important questions. The weak analysis bespeaks a disregard for scientific precepts and the nature of geologic study and processes.

Conspicuous omissions from DOE's analysis are the abundance of drillholes at and near the site, their effect on migration of moisture, seismic activity in the area, and the underlying fault.

4.2.2 SUMMARY Stratigraphic Setting: and generalitie assumptions unconfirmed by core samples make up most of this description. The text refers to measurements in feet but the charts are calibrated in meters--this inconsistency makes the text and diagrams impossible to readily correlate.

4.3 4-13 Overview of Flawed Process/Assumptions in SEIS 4.3 (Hydrology and Water Quality)

DOE habitually bases long series of calculations and resulting scenarios on unsubstantiated assumptions and simplistic conceptual models of hydrologic features. Since the 1980 FEIS was released, the hydrology of the region has consistently proven to be more complex, more variable and more unpredictable than uniform and homogeneous qualities ascribed by DOE for purposes of numerical modeling and predictions.

Hydrologic features about which uncertainties still exist and assumptions have been made include: brine inflow; gas generation; permeability and gas dissipation potential;

variability in porosity; far-field qualities; rates and mechanism of salt creep; variability of brine compositions; flow directions; variability of flow rates; exact boundaries of differing transmissivity zones; extent of zones of fracturing; potential for future fracturing; fluid-pressure differentials; damage to Marker Bed 139; cause and extent of formation dissolution; aquifer recharge rates; hydraulic continuity between adjacent formations; variations in fluid density; degree of anisotropy; mineral distribution; variability of stratigraphic thicknesses; volume, origin and age of brines.

Release scenarios in section 5.4 have been based on this web of uncertainties and assumptions. In many cases, evaluation and re- interpretation of existing data are still incomplete; in others, limitations of the data base are still not known; limitations of the testing and modeling systems are still being characterized. Cases where further study and written analysis are required represent illegal segmentation under NEPA, which requires a full assessment of potential environmental impacts, and public review of it in the SEIS itself.

It is particularly disturbing that this section, which should offer a conclusive analysis of the region's hydrology, completely ignores a huge body of scientific evidence that the site may not, in fact, be suitable.

Larry Barrows's definitive study of the WIPP region as a major karst land with significant potential for dissolution, cave and sinkhole formation and brecciation--included in EEG report #32 as well as thorough correspondence between Barrows and EEG--is never mentioned. Neither the word nor the condition of karst is addressed in the SEIS, a conspicuous omission in light of widespread knowledge that karst conditions greatly speed groundwater progress and render single-drillhole testing highly unreliable. Faster groundwater travel is a crucial issue in WIPP's ability to contain waste for the specified control period.

In general, the exhaustive studies by EEG and other independent scientific groups receive no attention whatever. The SEIS relies on studies done by Westinghouse and other DOE contractors, which of course paint a rosier picture of the project's chances for success than the full range of available data suggest.

4.3.1 4-13 Reference to section 7 of the FEIS (DOE, 1980)-- how it describes the regional hydrology "in detail." The FEIS does not describe the hydrology ACCURATELY according to findings since 1980.





"The Castile Formation...may contain pressurized brine deposits." Table 4.1 cites observable disturbances due to such deposits, and later in 4.3.4.2., 2 such deposits are estimated to hold 630,000 and 17,000,000 barrels...more than a "potential" presence!

4.3.1 4-16 Table 4.1 Overview of Table: In each case, the geologic structure and hydrology of each formation is now known to be more complex, more variable and less homogeneous than assumed in the FEIS. It's obvious that the more evidence is gained, the more complex the situation becomes. Yet DOE bases calculations and assumptions (scenarios) on simplistic numerical modeling which does not account for further complexities in areas not yet fully characterized (which are many and significant)

The site would probably never have been validated if it had been accurately characterized before FEIS.

Entire table consists of new data and new site characterizations--ALL UNFAVORABLE.

Present understanding (info not known for FEIS or SPDV that would probably have invalidated site if analyzed independently of DOE's plan of action):

* Salado formation probably hydrologically saturated.

* Darcy flow model assumed to be conservative--no references.

* Far-field brine permeability (originally not considered relevant) is now known to be important but not known accurately.

* Salado gas permeability (previously thought adequate) now questioned but not known accurately. Assumptions in FEIS were wrong by between 1,000--10,000 times! (Factor of 3-4 orders of magnitude)

* Gas generation will result in greater than lithostatic pressures unless gas is stored in disturbed rock zone or migrates past panel seals and up shafts--ie. finds pathway to biosphere. NO ANALYSIS

* Variability of brines now recognized; intergranular brines now recognized. "Brines often evolve gas, thought to be mainly nitrogen."

* Bell Canyon formation: low local permeability is assumed and flow is not considered.

* There are at least 5 water-bearing zones in the Rustler--not 3 as assumed in the FEIS.

* Layer thicknesses in the Rustler Culebra and Magenta Dolomites were combined or averaged "for purposes of numerical modeling" in the FEIS; uniform transmissivity was assigned. It is now known that transmissivity is variable by approx. 3 orders of magnitude (1,000 times); that a high-transmissivity zone exists. DOE claims necessary testing of the Culebra has been completed but concedes that the interpretation is not yet completed. (Illegal segmentation)

* Culebra Dolomite was modeled as a uniformly porous medium in the FEIS; measured matrix porosities are now characterized as between .07 to >.3 ( a range of more than 4 times).

* Ultimate discharge (flow patterns) of Culebra still not clear; interpretation "based on modeling."

* FEIS assumed "for numerical modeling" that Rustler carbonates were completely confined and at steady state; yet pressure potentials now show disturbances due to Castile brine reservoir; moreover, the Rustler hydrology is conceded to be "transient on a 10,000-year time scale" (length of control period.)

* Variability in Rustler water salinity was known at time of but FEIS "effects could not be considered in munerical modeling"; now the salinity is known to range from 4,000 to more than 300,000 mg/L TDS and the need for careful & repetitive sampling of groundwaters has been recognized. If this analysis remains to be done at some unspecified future time, this is yet another example of "illegal segmentation" or reliance on future studies to justify current plans.

In summary, Table 4.1 contains at least 16 examples of FEIS assumptions that proved to be highly inaccurate. How can we assume current characterizations are accurate?

4.3.1.2 4-14 Overview of issues developed in response to new data or current understanding of issues where it differs from assumptions in the FEIS: current "understanding," much of it still unverified, is incorporated into long-term performance analysis in subsection 5.4; this means the analysis in 5.4 is faulty and not credible--it does not take newer ranges of values fully into account.

4.3.2 4-14 Salado Formation "Subsequent to the FEIS,...investigations...and testing...have provided 'additional information.'" This so called "additional information" in many cases contradicts the assumptions of the FEIS.

4.3.2.1 4-14 Brine Inflow & Gas Dissipation Potential "Mine ventilation evaporates the brine water content in almost





all areas..." Thus, visible effects of brine inflow are currently being minimized. "Steady-state flow conditions may be determinable only from many years of observation." Illegal segmentation--NEPA document should address total environmental impacts without relying on future studies for crucial info.

4.3.2.1 4-18 "Studies aimed at characterizing the disturbed rock zone...will continue through the WIPP operational phase." (Illegal segmentation.) Release scenarios are all based on site characterization; the importance of knowledge about the disturbed rock zone's extent and implications must not be underestimated.

4.3.2.1 4-18 Water content of Salado salts is twice that estimated in the SPDV phase. Detectable fluid flow into the facility is "greater than expected" in the SPVD. How can a site be "validated" using invalid scientific data? The inescapable conclusion is that the site could never have been "validated" if the data currently available had been available during the SPDV phase.

4.3.2.1 4-18 Both brine inflow studies cited evaluate inflow of brine at ambient temperatures. Neither addresses the possibility of rising temperatures from decomposition and gas generation; as salt is a hydrophilic medium, rising temperatures ATTRACT moisture (accelerating breakdown of containers and potential slurry formation / migration).

4.3.2.1 4-18 Higher brine inflow occurs through Marker Bed 139 (3 feet below facility) as numerous near field fractures exist resulting from construction of WIPP. The section has a totally inadequate analysis of the impacts of WIPP construction on site characteristics.

4.3.2.1 4-18 Hydraulic conductivities have been estimated "assuming" a Darcy flow model and a porous and elastic medium. How accurate are these estimates? How would different values for conductivity affect release scenarios?

4.3.2.1 4-19 "The hydraulic characteristics of the Salado Formation have not yet been clearly defined." The facility is built within this formation; its ability to isolate the waste will be affected by these characteristics; environmental impact is thus not assessed; the SEIS does not fulfill its purpose; illegal segmentation is implied by the need for further studies.

4.3.2.1 4-19 The hydraulic uncertainties include: 1) the nature of the driving mechanism for brine flow; 2) presence of a gas-driven, two-phase behavior; 3) whether a porous-media Darcy flow is the predominant process. Darcy flow has been "assumed."

Observation has "not been sufficient" to distinguish between Darcy and non-Darcy flow.

Both conceptual models proposed for brine inflow rest on undocumented assumptions. DOE calls Darcy flow "conservative" yet the range of interpretations of existing data could obviously be more conservative.

4.3.2.1 4-19 Slurry formation "seems" unlikely. Yet independent scientists (notably Scientists Review panel) consider it likely; another example of the full range of scientific opinion not being addressed in the SEIS. DOE relies on brine inflow "modeling" which may be inaccurate by orders of magnitude to predict likelihood of slurry formation.

SEIS concedes that gas generation is a serious potential effect of brine inflow. Yet SEIS calls current estimates conservative which are based on unreliable brine inflow estimates. Independent scientists' predictions of inflow would yield truly conservative gas-generation estimates. "Fundamental model assumptions" in the SEIS are primarily favorable to the proposed action, rather than objective.

"In order to predict the final state of the repository...brine inflow must be characterized as fully as possible." When? (Illegal segmentation.)

4.3.2.1 4-20 The second "issue of concern" is the potential dissipation of waste-generated gas after closure. "Fractures are expected to form..." "Previously fractured zones...may provide a preferential pathway for gas migration." The hazards of this dangerous, combustible gas migrating or driving brine are insufficiently analyzed. The environmental impacts could be great; here again the SEIS does not fulfill its purpose.

Far-field Salado gas permeabilities are 1,000 to 10,000 times lower than assumed in the FEIS and "may be even lower than the present estimate." DOE is still working with unreliable figures.

"Far-field permeability issues...may not be sufficient to dissipate generated gas pressures within the WIPP facility to levels less than lithostatic pressures should conditions be favorable for the generation of large volumes of gas." What's not said is what the effects would be: accelerated fracturing, gas and brine migration, accelerated radionuclide migration, environmental degradation. SEIS does not accurately predict environmental impacts!





"Further detailed characterization of brine inflow" needed to predict gas pressures and final state of the repository is proposed to occur during the Test Phase. (Illegal segmentation under NEPA!) Real waste should not be used to study unpredictable and unknown hydrologic patterns. No analysis of retrieval measures or details of the Plan are included. No environmental impact analysis is offered.

4.3.2.2 4-20 Hydrologic Testing of Salado Formation at Facility Horizon: Salado permeability must be known to predict brine-inflow rates and evaluate gas pressure dissipation. Permeability is at least 1,000 to 10,000 times lower than assumed in FEIS. The pre-FEIS tests were "not defensible" --1) inadequate length of time between drilling and tests to allow equilibration; 2)testing periods too short. How do we know current testing methods are "defensible"? What if current estimates are still off--by orders of magnitude?

4.3.2.2 4-21 Tables 4.2-4.5 present results of tests conducted near the facility and affected by the disturbed-rock zone.

Far-field conditions (which should be known to predict repository performance) have been characterized from what is admitted to be a "limited data base." To implement the Test Phase to finish this characterization implies illegal segmentation.

4.3.2.3 4-21 Hydrologic Testing Adjacent to WIPP Waste-Handling Shaft:

"The long-term performance of WIPP depends on the effectiveness of the shaft seals." Limitations in the testing at the shaft could limit accurate predictions of performance. There is no analysis of effects of testing on the tested phenomena; constructions of test drillholes themselves could have altered fracturing patterns. See page 6-5 for a discussion of the disturbed rock zone (as usual, based on assumptions only) and page 6-10 for a description of some limitations of the shaft seal technology which is still untested and unproven. DOE seems to hope that by physically separating discussions of crucially related factors, readers will forget by the time they get to page 6-10 what was said on page 4-21.

4.3.2.3 4-26 Hydraulic-conductivity values presented in Table 4.6 are "on the order of those expected in the far field." This narrow range of values is an assumption; a wider range would lead to conclusions of higher or more variable hydraulic conductivity. The tests are acknowledged to be "short-term." The tests "appear to indicate" that no disturbed-rock zone exists more than 5 feet into the rock resulting from construction. What if this is not accurate? There is no analysis of implications of potential larger disturbed-rock zone.

"Fluid-pressure profiles at the 782-ft. and 850-ft. levels may not be reliable because of possible equipment malfunctions." The entire testing process is questionable and unreliable if the equipment does not function consistently. Other methods "could provide additional data." (Illegal segmentation.)

4.3.2.4 4-26 Marker Bed 139 / Structural Studies Near Facility: Mining-induced fracturing in this formation which lies directly (3') below the facility could provide migration pathways. The behavior of MB139 and its "impact" on the facility are acknowledged to be important; yet the SEIS conclusions are "preliminary." SEIS should accurately predict environmental impact!

"Away from the influence of the...excavation, permeabilities...APPEAR no greater than that of surrounding halites" (reference from 1985). Why is there no more current understanding or testing since 1985, if these findings are considered "preliminary"? There is no analysis of the potential range of unfavorable findings; no description of potential for further testing and characterization; no prediction of long-term continued fracturing in areas that have already been damaged.

Mining-induced fracture pathways "may require that damaged portions of MB139 be removed or grouted before seal emplacement." There is no analysis of cost, difficulty or hazard, no references. How would this be done? Would it be hazardous once waste is already degenerating in facility? Could the technique's long-term performance be predicted?

4.3.2.4 4-27 4.6 HYDRAULIC CONDUCTIVITY & FORMATION PRESSURE FOR BOREHOLES W805W and W805SW: Given the same materials (silty claystone) and identical depth and testing procedures, why the very different pressure results? This indicates a higher degree of structural variability in the formation than "assumed" for modeling purposes.

4.3.3 4-30 RUSTLER FORMATION: The Culebra Dolomite of the Rustler (the first laterally continuous hydrologic system above the Salado) is acknowledged to provide the most likely potential pathway for release.

4.3.3 4-33 "Characterization of the Rustler Formation since the FEIS has provided considerable evidence regarding the potential for dissolution at the WIPP." Once again, the more information is gained, the more complex and unfavorable the site appears. This is why DOE wants to start putting waste in the ground before they find out any more damaging information.





4.3.3 4-33 The concern that salt dissolution could play a role in breach of the facility is acknowledged. The assumptions that: rock salt was deposited with uniform thickness over a large area, that the Nash Draw feature is due to Rustler salt dissolution and that dissolution is the main cause of variability are "viewed as conservative." Are these really conservative assumptions? Would a potentially higher degree of inherent variability in the formation also result in more conservative or unfavorable conclusions?

The potential result of local evaporite dissolution is acknowledged to be a possible "solution hole" hydrologic system including "continuing formation of small caves and sinkholes." No references, no analysis, no predictions.

4.3.3 4-33 Studies cited indicate that vertical recharge to the Rustler is not active at the WIPP and that water currently present originated from recharge 10,000-20,000 years ago. Independent scientists (SRP, Larry Barrows, etc.) have arrived at different interpretations---not cited.

4.3.3.1 4-35 HYDROGEOLOGY OF RUSTLER WATER BEARING UNITS: This subsection describes limitations in the testing of the unnamed lower member. These limitations render the pressure data largely unreliable.

There is no analysis of direction of flow of high-transmissivity zones.

4.3.3.1 4-35 HYDROGEOLOGY OF RUSTLER WATER BEARING UNITS: Where dissolution has occurred, transmissivities tend to be higher. "The brine-bearing residue of the upper Salado "MAY BE HYDRAULICALLY CONTINUOUS" with the siltstone of the (Rustler) unnamed member.

This is a euphemistic way of admitting flow between the formation in which the facility is located and the formation known to bear the most water and the highest risk of off-site migration. The effectiveness of the confining beds is thus in doubt. No analysis.

4.3.3.1 4-35 HYDROGEOLOGY OF RUSTLER WATER BEARING UNITS: "The degree to which brecciation (breaking up into angular fragments...unnamed lower member of RF) may have caused enhanced transmissivity or decreased the effectiveness of the confining beds... is not clear from the available evidence." In other words, it is not known to what degree or why the two formations are hydraulically continuous, an important factor in flow prediction.

4.3.3.1 4-36 CULEBRA DOLOMITE: This subsection acknowledges limitations of the multipad interference test process: Culebra water-pressure levels affected by continuous discharge into shafts; "delineation of undisturbed potentiometric surface-difficult."

Variations in fluid density are important in determining flow directions accurately; low hydraulic gradients make it difficult to define flow directions (southern area).

* There is no analysis of the impacts of different flow directions.

Since single-hole testing is known to be unreliable in areas with karst conditions (widely acknowledged by everyone but DOE to exist at WIPP) the multi-hole testing becomes even more crucial in determining groundwater conditions. If the multipad testing process has been inadequately carried out and the results incompletely analyzed, it seems premature to base decisions on these limited test results. If more tests remain to be done, we are once again encountering an illegal segmentation problem.

4.3.3.1 4-41 MAGENTA DOLOMITE: High values of transmissivity, not predicted in FEIS. Forty-Niner Member: Here is yet another assumption--that transmissivities may be higher west of WIPP in Nash Draw.

4.3.3.1 4-42 HYDRAULIC-HEAD RELATIONS: Flow systems are "not at steady state" but in transient state following major recharge event during the last pluvial period. No analysis of future recharge events or their potential effects on flow systems.

Single-hole tests--more testing limitations are described, yet their impacts are not fully addressed.

4.3.3.1 4-50 MULTIPAD TESTING: Porous-Flow numerical approach is used to model Culebra fracture systems on regional scale. "These modeling efforts indicated that dual-porosity methods of ...simulation are not needed at a regional scale." This situation is subject to very different interpretations; c.f. Table 4.1.

Evaluation of the final multipad test is "still underway." "Preliminary" results are cited. This is unsatisfactory under NEPA.

4.3.3.3 4-50 BASIS FOR CULEBRA FLOW/TRANSPORT MODEL: "modeling of the Culebra Dolomite hydrologic system has undergone dramatic changes since the FEIS...(which) reflect modifications to the conceptual model...Current understanding shows that the





Culebra Dolomite is a more complex flow system than originally conceptualized." What if this formation is still more complex than the current understanding? As the most likely radionuclide migration pathway, doesn't it need to be fully characterized? How do we know that the "current understanding" won't be subsequently invalidated as was the model used in the FEIS?

New data have been collected and "old data were REINTERPRETED". In 1986, DOE began a "model development process that will continue through at least 1989". Isn't this a way of admitting that a wider range of credible interpretations exists for the data than the range assigned by DOE?

4.3.3.3 4-51 4.12 Calculations of apparent and effective transmissivity and storativity have been based on an assumption of homogeneous properties between WIPP-13 and a given well, as well as radial flow into WIPP-13. On what are these assumptions based? Also, why was the delay in drawdown so long for H-1?

4.3.3.3 4-54 "Particle travel time from the center of the...emplacement panels to the southern WIPP-site boundary, along the present hydraulic gradient, was computed to be approximately 13,000 years." This period is alarmingly close to the length of the control period (10,000 years). If the accuracy of the model is questionable, different interpretations could result in computations of off-site migration well within the control period.

This subsection includes a discussion of "transient hydraulic stresses," and the "adjoint sensitivity approach" model which allows "minor modification of assumed transmissivities or storativities to improve the model fit for the observed hydraulic heads" and permits modeling of "different conceptualizations of the flow system that...may result in different flow paths or travel times...to the site boundary." How different? How much would the differences affect migration over the 10,000 year control period? Why should DOE be allowed to use unreliable models?

DOE states the data collection phase of the Culebra program is "essentially complete" while admitting that "data gaps" exist in well distribution, even in the assumed high-transmissivity zone. "Re- interpretation" of existing data also remains. "Thus, modeling will be bound by the limitations of the current data base. This significance of these limitations will not be known until calibration of the...model is completed." In other words, calculations will continue to be unreliable. "Currently, the unexpanded version of the model is being used to make the long-term performance predictions presented in Subsection 5.4" The long-term release scenarios are then based on a chain of assumptions and limitations and simply cannot be considered

credible. Thus the SEIS does not do its job of predicting realistic impacts.

Description of more assumptions and uncertainties used in simulating Culebra flow and transport characteristics:

* Culebra assumed to be vertically homogeneous, with flow distributed equally throughout the unit's thickness; ("Modeling 'should be' reliable.")

* The Culebra is locally completely confined, with no vertical flow in or out; (the "uncertainty of the modeling...has not been fully evaluated.")

* The Culebra has uniform properties in all directions. Yet there is evidence of anisotropy that would require re-estimation of transmissivities "by a factor of 1.6 to 2.7." This could easily produce much faster travel times, i.e. within the control period. NO ANALYSIS

Assumptions of uniformity and homogeneity for the FEIS have nearly all been proven incorrect. The site is consistently more complex and variable than assumed.

4.3.3.4 4-55 GEOCHEMICAL ENVIRONMENT WITHIN RUSTLER FORMATION: Culebra fluids are partly buffered by the dissolution of rock salt. This subsection should include a more thorough discussion and analysis of dissolution, a prime manifestation of karst conditions.

4.3.3.4 4-57 ACCESSORY MINERALS..."are distributed heterogeneously both horizontally and vertically." So why is hydraulic conductivity (flow) assumed to be vertically homogeneous? (cf. 4-54; 4.3.3.3)

4.3.4.1 4-57 CASTILE FORMATION: Variability/ Deformation/Dissolution: Here DOE concedes that regional or localized dissolution may be a cause of variability of stratigraphic thickness. The northern portion of WIPP lies "within the disturbed zone...characterized by deformation and variability in the thickness of the Castile and Salado Formations."

"The thickness relationship is inconsistent with the concept of dissolution being the prime cause of the variation." This is yet another undocumented DOE assumption with no reference.

4.3.4.2 4-59 OCCURRENCE AND CHARACTERISTICS OF PRESSURIZED BRINES: "A relatively recent origin was postulated for the brine." This implies hydrologic change, dissolution. Why is there NO ANALYSIS OF FUTURE HYDROLOGIC SHIFTS?





"Brines are at or near salt saturation and have little potential to dissolve evaporite deposits." But if breached through intrusion, the brines could still dissolve and carry particulate waste matter on contact.

4.3.4.2 4-60 Here DOE concedes, "the hydraulic heads (pressures)...in the brine reservoirs are great enough to reach the ground surface in an open borehole." yet the chances of waste reaching the surface are downplayed throughout the SEIS.

A continuous deep conducting zone underlies the region of the WIPP emplacement panels. This was not known at the time of the SPVD or the FEIS. This factor might have been sufficient to invalidate the site.

"The presence of Castile brine beneath the repository is of concern only in the events of human intrusion." (No references) This assumption does not account for possible hydrologic shifts or unknown complexities, future changes, fracturing, seismic activity, pathways to and from existing boreholes.

4.3.5` 4-62 BELL CANYON FORMATION: The Bell Canyon is the first laterally continuous, water-bearing zone below WIPP and provides a potential local mechanism for the dissolution of the overlying evaporite sequences. The SEIS cites the SPVD studies which stated that no significant dissolution would be observed "for at least 10,000 years." The SPVD studies were based on poor and limited data. Why cite a study that has been proven inaccurate on so many other counts?

4.3.5.2 4-62 Potential for Fluid Flow between Bell Canyon and Rustler: Lappin (1988) argues that in a breach interconnecting the two units, local dissolution of the Salado would occur, so that the intruding fluids would become a saturated brine solution. "Given this assumption," SEIS concludes that a downward flow from the Culebra to the lower units would result. Why rest on this assumption? There is no consensus that this is true.

"This scenario also does not take into account the potential for gas pressure generation in the WIPP facility, which could produce driving pressure levels in both an upward and a downward direction." Why use scenarios which don't take into account factors elsewhere characterized as very likely?

5.0 SUMMARY ENVIRONMENTAL QUALITY

References are not footnoted in the text making access impossible, without master code.

Availability of "economic model" (Table 5.1) maintained at Los Alamos raises serious questions--is it available for inspection?

Averages, moving weighted averages and extrapolations, as well as assumptions, used to excess. See table 5.4 (p.5-12), footnote (d), page 5-19, PP4, "probability of given exposure...summed over all severity classes, page 5-19, PP5 "The total population..."etc, for examples:

Tables (All) are meaningless to the public, as sources are not listed, examples not defined, figures not explained.

Page 5-15 (section 5,2,2) PP 4, "Direct comparisons of doses and risks reported in the FEIS to those reported in this SEIS cannot be made because of the differences in the assessment methodologies and the method of expressing dose." Possible fatal flaw in SEIS, for following reasons:

* Comparison of "apples to apples" must be made under NEPA law.

* This constitutes a DOE attempt to prevent public and scientific community from participating in SEIS process.

* If no comparison can be made, then SEIS (as a legal document) fails to provide comparison of FEIS to SEIS, or allow a method to quantify changes.

This section glosses over most important areas of concern.

In references, there are no findings or negative impact ($) reports.

5.0 5-1 Section 5.1 (page 5-1) to 5.2.2 (page 5-37) is a morass of assumptions, justifications, and unqualified and unquantified statements. Because these sections pertain to risk assessments of nuclear waste transportation, the information presented must be beyond reproach. It is not. It is clear from the vague and imprecise language and data presented in this section of the SEIS that the energy department has no idea of how it intends to demonstrate safe transportation of waste on public highways without endangering the public health and environment or exposing workers and drivers to unacceptable does level commitments of radiation.

Specific criticisms of this section include the lack of negative economic impacts to communities along the WIPP route, such as threats to property values, loan portfolios, employment and public perception. The statement (5-15) that "Direct comparison of FEIS 1980 to SEIS cannot be made" should render the





entire document invalid, as does the excessive us of probability weighted averages.

Repeated use of phrases such as,"(breach) is not a credible event" indicate a total lack of contact with real world events and denial that human error will occur; human error is not factored into any of the models used. Failure to include recent (post 1987) truck accident data, depending instead on obsolete 1977 statistics indicates an attempt by the preparers to rush this most vital SEIS process to the detriment of the American people.

5.0 5-1 Section 5.1 should be considered a change from the FEIS, in that: "socioeconomics DO NOT address negative impact ($) to communities other than Carlsbad, Loving, or Lea or Dey counties.(i.e. Santa Fe, Roswell, Raton,etc.)"

5.0 5-20 5.6 Table 5.6 is meaningless because: a)Does not include other alternative b) Figures have no meaning to public c) Cannot be studied without references and sources of data at hand

5 5-21 5.7 This table has the same problems as table 5.6, but even more critical as it deals with RH-TRU.

5.1.1 5-3 "A total of 21 species of raptors have been recorded to date by surveys for the WIPP Biology Program (initiated in 1975) and its successor, the EMP. Two species, the Harris hawk and Swainson's hawk were found to breed near the WIPP site in unusually large numbers. This was an important finding because both species are uncommon in the US and are of uncertain status throughout most of their natural range. Since human influence adversely affects the nesting success of these birds..." WIPP (Los Medanos) site is a major breeding area of these important species of hawk. Human influence adversely affects breeding, thus: "modifications were modified" to avoid disturbance. What does this mean, what are the modifications? Modifications of Modifications? Are either species endangered, or endangered if breeding is disrupted? DOE must flesh out data on this.

5.1.2 5-3 "The primary area of socioeconomic impact defined in the 1980 FEIS was, and continues to be, Eddy and Lea Counties, or southeastern New Mexico. Thrust of this section (socioeconomics) continues to be a "positive economic impact" on local areas of Lea & Eddy counties.

No studies have been done by DOE in other communities (Santa Fe, Albuquerque, Roswell, Raton,etc.) on the WIPP route (in NM) or in other states that may prove a net negative economic impact (or offsetting) for those residing on, or in business, along the WIPP transport route.

At the CCNS meeting with John Arthur, SEIS Project Director, possible negative economic impacts of WIPP on property values, lost jobs, tourism, etc. were discussed. (If spill or accident results in negative publicity, or simply because a property may be on or near a WIPP route). Arthur replied that "study cannot be done as data base does not exist." DOE should then conduct such a study to encompass a) a 10,000 year period b) a positive economic impact c) data on negative economic impact as an alternative to positive economic impact.

5.1.2 5-4 "With the proposed initiation of the Test Phase in 1989, continuing for approximately five years, the annual total economic impact would range from about $150 million to $185 million (constant 1990 dollars). How did DOE arrive at "constant 1990 $'s in 1988-89. This is an unacceptable assumption, as to value of "1990 Dollars".

5.1.2 5-6 "The economic activity multipliers...'etc. How does DOE arrive at $4.3 billion in 1990 dollars?

5.2.1 5-7 "(about) 61% of Pad-stored defense TRU waste in the US is located at the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory." What is the national significance of this figure?

5.2.1.2 5-9 "Routine operations: Measurable exposure to the public or adverse effects on the surrounding environment would not be expected from the extremely small airborne releases experienced during routine operations." 1) An "extremely small airborne release" of PU238 or PU239 is deadly and, if interested, will cause lung, lymph, thyroid, or bone cancer. 2) Is this to say that there will be airborne releases during routine operations? DOE appears to be admitting to such releases here. 3) ALARA-"As low as reasonably achievable." This is a severely questionable assumption on DOE's part. Many studies indicate any increase is too much (in dose/exposure)

5.2.1.2 5-9 "Exposure is associated with a tornado with 280 mile per hour winds, which has an extremely low probability of occurrence at the Idaho National Engineering Laboratory. There is a moderate possibility of a tornado hitting at the WIPP site--this is not discussed.

Pantex Nuclear Bomb Plant in Texas was hit by tornado & caused major damage & contamination.

5.2.1.3 5-10 5.2 Tables 5-2 & 5-3 are meaningless, unreadable-- and are based on figures that are impossible for the public to understand or verify. What are the references?





5.2.2 5-14 "Differences in level of characterization of the radionuclide and hazardous chemical source terms required the use of different risk assessment methodologies for evaluating the radiological and hazardous chemical components of the TRU waste."

There is no credible evidence of what "Difference in level of characterization", means.

Why is "a use of different risk assessment methodologies" required? This appears to be another attempt to confuse the issue and suggests that DOE is attempting to hide something.

5.2.2.1 5-15 "Direct comparisons of doses and risks reported in the FEIS to those reported in this SEIS cannot be made because of the differences in the assessment methodologies and the method of expressing dose."

This is an unacceptable statement, as:

* NEPA requires comparison to be made, and alternatives to be studied & presented. DOE fails to do so, and uses this statement as proof.

* If no direct comparison (apples to apples) can be made. How can we validate or approve changes made over 10 years?

* NEPA requires public participation. Public is excluded if methods change in midstream. The same is true regarding "dose assessment."

If DOE cannot explain this now to our satisfaction then they must be forced to before Congress and in a court of law.

5.2.2.1 5-16 "In the RADTRAN models, risks are not based on specific accidents but on the likelihood and consequence of accidents of various severities, with more severe accidents having a higher release fraction (ie amount of wastes that are released to the environment but lower probability of occurrence. The fractions of material released vary as a function of accident severity category. The model provides a probability weighted estimate of cumulative risk rather than specific dose calculations for individual accident scenarios." This reasoning is severely suspect and in fact meaningless. The public must be able to know risk possibilities, not a "probability weighted" chart or graph of risk exposure.

What is impact of spill & breach of one Trupact (of three) and five drums in a propane fire in a 15 knot wind SSE?

Regardless of the wording by the DOE, it is still an estimate.

Is the RADTRAN CODE still available, as it is not in Appendix D3?

5.2.2.1 5-16 "The only potential radiation exposure during routine transportation activities will be from direct radiation which penetrates the TRUPACT-II container. Direct radiation exposures to truck drivers, to members of the public driving alongside a waste shipment, to the roadside population, and to people in the parking lots where stops are made, are estimated."

An admission by DOE that there will be RAD exposure penetrating the TRUPACT II (recently admitted by DOE, reported in media):

1) Direct to truck driver
2) Public traveling alongside
3) People in parking lots

Why are exposures "estimated?" rather than calculated? What mitigation procedures does DOE use to ensure protection of drivers?

5.2.2.1. 5-19 An amazing page, filled with vague generalities, assumptions, contradictions, etc.

"Quantitative estimates of the occupational radiation risk, such as to the involved truck driver or train crew, resulting from transportation accidents were not made in the FEIS or SEIS." Studies were not made as to radiation impact to drivers. OSHA violation? Why were no studies done?

"Will follow predetermined safety procedures" What procedures? Who follows them? Who chooses & approves them? Where are references & manuals?

"Such training will minimize" How--By Whom--etc. etc.

5.2.2.1 5-19 Last 2 lines "the probability of a given exposure to the population along the route is the product of accident frequency per mile, probability of occurrence of a given severity class accident, and the probability that the event will result in an impact or a fire. These probabilities are then summed over all severity classes." The statement is meaningless and inaccurate. The attempt here is to "average out" to the maximum, thus minimizing any specific threat.

"The total population along the route is a sum of the products of the population density for rural, suburban, and urban zones, the length of the transportation route, and the fraction





of travel through each of these zones." How was this derived? What model and reference are used here? DOE's determination appears to be based on averaging, thus rendering the statement meaningless.

5.2.2.1 5-24 "...major (TRUPACT) breaches are not credible..." This is a thoroughly shocking statement as the container has repeatedly failed testing, undergone numerous redesigns, and has not received NRC certification. DOE must explain such dangerous assumptions.

The statement, "no breach will occur" is ignoring human error in design, engineering, testing, fabrication (ESP) and handling.

"Releases are not expected during routine transportation because of the TRUPACT-II design and performance criteria." (Page 5-27). This assumption cannot be validated, see (TRUPACT 5.2.2.1 5-24) above.

"In an accident involving a severe fire, there is a potential for release of a wide range of combustion products from the firing of plastics and other combustibles. As discussed in Subsection 5.2.2.1, a major breach of the TRUPACT-II was not considered as a reasonable event, and therefore external oxygen/air sources would be limiting (i.e. when internal combustion is limited).(last paragraph on 5-33) This is again ignoring human error in design, engineering, testing, fabrication and handling.

"Major breach of any of the Type B TRUPACT-II transporters is not credible'... Again, the word "assume" is used 5 times on page 5-24, four times in this paragraph.

5.2.2.1 5-24 "The "bounding case" has an extremely low likelihood of occurring." The Challenger explosion odds were said to be 1/178,000, but were actually 1/25. The Exxon Valdez was 1/in millions, not to mention 3 Mile Island, Chernobl, etc. DOE has no credible means of supporting such an outrageous conclusion about a "bounding case."

What is the actual likelihood? How was this modeled? DOE's prediction does not account for human error, or substance abuse. In general, this is a false assumption not based in fact.

5.2.2.1 5-24 "Probability of breaching three TRUPACT-IIs (which are specifically constructed to withstand severe accidents and engulfing them in a two-hour fire (requiring the fuel equivalent of two fully loaded fuel transports) in an urban area during adverse meteorological conditions is extremely small."

Another example of assumptions. In Los Angeles, about 1984 or 1985, two gasoline trucks collided on slippery pavement (during a rainstorm) in a freeway underpass; the resulting accident, explosion and fire destroyed the bridges (Route 5 and Route 2 SB) at the busiest interchange in LA. It also melted the pavement, vaporized concrete, etc. This kind of accident might potentially happen during the WIPP shipping program, yet DOE does not even consider it here.

5.2.2.1 5-25 "This report (BEIR-111) uses a variety of data and accepted methods to quantify the health impacts of low levels of radiation." This definition of "low level" radiation is highly controversial among scientists nationawide.

"However, because its appropriateness for high-LET radiation has not been definitely established, it is possible that the potential number of fatal cancers associated with WIPP operations is lower than presented in this SEIS." If "lower than" is an assumption, then "higher than" may also be "assumed" by DOE.

5.2.2.1 5-26 All of first paragraph is important, ending with, "The cancer risk estimates used in this SEIS represent an average of those calculated using the absolute-risk and relative-risk models for both low-LET and high-LET radiation." Here, excessive use of averages serve to explain away lack of knowledge/data. a) currently, there is only 40 years of (incomplete) data. b) If DOE records of worker exposure were more complete, it would provide useful charts, but DOE has failed to provide this.

5.2.2.1 5-26 " ... the very low radiation exposures predicted in the D-SEIS lead to an insignificant number of health effects and k ri values to the population." This constitutes an extremely dangerous assumption and remains totally unsupported by the SEIS.

5.2.2.1 5-27 Entire paragraph titled "Risk of Transportation Related Exposures." First, "Releases not expected" etc. This is not an acceptable statement as it is not factually supported. Second, the entire paragraph is impossible for the public to understand. Third, uses a 1/4 background cancer rate, American Cancer Society, etc. to justify an increase in dose rates.

5.2.2.3 5-35 "Recent national estimates of truck accident rates are not available." (refers to "NRC 1977" data earlier in paragraph. This statement is a blatant attempt to avoid later data that may show negative impact. DOE made no attempt to study data from:





1) Insurance companies/claims
2) American transport carriers ass'n
3) State highway departments
4) Union data

DOE's statement here defies common sense, as:

* A major change from FEIS to SEIS is change of mode from rail to truck. Yet, DOE failed to obtain late (recent) data to use, choosing instead incomplete data that is over twelve years old. How can such a major change be made in the absence of supportive evidence?

* What is % growth of truck transport?

5.2.3 SUMMARY The SEIS does not adequately address the many possible health effects of radiation exposure. SEIS analyses are limited to fatal cancers and are thereby misleading by ignoring the many other known health problems associated with radiation.

5.2.3 SUMMARY RISK ASSESSMENT AND ANALYSIS OF RADIOLOGICAL ENVIRONMENTAL CONSEQUENCES OF OPERATIONS AND POSSIBLE RETRIEVAL AT WIPP

A myriad of assumptions readily invalidate the so-called "conclusions" reached in this section. The risks and consequences evaluated here are based upon supposedly worst-case or "bounding" accident scenarios. However, these scenarios assume that the HEPA filter system in the waste handling building never fails and operates at an efficiency of 99.9999%; that workers will respond as trained and immediately leave the accident area [therefore exposure to workers in the case of an accident is never considered]; that management and control systems will operate as designed; that the majority of accidents will be "industrial in nature" and will not result in releases of radioactivity; that the air pathway is the only significant release and exposure pathway from WIPP; that the storage drums will maintain their structural integrity in the event of retrieval; that unrealistically low releases will result from accidents [for example, 1% of the contents of a drum released in the event of a spill]; that latent cancer fatalities are the only risks associated with the operation of WIPP; and that human error is not a possibility in these accident scenarios.

It should be noted that the dose assessments, methodologies, estimates of routine and accidental radiological releases and subsequent dose calculations are based upon the draft FSAR, a critical document which is not yet available in final form. Many of the accident scenarios presented are immediately dismissed as "unforeseeable" and are therefore not considered at all. Inconsistencies and inaccuracies lead to many questions about the

validity of this section. It is postulated that releases of radioactivity will not occur as the result of most accidents at the WIPP site; however, it is also stated that radioactivity will be released even in the course of normal operations. Health risks for workers under routine conditions are estimated to be twice that under worst-case accident releases [table 5.22 & 5.23]

In sum, risk assessments are based upon a safety document still only in draft form, gross and unrealistic assumptions, and inaccurate and inconsistent information which effectively nullify all conclusions reached.

5.2.3.2 5-42 "It was determined in the draft FSAR that the air pathway is the only significant release and exposure pathway from the WIPP during operations." Here, DOE significantly fails to address:

* Liquid pathways. Liquid releases to ground water or surface water operations are dismissed as "not credible", despite the fact that the four shafts transverse an aquifer and ignoring the existence of a pressurized brine reservoir beneath the repository. Consideration is made only of a release of liquid radioactive material as a possible source of contamination of water, when solid radioactive particles are capable of entering waterways as well. The SEIS states that no major surface waters are within ten miles of the site, thereby handily bypassing the fact that the Pecos River is only 14 miles away. Mention is made only of surface waters - possibility for the contamination of underground aquifers is ignored.

* Soil pathways. Direct release to the soil is dismissed as not credible because of the nature of the operations, i.e. the fact that the waste is "containerized, handled within the Waste Handling Building and emplaced in rooms 2,150 feet below the ground surface." The argument that the waste cannot come into contact with the soil because it is being placed underground makes absolutely no sense whatsoever. No consideration is made of a possible breach and therefore direct contact between radionuclides and the soil. Furthermore, if radioactivity were to enter the groundwater it would then contaminate the soil as well.

5.2.3.2 5-44 "Public risk estimates for waste retrieval activities assume the waste containers remain intact throughout the test phase and the subsequent, assumed, 10-year retrieval period." If a worst case scenario were to be presented for retrieval operations, the possibility of a breached drum should certainly be considered. This is an overly optimistic assumption and does not realistically address the possible risks associated with the retrieval of a breached drum.





5.2.3.2 5-47 The SEIS routine operations and accident scenarios assume that all particulates released through the Waste Handling Building pass through HEPA filters operating at a removal efficiency of 99.9999 percent, thereby reducing the amount of radioactivity by a factor of one million. This can hardly be said to represent a worst case scenario. In fact, the assumption that the filters will be operating at all at the time of an accident is presumptuous in and of itself. What if there were a malfunction in the filtering system and a million times the estimated radioactivity was released into the atmosphere? The SEIS does not consider the risks associated with such a scenario.

5.2.3.3 5-45 The SEIS states that "small amounts of radioactivity may be released during normal handling and storage operations." Gross assumptions associated with this statement include that only 10% of all drums and boxes received at WIPP have the maximum permitted level of surface contamination, that only one percent of the radioactive content is spilled, and that the HEPA filters are operating at a 99.9999% removal efficiency at the time of the "routine release." Even under these "optimum" conditions, releases of plutonium, uranium, americium, californium, and other radioactive materials will "routinely" be released into the environment. The SEIS claims that "these individual doses are considerably less than limits established by EPA." The medical community at large has consistently insisted that there is no safe or acceptable dosage of radiation. Just one-millionth of a gram of plutonium can cause cancer when inhaled. We have seen the effects of "routine releases" at other nuclear facilities in the form of cancers, thyroid disorders, miscarriages and deformities. Furthermore, it is later stated that "Most of the accidents during the WIPP's operating lifetime are expected to be industrial in nature . . . and will not result in releases of radioactive material ." [page 5-49] How is it possible that there will be routine releases of radioactive materials under normal operating conditions, but there will be no releases under accident conditions?

5.2.3.3 5-46 "Routine releases are not anticipated [during the retrieval stage] because waste containers are designed to maintain their structural integrity for at least 25 years." According to the WAC (summarized on page 2-10), container design life is anticipated to be only 20 years. No consideration is given to possible exposures should a container be found to have breached upon retrieval later. This is a very serious possibility and one that should be assessed.

5.2.3.3 5-49 "Routine releases from retrieval are estimated to be much less than those from routine emplacement because it is a slower process." In comparing the possible radiation exposures between emplacement and retrieval, no

consideration is given to the fact that the drums that have been buried have been under tremendous pressure and may have been exposed to brine seepage. The chance of the drums breaching is much greater for those being retrieved than those being emplaced, therefore the possibility for exposure to radiation should be much greater for retrieval than for emplacement.

5.2.3.3 5-49 The routine waste retrieval exposures are based upon an assumption that 5% of waste containers are contaminated. What is this assumption based upon? 5% is a low number for a supposedly bounding case scenario.

5.2.3.4 5-49 The SEIS only covers accidents involving equipment failure - no consideration is ever made of possible operator errors! Human error has been the main cause of many major accidents - Chernobyl, Three Mile Island and the recent Exxon oil spill are all outstanding examples of unexpected disasters brought on by human operator errors. This entire section is worthless due to this glaring omission. The unspoken assumption that there will be no human errors is unrealistic and misleading.

5.2.3.4 5-49 "Most of the accidents during the WIPP's operating lifetime are expected to be industrial in nature and not unique to a facility handling radioactive material and will not result in releases of radioactive material." On what are they basing the assumption that most accidents will be "industrial" in nature? What does this mean? Why would accidents not result in the release of radioactive material when it is stated earlier that even routine operations will result in the release of radioactive material? [SEIS p. 5-45]

5.2.3.4 5-49 The SEIS states that "No pathways were identified whereby accidental releases of liquids to the environment might occur." 40 acres of the disposal site sits directly above a highly pressurized brine reservoir. Since the DOE will be drilling and mining in the area, possible releases of pressurized brine carrying radionuclides should certainly be a consideration. Several million gallons of brine erupted from the WIPP site in 1981. No consideration is given to brine flow and possible transport of radionuclides to nearby aquifers via this flow. It is unreasonable to dismiss the possibility of releases of liquids to the environment without any analysis of the possible risks involved in such a scenario.

5.2.3.4 5-53 "The maximum exposure to a single worker is estimated to be 9.2 rem [under the worst case accident scenario] which is well within DOE guidance for accident exposure to individuals in the public." There is no safe level of exposure to radiation. If there are separate DOE guidelines for exposures to workers as opposed to members of the general public, then the





statement that the maximum exposure to a worker is within the guidelines designed for the public tells us nothing. How does the maximum exposure to a worker compare with the exposure guidelines for the general public?

5.2.3.4 5-53 5-54 5.19 5.20 These worst case accident scenarios, as detailed in Appendix F, cannot be considered "bounding cases."

* Many of the possible accidents are simply dismissed as "unlikely" and are therefore not assessed at all.

* The amounts of radioactivity assumed to be released are unrealistically small [often only 1% of the contents in a drum spill].

* The possibility of human error is not a factor considered in any of these scenarios.

* Failure of the HEPA filter system in the Waste Handling Building is never considered; failure of this system would, according to the SEIS evaluation of their efficiency, increase the amount of radioactivity released to the environment by a factor of one million.

* In each scenario, workers are assumed to respond as trained and immediately leave the vicinity of the accident. No consideration is given to exposure levels for workers who do not respond as trained or who may be injured and physically incapable of leaving the area.

5.2.3.5 5-55 "It is assumed that management and control systems operate as designed and that normal operations remain within established limits in the assessment of consequences related to routine operational releases and exposures resulting from WIPP operations." Blithely assuming that everything operates as designed and within designated limits defeats the purpose of analysis altogether and is hardly realistic.

5.2.3.5 5-56 5-57 5.22 5.23 Human health risks associated with routine radiological releases from WIPP operations during the Proposed Action [expressed as number of excess fatal cancers] for workers are estimated to be .0058, whereas the risks associated with worst-case accidental radiological releases during the WIPP operations are estimated to be only .0026 for workers. How and why is WIPP safer under accident conditions than under routine operations?

5.2.4 5-58 This section, entitled "Risk Assessment and Analysis of Hazardous Chemical Environmental Consequences of Operations and Possible Retrieval at the WIPP", is again evidence of how the D-SEIS places the objectives of its 'Proposed Action'

before health and safety concerns. The section lacks the scientific objectivity that would be derived from an appropriate range of data and credible interpretations. Rather, it consistently offers predictions that arise from ill-conceived assumptions and suspect methodology. The very real risks and costs of retrieval are completely glossed over.

Vital facts and figures are missing or "unavailable," documentation from which much of DOE's estimates/assumptions derive is yet to be completed (e.g. FSAR), "bounding case" scenarios are biased towards averaging instead of implied severity, critical data offered by independent groups such as Environmental Evaluation Group (EEG) and the General Accounting Office (GAO) remain unaddressed and ignored, accident scenarios do not encompass realistic worst-case factors. The incomprehensible charts and weak scientific process (Appendix F & G) in no way justify proceeding with the 'Proposed Action' which includes the controversial five-year experimental program.

For this section please note that direct quotes from the SEIS appear in upper and lower case letters, while CCNS commentary/evaluation appears in CAPITAL LETTERS.

5.2.4.1 5-58 "additional health, safety and environment concerns are addressed in (FSAR) for WIPP which is being prepared in compliance with DOE Order 5481.1B ".

THE FSAR IS TO DATE INCOMPLETE AND ONLY AVAILABLE IN DRAFT FORM. WITHOUT THIS DOCUMENT COMPLETED IT IS IMPOSSIBLE TO KNOW WHETHER THE SEIS (AND THIS SECTION) ACCURATELY DESCRIBES THE ENVIRONMENTAL AND RISK ASSESSMENTS ASSOCIATED WITH THE WIPP.

"The estimation of human health risks is a characterization of the general range of potential risks based on a selected set of assumptions".

HERE, DOE'S PREDICTIONS ARE BASED ON ASSUMPTIONS.

5.2.4.1 5-58 "the waste related chemical characterization data for this assessment are restrictive with limited quantitative concentration data."

THE DATA IS LIMITED BECAUSE OF POOR DOE RECORD KEEPING DURING THE PAST 40 YEARS, AND THE FACT THAT DOE REFUSES TO ANALYZE IN DETAIL THE CONTENTS OF THE WASTE SCHEDULED TO GO TO THE WIPP.

"assumptions in the risk assessment result in strong bias toward health protection".





THIS PRESENTS ITSELF AS ANOTHER FALSE & MISLEADING DOE STATEMENT. FOR EXAMPLE, THE D-SEIS DOES NOT ADDRESS A FIRE (major/minor) AT THE SITE (OTHER THAN IN A SINGLE CONTAINER).

5.2.4.1 5-59 "Migration Pathways"-"subsection 5.2.3 explains why air is the only credible pathway".

YET, A FACILITY (ROOM) FIRE SCENARIO IS NOT REALISTICALLY ADDRESSED BY DOE AS A POSSIBILITY FOR AIR MIGRATION.

5.2.4.1 5-59 'Evaluation Chemical Data' Regarding old Rocky Flats waste now at INEL, "it is assumed that these contain the minimum and maximum total concentrations of hazardous chemicals present in currently generated CH-TRU waste at Rocky Flats".

HOW CAN THE D-SEIS MAKE THIS ASSUMPTION? WHERE IS SUPPORTING EVIDENCE THAT SAME CHEMICALS, CONCENTRATIONS, PROCESSES USED FOR THE PAST 30 YEARS? HERE AGAIN, AN ASSUMPTION IS USED TO MAKE A PREDICTION.

5.2.4.1 5-59 re: formula for weighted average concentrations....

HOW IS PUBLIC TO READ/UNDERSTAND THIS?

5.2.4.1 5-60 5.24 "WEIGHTED AVERAGE" (far right column on table) - THIS DOES NOT REPRESENT THE "STRONG BIAS" TOWARDS "CONSERVATISM" AND HEALTH PROTECTION THAT DOE CONTINUOUSLY CLAIMS IN THIS SECTION, AND THROUGHOUT THE D-SEIS.

5.2.4.1 5-61 "No analytical data were available on concentrations of metals in TRU waste"

WHY ISN'T THERE? WHY HAVEN'T TRU-WASTES BEEN TESTED/ANALYZED TO GAIN SUCH DATA? IT WOULD SEEM THAT DOE HAS A RESPONSIBILITY TO PERFORM SUCH TESTS.

5.2.4.1 5-61 "Particulate releases of heavy metals during routine operations were assumed to be insignificant due to..."

"The elaborate HEPA filtration system designed for the ventilation system at the WIPP".

THE PERFORMANCE OF THIS "ELABORATE SYSTEM " HAS ALREADY BEEN SEVERELY CRITICIZED BY THE NEW MEXICO ENVIRONMENTAL EVALUATION GROUP (EEG), YET THE DOE NEVER ACKNOWLEDGES THIS IN THE SEIS, OR OTHER EVIDENCE CONCERNING THE POOR H.E.P.A. PERFORMANCE AT EXISTING FACILITIES.

5.2.4.1 5-62 5.25 "Hazardous Chemical Constituents reported in CH- TRU mixed waste for which NO estimates on concentrations are available"

DOE CLAIMS, "NO ESTIMATES", YET IT IS RELYING ON WESTINGHOUSE'S, "WIPP RCRA TRU MIXED WASTE CHARACTERIZATION DATA BASE"(WEC 1989), OF WHICH THERE IS NO INDEPENDENT CORROBORATION. ALSO, DOE HAS NOT YET PROVEN IT CAN COMPLY WITH RCRA.

5.2.4.1 5-63 "Because of the types of hazardous chemicals & physical waste forms of RH-TRU mixed wastes, NO releases of hazardous chemicals during routine operations or accidents were postulated."

DOE USES TERMS LIKE, "NO ESTIMATES" AND "NO DATA", YET CONSISTENTLY ASSUMES THERE WILL BE NO RELEASES. THIS DEFIES LOGIC AND SOUND SCIENTIFIC PRACTICE.

"Routine releases of hazardous chemicals from RH-TRU mixed wastes were not considered as reasonably foreseeable events. The only accident considered in the FSAR....".

HERE AGAIN, FSAR IS REFERRED TO. IT IS AN INCOMPLETE DOCUMENT THAT IS PRESENTLY ONLY IN DRAFT FORM.

5.2.4.1 5-63 "studies of TRU waste at INEL..""the nature & objectives of the study necessitated drums have airtight seals to allow accurate measurement of gas generation rates, gas concentrations..."

ISN'T THIS INDEED EVIDENCE THAT GAS GENERATION TESTS CAN BE DONE ON - SITE (AT INEL) THUS DISPROVING DOE's PROPOSED "TEST PLAN" (WHICH DOE SAYS IS NEEDED TO PERFORM GAS GENERATION TESTS) AS THE BASIS FOR "PROPOSED ACTION" AT WIPP.

5.2.4.1 5-63 "the average void volume within the drums sampled was 147.26 liters. Since 55 gallons is approximately 208 liters, it's assumed that more than half of each drum is comprised of air and other gases."

WHEN ASSESSING "RISKS" AS THIS SECTION IS SUPPOSED TO, WHY ARE AVERAGES USED INSTEAD OF HIGHER END DATA? RISKS SHOULD BE ASSESSED WITH DATA THAT BETTER PORTRAYS AN "UPPER BOUNDING CASE" SCENARIO.

5.2.4.1 5-64 Referring to TABLE 5.27- "Thus the use of these average concentrations represents a bounding case assumption".





AGAIN, THE BOUNDING CASE IS BASED ON AVERAGES. BOUNDING OR "WORST CASE" SCENARIOS SHOULD BE BASED ON UPPER END (HIGHER CONCENTRATION LEVELS) DATA. THIS IS CLEARLY A FAULTY AND HIGHLY DANGEROUS ASSUMPTION ON DOE'S PART.

"Waste containers for shipment to the WIPP will be vented...."

WASTE CONTAINERS (TRU-PACT II) HAVE TO DATE YET TO BE N.R.C. CERTIFIED.

"Potential Releases for Hazardous Chemicals"

THE E.E.G. SCIENTIFIC REVIEW PANEL (ALBUQUERQUE), U.S. GENERAL ACCOUNTING OFFICE(G.A.O. 6/12/89), & U.S. HOUSE OF REPRESENTATIVES ENVIRONMENT, ENERGY, NATURAL RESOURCES SUBCOMMITTEE OF THE COMMITTEE ON GOV'T. OPERATIONS (6/12/89) HAVE ALL SERIOUSLY QUESTIONED IF DOE HAS SCIENTIFIC JUSTIFICATION FOR THE "TEST PHASE", PARTICULARLY IN THE AREA OF GAS GENERATION TESTS. THE SEIS DOES NOT ADDRESS THESE VALID CONCERNS.

5.2.4.1 5-68 'Potential Releases' "Therefore, the period of maximum potential exposure is assumed to be during the Test Phase because none of the rooms will be backfilled and sealed during this period"

THIS DOES NOT ADDRESS THE EXPOSURE POTENTIAL DURING THE OPERATIONAL PHASE PRIOR TO A ROOM BEING FILLED. ALSO, SEE ABOVE COMMENTS ON TEST PHASE CREDIBILITY ( REMARKS OF EEG, SRP, GAO, ETC.).

5.2.4.1 5-68 "the following assumptions were employed in estimating potential releases of hazardous chemicals....."

HERE AGAIN, ASSUMPTIONS FORM THE BASIS OF CRITICAL PREDICTIONS.

'After the Test Phase no more than 6000 drums (one full room) will be available as an underground emission source at a given time".

THIS IS ASSUMING THAT ROOMS ARE PERFECTLY SEALED (DOE DOES NOT DELINEATE ON USING BACKFILL: PROPORTIONS, VOLUME, ETC.), THAT ONLY ONE ROOM WILL BE IN OPERATION AT ANY GIVEN TIME DURING THE OPERATIONAL LIFETIME OF WIPP. ANO6HER CASE OF DOE MAKING PREDICTIONS BASED ON FAULTY ASSUMPTIONS.

'No more than three TRU-PACT II's (42 drums) will be opened in the WHB at any one time."

THIS DOES NOT ADDRESS DELAYS/BACKLOGS OF DRUMS IN THE WHB. CAN DOE ASSURE THAT THIS WILL BE TRUE WHEN THERE ARE SUCH BACKLOGS?

5.2.4.1 5-69 5.29 (a)"assuming gases flow at a constant rate through the carbon composite filter."

WHERE IS THE SCIENTIFIC EVIDENCE TO SUPPORT SUCH AN ASSUMPTION. SEIS APPENDIX F DOES NOT ADEQUATELY JUSTIFY SUCH AN ASSUMPTION.

5.2.4.1 5-70 "Accident scenarios were evaluated as short term events."

THE ENVIRONMENTAL EVALUATION GROUP HAS REPORTED THAT AIR MONITOR NOISE WAS SO LOUD THAT WORKERS WOULD HAVE DIFFICULTY HEARING WARNING ALARMS OR INSTRUCTIONS.

"For above ground accident events, it was assumed that a vapor cloud resulting from accidental release would take one minute to pass the occupational worker location"

WHERE'S THE EVIDENCE TO SUPPORT THIS? ANOTHER CASE OF ASSUMPTION MADE INTO PREDICTION.

5.2.4.1 5-70 "No data were available to estimate the probable duration of an underground fire in a single drum. A release period of 30 minutes was assumed fro this hypothetical scenario."

THIS IS ANOTHER ASSUMPTION MADE INTO A HIGHLY SUSPECT PREDICTION.

5.2.4.1 5-70 Hazardous Chemical Risk Evaluation Waste Retrieval "Containers were assumed to maintain their integrity during the Test Phase and throughout the retrieval period."

ANOTHER ASSUMPTION -- AS THE SCIENTIFIC REVIEW PANEL HAS EVIDENCE OF FASTER CONTAINER BREAKDOWN AND EEG, SRP, AND GAO HAVE DOCUMENTED THAT WASTE ROOMS ARE CLOSING AT A RATE OF 4-5 TIMES FASTER THAN THE SEIS ADMITS TO.

5.2.4.2 5-71 "The maximum concentration point from aboveground operations was 500 m. south & 200m west of ventilation exhaust a WHB.."

HOW ARE THESE DISTANCES ARRIVED AT, AS THERE IS NO CLEAR EXPLANATION?

5.2.4.2 5-72 5.30 The minimum & maximum exposures are estimated to be the same on this table.





LOGIC DOES NOT SUPPORT DOE'S ESTIMATIONS HERE.

5.2.4.2 5-73 'Residential Exposures from Underground Operations' "potential exposures to nearby populations may also occur as a result of releases from underground waste storage during routine operations. Estimates of these potential exposures are calculated based on predicted maximum ground level concentrations at the site boundary".

THIS IS ALL THAT IS SAID REGARDING THE MATTER - - NO DETAILS, NO EXPLAN- ATIONS..., JUST, 'IT CAN HAPPEN'. DOES THIS INSTILL A FEELING OF PUBLIC CONFIDENCE AND TRUST WHICH DOE SAYS THE SEIS IS DOING?

5.2.4.2 5-73 5.32& 5.33 "Estimated Daily Intakes"

AGAIN, DOE CLAIMS "INTAKES WILL BE" THE SAME IN MINIMUM & MAXIMUM CASES. CCNS QUESTIONS THE VALIDITY OF SUCH FIGURES AND SUGGESTS INDEPENDENT STUDY OF SUCH DATA.

5.2.4.2 5-74 5.32 & 5.33 "Estimated Daily Intakes" are same for both minimum/maximum cases.

WE QUESTION THE VALIDITY OF SUCH ESTIMATES AND REQUEST DOE TO DELINEATE.

5.2.4.2 5-77 Waste Retrieval/Exposures "The routine releases of hazardous chemicals during waste retrieval are expected to be identical to releases during explacement. The integrity of the waste containers are not expected to deform or degrade during the retrievable storage period...waste containers-design life 20 years".

THE SRP HAS PRODUCED EVIDENCE OF CONTAINER BREAKDOWN IN POTENTIALLY LESS THAN 20 YEARS. THE WIPP ROOMS ARE CLOSING 4-5 TIMES FASTER (EEG 6/12/89) THAN THE D-SEIS PREDICTS, THUS CASTING SERIOUS DOUBT ON DOE- SEIS RETRIEVABILITY CLAIMS.

5.2.4.3 5-77 "Accidental Releases and Exposures for Hazardous Chemicals"

THIS SECTION RELIES ON SCENARIOS OUTLINED IN SEIS VOLUME II, APPENDIX F.3, WHICH IN TURN RELIES ON THE "DRAFT FSAR"(F-19). AGAIN, FSAR IS INCOMPLETE.

5.2.4.3 5-79 5.35 THIS TABLE IS NOT MADE CLEAR ENOUGH FOR THE PUBLIC TO UNDERSTAND. HOW CAN PUBLIC (AS REQUIRED UNDER NEPA) INTERPRET AND COMMENT ON SUCH DATA?

5.2.4.3 5-80 "Accident ID C2"

WORKER IS 'ESTIMATED TO BE 20FT. AWAY. DOE ALLOWS FOR ONLY "ONE MINUTE EXPOSURE" - ASSUMED TO BE A "CONSERVATIVE ESTIMATE"(SEIS F-20) DUE TO "HEPA FILTERS" AND WORKERS BEING TRAINED TO "LEAVE AREA".....(F-20). YET EEG HAS ALREADY IDENTIFIED PROBLEMS WITH THE HEPA SYSTEM AT WIPP INCLUDING NOISE PROHIBITING WORKERS TO RESPOND TO EMERGENCY ALARMS.

"Accident ID C3" -"one minute exposure".

AGAIN, RELIANCE IS PLACED ON SEIS APPENDIX F.3 AND THE FSAR. THIS SCENARIO ASSUMES ONLY "25% of the radioactive content was released..." IS THIS THE CONSERVATIVE, BOUNDING CASE SCENARIO EFFORTS THAT DOE CLAIMS TO CREATE? IT DOES NOT SEEM TO BE THAT WAY AT ALL. HERE AGAIN, WORKER "EVACUATION" IS DISCUSSED IGNORING THE HEPA & NOISE PROBLEMS (SEE ABOVE COMMENTS ON HEPA AND AIR MONITORING).

"Accident ID C4" - A "15 second exposure" PERIOD IS ASSUMED BASED ON THE FSAR. Accident ID C6-'' '' '' ". Accident ID C10-"it was assumed that all gases in the void volume of the drums were released instantaneously".

AGAIN DOE MAKES A POTENTIALLY DANGEROUS ASSUMPTION INTO A PREDICTION AFFECTING HEALTH AND SAFETY.

**THERE IS NO ACCIDENT SCENARIO THAT ADDRESSES A FACILITY FIRE CAUSED BY HUMAN RELATED ERROR. HOW CAN A CREDIBLE EXPOSURE ASSESSMENT BE CONCLUDED WITHOUT THIS?

5.2.4.3 5-80 "Exposure of underground worker to volatile organics and lead is not considered a reasonably foreseeable event..."

THIS DOES NOT AT ALL ADDRESS THE EVENT OF A FIRE .

(5-81)(cont'd) "This removal rate was assumed to be 80 percent". "These assumptions are consistent with the accident scenario for radiological exposures".

DOE AGAIN TURNS AN ASSUMPTION INTO A QUESTIONABLE PREDICTION.

5.2.4.4 5-81 "For residential exposures.....over the five year test phase....one excess cancer risk in four billion".

THESE AND OTHER ESTIMATIONS FROM TABLE 5.36 MUST BE SERIOUSLY QUESTIONED AS DOE'S METHODOLOGY HERE IS SUSPECT.





5.2.4.4 5-82 5.63 minimum/maximum cancer risks are same. CCNS AGAIN QUESTIONS THESE FIGURES AND THE METHODOLOGY USED TO ATTAIN THEM

5.2.4.4 5-83 "On site accidents all represent acute (i.e. exceedingly short) exposures."

YET UNDETECTED LEAKS, MECHANICAL MALFUNCTIONS ARE NOT EVEN CONSIDERED HERE IN THE SEIS.

"There is no IDLH for lead.." IS THERE NO IMMEDIATE DANGER POSED BY LEAD?

5.2.4.4 5-86 5.39 THIS TABLE IS DIFFICULT TO UNDERSTAND/JUSTIFY. THE PUBLIC (UNDER NEPA) SHOULD BE GIVEN MORE DECIPHERABLE INFORMATION.

5.2.4.4 5-87 "Accident ID C3-...A third drum falls & ruptures as a result of the initial accident".

C3 ASSUMES THAT ONLY 25% OF RADIOACTIVE CONTENT IS RELEASED. DOES DOE FOLLOW THIS ASSUMPTION BY FIGURING ONLY 25% OF CHEMICAL CONTENTS WILL BE RELEASED? IF SO, HOW IS IT AS THESE ARE "MIXED WASTES" AND DO NOT NECESSARILY FOLLOW UNIFORMITY? ANOTHER ASSUMPTION-BASED PREDICTION.

"Accident ID C4"- WHY IS LID KNOCKED OFF OF ONLY ONE DRUM? CONSERVATIVE ASSESSMENTS WOULD ALLOW FOR MORE THAN ONE.

"Accident ID C10-..a spontaneous ignition in a single drum in an underground storage chamber."

WHY ONLY A SINGLE DRUM, AND WHY HASN'T A ROOM OR FACILITY FIRE BEEN CONSIDERED HERE?

5.2.4.4 5-88 'Consequences of Waste Retrieval' "Hazardous chemical exposures from both routine and accidental releases during waste retrieval were predicted to be the same or less than exposures during waste emplacement."

THIS IS ANOTHER ASSUMPTION. DOE DOES NOT ADDRESS DRUM DECOMPOSITION AND GAS GENERATION ISSUES THAT AFFECT RETRIEVABILITY. ALSO, ROOM CLOSURE IS NOW ESTIMATED AT 4-5 TIMES FASTER THAN DOE ADMITS TO IN THE D-SEIS. (SEE COMMENTS FOR PAGE 5-70 ABOVE).

5.2.4.5 5-88 'Uncertainty Analysis'

"Despite the conservative assumptions employed to counteract the uncertainties, the estimates of risk are best viewed in a qualitative sense, i.e., in relation to other potential risks' and not as absolutes."

HERE, THE SEIS ADMITS TO MANY UNCERTAINTIES, BUT STILL CONTENDS THAT THERE ARE NO SIGNIFICANT RISKS. THIS DEFIES LOGIC AND BASIC COMMON SENSE. THIS ENTIRE SECTION IS EVIDENCE THAT DOE HAS MADE ANYTHING BUT "CONSERVATIVE ESTIMATES" IN PREPARING THE D-SEIS.

5.2.4.5 5-89 "It must be stressed that although other constituents are expected to be present in the waste, quantitative analytical data do not exist for waste composition and headspace gas concentration. The quality of the data suggests that it would be prudent to view the numerical results in a quantitative and, therefore relative sense."

THE DOE HAS FAILED TO KEEP ADEQUATE RECORDS AT ITS WEAPONS FACILITIES (E.G. INEL, ROCKY FLATS, ETC.) AND REFUSES TO TEST THE TRU-WASTE FOR ITS COMPOSITION. HERE IT CLAIMS THAT THIS IS NOT A CAUSE FOR CONCERN, BECAUSE IT'S ALL "RELATIVE". THIS IS AN ABSURD ATTEMPT TO JUSTIFY PREVIOUS DOE IRRESPONSIBILITY.

5.2.4.5 5-89 "Exposure Elements" "No field studies were performed. Existing data obtained from appropriate sources were employed."

DOE HAS MADE MORE PREDICTIONS FROM ASSUMPTIONS.

5.2.4.5 5-89 "...if these values do not exist as a result of previous scientific inquiry, assumptions are made that permit estimation from the best available, most relevant information."

DOE CONTINUES TO BASE ESTIMATIONS ON ASSUMPTIONS.

5.2.4.5 5-90 "A linear relationship is assumed that is not necessarily reflective of real world conditions. "

HERE THE SEIS ADMITS THAT DOE'S ANALYSIS DOES NOT ADDRESS 'REAL WORLD CONDITIONS'. UNFORTUNATELY, THE CONDITIONS DOE ASSUMES DO NOT FORM A REALISTIC ASESSMENT OF RISKS TO HEALTH AND SAFETY.

5.2.4.5 5-90 'Toxicological Data & Risk Characterization'--

AGAIN--PREDICTIONS BASED ON ASSUMPTIONS.

5.2.4.5 5-91 "To minimize the effect of uncertainties in the evaluation each step is biased toward health protective estimations. This biased approach more than compensates for risk assessment uncertainties..."





UNFORTUNATELY THE "BIAS" IN THIS SECTION IS ENTIRELY TOWARD PROTECTING THE 'PROPOSED ACTION' BUT NOT PUBLIC AND ENVIRONMENTAL HEALTH AND SAFETY. THE DOE HAS COMPROMISED HEALTH AND SAFETY CONCERNS THROUGHOUT THIS SECTION; THE SEIS DOES NOT FULFILL ITS PURPOSE UNDER NEPA OF FULLY ADDRESSING CONSEQUENCES OF THE PROPOSED AND ALTERNATIVE ACTIONS.

5.4 SUMMARY DECOMMISSIONING AND LONG TERM PERFORMANCE Throughout the section, in calculating the health risks and exposure levels to humans from possible releases, the SEIS uses tables devised by the International Commission on Radiological Protection. Are these tables a standard accepted by environmentalists and health practitioners?

5.4 5-105 DECOMMISSIONING AND LONG-TERM PERFORMANCE: This is one of the SEIS's most important sections, as it evaluates the possible long-term effects of WIPP on the local environment, including residents near the facility.

It is also a very complex section, as there are many factors which play a role in the long-term behavior of the facility. This includes brine seepage rates into the underground, gas generation rates of the waste material, closure rates of the rooms, tunnels and shafts, and the effectiveness of seals in the tunnels and shafts.

In general, the SEIS clearly points out that many of these factors are yet unquantified or open to question, review and change.

Other factors aren't even brought into the possible equations or scenarios because of their theoretical nature. This includes factors like climatic changes, which could make the region much wetter and thus speed saturation times and radionuclide migration out of the underground. Population figures in the immediate area are also assumed to remain consistent, and thus radioactive exposure to humans limited.

Such assumptions invalidate this section of the document. Suppression of potential developments or occurrences makes the section worthless as an objective review of all possible scenarios for the future of the site and its contents.

5.4 5-106 The pattern of assumptions and exclusion of certain scenarios becomes evident right from the very start of the section. In the introduction the SEIS states, "Calculations of long- term consequences are based on current technologies, social patterns, agriculture, diets, etc.,because there is no credible rationale for selecting a likely future among the unknowable possibilities. In effect, the SEIS uses the present era to illustrate a possible future."

If this document is supposed to look at both best and worst case scenarios, then surely there is a "credible rationale" for designing possible scenarios which take into account changed climatic conditions, increased local populations and other major parameter changes.

In general, the solution selected for disposal of these extremely long-lived waste products needs to be assured of success independent of conditions and factors DOE clearly can't define of quantify.

5.4.1 5-106 Environmental Consequences of Decommissioning: In describing decommissioning activities, there is no mention in the first paragraph about the necessity for decontaminating surface facilities. Obviously the SEIS is attempting to downplay this process, as it makes clear that there WILL BE radioactive releases and contamination above ground.

In describing decommissioning activity in greater detail, the SEIS does note that it will "potentially expose workers to radiation." But, it says that "temporary shielding and extensive decontamination will reduce the exposure of workers."

It does not give any details on these exposure levels, the work required in the decommissioning and decontamination steps, the shielding to be used or other critical information in order to evaluate the dangers involved.

5.4.2.1 5-107 POST-OPERATIONAL PERFORMANCE: The SEIS notes that the FEIS has miscalculated the gas permeability of the Salado formation by "approximately three orders of magnitude too high." (This is a minimum of 1000 percent!) Now they say they know the permeability, but in light of the tremendous discrepancy between their first calculations and their current figures, one must question whether or not they now have the correct information.

The SEIS notes, "The scenarios discussed below treat gas generation as an important driving force." Indeed. If DOE's calculations for Salado permeability are still too high, there will be much greater pressure forcing brine out of the underground than they have predicted. This would result in greater radionuclide release and subsequent danger to the biosphere.

5.4.2.1 5-107 The SEIS also notes that the source and quantity of brine inflow is much different than postulated in the FEIS. "Experience in the underground has drawn attention to another source of brine inflow, intergranular brine...Moisture builds up in some closed holes, and it would build up to some extent in the WIPP storage rooms after they are closed."





The FEIS stated that brine would not be a problem: "Current knowledge is sufficient to predict that brine migration will be of little concern in the WIPP." Throughout the SEIS, one finds similar language, where unknowns are quantified and predicted on so-called "sufficient" information. This is clearly no more than a pattern of guessing, hardly a process of basing estimations and predictions on valid, objective proof.

5.4.2.2 5-109 DESCRIPTION OF APPROACH AND DATA SELECTION: The SEIS says the release scenarios deal only with CH-TRU waste. It justifies this by noting that the RH waste gamma emitters have half- lives of 30 years. But RH waste also contains Pu and other radioactive elements which will remain radioactive for thousands of years. The SEIS also says the chance of a drill hole piercing a RH canister are "much less likely" than hitting a CH waste room. This completely avoids the question of potential release rates from breach of a RH canister. This SEIS should evaluate such a scenario.

5.4.2.2 5-109 In discussing the release scenarios, the SEIS notes that in cases IB, IIB, and IID, "potential treatments/engineering modifications are postulated."

Treatments/modifications would have a significant effect on potential release rates, most likely reducing them substantially.

In light of this, the sentence which immediately follows the one quoted above is false: "Therefore, these scenarios predict the undisturbed behavior of the repository, under expected conditions and under more pessimistic assumptions." Modifications/treatments provide a more optimistic scenario, if, in fact, WIPP is carried forward without these additional safeguards.

5.4.2.2 5-110 The SEIS makes many assumptions on critical matters, as noted. Here is another: "The calculations... assume unchanging physical properties" (e.g. seal permeability, waste porosity)....

Assumptions are also made for the hazardous chemical wastes to be loaded in WIPP, while their behavior remains an open question: "The release of chemical constituents of the WIPP waste depends, among other things, on the initial concentration of the chemicals, the processes that may degrade or alter the chemical species present, the rate at which these processes progress, and the solubilities of the individual chemicals in the brine. Limited information is available on these factors as they relate to the chemical constituents of TRU waste."

5.4.2.3 5-111 NARRATIVE DESCRIPTION OF RELEASE SCENARIOS: In Case IA (the undisturbed facility scenario), the SEIS states that the waste storage tunnels will close within 60 to 200 years after decommissioning, and that only during the final stages of closure will there be any "appreciable resistance" from the waste to closure. This is contradicted by other studies, which I will note below.

The SEIS concedes that the "long-term integrity of the shaft seals depends on the lower salt section, which, like the underground tunnels, will be compressed to about 95% of the salt's original crystal density within about 100 years."

This is contradicted by many other references (which I will point out below) to the fact that closure is based on many variable factors and open to speculation. If closure weren't to occur as fast as noted here, or consistently, or at all, the integrity of the shaft seals is not something that can be verified or even predicted.

The SEIS notes, "Assuming that the present gas generation rates are reasonable, then during the hundred years after WIPP is decommissioned, gas will be building up in the now closed rooms at a faster rate than it can permeate out into the Salado salt (recall the 3 Order of Magnitude miscalculation described on p. 5-107), then one or more of the following may occur: 1. Re-expansion of the storage rooms or, 2. Storage of the gas in the disturbed rock zone or, 3. Gas movement into Marker Bed 139 with potential for migration up the shaft or, 4. Gas movement either through or past panel seals and then up the shaft."

Concerning these possibilities, the SEIS says that "the most probable escape route for gas is through MB139 (Marker Bed 139). The MB139 is just a short distance below the floor of the storage rooms...MB139 is a bed of broad extent; it is fractured away from the WIPP underground excavations and has a permeability about ten times greater than that of the Salado Formation. MB139 may allow gas to migrate to the bottom of the shafts, from where the gases may find a path upward."

MB139's gas permeability is a very troubling factor. What is not explored (at least in this section) is MB139's potential for serving as an easy avenue for brine migration as well. It seems that its permeability and location would make it a natural migration pathway for brine as well as gas.

5.4.2.3 5-113 The radon-222 gas generation figures quoted here (2 x 10 -4) Ci at 5000 years and 1.1 x 10-3 at 10,000 years) have no reference. Here the SEIS notes a study by Lapin et al. which assumes that after some 2000 years the gas generation ceases and the rooms begin to saturate with brine. "The





repository rooms then slowly saturate, and the brine in the waste storage rooms is able to seep out to the base of the shafts and may move upward through the consolidated salt in the shaft seals in response to pore pressure gradients."

The SEIS says IA calculations estimate the rate and magnitude of these liquid borne releases, "assuming...steady state hydrologic pressures and flow rates." This is yet another major assumption. Other portions of the SEIS say many hydrologic factors are still unquantified. In light of this, how can the SEIS assume "steady state" pressures and flow rates? What if pressure and flow increased significantly or are already far greater than now estimated?

5.4.2.3 5-114 Same assumptions for hydrologic conditions are made for scenario IB. The SEIS says the precaution will be taken to mark the WIPP site with a "permanent monument." Because of this, the SEIS says human intrusion into the underground is " unlikely."

What is the exact composition of this "permanent marker"? With acid rain and air pollution eating away the Great Pyramids and eroding metallic structures, how would the site be "permanently" marked? THIS is a very crucial question that the SEIS just glosses right over.

And how likely is "unlikely?" Is that somewhere between far-fetched and improbable, or closer to maybe and perhaps? How can such an essential question be answered with subjective terms? Human intrusion into the WIPP could result in a major ecological disaster for some future generation. Far better assurances are required than some document writer saying the chance for this happening is "unlikely!"

5.4.2.3 5-115 In describing scenarios IIA-D, The SEIS assumes that the only impacts in the WIPP after a bore hole breach of the underground would be to the geologist examining the drill "cuttings" and possible contamination of a stock well through radioactive migration in the Culebra aquifer.

This is the "worst case" scenario? If so, DOE has failed to address the "worst case" wih any degree of seriousness. To examine the details of these scenarios is almost a waste of time in light of these basic assumptions.

5.4.2.4 5-117 ANALYSIS OF SCENARIOS--INITIAL CONDITIONS; TUNNEL CLOSURE: Here the SEIS notes the critical importance of the process of closure to the success of WIPP as planned. Yet on the next page (p. 5-118),it says, "The existing model of the closure behavior of the formation is at least partially consistent with available data."

Here we have yet another example of where the DOE takes even a glimmer of information that confirms its hoped-for results and then proceeds to base a number of conclusions upon such unreliable data.

It goes on to note that the closure "model is based upon the interpretation that coherent creep (i.e. movement of the rock mass as a whole rather than by the formation of fractures) of the Salado Formation will completely dominate the system, independent of any disturbed rock zones that might develop. (This in spite of the ongoing findings of more complex and heterogenous geologic qualities than initially assumed.) The model assumes that: 1) any disturbed rock zone is small in volume and importance relative to the volume of the deforming portions of the Salado Formation, and 2) the disturbed rock zone developed during excavation will be healed during the final stages of closure." It also assumes that, "Mechanical back pressures, especially if the disturbed rock zone has expanded to include the anhydride marker beds, will not occur until very late in the closure process."

That is a troubling number of very important assumptions...Yet, the guessing game continues with the estimations of how this "disturbed rock zone" might act.

5.4.2.4 5-118 "The disturbed rock zone may:
* Serve as a sink for some of the brine into the facility.

*Create a larger effective room size, increasing the time required for closure and the volumes available for brine inflow.

* Affect the final state of closure by extending to intersect the relatively brittle MB139 or other more permeable units above or below the repository level.

* Provide discrete fractures that might be propped open by high gas pressures.

* Degrade the expected post-emplacement performance of seals in tunnels and shafts.

"It is now known that there are strong structural members in the waste such as pipes and rods. This raises the possibility of less than complete compaction of waste and backfill under lithostatic load."

Clearly there are many unknown factors regarding room closure, which in turn affects all the performance models, including estimations of brine flow quantities, speed and direction; gas generation and migration; and thus potential radionuclide releases.





5.4.2.4 5-119 In spite of these uncertainties, the SEIS rambles on with continuous assumptions backed by no references or facts: "Far-field coherent creep of the Salado Formation salt is still the dominant process involved. The present uncertainty concerns only the time-dependent extent and possible importance of the disturbed rock zone."

Regarding possible "backstress" and its impact on closure, the SEIS states, "The only effect of backstress is to prolong the time required to achieve the final compacted state." There is no reference of any study cited to back this assumption, and from previously quoted material, it's obvious that effects of backstress in the disturbed rock zone are only being guessed at.

The SEIS says that "estimates using these assumptions show that the final void volume will be achieved in about 60 years, and that the amount of brine inflowing into the rooms during that time will be of the order of 6 to 37 m-3..., far less than would be required to saturate the total of 106m-3 of void volume. All this brine can be absorbed by the bentonite in the backfill."

Using "estimates" based on "assumptions" is irresponsible and scientifically invalid. Therefore the brine inflow figures cannot be counted on. Furthermore, the conclusion that this brine can be "sorbed" by the backfill is contradicted by the SEIS itself in describing Case IA (on p. 5-113), where it states that the "repository rooms then slowly saturate."

As if all the above were verifiable fact, the SEIS grandly states, "The net conclusions of these studies are:" and proceeds to list a set of guesses and hoped-for outcomes.

5.4.2.4 5-121 SEAL COMPACTION: Confirming the criticism that the SEIS's "conclusions" are little more than guesses, the document states, "Only small-scale seal performance tests have been conducted in site at the WIPP.... Uncertainty still remains on the long-term performance of full-scale seals. Therefore, in an attempt to bound this uncertainty, a MB139 seal permeability of 4X10 -17 m2 was used for calculations in the degraded Case IB. During the Test Phase, large-scale performance tests will be conducted to reduce this uncertainty associated with long-term seal permeability."

Why and how was the permeability figure used arrived at? Is it, in fact, too low? And isn't the deferral of information an example of Illegal Segmentation of the SEIS?

5.4.2.4 5-122 BRINE INFLOW: The SEIS states that the "use of the present Darcy-flow model for estimation brine inflow at the WIPP involves several assumptions." Again, we have critically

needed information being based on "present" models and assumptions. What will next year's model look like?

The SEIS says, "In actuality, the room walls will have closed in on the waste in half that time (100 years)..." This is contradicted by figures elsewhere in this same section and, as seen, closure speed and extent is entirely open to question. It says the gas generation will "stop" the brine inflow, Elsewhere (p. 5-111) the SEIS says it will "retard" inflow. These are two very different effects...

5.4.2.4 5-123 Here it says, "Brine sorption may be an important function of backfill." Elsewhere, it has stated that backfill WILL absorb any brine entering the repository. Which is the more accurate statement?

5.4.2.4 5-124 POTENTIAL FOR FORMATION OF A SLURRY: The slurry possibility raised by a number of studies conducted by non- DOE scientists is dismissed in a single paragraph! This SEIS says that based on its calculations for fluid flow into the underground, even in cases of bore holes penetrating the brine reservoir, only "very small particles (i.e. colloids) could be entrained in such a low-velocity flow..."

As seen, the fluid flow calculations are entirely open to different interpretations. And, the SEIS does postulate saturated conditions under even Case IA. Bump up the inflow rates by a few magnitudes and instead of a "saturated facility," you have a facility filled with slurry. DOE should coinsider that facility pierced by a borehole into the brine reservoir below and then run computer models for radionuclide releases.

If this document is supposed to look at both the up and down sides of WIPP, then it can only be considered a complete whitewash and a mockery of its intended and lawful purpose.

5.4.2.4 5-124 Another example of illegal segmentation: "Two-phase flow and transport are not treated quantitatively in this SEIS because of code limitations. One of the purposes of the Test Phase is to investigate the implications of two-phase flow."

5.4.2.4 5-126 GAS GENERATION: "The period over which the repository behavior will be dominated by gas generation is uncertain because of uncertainties in gas-generation potentials and gas-generation rates." Can one then conclude that the figures arrived at for gas generation are "uncertain"?

5.4.2.4 5-126 RADIONUCLIDE CONCENTRATIONS IN BRINES: The SEIS says "an attempt was made to estimate thermodynamic data for these elements"(AM, Np, Pu, U, and Th) by "extrapolating" and by





"arbitrarily changing" data on WIPP brine. Not surprisingly, it notes, "Unfortunately, these procedures result in order-of-magnitude uncertainties."

5.4.2.5 5-129 ANALYSIS OF SCENARIOS: CASES IA & IB. Here the SEIS says Case IA is "the most realistic evaluation of expected undisturbed repository behavior." It says Case IB "is intended to simulate performance under unfavorable and unlikely conditions." Terms like "most realistic, " "expected," "unfavorable" and "unlikely" are all relativistic, subjective terms which have no place in a supposedly objective document. They have yet to be supported by fact or concrete information.

5.4.2.5 5-131 Here the SEIS notes that transport of radionuclides through the shafts is not the only way for repository material to reach the overlying aquifers. It admits that flow directly through the Salado Formation itself "must also be considered because of the large cross sectional area of the facility."

5.4.2.6 5-138 ANALYSIS OF SCENARIOS: Cases IIA, IIB, IIC & IID: Discussing the consequences of a drilling crew cutting through the repository, the SEIS predicts the exposure would be limited principally to the geologist examining the drill bit "cuttings" and to a family living 500 meters away. It notes the geologist would receive eight times the normal background level, but that it would last only an hour. Does DOE consider this good news for the geologist?

As for the family, the SEIS says that even including the possibility of exposure to a family is generous because "most lands in this arid region are federally owned and not available for habitation." In 5,000, or 10,000, or 15,000 years, the region could be a thriving, wet farm belt with thousands of people living there. This is as valid an assumption as the SEIS's prediction that nothing will change...

It goes on to say surface water was not considered as a transportation mode for radionuclides, again basing its assumption on the fact that the region currently has no permanent surface waterways. DOE has no way of knowing or accurately predicting future surface water flows. In light of the way mankind is now beginning to alter the planet's climate systems, such assumptions could have fatal consequences for our descendants.

5.4.2.6 5-142 POST-PLUGGING ANALYSIS: MODELS AND CODES: Two more major assumptions are noted: that colloid formation and particulate transport will be minor, and that if the site is penetrated by a drill hole, only gas from the immediate room would vent through the hole. The SEIS notes that "it is

possible" that gas from an entire panel of rooms might vent, thus increasing fluid pressures tremendously. "This process, however, could not be evaluated in a quantitative fashion at the present time." Well, we've seen many instances where DOE can't quantify figures but selects some reasonable or unreasonable number in order to run assessments. Why not with entire panel gas venting rates? This is also another example of Illegal Segmentation.

5.4.2.6 5-142 FLOW CALCULATIONS: Another major assumption noted: the SEIS says that it has been assumed that "the amount of brine entering the intruding borehole was small enough that the Culebra aquifer flow continued almost undisturbed." If brine flows are much greater than the obviously slanted assumptions, then Culebra flows would also increase substantially, thus increasing radionuclide release to the "accessible" environment.

5.4.2.6-B 5-155 The SEIS again says that intrusion into the site is "unlikely" because it will be "well-marked" and "well-recorded." See comments on p. 5-114.

5.4.2.6 5-155 RADIONUCLIDE CONCENTRATIONS AT THE STOCK WELL: Here another set of variables is noted: the "rock matrix" and "fracture spacing" in this rock. The SEIS notes that, "The importance of the rock matrix is evident when one notes that, without diffusion into the rock matrix, the contaminants would require only about 150 years to reach the stock well." (In scenarios IIA-D)

This deviates greatly from other figures of contaminants reaching the well in 10,000 years or more. Obviously fracture spacing in the rock matrix is a crucial area of unknown information. This 150 year figure is chilling in its implications.

5.4.2.6 5-155 RADIATION EXPOSURES FROM STOCK WELL WATER: The SEIS assumes in all four variations of Case II that the only significant point of exposure to humans would come from some mythical stock well. It never mentions or considers drinking wells, agricultural wells or release at natural artesian wells and springs. Again, this is a glaring hole in any credible review of probable possibilities.

Even in its stock well scenarios, the SEIS assumes only eight cattle would drink from the stock well. What if the land can support more cattle in a wetter period of the future?

5.4.2.6 5-157 Here SEIS says, "A key purpose of geologic disposal is to delay the appearance of contaminants in the accessible environment for very long times." The word "delay" is key. "Delay" does not mean "prevent." And, geologic disposal can delay for "very long times" only if it works almost exactly as predicted.





5.4.2.7 5-160 SUMMARY: HUMAN EXPOSURE: The summary simply repeats and consolidates all the mistakes, assumptions, and biased scenarios laid out in the previous pages of this section of the SEIS.

Saying that "no radionuclides reach the Culebra aquifer or the surface in 10,000 years" in Cases IA and IB cannot be substantiated by the data presented. As seen, there are many crucial assumptions made in such rosy scenarios, and many unknown processes that could radically alter the outcomes, such as closure rates and completeness, gas generation and migration, aquifer pressure and flow patterns, brine seepage quantities and flow.

Saying that Cases IIB & IIC (their "worst case scenarios") would produce only doses on the same order of magnitude as background radiation in the U.S. is a non-statement in light of the assumptions and biases found in the document.

Again, words like "more likely assumptions in Cases IIA and IID" have no basis.

5.4.2.7 5-161 INTEGRATED RELEASES: Here the SEIS notes that total integrated releases over a 10,000 year period have only been determined by "(bounding) the releases over time out to 10,000 years using simplified analyses. These may provide some insight, in the absence of defensible, probabilistic performance assessment evaluations, about the prospects that the WIPP will comply with the long term release criteria specified in 40 CFR 191."

Words like "simplified," "may provide some insight," "absence of defensible, probabilistic assessment evaluations" next to the notation that they might serve as terms of compliance with 40 CFR 191 is a telling example of the SEIS attempting to use conjecture as the basis for crucial evaluations.

5.4.2.7 5-167 Here the SEIS admits that all the preceding figures and assurances of lower acceptable radionuclide releases are no more certain than the suggestion of "a likelihood." WIPP can't be based on "likelihoods." It should only be based on certainty. This section of the SEIS contains few, if any, certainties.

5.5 5-168 NO ACTION ALTERNATIVE: In general, this section is quite inaadequate. While the SEIS is supposed to study all possible alternatives in detail, it covers the No Action alternative (basically leaving the wastes where they are) in nine pages! Compare that to the detail provided for the Proposed Action--104 pages in the central section, plus many supporting sections.....

The economic downside of No Action is played up, while the possible economic savings are entirely left out.

The value of uncontaminated air quality during the operational phase of WIPP, and the value of uncontaminated aquifers and ground water in the post-operational phase aren't even mentioned.

5.5.1 5-168 BIOLOGY: "Biologic impacts at the WIPP from implementing a No Action alternative would be dependent upon the final status of the facility. Impacts would be similar to those identified for the proposed action if the facility were put to other uses which involved comparable levels of activities for comparable periods of time as proposed for WIPP operation."

This sub-section provides absolutely no information and is very misleading and confusing. If biologic impacts are dependent upon the final status of the facility, why doesn't the SEIS describe, in detail, a range of possible final statuses? And wouldn't there be ONLY one status of the facility under the No Action alternative--that is a site free from any radionuclides?

And, what does the SEIS mean by the second sentence quoted above? Does it suggest that WIPP might be used for other nuclear waste storage projects? Is that what "comparable levels of activities" means? If not, then the sentence is totally inappropriate and misleading. If so, what "comparable activities" does the document refer to?

5.5.1 5-168 Plants and animals in the area would be affected by fugitive dust, noise and road traffic." While the SEIS notes the downside of the No Action alternative, it fails to point out that such disturbances would be far less than those associated with the Proposed Action. Elsewhere (as noted below) it DOES point out the apparent financial downside of No Action versus Proposed Action. This is inconsistent and intentionally paints a negative picture of the No Action alternative.

5.5.2 5-168 SOCIO-ECONOMICS: Here the SEIS provides only an assessment of the negative impacts of the No Action alternative (i.e. loss of income to the immediate region). Because the SEIS does not thoroughly address the possible negative financial impacts of WIPP's Proposed Action alternative, there seems to be no positive financial impacts with the No Action alternative. In fact, there could be hundreds of millions to billions of dollars saved through the No Action alternative if the Proposed Action resulted in contamination along the route or release from the site itself in the near or distant future. The SEIS does not discuss these possible savings. Instead, it spends the bulk of this subsection discussing the potential economic





windfall from the Proposed Action---which is discussed elsewhere in the SEIS again.

5.5.3 5-169 LAND USE: Land use is covered in one paragraph. The SEIS notes that No Action would return existing mineral rights to the market place. Yet, it provides no estimation of the value of these mineral rights. It does not address the fact that No Action would ensure that the land will be available essentially forever for agricultural uses, grazing, parks, residential development and/or other beneficial uses. It provides no dollar figures for such uses.

5.5.4 5-169 AIR QUALITY: This subject is also covered in one paragraph. It says that the "impacts would be similar to those that could occur during decommissioning of the WIPP in the Proposed Action." This is clearly a major erroneous assumption.

In the section on decommissioning (p.5-106), the SEIS notes that surface facilities will have to be decontaminated and that workers will have to be shielded during this process. Does the DOE expect that there will be no airborne releases of radioactivity during decommissioning activities---which require entire buildings to be torn down and the shafts sealed? Under the No Action Alternative, there would be obviously be no such radionuclide releases to the air. This is an important potential benefit clearly suppressed or overlooked by DOE.

5.5.6 5-169 WATER QUALITY: As with air quality and land use, the SEIS fails entirely to include the positive impacts of the No Action alternative on water quality . Pros and cons are covered in two sentences! The benefits of the No Action alternative regarding water are not discussed. There is no estimation of the value of uncontaminated water for use in farming, grazing, industrial or residential development. This is not done on a local scale, or a regional scale. Should the Pecos River become contaminated under the Proposed Action, the agricultural losses in Texas would be astronomical. Even the Gulf of Mexico could be affected, and with it fisheries and other oceanic resources.

5.5.7 5-170 TRANSPORTATION: Again, the SEIS fails to include any meaningful discussion or review of the positive impacts of the No Action alternative on issues associated with transportation of wastes to WIPP. The impacts are covered in two sentences!

It merely says, "There would be no transportation risk from transportation of CH-TRU or RH-TRU waste to WIPP." No attempt has been made to calculate the economic gain or savings in health associated by eliminating waste shipments to WIPP. This is based, I assume, on DOE's negligible assessment of economic

impacts from an accident. In that light, according to DOE, there would be no economic savings from the No Action alternative.

5.5.8 5-170 RADIOLOGICAL ASSESSMENT: Again the benefits of the No Action alternative (in this case for possible radiation exposure) are downplayed. All that is said is, "there would be radiological consequences to workers or the public at the WIPP site."

In fact, the only "consequences" possible are positive. No workers could die of cancer. No one along the shipping route could have negative health impacts. Air and water could not be contaminated. Such "consequences" we could live with...the SEIS should include a realistic assessment of such gains instead of a brief sentence revealing the obvious!

5.5.8 5-170 RADIOLOGICAL IMPACTS---INEL: The SEIS notes, "Waste could continue to be shipped to Idaho National Engineering Laboratory from other DOE facilities and held in storage throughout the same indeterminate period."

5.5.8.1 5-173 The SEIS notes, "In summary, no environmental reasons have been found why TRU waste could not be left at the Idaho National Engineering Laboratory stored as it is for several decades or even a century..." Why then all the rush to get it to WIPP?

SUMMARY CHAPTER 6 MITIGATION MEASURES

The mitigation measures offered here are either inadequate or in fact have yet to be developed or designed. The majority of the measures offered are dependent upon the Test Phase for further evaluation.

In the interest of socioeconomic mitigation, more acreage at the WIPP site is now available for drilling and mining - not very desirable in the vicinity of buried radioactive waste. The TRUPACTs are relied upon as a mitigation measure, though they have yet to meet NRC certification requirements. The trucking contract was awarded to the lowest-bidder, a company with very little experience in handling hazardous wastes.

In terms of engineering modifications, mitigation relies heavily upon "future studies" under the auspices of the Test Phase. Plans for dealing with the disturbed rock zone, accumulation of brine around the containers, and sealing the shafts are all tentative at this point. Mitigation by waste treatment is almost totally irrelevant here, as many of the technologies described are not pertinent to transuranic waste, or else the long term viability of the process is not known. In





addition, many of the treatment technologies in fact create more problems, such as higher solubility of resultant radioactive ash or increased gas generation by radioloysis. Once again, problems with the site are sidestepped by delaying decisions until some future, unspecified date and relying upon assurances that some solution will somehow manifest during the Test Phase.

6.2 6-2 The most obvious safety precaution regarding buried radioactive waste would certainly be to ban all mining and drilling in the area. However, the D-SEIS seems to take the opposite point of view and in fact encourages the exploitation of underground resources at the WIPP site to the maximum extent possible [p. 2-1] in order to offset any negative socioeconomic impacts from restricting land use activities at the site. How ridiculous to allowing drilling and mining in an area where radioactive waste is buried underground, below an aquifer and above a pressurized brine reservoir. If Control Zone IV was not considered safe for geological exploration and human habitation in the FEIS, what has changed since then to now open that area up for access to resources? The SEIS refers to "denied" resources now being available due to this change. It seems that economic pressures have overpowered any safety concerns here. Drilling and mining in this area is foolhardy at best, as an accident in boring through the waste and into the brine reservoir will provide an immediate pathway for release of radioactivity into the atmosphere. Grazing is also a ridiculous consideration. "Routine releases" of radioactive materials through the air vents at the WIPP site will be settling on the ground and vegetation of the surrounding area, there to be consumed by grazing livestock

6.2 6-2 DOE takes mitigation credit for having installed HEPA filters in the existing facilities at the WIPP. While HEPA filters do work for most particles, DOE has never adequately answered concerns about whether the filters can stop rebounding radionuclides, or whether DOE can take any credit for HEPA filtration during fire events when the fragile, paper-like filters themselves could go up in smoke.

6.2 6-3 Transportation mitigation should be based upon programs developed to reduce the chances of accidents and the effect of any accident when transporting waste to the WIPP site. The D-SEIS however, outlines only one program -- emergency response training. The D-SEIS never described the allegedly in-place plan which would reduce the chances of accidents. If DOE truly wants to avoid as many accidents as possible, then what is the justification for using truck transport when DOE's own calculations show that rail transport would be safer? [Table S-1 page S-9]. Emergency training along the transportation routes has been sporadic and inadequate and many communities do not have the proper equipment to deal with accidents involving radioactivity. The D-SEIS states that two hospitals, in Carlsbad

and Hobbs, New Mexico, have received loans of emergency equipment and received training for dealing with victims of radiation exposure. Two hospitals in the southeastern corner of New Mexico are hardly adequate when the waste is schedule to be transported through 23 states. Highway bypasses around major population centers were proposed as a means of reducing the severity of any accidents, but as of yet no action has been taken in this regard. Thus, it is improper for DOE to rely upon these measures as fait accompli.

6.2 6-3 It is impossible to assess the safety of the shipping containers when they have not yet passed all the required safety tests for certification by the NRC. There is also some question as to whether the TRUPACT tests have in fact been rigorous enough to fairly judge the safety and strength of the containers. The TRUPACTS have only been subjected to a 30 foot drop test, but they will be traveling on slick and icy roads along sharp drop-offs, such as the road from Los Alamos, where an accident could result in a TRUPACT falling several hundred feet, being subjected to numerous drops and possibly to crush forces as well. Yet, at the same time The D-SEIS relies on NRC's accident severity classification scheme to assess the performance of the TRUPACTS. This classification scheme relies upon two factors to assess the severity of an accident, crush force and fire duration. The D-SEIS states [p. D-62] "The crush force may result from either an internal (e.g., container crushed upon impact by other containers in the load) or static load (e.g., container crushed beneath vehicle)." Yet the safety performance of the TRUPACT has never been tested under "crush" accident conditions.

6.2 6-3 In the D-SEIS, DOE relies upon the safety and other requirements of its contract with Dawn Trucking as a mitigation measure. In fact, the contract for transporting the waste to the WIPP site has gone to a company with very little experience overall, and extremely limited experience in trucking hazardous wastes.

6.3.1 6-4 The D-SEIS states that the excavation of underground rooms at WIPP has created a disturbed rock zone which "may provide pathways through which fluid can bypass the seals." It goes on to state that "if the disturbed rock zone fractures are not healed by salt creep, they could interconnect the waste disposal panels with other portions of the underground facility." The SEIS further admits that "The development of disturbed rock zones has already affected maintenance for several underground excavations."

The proposed plan for eradicating the existing disturbed rock zones is to excavate further to remove the zones. "Of course, a new disturbed rock zone would form around the newly





excavated volume," it states. The conclusion reached is that "During the Test Phase at the WIPP the DOE would continue to look for more effective means of isolating the waste disposal panels from each other and sealing the shafts to the surface." In other words, DOE does not really know how to deal with this problem and is assuming that some answer will appear during the five year test period. The possibility of radionuclides leaching into the groundwater through this uncontrollable disturbed-rock zone is too great a gamble to undertake and "test out," or to undertake while simply relying upon the ingenuity of future employees' to solve.

An alternative that seems to be thrown out as an afterthought is grouting of the disturbed rock zone. DOE sets forth no detail for rejecting this method. Nor does it appears that DOE performed any in-depth analysis on the potential use of this strategy.

The risks are too high here to take an attitude of "let's try it and see if it works." What if it doesn't? There should be some viable plan for protecting the environment from radioactivity before any waste is emplaced. We cannot simply bury the waste knowing that problems exist and say we will deal with it later. This is a highly irresponsible and dangerous attitude, and one that is completely unacceptable, and yet is prevalent in the D-SEIS.

Moreover, the D-SEIS mentions "evidence" which purports to establish that "disturbed rock zones grow slowly" which evidence DOE cites to support the notion that it can easily seal disturbed areas. If such evidence derives from tests in salt formations, DOE should cite the tests explicitly. If this evidence does not derive from salt dome experiments, then DOE must explain why it is appropriate to rely on such evidence, particularly given that, to date, DOE has seriously mischaracterized the rate of salt creep at WIPP.

6.3.2.2 6-6 The D-SEIS states "the amount of brine inflow would be small, about 43 cubic meters per room in 100 years." Forty-three cubic meters per room sounds like more than just a small amount in only 100 years; since we need to consider isolation from the environment for 10,000 years, extrapolation suggests that a steady flow would allow 4,300 cubic meters of brine to accumulate per room in that time period. Brine coming into contact with the waste drums would corrode the metal in short order and the radioactive contents would be free to migrate outward and into the water table. Once again, the D-SEIS looks to future, possible developments for dealing with an existing problem, stating "steps to control the accumulation of brine that may come into contact with containers are being explored." This is not good enough. We cannot go forward with this project while

these questions still exist and there are no viable solutions being presented to us. These problems must be addressed before WIPP is opened.

6.3.2.2 6-6 This description of what happens if WIPP's waste filled rooms do not reach steady state conditions rapidly gives credence to the "radioactive slurry" concern, first raised by members of the SRP, which the D-SEIS dismissed out-of-hand back on p. 4-19. As the D-SEIS concedes, at least in this section, backfilling of all waste-filled may be necessary. Yet, DOE has not analyzed the costs involved, the changes to a waste emplacement time schedule which might be involved or any of the other environmental impacts associated with the need to do such backfilling systemically at WIPP.

6.3.2.2 6-7 DOE floats the idea of "storing sludges containing nitrate ($NO_3$) apart from waste containing cellulosic materials." Is such waste separation realistic? Where would it be done? Elsewhere, DOE claims that it is unsafe to open waste containers at INEL for waste characterization purposes; how would waste separation occur without presenting additional risks to workers?

6.3.2.3 6-7 All holes and shafts will be sealed "in order to eliminate, as much as possible, the pathways where waste material might migrate to the overlying Culebra water-bearing zone or even the ground surface itself." The fact that these shafts pass directly through the water-bearing zones and connect the disposal rooms with the atmosphere make it absolutely critical that these seals function perfectly. Yet the D-SEIS states that "Since the Rustler is at a lower lithostatic pressure, salt creep and shaft closure cannot be counted on to ensure full reconsolidation in the Rustler formation." It goes on to admit that "The physical form of this salt [to be used as the primary material in the seals] and the manner of its emplacement, however, remain open to study and future decision." Here again is a serious safety risk that the D-SEIS cannot address in a satisfactory manner except to put off any decision or plan of action to some unspecified future date.

6.4 6-10 The D-SEIS offers information on some low-level waste treatment systems "to indicate that the technologies are developed to the point of use in the processing of radioactive waste, if not specifically TRU waste." The fact that these technologies are in the process of being developed for other forms of waste is totally irrelevant in dealing with the potential treatment of waste bound for WIPP, all of which is TRU waste. In addition, here is another instance where DOE is relying upon potential future developments (for a different waste stream) to correct known and present problems. For example, after a detailed explanation of vitrification, the D-SEIS





concedes that "vitrification technology is not considered adequately developed for current application specifically to TRU waste." [p. 6-15] How can the public assess the adequacy of DOE's mitigation plans when they are all based on rosy assumptions about the advance of technology?

6.4.1 6-13 Although it presents several forms of waste treatment as mitigation measures, the D-SEIS states that the long-term benefits of these processes are not known and "would be determined during the Test Phase." How can these be offered as mitigation measures if we don't even know whether they will work? The D-SEIS further states that "immobilization, incineration, and compaction all theoretically reduce gas formation and solubilities to varying degrees." How much credibility can we give to theory? Mitigation necessary to eliminate or reduce adverse environmental impacts which result from DOE choosing something other than the least damaging alternative (as would be the case with the choice of DOE's preferred alternative) cannot be based upon theoretical and potential methods of waste treatment technology. How could any decision maker base a decision about a major federal action on this type of speculation?

6.4.1.1 6-13 What changes to the waste, particularly in terms of changes in gas generation are associated with mixing of particulate wastes with hot asphalt? What have been the reasons for DOE's past reluctance to use this technology, one which the commericial nuclear power sector appears to have embraced?

6.4.1.1 6-14 The D-SEIS' apparent approving citation of West Germany's use of various mobile in-drum cement solidification systems would appear to contradict earlier assertions in the D-SEIS that it would be unsafe for DOE workers to have to open waste containers either for the purpose of ascertaining the contents or for the purpose of waste treatment.

6.4.1.1 6-15 "Vitrification technology is not considered adequately developed for current application specifically to TRU waste." This discussion, then, has no place in the D-SEIS; its inclusion here is misleading since it is not intended for use at WIPP.

6.4.1.2 6-15 From the study cited, the costs of waste compaction are five times less than the expense of incineration, even after accounting for the differences in volume reduction. Yet, throughout this chapter, DOE's bias towards incineration is clear. Since it is clearly not for economic reasons, the next version of the D-SEIS should explain more fully the perceived benefits of incineration over compaction. In addition, DOE has asserted that a supercompactor at Rocky Flats will achieve 70 to 80 percent volume reduction, a far better ratio than stated in

the D-SEIS -- why?

6.4.1.2 6-16 While extolling the benefits of incineration, DOE appears to ignore the significant increased risks which could accompany its widespread use for TRU waste prior to such waste's emplacement at WIPP. In addition, the D-SEIS appears to ignore the explosive negative public reaction to all of DOE's recent incinerator proposals. DOE does admit, however, that while "incinerator ash would be leach resistant[,] ... oxidation of the metallic compounds would tend to convert them to a more soluble form, which is an undesirable characteristic." Except possibly for the release of large quantities of Plutonium particles into the air we breathe, one of the greatest risks we face is the possible contamination of our water supplies. It is completely unacceptable to create - through treatment technology intended to reduce risks - a more soluble form of contaminant.

6.4.1.3 6-17 Although the D-SEIS addresses waste compaction in the most cursory of discussions, DOE does assert that "compressed waste would concentrate radioactive particles and might be expected to generate gas generation by radiolysis." Thus, one sees, once again, DOE proposing a measure as mitigation which may in fact have more serious ramifications than were DOE not to use it. Selecting only treatment techniques with built-in problems does not satisfy the requriements of NEPA.

6.4.2 6-17 "During the WIPP Test Phase, the DOE would determine whether the mitigation measures of waste treatment should be proposed as requirements for disposal of waste at the WIPP." Again, the decision of whether and how to treat the waste in any way is deferred until after completion of the Test Phase. This is not acceptable. Delaying decisions only serves to prove that the DOE is not fully prepared to open WIPP.

6.4.2 6-19 Immobilization, incineration and compaction are all presented as the treatments of choice because they retard gas generation, although the "long term benefit of this effect has not yet been determined." The D-SEIS further states that, "since the lifetime of the immobilization agents is unknown, the long-term benefits are also unknown." These are big unknowns when one is dealing with a substance that is lethal for 240,000 years. Long-term considerations are critical here.

7.1.1 7-1 Expanded Security Area: DOE is proposing to expand the WIPP security area from 250 acres to 1454 acres with no justification for requiring six times the amount of land. Not only should the D-SEIS include a rationale for this major change from the major federal action described in the 1980 FEIS, but DOE must address the environmental impacts which would flow from this change. The D-SEIS does not do this.





7.2 7-3 Originally DOE planned to locate WIPP at least two miles from the nearest mining activity, well or bore hole. This chapter's description of mining which may take place adjacent to the WIPP site does not address the implications or potential environmental impacts of DOE having abandonned this two mile rule; the D-SEIS should include such an analysis.

7.2 7-3 "Operation of the WIPP would release some radioactivity." The estimated dose would be 0.07mrem. This is unacceptable, even though it is characterized as only a small portion of background radiation, (0.07%). Every time the DOE authorizes another "routine" release, it serves to raise the background radiation level.

7.2 7-4 "Transportation of TRU wastes to the WIPP would expose people living near the transportation routes to radiation. A hypothetical person living near the highway or railroad as every waste shipment passes could receive a maximum...dose equivalent of up to 2.6mrem (about 2.6 percent of the dose received from natural background radiation)." This is also UNACCEPTABLE; again, every time DOE releases radiation, background levels are increased. Also, DOE cannot prove that low levels of radiation are not harmful, and in fact most research -- e.g., that done by Drs. Karl Morgan, Thomas Mancuso, Alice Stewart, John Gofman, and others -- indicates significant health impacts from "low levels" of exposure.

7.3 7-4 "No new long-term unavoidable adverse impacts have been identified...since the FEIS." After admitting the routine release of radioactivity (not to mention numerous adverse characteristics of the site identified since the FEIS), this statement is misleading and reveals a careless attitude toward the very real short- and long-term risks posed by WIPP and by radioactive exposure in general. No admission is made of the fact that in places where there are high levels of background radiation, there is a corresponding increase in genetic birth defects.

7.4 7-4 The "no action" alternative is not fully explored in this section. The DOE says that no action would have "unavoidable adverse impacts." This directly contradicts the admission that no adverse impacts have been identified that would result from leaving the wastes on-site for several decades or even a century (see subsection 5.5.8). The major difference would be bin-scale tests at other sites, with short term minor impacts of construction. The D-SEIS does not mention that the no action choice would cut out all transportation hazards and would result in no release of radiation to people living on the route. There would clearly be less impact from leaving the waste where it is and trying bin-scale tests.

7 Refs. 7-5 The only reference is to the 1980 FEIS.

8.0 8-1 Short-term uses and long-term productivity: The DOE admits again that conducting bin-scale tests at an existing DOE facility would have a "negligible (environmental) impact," thereby providing a preferable alternative to bringing waste to an unproven facility and incurring great transportation risks in the process. Here the D-SEIS also states that after "decommissioning" the site would be restored by "recontouring, grading, seeding, and other methods to return it to its natural condition." In the event of a major breach of the facility, or a serious waste-handling accident, might not the resulting contamination require more drastic mitigation techniques? Again DOE does not accurately describe potential environmental impacts.

8.0 8-2 The only reference for this section is to the 1980 FEIS; how can that be? Has DOE really discovered no additional information that would be relevant? Is there nothing about the new alternatives being considered in the D-SEIS that would might change the short term uses in the area or its long term productivity?

9.1 9-1 The DOE admits an alternative to WIPP would be an above-ground facility, but the cost of above-ground testing at an existing DOE site has not been considered, nor has the cost of constructing a new facility for this purpose. Moreover, it is believed that no new facility would need to be constructed because appropriate areas already exist within current DOE facilities. They also admit "the resources for bin-scale construction would be very minor in comparison to those used for construction of the WIPP facility." The Congressional General Accounting Office, the U.S. House Subcommittee on the Environment, Energy and Natural Resources, the Scientists Review Panel and the EEG have all disputed the "need" for bin-scale testing at WIPP, and conclude that such tests could be performed more safely and conclusively on-site at existing DOE facilities.

9.2 9-1 The cost of transporting waste to the WIPP is high; to leave it where it is would, therefore, eliminate transportation costs. Also, DOE admits again that to leave the waste where it is would have little impact on local or regional resource availabilities. "Bin-scale tests at an existing DOE facility other than the WIPP would have negligible impact on land use."

"However, the amount of diesel fuel required for TRU waste transportation would depend on the locations of the specific DOE facilities that would ship wastes to the WIPP and the transportation modes and routes to be used." The purpose of the D-SEIS is allegedly to fully address all impacts of such actions





and to describe in detail what facilities, how much waste, what transportation modes and what routes are to be used. How can the document purport to describe environmental impacts of programs that are not clearly defined? Or is it possible that DOE itself does not put credence into the material which constitutes the preceding eight chapters?

9 Refs. 9-2 The DOE again only references the 1980 FEIS; how can that be?

SUMMARY CHAPTER 10 -- ENVIRONMENTAL REGULATORY REQUIREMENTS

This chapter is concerned with regulations and the standards DOE must meet to have a safe facility. The pertinent regulations were written with the health and safety of the public in mind. DOE consistently states in the D-SEIS that it will fully comply with all regulations, while at the same time, they are attempting to find "options" for full compliance. At thsi stage of the project, not knowing whether or how to comply with the relevant regulations is unacceptable.

DOE wants to comply with EPA standards that have been thrown out of court as less protective than the Safe Drinking Water Act. DOE wants us to think they are bending over backwards to comply with standards that are vacated. Jack Tillman, WIPP Project Manager, in response to a question posed by a CCNS representative, asked "What do you want [DOE] to do, wait till the new standards are written?" The answer to that question for a responsible and prudent federal agency intent on complying with the laws of the nation would obviously be, "Yes." How else can DOE comply with standards that are not yet written?

The DOE also wants a 'no migration" petition from RCRA. This again, is UNACCEPTABLE! U.S. Representative Michael Synar's house subcommittee has already stated that the "no migration petition" is deficient and to complete it by February 1990 would be beyond ambitious. This section is full of regulations that with which DOE can't comply unless WIPP undergoes major modifications. DOE must comply with regulations that were written to protect the public. There is no way around these regulations, not even for DOE.

10.0 10-1 WIPP is subject to EPA's Radiation Protection Standards, 40 CFR Part 191; regardless of what DOE and/or the State of new Mexico would like to believe, this means the new regulations, not ones which have been vacated. In addition, much DOE-generated radioactive waste also qualifies as hazardous waste and is thus regulated as well by the Resource Conservation and Recovery Act (RCRA).

Given that Subpart B of the EPA standards have been vacated pending EPA's repromulgation thereof, DOE's agreement with New Mexico to continue its performance assessment planning as though the 1985 standards remained in effect is irrelevant. DOE plans to adhere to standards that were thrown out because they did not comply with the Safe Drinking Water Act. DOE acts like it is doing something wonderful by agreeing to follow these illegal and inadequate standards. Why?

10.2.1 10-1 Wastes containing hazardous and radioactive constituents are subject to regulation under RCRA, the nation's hazardous waste law. DOE, however, is seeking a "no migration petition" which would allow WIPP to be the first place in the country permitted not to comply with the land ban, which disallows burial of these hazardous chemicals without complaince with a long list of RCRA regulations. RCRA states that "whenever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment." Why is DOE so unconcerned with this law?

10.2.1 10-5 "DOE is committed to full compliance with RCRA requirements." How can the DOE make this statement with a straight face while the Department is actively seeking a legislative fix to exempt WIPP from RCRA coverage?

10.2.1 10-5 Of the three major RCRA issues which DOE discusses in the D-SEIS, first on the list is whether WIPP has interim status, i.e., whether WIPP has to be a "designated facility" under 40 CFR 260.10. The WIPP facility has not received a RCRA permit from EPA nor has it obtained interim status. New Mexico is a RCRA-authorized state, although not yet authorized to regulate mixed wastes, and although until recently WIPP was exempt from hazardous waste regulation under New Mexico law. Therefore, WIPP has not received a RCRA permit from New Mexico. Since WIPP is not subject to appropriate RCRA regulation, it cannot be considered a "designated facility," and the shipment of RFP-generated and other hazardous wastes to WIPP constitutes a violation of 40 CFR 262.20.

10.2.1 10-6 The second major RCRA issue is that of waste characterizations. Complete waste characterization data for WIPP-bound waste is not yet available. Under RCRA, the DOE must have "a detailed chemical and physical analysis of a representative sample of the waste." DOE has simply not been able to comply with this RCRA requirement. Most of the existing waste is classified as "old waste" and there is no record of the contents. DOE says it will characterize the waste by attempting to recreate through employee interviews and records the process that produced the waste because opening the barrels might subject





workers to unnecessary radiological risk. The speculation involved in DOE's plans is unacceptable, particularly given the precedent setting nature of DOE's no migration petition. For EPA to grant the variance, they must have an accurate assessment of the waste contents so as to understand what could be released into the environment in case of a breech.

10.2.1 10-6 Finally, WIPP faces the RCRA land ban hurdle. The 1984 Amendments to RCRA require that levels or methods of treatment be established for groups of chemical and toxic wastes that would diminish a waste's toxicity or reduce the likelihood that a wastes' hazardous constituents would migrate. These amendments prohibit the land disposal of wastes not meeting the treatment standards, except in the event that an entity successfully petitions EPA for a variance. To obtain such a variance, the petitioner must demonstrate to the EPA "to a reasonable degree of certainty that there will be no migration of hazardous constituents from the disposal unit for as long as the waste remain hazardous." DOE must obtain such a variance so that "defense program facilities could ship to and have emplaced in the WIPP, radioactive mixed waste that would otherwise be prohibited from land disposal." DOE says several options are available under the regulations for "accommodating" these restrictions. WHAT DOES THIS MEAN??? If there is no compliance, there is no other way to accommodate. If the no migration petition is not granted, the D-SEIS states, "the DOE will consider other ways to comply with the EPA regulations." What is DOE considering?

10.2.2 10-7 EPA is charged with regulating hazardous air pollutants. DOE facilities constitute one of the four emission source categories covered by EPA regulation. DOE is currently preparing a NESHAP (National Emissions Standards for Hazardous Air Pollutants) notice of anticipated date of facility start-up that will be filed with EPA. DOE has not adequately addressed the environmental impacts of air pollution from WIPP in this D-SEIS.

10.2.3 10-7 WIPP triggers compliance with FLPMA requirements primarily because DOE is seeking an administrative withdrawal from the BLM of the WIPP site lands, rather than trying only to obtain a legislative withdrawal. DOE has not given any good reason for an administrative withdrawal, which would circumvent much of the public process on the controversial transfer and allow DOE to open WIPP without requiring it to provide certain health and safety measures to New Mexico and at the facility itself. Noting DOE's miserable track record on health and safety issues, it is no wonder they would want to cut short the public process and answer no questions.

The SEIS does not provide any detailed explanation of the basis for an administrative withdrawal, nor does it address other issues that provide an adequate basis for approving the land withdrawal application, including:

1) how compliance with EPA standards and RCRA would be accomplished before wastes are emplaced;

2) BLM's ability to review and oversee the test phase;

3) Why DOE needs another administrative withdrawal now, since the existing withdrawal, which prohibits any waste emplacement at WIPP, remains in effect until June 1991; and

4) The legal basis for such and administrative withdrawal, since BLM's position has always been that only Congress can approve a withdrawal which would allow waste emplacement.

10.2.4 10-9 Because the WIPP will not be a disposal facility during the Test Phase, DOE contends in the D-SEIS that subpart A of the EPA standards technically does not apply to the Test Phase. However, DOE has agreed with New Mexico to comply with the standards of subpart A upon the initial receipt of wastes. The Final Safety Analysis Report, which will be issued by the DOE prior to the receipt of waste will document the DOE's ability to comply with the provision of subpart A of 40 CFR 191. The FSAR is not in existence except in draft, to refer to and rely upon compliance with something that is not prepared is ridiculous.

The requirements of Subpart B for containment limit projected releases of radioactivity to the "accessible environment for 10,000 years after disposal." How can the DOE possibly prove that they can contain plutonium for 10,000 years? Also, when plutonium has a half-life of 24,000 years, what difference does it make if the DOE contains the release for only 10,000 years?

While CCNS recognizes that DOE need go no farther than the minimum regulatory requirements, we feel compelled to point out that even EPA's individual protection requirement limits assumes there is an allowable dose, thus subscribing to the theory that a threshold under which there is no adverse medical effects. This is not proven and there is a report from Physicians for Social Responsibility that there is no safe level of exposure. Given there is no dose so low that the risk of a malignancy is zero, what DOE should be doing at the WIPP is to achieve a zero dose level both for WIPP's workers and its affected public.

10.2.4 10-9 EPA's assurance Requirements, 40 CFR Part 191.14, mandate active institutional controls over disposal sites





for as long a period of time as is "practicable." WHO decides how long is "practicable"? For DOE to appoint itself is unacceptable.

Assurance requirements are selected to provide confidence that containment requirements can be met. How can we trust that containment requirements will be met when they talk about mandating active institutional controls for as long as practicable. The period of time during which TRU wastes will remain hazardous far exceeds the term for practicable institutional controls. Thus, this assurance inspires little confidence. For purposes of assessing the performance of a geologic repository, DOE even admits that its "institutional controls are assumed not to contribute to waste isolation longer that 100 years following disposal," a concession which points up the impossible task of protecting the public from plutonium, given its half-life. One hundred years of accountability is simply not enough. When the RCRA standards say that disposal should limit releases of radioactivity to the environment for 10,000 years, so why does the DOE think that 100 years is long enough for institutional control.

Containment Requirements of 40 CFR Part 191 require that radioactive waste disposal systems be designed to provide a "reasonable expectation" that cumulative releases of radionuclides over 10,000 years will not exceed the levels in appendix A, Table 1. "It is not anticipated by the standards that containment requirements will be met with absolute assurance," since "there will inevitably be substantial uncertainties in projecting disposal system performance." Given the substantial uncertainties, where is the science in this process? How can DOE choose a geologic disposal system when it already expects "substantial uncertainties" in performance? "Reasonable expectations" that cumulative releases of radionuclides over 10,000 years will not exceed certain levels must be based on more than hope.

10.2.4 10-9 There is great question as to the effects of low-level radiation. Dr. Earnest Sternglass has amassed data that supports the theory that low-level long-term exposure to radiation is far more harmful than high intensity, short dose radiation. Low-level radiation over a long period of time lowers the immune system and creates free radicals in the body which do extensive biological damage. Therefore, the limits of 25 mrem to the whole body, and 75 mrems to any organ is UNACCEPTABLE!

10.2.5 10-11 The State of New Mexico has the duty to provide optimum public health for its people. In agreeing with DOE that WIPP need only comply with vacated EPA standards, they have shown little regard for the health and welfare of this state.

10.2.5 10-12 Under the stipulated agreement with the state, DOE must address emergency response preparedness, which at this point is very little training to appropriate personnel. The supplies given for a radioactive emergency consists of two paper suits, a roll of duct tape, a blanket, and two respirators. This is totally unacceptable. How are these supplies adequate for a city the size of Santa Fe? Also, how many geiger counters have been given out to the State Patrol or to City and County Police? Have hospital personnel been trained in radioactive accidents? Is there an evacuation plan for Santa Fe? We cannot be unprepared for an accident of this magnitude!

10.2.6 10-13 The NRC has not certified the TRUPACT yet, and our regulations do not require a crush test. The crush type of accident is the most probable type of accident, by DOE's own admission. the IAEA requires such tests; so should DOE. Moreover, full regulatory compliance does not substitute for NEPA's requirement that DOE assess all environmental impacts. This means that DOE must analyze even those impacts which would be allowed under existing regulations. For this reason alone, given that DOE has found crush forces to be the dominant truck accident, DOE must perform crush tests with TRUPACT.

10.2.6 10-13 Chemical compatibility has not been proven of the chemicals included in the TRUPACT. Gas generation inside the container has also not been adequately assessed.

APPENDIX F

F.2 F-17 This explanation of the plutonium-equivalent curie, replete with integrals, is an overly complicated and technical concept to be presented in a document intended for public comment.

F.3 N SEIS bounding case scenarios utilize average levels of radioactivity in drums. Worst case scenarios should be based upon levels of radioactivity at the upper end of the scale, not the average of all possible extremes.

F.3 F-23 R4 RH TRU Waste Container Drops from Hot Cell into the Transfer Cell

This scenario assumes that in the case of an RH TRU waste container dropping a distance of 36 feet, only 1% of its radioactive contents are spilled. This is neither a realistic figure nor does it present us with the worst case. What if more is spilled, what would the risk of exposure be then? How much radioactivity would be released in a true worst case scenario wherein 100% of the contents were spilled and the HEPA filter system failed to activate?





F.3 F-22 C8 Hoist Cage Drop

According to the SEIS, a hoist design based on multiple cables makes this accident "very unlikely" and it is not analyzed further. This is not, therefore, a worst case scenario, which should certainly consider the possibility of the cables snapping.

F.3 F-22 C10 Fire within a Drum Underground

The SEIS states that "should a fire occur within a drum within a storage array, it was not expected to propagate to adjacent waste containers." What is this assumption based upon? Why would it be unlikely for a fire to spread to adjacent containers? Wouldn't that very scenario present the bounding case? Depletion is assumed to occur at a very high rate of 80%, and no exposure is considered to workers who are supposedly "downstream" from any such possible accident. Is there a possible case wherein a worker could be caught "upstream" in the event of an accident?

F.3 F-21 C4 Transporter Hits a Pallet in the Underground Storage Area

This scenario assumes a transporter hits a pallet of CH TRU waste drums and that one of the drums is opened.

Assuming the same release levels as C2, only 25% of the waste is spilled and only 0.1% resuspended, both very low estimates for a bounding case. If a transporter hits an entire pallet filled with drums, it is hardly a worst case scenario to assume that only one will fall off and break open.

F.3 F-21 C7 Spontaneous Ignition in a Drum

Although there has been an instance of a container fire in the past, this scenario is dismissed as "reasonably unforeseeable" and is not analyzed further. This cannot, therefore, be considered a worst case scenario.

F.3 F-19 Many of these scenarios make an optimistic assumption that all workers in the vicinity of any accident will immediately leave the area and that, "due to the slow rate of contamination spread, internal deposition was therefore not estimated for these workers." [F-20] Risks associated with inhalation of radioactive materials are assessed only for workers in adjacent work areas. These scenarios fail to take into account the very real possibility that a worker could be injured and possibly trapped or pinned down in one of these accidents, and therefore unable to leave the scene. This worker would then be subject to very high levels of radioactivity which are not considered here. It should further be considered that the inhalation of only one-millionth of a gram of plutonium can cause cancer.

These exposure models are invalid because they fail to analyze the exposure risk for a worker in the immediate area of an accident: C2, C3, C4, C6.

F.3 F-19 C2: Drum Drop from a Forklift in the Inventory and Preparation Area

In this "worst case scenario," a bundle of CH TRU waste drums is dropped from a forklift and one of the drums has the lid knocked off and the inner lining torn. 25% of the contents are assumed to be spilled, and 0.1% resuspended in the air.

The SEIS states that the drums are designed to withstand a 4-foot drop without being damaged, but admits that the drop from the forklift would exceed the rated design. If this is truly a "bounding case," why is it assumed that only one drum out of the "bundle" opens up, and only 25% of the contents spilled? What would the risks be if all of the drums opened? If the drum has opened up enough to release 25% of the contents, what is there to keep it from losing 100%? The drum is further assumed to have an "average" content of 12.9 PE-Ci of radioactivity. A bounding case should consider a higher-than-average level of radioactivity in this accident. 0.1% resuspension is a very small fraction for a bounding case as well. Workers in the area are assumed to leave immediately. No exposures are calculated for workers who do not do so or who are unable to do so. What would be the level of exposure in such an instance?





APPENDIX C

ADDITIONAL COMMENTS AND DOCUMENTS SUBMITTED BY SOUTHWEST RESEARCH AND INFORMATION CENTER


| | Page |
|---|---|
| SRIC's additional comments on D-SEIS Chapters 1, 2, and 3 | 1 |
| Scientists Review Panel on WIPP: Evaluation of the Waste Isolation Pilot Plant (WIPP) As a Water-Saturated Nuclear Waste Repository | 13 |
| Evaluation of Preliminary Draft of the Radioactive Waste Experiment (Panel One Monitoring Plan) Waste Isolation Pilot Plant | 45 |
| Pressurized Brine Beneath the WIPP Facility As a Threat to Compliance with EPA Standards | 53 |
| Review of U.S. Department of Energy's "Draft Paln for the Waste Isolation Pilot Plant Test Phase: Performance Assessment and Operations Demonstration" | 62 |
| Letter of Ronald G. Cummings, Ph.D. | 65 |
| Socioeconomic Reports of the Nevada Nuclear Waste Project Office | 69 |
| SRIC's Testimony on DOE's Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program | 73 |
| "DOE Defends Planned WIPP-Site Tests," Albuquerque Journal, April 27, 1989, page A-1 | 86 |
| Letter of Rep. Melvin Price to Governor Toney Anaya, September 7, 1983 | 89 |
| Letter of Joseph Goldberg to Mr. Bruce G. Twining | 91 |

Chapter 1

Page

1-1 A portion of Public Law 96-164 is quoted. However, the D-SEIS offers no explanation of how DOE interprets "research and development facility" nor does it cite any DOE document that provides such an interpretation. DOE seemingly believes that it can interpret that mission any way it pleases, since at various times it has considered it to include high-level wastes, permanent disposal of TRU wastes, and various test phases including the SPDV program and now the performance assessment test phase. It is long overdue for DOE to clearly state its interpretation of what is permitted and not permitted at this "research and development facility." For instance, as a research and development facility, can WIPP be the nation's first permanent repository? Can the WIPP site or any nearby site be used as a licensed nuclear waste repository? Can WIPP be used to storage or disposal of "research and development" wastes, including commercial wastes from the Three Mile Island Nuclear Plant, some of which are "temporarily stored" at INEL? Can WIPP be used for "research and development" activities associated with DOE's Office of Civilian Radioactive Waste Management (OCRWM) program; if so, what activities could be allowed?

Four requirements to be completed before WIPP opens are listed. More specific, explicit information is required. For example: (1) should be that Nuclear Regulatory Commission (NRC) certification of the shipping containers and Department of Transportation (DOT) transportation requirements will be met. In (2) the words "or administrative" should be deleted because the proposed administrative withdrawal should be withdrawn by DOE or rejected by the Department of Interior (DOI) because it would be in conflict with legal requirements. Regarding (4), it should be clarified to specify that "all applicable environmental requirements" includes compliance with 40 CFR 191, subparts A & B; compliance with the Resource Conservation and Recovery Act (RCRA); compliance with the Safe Drinking Water Act, compliance with DOT transportation regulations, among others.

The last paragraph on the page, which continues on page 1-2, is incomplete and inaccurate. While the existing TRU waste storage sites were designed for interim storage, those sites have the physical capacity to have storage facilities that could be used for decades more. Moreover, according to both the D-SEIS (p. 5-7) and other DOE documents (DOE, Integrated Data Base for 1988), much of the wastes currently in "interim" storage will probably not come to WIPP.

The sentence regarding the "concern" of the governors of Idaho and Colorado should be referenced. In its present form it does not appear to correctly characterize the position of those governors. Comments made on the D-SEIS by those governors should be used instead of DOE's (mis)representations of those "concerns." Moreover, the sentence is notable for its unexplained incompleteness — for example, why is the governor of New Mexico not mentioned, why are the positions of the





Attorney General of Texas (which have been known to DOE prior to the release of the D-SEIS as well as being clearly stated in his oral testimony and in the joint comments) and that of the Attorney General of Idaho (who has called for a programmatic EIS) not mentioned and referenced?

The last sentence regarding nuclear weapons production is unsupported and, we believe, totally fallacious. There is no reference or other support for the assertion. This nation has produced nuclear weapons for 45 years without WIPP, so clearly the country has and can produce weapons without WIPP. If our current weapons production capabilities are dependent upon WIPP, DOE must explain why that is the case, why such a reality has never been justified in the FEIS or the D-SEIS, the Defense Waste Management Plan (Hereinafter: DOE, 1983) or another documents, and why Rocky Flats and other weapons plants could not operate if WIPP doesn't open. Moreover, if WIPP is needed, DOE should describe what the need is, by what date it is needed, why DOE has not developed alternative sites and contingency plans, and how such weapons production or lack thereof relates to last year's arms reduction agreement with the Soviet Union and on-going arms control negotiations.

1-2 The discussion of the 1980 WIPP FEIS is misleading. In the FEIS (p. 1-7) alternative 3 was the preferred alternative. Neither the D-SEIS nor any other DOE EIS adequately analyzes why that preferred alternative was rejected and why it should not be considered as an alternative in the SEIS.

1-3 Figure 1 is misleading and unsupported. There is no site characterization plan, as required for any other repository, so to show that site characterization started in 1975 and will continue until 1995 is an unsupported and unsupportable assertion. Moreover, facility construction is not defined but should be considered to include underground mining, which, in fact will continue throughout the lifetime of WIPP. Finally, the figure shows that the test phase will end in 1994, which is at odds with other DOE public statements (Albuquerque Journal, April 27, 1989, p. A-1--copy attached).

1-4 DOE's discussion in Section 1.2.2 is inadequate and incomplete. In describing the cost reduction program there is no mention that some significant changes were made from that program, especially the decision to construct a fourth shaft after having eliminated that shaft in the cost reduction program. The D-SEIS does not, but should include an analysis of the environmental and economic impacts (how much was actually "saved" in the cost reduction program and how much did the later revisions to the program add to the total estimated costs). Regarding the SPDV program, the D-SEIS does not analyze how some significant conclusions of the SPDV review are now known to be inadequate or incorrect. (E.g. Part VI comments.) The D-SEIS must be revised to include such an analysis.

1-4 & 1-5 (Section 1.3) An adequate discussion of the need for the supplement would include that such a supplement was always known to be necessary (FEIS, Preface), that it had been requested for years (SRIC requested a supplement in its 1981 lawsuit and again in its 1983 Comments on the SPDV Program [attached], and the Environmental Defense Fund requested a supplement in a December 31, 1987 letter to DOE), and that changes in the proposed action required it.

Moreover, this section must be totally revised to discuss also the relationship of the D-SEIS to a needed programmatic EIS on TRU waste storage, transportation, and disposal. The D-SEIS admits (p. 1-5) that required NEPA analysis has not been done on the "impacts of retrieving and processing wastes at these [Oak Ridge, LANL, Mound, Argonne, NTS, and Lawrence Livermore] sites." Moreover, the analysis done for existing facilities, including INEL and Rocky Flats, is not complete and up-to-date. For example, at INEL DOE has yet to complete a NEPA analysis of the buried TRU waste. Moreover, DOE is now proposing to reclassify "about 1/2 of the 2.3 million ft$^3$ of waste stored at the RWMC" (p. 5-7) so that WIPP's volume should apparently be reduced by about 1.1 million cubic feet. At Rocky Flats, the D-SEIS must discuss the impacts of the proposed waste compactor on operations and waste management at that facility and the impacts of compaction on WIPP. (How much volume reduction will be accomplished and how much does that reduce the volume proposed for WIPP? What are the transportation impacts of lower volume, higher radioactivity shipments from Rocky Flats?)

Further, since DOE is at least considering a major change in its TRU waste management plans (DOE, 1983), a programmatic EIS is the best way to analyze the various reasonable alternatives and their environmental impacts.

The D-SEIS must also examine the changed circumstances since the 1980 FEIS. Examples include why the FEIS preferred alternative should no longer be considered, technology changes in on-site storage since 1980 and why long term on-site storage is not a reasonable alternative, Congress' unwillingness to authorize WIPP's opening for waste storage and disposal, the current "crisis" in waste storage capacity at Rocky Flats and INEL, the possibility that governors in other states (including New Mexico) may in the future bar waste shipments as Governor Andrus has done, Secretary Watkins' June 27, 1989 statement regarding the need to reevaluate previous decisions and the pronouncement that WIPP will not open in 1989, the FBI investigation at Rocky Flats -- including possible criminal indictments, the likelihood that all RFP wastes will have to be re-examined and re-certified, possible closure of RFP thereby reducing wastes produced and raising the need for decommissioning of the site.

Additional new data on the site that are omitted, but which must be considered, are that potential ground water travel time in the Rustler aquifer is much faster than previously stated (EEG-32), data on observed "cracking" in the floors and ceilings of various rooms, gas problems caused both by gas generation from the wastes and gas buildup within the





Salado Formation, as well as other issues raised in Part VI of the joint comments.

1-5 and 1-6 (Section 1.4 Proposed Action)
The first sentence of this section must either be eliminated or it must be explained in the light of known facts. First, how could WIPP ever become "a permanent repository" since Rep. Melvin Price, the chief sponsor of the WIPP authorizing legislation, clearly stated that such a mission is not consistent with PL 96-164? (Price, 1983--attached) Second, what are the criteria by which the public and decision makers can "determine whether the WIPP should become a permanent repository"? Third, why aren't the criteria to determine the suitability of WIPP for waste disposal repromulgated EPA standards, 40 CFR 191, subpart B? Fourth, how can DOE propose a test phase without a test phase plan covering what wastes will be used, from what generator sites, for what experiments, to produce what data, for what analyses, for what technical and decisional purposes, for what period of time, what will be done with the wastes once the test phase is completed, how will anyone know when the test phase is completed and what are its results, etc. Fifth, why is a test phase plan now necessary in light of DOE's previous confidence that the site is suitable and that geotechnical issues had been resolved (FEIS, SPDV report)? In light of new findings, why shouldn't the basis for all previous decisions be questioned? Sixth, why should operational demonstrations precede a final decision on site suitability -- what are the costs of such operational demonstrations?

The D-SEIS must also discuss why "options" if there is a determination of noncompliance with EPA disposal standards should not be discussed in this document rather than in some future document. The lack of such a discussion in the D-SEIS appears to be illegal segmentation under NEPA.

The alternate action posited in the D-SEIS seems directly aimed at legislative proposals (H.R. 2504 in the 100th Congress) to require compliance with EPA standards before waste emplacement. The SEIS must acknowledge that the majority of those who testified at hearings on the D-SEIS favored compliance with EPA disposal standards before any wastes are emplaced. The D-SEIS must also consider as part of the proposed action that same 1988 House Interior Committee bill (H.R. 2504) required that the Administrator of EPA, not the DOE, determine compliance with EPA disposal standards.

The D-SEIS, as already noted, is clearly legally inadequate because it does not consider all reasonable alternatives. At a minimum, the following additional alternatives must be considered: 1) emplacing TRU wastes in a licensed repository; 2) determining what to do with TRU wastes if WIPP does not comply with EPA disposal standards; 3) awaiting waste emplacement at WIPP until Congress approves a legislative land withdrawal; 4) developing interim or long-term storage facilities for TRU wastes; 5) postponing opening of WIPP until a determination is made about cleanup and disposal of buried TRU wastes; 6) "banking" WIPP until a programmatic EIS for all TRU wastes is prepared; 7) considering what to

do with mixed TRU wastes if DOE is not allowed to emplace those wastes at WIPP: 8) discussing the eventuality in which the present or a future governor of New Mexico closes the border to further WIPP shipments for several months or forever, and 9) conducting a two-year test phase without radioactive waste which would be consistent with the current administrative land withdrawal (PLO 6403), since that is the only alternative currently allowed by current federal law.

1-6 to 1-8 (Section 1.5 Content of the SEIS)
It is certainly true that the D-SEIS does not help resolve the issues involved in compliance with 40 CFR 191, NRC certification of the TRUPACT, and compliance with RCRA. Since those issues have not been resolved, the D-SEIS must address the possibility that any one or any combination of those three regulatory requirements will not be met. Compliance with the EPA standards has already been addressed. Regarding NRC certification of TRUPACT, the D-SEIS must address what DOE will do if NRC does not certify the TRUPACT or if the certification is conditioned in ways that limit the amount of wastes that can be shipped. Questions that must be addressed include: what container will DOE use if TRUPACT-II is not certified--the Gemini, the TMI waste shipping container, some other type B container, a newly developed TRUPACT-III, or some other container?

Regarding RCRA, the D-SEIS must evaluate what alternatives exist for handling such wastes is they can not be emplaced at WIPP. What kinds of treatment of mixed wastes could occur if required under RCRA; what are the environmental impacts, including costs of such treatment options?

Regarding footnote [a] on page 1-7, a new D-SEIS must be prepared once a FSAR is released, since that document includes essential data for an adequate SEIS analysis and since such a document must be available for public comment on the D-SEIS. It is not appropriate, as that footnote states, for DOE to revise the SEIS based on changes in the FSAR as compared to the draft FSAR without allowing and considering public comments.

It should also be noted again that, as these comments indicate, there are serious inadequacies in the discussion and analysis of each of the nine sections included in the D-SEIS. These inadequacies are so serious that the D-SEIS must be revised and reissued for public comment before DOE can proceed with the final SEIS.

1-8 (Section 1.6 Overview of Consultations)
This section clearly states that DOE "briefed" various entities "regarding the SEIS" and "sought input from these groups on key issues that should be addressed in the SEIS." However, many of the "consultations" that are mentioned in Appendix H had nothing to do with the D-SEIS. Moreover, various suggestions from groups about what issues should be addressed and the process for the D-SEIS public comment period and hearings format were not considered. (See for example, the attached suggestions of the Committee to Make WIPP Safe, many of which were not included in the D-SEIS.)





1-9 to 1-16 (Table 1.1 Cross-references between FEIS and D-SEIS
There are many issues in the FEIS that must be updated, but which are not mentioned in the D-SEIS. The FEIS discussion of Hydrology (p. 1-4) is clearly inadequate and does not represent current hydrologic information, so that section must be updated.

The FEIS discussion (pages 1-5 to 1-7) of the "authorized WIPP facility" contains many statements that must be revised and which are not included in the D-SEIS. The D-SEIS must discuss these issues and questions. For example, the D-SEIS should discuss why WIPP was not operational in 1987, as stated in the FEIS. Is it still DOE's position that "the SPDV program would be compatible with the characterization activities that would be needed to qualify the Los Medanos site for a high-level-waste repository...."? Why has WIPP's mission regarding TRU wastes stored and generated between 1980 and 1990 changed? What were the environmental, physical and socioeconomic impacts of the SPDV program and how did the actual impacts compare with those predicted? How have actual costs of WIPP compared with those predicted? How did the actual costs of the Cost Reduction Program compare with those predicted? As a result of subsequent changes in the agreed Cost Reduction Program (for example, adding the fourth shaft), how have costs changed? Is it still DOE's position that operations of WIPP will cost $24 million per year? Why were projected peak employment estimates for construction and operations so badly overstated? How did the much lower actual number of workers affect projected socioeconomic impacts? DOE should re-analyze the transportation, operation, and long-term release scenarios included in the FEIS and compare them with those in the D-SEIS. Specific comparison should include an explanation of all variations from those predicted and an analysis of why current models and assumptions are more accurate than those used in the FEIS.

FEIS alternative 4 must also be re-examined in light of President Reagan's 1983 decision to co-locate defense and civilian wastes in the same licensed repository.

The D-SEIS must include a thorough analysis of other changes in the FEIS or else DOE must agree that the FEIS statements are still correct.

Chapter 2

Page

2-1 (2.1 Location)
Public Land Order 6403, dated June 29, 1983, is an 8-year administrative withdrawal, which means that the site is protected until June, 1991. This statement must be included in the D-SEIS, and the document must analyze why the current administrative withdrawal is not adequate for additional data collection, including experiments without radioactive waste. An explanation of DOE's decision to proceed with opening WIPP before the end of the administrative land withdrawal must be discussed in the D-SEIS. The D-SEIS should also discuss the alternative of conducting such experiments without bringing wastes to WIPP, since that it the only alternative currently allowed by the existing land withdrawal and federal law.

The D-SEIS should discuss why a 1-mile site boundary is an adequate buffer area between the WIPP disposal area and the accessible environment.

The D-SEIS must discuss why DOE proposes to expand the Exclusive use area to include 1,454 acres and the impacts and costs of such an expansion.

2-3 to 2-7 (2.2 Facilities)
The D-SEIS must discuss the changes in surface facilities since the FEIS, especially since those changes have been the subject of both significant DOE investigations and two congressional hearings (House Government Operations Subcommittee on September 13, 1988 and June 12, 1989).

The D-SEIS should also discuss the costs and impacts of building the railroad spur and what purposes it will be used for if DOE's preferred transportation mode (100% truck) is used.

The D-SEIS must also describe the capacity of the hot cell in the waste handling building including whether it can handle 250,000 cubic feet of RH-TRU wastes, how much "high-curie and high-neutron" wastes it can safely handle, and much high-level waste it can handle (and whether that HLW capacity will be maintained given the decision to not emplace HLW -- SEIS, p. 3-8).

Regarding underground facilities, this section should discuss the decision to reduce the facility from 4 shafts to 3, then to change that decision and add the fourth shaft. At a minimum, the discussion should include why was those decisions were made and what were the impacts and costs of the changes.

The discussion of reconfiguration of the underground panels is garbled. The underground facilities were rotated to the south to avoid the WIPP-12 brine reservoir which lies to the north of the disposal area.





The D-SEIS states that about 15 acres have been mined. What is the disposal capacity of that area? If the required capacity for WIPP is about 5.7 million cubic feet (p. 3-2) or even less, will the actual underground area be reduced -- why or why not? If the volume of TRU waste turns out to be more than anticipated, what plans does DOE have to expand or reconfigure the underground facilities? How does DOE intend to calculate the volume of TRU wastes emplaced at WIPP -- based on the total volume of each 55-gallon drum and box or assuming that each container is 80 percent as was done to calculate the number of waste shipments?

Regarding the 15 acres mined and the salt creep phenomenon, how long can those rooms be used without further mining or alterations? For how long can rooms be safely maintained after they are mined? Does that time period mean that mining of underground panels will not proceed until some amount of waste is emplaced? This issues should be discussed and analyzed in the D-SEIS.

2-7 to 2-12 (2.3 Waste Types and Forms)
The D-SEIS should discuss in detail the amounts and implications of the reduction of TRU wastes coming to WIPP, including when the decision will be made as to what wastes will "be reclassified as low-level wastes," what estimates DOE has about the volumes of wastes involved in such reclassifications, the basis for those estimates, what alternatives DOE has if those estimates are either high or low, etc.

What is the decision process and criteria that will be used to determine whether the high-curie and high-neutron wastes "may" or may not be disposed of at WIPP?

Regarding the chemical composition of wastes in drums or other packages, the D-SEIS should analyze the reliability of package labeling, the basis for those estimates and for the composition of future wastes, given the fact that in some cases new facilities have not been designed or built. The D-SEIS should also discuss in detail the basis for the statement that "waste sampling and analysis would result in increased radiological exposure of personnel." What studies support that statement (none are referenced), how much increased radiological exposure would result, what remote technologies are being developed that would minimize or eliminate such increased exposures? How do such exposures compare with those that workers are exposed to during operations and waste generation activities?

Regarding the WIPP WAC, what is the process for future changes in the criteria? Does WIPP-DOE-069, Revision 3 really describe the basis for all of the changes listed? More detailed information is certainly needed regarding gas generation and immobilization. The changes generally appear to relax previous requirements (allowing small particulates and "minor liquid residues," changing criticality limits), how do such changes affect worker exposure and long-term release scenarios? When are the WIPP-WAC criteria going to be altered to address the toxic wastes mixed in the large majority of the drums?

What is the basis for eliminating "site-specific radiological analysis" and what are the impacts and costs of those changes?

The fact that the FSAR is only in draft form is a reason why the D-SEIS is inadequate. Using unreliable data from an incomplete FSAR is not an adequate basis for D-SEIS calculations. A revised D-SEIS should be issued to incorporate data from the FSAR. The comment period on the D-SEIS should be extended to ensure that the public is able to consider the FSAR in its comments on the D-SEIS.

Since DOE's estimates of the amount of TRU wastes that are "mixed wastes" have varied widely (DOE, 1988) from the 60 percent DOE now claims, the D-SEIS must describe the basis and reliability of all current estimates. Further, a much more complete explanation is needed of the new processes being used to reduce mixed wastes, including pursuant to RCRA's requirements for waste reduction and minimization, and estimates for how much wastes will be generated in the future, including from DOE plants that are currently being remodeled and from new DOE plants that are not current operating.

Chapter 3

Page

3-1 The D-SEIS states that DOE still will determine whether to use WIPP as a repository, but that issue was decided in DOE's January 1981 Record of Decision for WIPP. If DOE still has not decided that WIPP will be a repository (and it would be a good decision to not use the site for permanent nuclear waste disposal), the 1981 Record of Decision should be withdrawn.

3-2 Another issue that DOE has decided, but wants to leave the impression that a decision is still to be made, relates to which sites will ship wastes to WIPP. According to this page, four sites will definitely send wastes to WIPP, and there are six more potential sites. However, in its Defense Waste Management Plan (DOE, 1983) DOE discussed no site other than WIPP for disposal of wastes from those other six sites. If that decision now has been changed, the 1983 document should be withdrawn or formally amended.

The charade becomes even more obvious in looking at the Draft Test Phase Plan. That Plan (p. 3-5) clearly shows that wastes will be coming to WIPP during the 5-year experimental plan. Thus, that is further evidence of the fact that DOE has already made the decision to bring waste from all ten sites to WIPP -- even before DOE says WIPP is for permanent disposal! The real reason that the D-SEIS wants to maintain the fiction that no decision has been made on those six sites is because the document admits that no NEPA documentation has been prepared for those facilities. That's a correct statement. But, the solution to the problem of not having NEPA documentation is to do a programmatic EIS on all DOE sites before proceeding with WIPP, not to continue with the fiction that no decision has been made or to continue with the piecemeal NEPA process that is contrary to the spirit and letter of NEPA.





3-3 According to Table 3.1, 31.25 percent of the 5.6 million cubic feet of CH-TRU waste destined for WIPP has been generated. Fully 68.75 percent is yet to be generated, but the D-SEIS asserts that the volumes and characteristics of those to-be-generated wastes are known and can be shown to meet the requirements of RCRA. That is clearly a ludicrous assertion! Some of the facilities that would generate those wastes do not even exist, so how can the types of processes and materials that they will used be known? The D-SEIS's waste characterization for the majority of wastes proposed for WIPP seems to be on the order of fortune-telling not science. Moreover, if that 1.75 million cubic feet is compared to the 6.2 million cubic feet that the D-SEIS still claims WIPP is designed for, about 28 percent of WIPP's capacity has been generated.

Given that WIPP will handle from 11 percent to 15 percent of the existing TRU wastes (see Part IV.A.2), the inescapable conclusion seems to be that WIPP has very little to do with the supposed current waste "crisis." Rather, WIPP seems to be primarily for wastes that do not exist. So WIPP then could be better defined as a speculative facility, rather than a research and development facility.

3-5 The revised and reissued D-SEIS must justify the statement that "approximately 60 percent of TRU waste that may be emplaced at WIPP contains hazardous chemical constituents." That statement is not referenced and conflicts directly with previous DOE statements that perhaps 80 percent of existing TRU wastes are mixed. DOE officials have also said that 90 percent of RFP wastes are mixed. Is this another example of DOE not knowing what exists? Or is the 60 percent estimate based on speculation as to the composition of wastes to be generated in the future?

3-6 The D-SEIS admits that the FEIS used erroneous data regarding important characteristics of TRU wastes -- though the D-SEIS euphemistically says that "more current data" are now being used. However, Table 3.3 clearly shows major underestimates were used in the FEIS. For example, the amount of curies of CH-TRU wastes in each drum is 6 times higher than calculated in the FEIS and total plutonium is twice as much. In the Type 7A boxes there are 14 times the amount of curies and 6.5 times the total plutonium. Those are very significant differences, which also result in the accident and release calculations of the FEIS being large underestimates. In short, DOE used gross underestimates in its FEIS as to potential harm to the public and to the environment. Consequently, the decisions based on that FEIS must be re-examined in light of the new information.

3-8 Another major inadequacy of the FEIS was that it did not address hazardous chemicals mixed with the wastes coming to WIPP. That's another example of how inaccurate information resulted in an inadequate FEIS which was then used to make decisions that were not based on scientific facts. Why did DOE not withdraw the FEIS since it is based on such inaccurate information about the wastes and, as discussed in Part 6, on very inaccurate information about the suitability of the site?

The D-SEIS admits the obvious fact that DOE has not kept records and therefore does not know what hazardous chemicals in what quantities are in each container of TRU wastes. The D-SEIS tries to ignore this fatal flaw, which prevents DOE from having the data necessary to comply with RCRA and to produce an adequate SEIS, by stating that DOE will use "process knowledge," (p. 3-9) which is not clearly described and for which no technical document is cited. Given the current FBI and EPA allegations about the "process knowledge" (among many other things) at Rocky Flats, DOE must develop a plan to re-analyze all the drums at Rocky Flats until it can clearly demonstrate that it does know what radioactive and hazardous materials are in each container of TRU waste.

3-21 The first part -- and first priority -- of the Test Phase is for operational demonstrations. Such a program is clearly to get WIPP open and load in as much waste as possible as quickly as possible. The emphasis is not on science. In fact, there is no technical justification for loading wastes, especially since the site cannot meet RCRA and EPA disposal standards requirements. Given DOE's two-year long history of trying to justify a test phase -- starting with 15 percent of WIPP'S capacity -- it is obvious to everyone that the Test Phase is only a ploy to put waste in the ground. If operational demonstrations are needed, they can and should be conducted once the site has been shown to comply with the EPA disposal standards and has been issued a RCRA permit.

If the decision to make WIPP a repository has really not yet been made, there is no reason to do operational demonstrations. There are certainly no specific goals set for operational demonstrations. Any such operational tests should await compliance with regulatory requirements, especially including RCRA and the EPA disposal standards at the site and compliance with DOT and NRC requirements for transportation.

Regarding performance assessment experiments, they are a fundamental contradiction in terms. Performance assessment by definition is based on probabilistic models using geotechnical data and conservative assumptions. There is no requirement in the EPA disposal standards that any waste be emplaced. Such experimentation would not be allowed at an NRC-licensed repository, even one for mixed wastes -- so why are such experiments required at WIPP? Moreover, the many geotechnical issues that remain unresolved at WIPP (see Part 6) require data collection, interpretation, and independent and public review; but waste emplacement is not required. Indeed, the brine seepage, cracking, and permeability issues have nothing to do with waste emplacement.

Gas generation must be measured in a closed, controlled environment -- similar to the closed environment of the sealed repository. Gas generation experiments effectively can be done underground only if there is no gas lost from air ventilation, seal failures, and fractures. That situation cannot be constructed at WIPP. Gas generation experiments should be done at the generator sites so that wastes are not transported, so that scientifically accurate measurements can be taken, and so that various actual scenarios can be simulated if DOE thinks it necessary.





Moreover, experiments done for 5 years or less underground cannot be representative of 10,000 years underground.

3-31 So desparate is DOE to try to justify the Test Phase that the D-SEIS says that it would cost $3.4 million more to conduct experiments at an existing site, such as INEL. What about the $10-million saved from not having the trucking contract with Dawn? What about the millions saved by not building the entire fleet of TRUPACTs? What about the millions saved from avoiding the transportation accidents that even DOE admits would occur during the Test Phase? What about the extra costs of moving wastes around at WIPP after the test phase rather than just handling them once as would be the case once the site is shown to meet RCRA and the EPA standards? And why would the experimental program even begin sooner at WIPP, since no RCRA permit has been issued at WIPP and no land withdrawal has been approved to allow for such a test phase? Indeed, despite the D-SEIS statement, there is no "test facility ... already in place at the WIPP." The test alcoves have not been constructed and the instrumentation is not in place -- what are the costs of doing that construction at WIPP? What about labor costs at WIPP compared to existing sites? None of those issues are ever mentioned in the D-SEIS. Thus, the supposed extra costs of doing bin-scale experiments at some site other than at WIPP have not been proven.

SCIENTISTS REVIEW PANEL ON WIPP

# EVALUATION OF THE WASTE ISOLATION PILOT PLANT (WIPP) AS A WATER-SATURATED NUCLEAR WASTE REPOSITORY

Albuquerque, New Mexico

January, 1988



## WHAT IS WIPP? and WHAT IS THE PROBLEM?

WIPP is the nation's first project for the underground disposal of nuclear waste. Drums of radioactive waste are to be brought to New Mexico in October, 1988 and placed in a mine near Carlsbad. The mine is 2100 feet deep and has been dug out of layers of salt. Vertical shafts with elevators are to be used to carry the waste down to the mine, where the barrels of waste are to be packed in crushed salt and sealed behind blocks of salt and cement. The rooms containing waste are expected to be squeezed and sealed by the slow creep of salt which takes place in salt beds deep beneath the surface. WIPP has been designed to seal and protect the toxic waste from any water that might reach the mine and carry waste to the surface.

Thirty years ago it was decided to bury our nuclear waste in salt beds. At that time it was generally assumed that salt beds are dry, that is, impermeable to water. The mere presence of salt, it was argued, was a guarantee that no water could enter and dissolve the waste. Another attractive property of salt was that it was "self-sealing". The slow creep of dry salt would seal the waste and keep it away from water. We now know that salt contains water and has a low permeability. Given a difference in pressure, water can slowly flow through salt.

Today, water (brine) is entering WIPP and the inflow of brine is likely to continue. If the amount of brine is significant, the drums of dry waste that were to have been sealed in a dry mine will be exposed to water. The drums will corrode in the brine and their contents will be exposed to chemical and bacterial decay. The mixture of brine and waste will make a slurry of liquid radioactive waste. The slow creep of salt, once believed to be an advantage, reverses its role as a protector of waste. The squeezing action of creeping salt is now directed upon the slurry of waste, which will also contain gas given off by the bacteria. The mixture of waste, water, and gas will then be under high pressure and will seek escape along any path it finds. Even if the amount of brine inflow is small, pockets of liquified waste can be created and present a possible hazard that was not considered in the original design of WIPP.

In this report we examine the published evidence that a significant amount of brine will seep into the WIPP repository and we explore the ramifications of that seepage. In addition, we consider why brine inflow was overlooked, how such an oversight could have developed, and suggest policies designed to correct the oversight.

CONTENTS


| | Page |
|---|---|
| What is WIPP? | i |
| Introduction | 1 |
| Background of Water-related Problems at WIPP | 1 |
| Water-saturated Repository | |
| Seepage From the Salado Formation | 4 |
| Volume of Brine Expected in the Repository | 5 |
| Pressurized Repository | |
| Effects of Pressurization | 8 |
| Reactions of Waste in a Water-saturated Repository | 8 |
| Effect of Saturation on Release Scenarios | |
| Human Intrusion Scenario | 9 |
| Natural Release Scenarios | 11 |
| Plugging and Sealing Program | 12 |
| Sealing of Shafts and Boreholes | 14 |
| Sealing Rooms and Sections | 15 |
| Effects of Excavation | 15 |
| WIPP Policy Issues | |
| Intergovernmental Relations and Responsibility | 16 |
| Exemption of WIPP from Major Federal Regulations | 17 |
| The Role of the Scientific Community in the Policymaking Process | 17 |
| Public Opinion and the Policy Process | 18 |
| Consequences of WIPP Policy Exemptions | |
| History of the Oversight of Brine Inflow at WIPP | 19 |
| Effects of the Brine Oversight on the WIPP Project | 20 |
| Future Policy | 21 |
| Conclusions | 22 |
| General Summary and Recommendations | 24 |
| Technical Review Summary | 25 |
| References Cited | 26 |
| Glossary | 27 |
| Scientists Review Panel on WIPP | 29 |






GENERAL SUMMARY AND RECOMMENDATIONS
(see page 24)

TECHNICAL REVIEW SUMMARY
(see page 25)

## INTRODUCTION

Contrary to the original assumption, the underground repository at WIPP has a steady inflow of brine "weeping" into the underground excavation. A visitor to the mine may not see the brine because a ventilating system now evaporates the water. However, after seals and plugs are in place, a significant volume of empty space in the mine could be filled by the inflowing brine. The brine, mixed with waste, produces undesirable effects and provides several ways for releasing toxic radionuclides into the water supply and atmosphere (see Technical Review Summary, p. 25). These unforeseen conditions at WIPP affect the ability of the project to comply with environmental standards. For example, the penetration of the repository by a borehole is almost certain to carry waste directly to the surface and may release radionuclides in quantities that exceed standards set forth by the Environmental Protection Agency (EPA).

In this report we describe how the problem of brine seepage originated and we explain why the inflow of brine could continue. We show that the volume of brine in the repository is likely to be significant and then go on to show how the brine can react with the canisters to create a gaseous slurry of liquid waste. Next we examine the consequences when a slurry of liquid radioactive waste is squeezed by the slow creep of salt and show that these consequences are likely to be unacceptable in terms of EPA safety standards. We also consider the methods proposed for sealing a dry respository and examine the status of the plugging and sealing program which now must contain the liquid waste. In addition, our report summarizes the history of the oversight at WIPP because successful resolution of the wet-repository problem will require decisions of public policy that recognize its origin. Finally, our report concludes with specific recommendations for the successful resolution of the present difficulties (see General Summary and Recommendations, p. 24).

## BACKGROUND OF WATER-RELATED PROBLEMS AT WIPP

In 1956, the National Academy of Sciences (NAS) recommended salt as a medium for the disposal of radioactive waste. This recommendation was based partly on the low cost and availability of abandoned salt mines. In addition, the following quotations show that two factors made salt appear attractive: its plasticity (ability to flow and encapsulate waste) and its dryness:

> "The most promising method of disposal of high level waste at the present time seems to be in salt deposits. The great advantage here is that no water can pass through the salt. Fractures are self-healing... Salt is a weak material and will flow" (NAS, 1956, p. 4).

> "The salt is impervious to the passage of water because of its plasticity and crystalline structure, so the mined-out space is very dry. This dryness increases the life of metals by reducing rust and corrosion" (NAS, 1956, p. 135).

These NAS recommendations are the basis for the strategy for the permanent disposal of nuclear waste at WIPP.

While it is generally true that pure salt has low permeability and will allow little water to pass through, the present WIPP site is not located in a zone of pure salt. When the disposal of high-level waste (HLW) was dropped from the mission of WIPP the repository for transuranic (TRU) waste was completed in shallower salt beds that contained seams of clay and thin interbeds of fractured and more permeable anhydrite. A thick bed of pure salt was available but this bed lies immediately above a suspected reservoir of trapped and pressurized brine. Having the repository in the less pure salt beds assured that TRU waste was farther from the brine reservoir but had the effect of increasing the flow of water from within the enclosing geologic formation. Brine from the Salado Formation is now "weeping" into the mine at a slow but significant rate. We believe that this rate of inflow could be sufficient to saturate the repository with an appreciable volume of water after the mine is closed and before the final encapsulation of waste-disposal drums by the creep of salt. Drums containing waste, in contact with brine, will corrode to produce a liquid slurry of dissolved and partially dissolved waste.

Under these conditions, a slurry of waste rather than dry cannisters will be squeezed by the creep of salt. If the repository is penetrated by a borehole, the drilling operation might bring liquified waste to the surface. In addition, the creep or self-sealing property of salt may exert pressure on the liquid waste. A borehole that penetrates liquid waste under high pressure might carry large quantities of waste to the surface (Fig. 1). If the seals in the mine fail to hold, any one of the vertical shafts in the mine may allow waste to escape into the overlying Rustler aquifer (Fig. 1). Hence, the inflow of brine into the mine is an important development and the factors involved and the consequences that follow are considered in the next section of this review.

Another historical development has worked to the disadvantage of the disposal strategy at WIPP. The first WIPP site was abandoned after the discovery of pressurized brine and complex geologic structure. The project was moved westward to its present location in 1975. The only available site was in an area where the principal water-carrying geologic formation (Rustler aquifer) was involved with dissolution near the surface.





Dissolution in the Rustler at the new site has formed a network of enlarged fractures and dissolved channels that increase flow and that markedly shorten the travel time of water and radionuclides to the biosphere.

The flow of brine into the mine and the network of solution channels in the Rustler are conditions that could have been identified early and with little expense had there been a more comprehensive program of exploration, testing, and review. The history of this belated discovery and the premature development of WIPP illustrates several defects in the use of science in public policy which are considered in a later section of this report. The body of this report deals first with the prospects and problems of having a water-saturated repository.

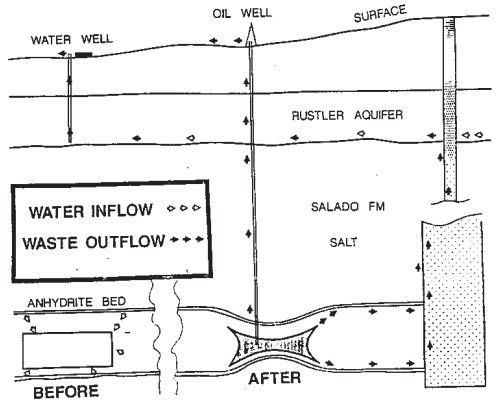



Fig. 1. Cross-section diagram of WIPP showing a room in the repository before and after the creep of salt. Liquid waste in the squeezed chamber can reach the surface if the chamber is penetrated by a borehole (oil well). Water (open arrows) flows into the before excavation on the left through salt and thin beds of clay and anhydrite and forms a slurry of waste. If seals fail, the waste (solid arrows) may be squeezed from the chamber and enter the Rustler aquifer (not to scale).

WATER-SATURATED REPOSITORY

Seepage from the Salado Formation

The inflow of brine into the mine at WIPP was recognized shortly after the mine was excavated and brine "weeps" were described in late 1983 (Alcorn, 1983). The driving force that brings water into the mine, according to Deal (1987) and Case and Deal, (1987) is a difference in pressure between the enclosing rock and the mined excavation. Water that is held within the pore space of the enclosing rocks is pushed into the mine. The flow is stimulated by mining and the subsequent creep of salt which fractures adjacent rock and increases the porosity and permeability in the rocks adjacent to the excavation.

A systematic study (Brine Sampling Evaluation Program - BSEP) was initiated in 1984 at the request of the New Mexico Environmental Evaluation Group (EEG) after it was noticed that several liters of brine had collected rapidly in newly drilled boreholes. An initial surge of brine inflow was expected as the salt near the mine excavation was dewatered but it was anticipated that the inflow of brine into the repository would diminish in a short time. As expected, there is an initial pulse of inflow after excavation but this brief pulse has been followed by a sustained flow that in a number of test holes shows little sign of decreasing (Deal and Case, 1987, figs. D-9, D-11, D-13, D-15, etc.). In some tests the flow after the initial surge has actually increased (Deal and Case, 1987, figs. D-10, D-12, D-25).

A simple difference in pressure between the excavation and the enclosing "impermeable" geologic formation can explain some of the "weeping" of brine. However, this is an inadequate explanation for the sustained inflow of brine that has been observed in the mine. The persistence of this inflow raises questions about the "impermeable" nature of the salt beds. More than local or transient effects are needed to account for steady and increasing flow (Deal and Case, 1987) and the chemistry of the brine is clearly different from the brine contained in the salt (Stein and Krumhansel, 1986), indicating that the flow is not derived from the dewatering of salt. A typical 4-inch X 50-foot test hole in the mine is receiving several liters of brine/square meter of surface area/year and the hole will fill with brine in less than 20 years. The rate of inflow, however, can be expected to decreases considerably as the diameter of the opening increases. Also, The rate of inflow between different test holes in the WIPP mine is highly variable, with significantly greater flow through the impure interbeds. Hence, it is difficult to determine precisely the volume of brine that will enter an excavation which will extend over an area of about 1 $k^2$ after it is completed.

Bredehoeft (1987) showed that the observed brine inflow data was consistent with the hypothesis that the salt beds are saturated with water and that water flows through the porous salt beds in accordance with Darcy's law. The validity of Bredehoeft's model is supported by drill stem and shut-in tests conducted in boreholes that penetrate the Salado Formation from the surface. Surface pressures of up to 472 pounds per square inch have been found at three different localities (Mercer, 1987) and these high values indicate that the Salado has a significant capacity





to move water. Bredehoeft's model explains the persistent flow of brine into the test boreholes in the mine and suggests that the inflow observed over the 600-day interval of observation in the BSEP are probably "steady state" and will not diminish even over long intervals of time.

The implications of having permeable flow and a water-saturated repository are not fully known and have been a topic of discussion and concern by WIPP scientists for the past 6 months (Chaturvedi, 1988). One prediction (Nowak, 1988) estimates that a maximum brine volume of 43 $m^3$ (11,000 gallons) after 100 years. Nowak postulates that this volume of brine, a layer 1.8 inches thick on the floor of the empty mine, will be absorbed by the backfill and that the waste will remain dry.

The Nowak (1988) report implies that complete closure by salt creep in 100 years will prevent a further accumulation of brine. Complete closure in a predictable interval of time, however, is uncertain and the NAS (1984) calls for assurance that the mine will actually close. Field studies of rates of salt closure in boreholes show that actual rates of closure can be far below calculated rates (Stickney, 1987). Furthermore the effects of rigid anhydrite layers on salt creep and closure are difficult to predict. More important, the effect of creep on brittle anhydrite is to induce fractures and increase permeability. Some low permeability values have been reported from the interbeds (Peterson et al., 1987) but permeability is generally higher than in salt and can be enhanced several orders of magnitude by creep (Peterson, et al., 1985). For example, a large fracture, with a large flow of brine, intersects anhydrite Marker Bed 139 and the floor of the mine in Room 2. This type of fracturing is expected to have a permeability higher than field measurements (Deal and Case, 1987). Most important, brine can move directly through Marker Bed 139 which will be separated from waste on the floor of the mine by a flow path of slightly more than 1 meter. This short path of travel means that water need not pass through and be absorbed by the backfill before finding the waste. Hence, the compacted waste, which will still contain a significant volume of pore space, may not be isolated from water by creep and closure.

Waste that is not protected from brine will react to generate a liquid form of waste that will be more readily available for transport in release scenarios (see later discussion) than will the solid waste precursor. We conclude that a slow rate of brine inflow does not automatically assure a dry, unreactive environment and does affect the ability of the repository to contain waste in conformance with EPA standards.

The presumption that the inflow of brine will be small is based on estimates of low permeability for the salt beds. Inasmuch as the rate of inflow in any hydrologic system is highly sensitive to permeability we examine next the uncertainty in estimates of permeability of the salt beds.

Volume of Brine Expected in the Repository

The permeability of salt beds is very low compared to that found in rocks such as sandstone and limestone. The measurement of permeability in "impermeable" rocks with extremely low porosity is difficult, subject to considerable error, and based upon important assumptions about the character and uniformity of the rock. The groundwater flow model (Nowak,

1988) that was used to calculate brine inflow used permeability values for salt between $10^{-8}$ to $10^{-9}$ darcy. The model with $10^{-8}$ darcy generates inflow that would place 43 $m^3$ (11,000 gallons) of water in a room in the the mine 100 years after the room is sealed. Uncertainty in the permeability value was estimated by Nowak (1988) to be an order of magnitude and the model "rest(s) upon a number of assumptions that are being subjected to further testing" (Nowak, 1988).

The permeability values used in the model by Nowak (1988) to calculate brine inflow may, in fact, be too low because other measurements of the permeability of the Salado Formation appear to be somewhat greater. For example, field measurements in the AEC 7 borehole, with specially designed methods to measure low permeability, have yielded values in the range of $10^{-5}$ darcy (Peterson et al., 1981; Mercer, 1987) or 3 orders of magnitude greater than used in Nowak's calculations. Another test in the ERDA 9 borehole (located near the main shaft at the center of the WIPP site) was in the range of $10^{-6}$ darcy. These test results were accepted with qualifications owing to difficulties of measurement and the special methods used. These relatively high permeabilities, however, cannot be discarded and illustrate the problems of estimating permeability over a wide spatial area that contains strata of variable character. Both of these tests were in the same impure salt beds used for the repository and the high values have been attributed to greater flow in the interbeds (Mercer, 1987).

A summary of available data from surface borehole and in situ tests (Bredehoeft, 1987) shows permeability measurements ranging from $10^{-3}$ to $10^{-10}$ darcy. Most of the permeability values tend to fall within the range of $10^{-6}$ to $10^{-8}$ darcy, with the average near $10^{-7}$ darcy (Fig. 2). This higher estimate of permeability ($10^{-7}$ darcy) leads to significantly different estimates of brine volume. For example, as permeability increases, the rate of brine inflow will also increase by about an order of magnitude (Bredehoeft, 1987) so that the estimate of 11,000 gallons, based upon a permeability of $10^{-8}$ darcy, becomes about 100,000 gallons at $10^{-7}$ darcy. This volume of brine translates to a depth of brine of about 18 inches in an empty room. In a room filled with drums and backfill this volume of brine would occupy more than half of the original empty space and would contact all of the drums after the creep of salt has changed the shape of the room. This volume is also several times more than the volume required to saturate the backfill (Nowak, 1988). Hence, this difference in permeability can lead to a significantly larger volume of brine.

The mathematical models upon which predictions of brine accumulation are based use a constant value of permeability for estimates of inflow through the entire repository even though estimates of permeability are highly variable (Fig. 2). If an area of low or average permeability is connected to an area of high permeability in the repository, the rate of brine inflow is determined principally by the region of high permeability. Thus, it is plausible that the highest values of measured permeability could determine the filling rate and an average value, as assumed in models, may not be meaningful in terms of brine inflow.

In summary, only recently has the type of groundwater flow system at WIPP been identified and only recently has the possibility of a water-saturated repository been considered. A water-saturated repository, even





with low estimates of steady-state brine inflow, will ultimately produce a more mobile form of waste. Equally important, estimates of permeability cover a broad range of values and include a wide margin of uncertainty. This range is consistent with a fully saturated repository that contains enough brine to negate planned methods of disposal. In view of the uncertainty, and the important consequences that might follow, it is prudent to assume that the repository will in fact contain a significant volume of water which will interact with the drums and produce a liquid slurry of waste. We consider next what happens when an underground chamber containing brine becomes encapsulated by the creep of salt.

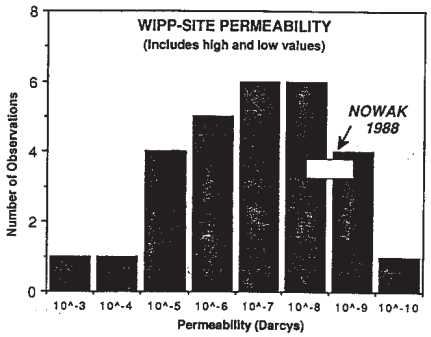



Fig. 2. Summary of borehole and in situ permeability observations from at and near the WIPP site (from Bredehoeft, 1987). The average permeability lies near $10^{-7}$ darcy. The calculations used by Nowak (1988) hypothesizes that with a permeability of $10^{-8}$ darcy a maximum of 11,000 gallons will enter a room in the repository in 100 years. A permeability of $10^{-7}$ darcy, however, would increase the volume of brine inflow to about 100,000 gallons or enough to fill most of the empty space in the backfilled mine and produce a slurry of waste. The clear box is the window of uncertainty assumed by Novak.

PRESSURIZED REPOSITORY

Effects of Pressurization

The creep of salt will heave the floor of the mine upward, sag the roof downward, and bow in the walls (compare before and after illustrations in Fig. 1). Eventually, in a dry mine, the steady creep of the salt at a depth of 2100 feet would completely fill the empty space. However, after the mine is sealed and before the space in the mine is closed by creep, the inflowing brine will fill up any available opening. If the empty space is saturated with enough brine, the weight of the overlying rocks will be supported by the water trapped in the chamber and by crushed salt that has been placed in the mine as backfill. The newly created chamber of brine and crushed salt will be encapsulated by the creep and self-sealing behavior of the salt (Fig. 1). At this point the chamber will be repressured by the weight of overlying rocks and the enclosed brine will be under a pressure of about 2000 psi (lithostatic pressure). Partial closure of the excavated space will spread the brine through the chamber, after which it will be in contact with the partially compressed and collapsed drums.

Reactions of Waste in a Water-saturated Repository

The soft-steel drums (barrels) that contain low-level waste were not designed to survive brine. We assume that the contents of the cannisters will be in contact with an aqueous environment shortly after the mine is sealed and that the contents of the drums will be exposed to water, perhaps within the 20-year certified life-expectancy of the drums. The end result of having barrels in contact with brine will be a liquid mixture or slurry of partially decomposed and partially dissolved waste and salt crystals. Organic cellulose in this aqueous environment is likely to be broken down by ubiquitous heterotrophic and anaerobic bacteria. This decomposed material then becomes an energy source for sulfate reducing bacteria in the sulfate-rich brine. Sulfate reduction produces copious quantities of hydrogen sulfide gas ($H_2S$). The volume of gas that will be generated is unknown and contracts to study gas generation have been awarded by Sandia Labs.

The total amount of gas evolved from the waste has been previously estimated to be 2000 moles per drum to be generated at a rate of 5 moles per year. This rate of gas generation does not consider the action of sulfate-reducing bacteria which will add hydrogen sulfide and carbon dioxide as a by product. Nor does it consider corrosion of the drums which alone adds 430 moles of hydrogen gas per drum (NAS, 1984). Most important, estimates for a dry mine assume that gas is generated slowly over an interval of 400 years with a peak rate of only 5 moles per year. However, in a wet mine the reaction could produce more gas (NAS, 1984) and the rate of generation of gas could peak shortly after the chamber is sealed and pressurized.

It is difficult to predict what the effects of rapidly generating an appreciable volume of gas might be. It has been assumed by NAS (1984) that there is a "danger point", assumed to be 150 atmospheres (about 2000 psi), that pressures should not exceed. However, the critical or liquifying





pressures for $H_2S$ and $CO_2$ are lower than 150 atmospheres. Much of the gas generated may be stored in solution and be available to help drive the slurry from the mine.

We cannot estimate the effects of heating on a pressurized and water-filled repository because no specific information has been released about the heat loadings of waste to be placed in the mine. However, heat will be generated by the transuranic (TRU) waste and heating of water at constant volume can increase pressure by about 10 atmospheres per degree centigrade. Lithostatic pressure will be about 150 atmospheres which means that only a slight rise in temperature in a sealed chamber might raise pressure above lithostatic. Also, a source of heat increases the inflow of water from the surrounding rock. Calculations by organizations with access to the data must be done to determine if increased pressure will be problem.

The presence of water and aqueous bacterial and chemical reactions assure that some waste will be in solution or capable of being suspended in a liquid. Hence, we must assume that waste in a liquid form will be available for transport within a few hundred years after disposal. Neither a saturated repository nor a mobile form of waste was anticipated and neither is considered in the release scenarios presented in the Final Environmental Impact Statement (FEIS, 1980) which is outdated and should be revised. The relationship of brine to the release of radionuclides and the effect on recognized release scenarios will be examined next.

Effect of Saturation on Release Scenarios

Human Intrusion Scenario

A scenario that considers the consequences of the penetration of the repository by a borehole within 10,000 years after decommissioning is a requirement of Part B of EPA standards. Inasmuch as WIPP is located in a geologic basin with significant reserves of oil and gas, this is a reasonable requirement. A drilling operation that is capable of reaching the depth of the repository will probably use a drilling fluid of water or mud. In a dry mine, a borehole passing through the repository will intersect and penetrate drums of dry waste and consolidated backfill. In a wet mine, however, the drilling fluid will come in contact with a mixture of radioactive waste and water. Less than about 2% water by weight in the backfill may facilitate compaction (Holcomb and Shields, 1987; Sjaardema and Krieg, 1987) but a slightly larger proportion of water coincident with saturation is likely to inhibit consolidation and produce a loose aggregate or a slurry of salt (engineering experience shows that small differences in water content of an aggregate can have a profound effect on compaction). If a borehole enters a room in a water-saturated repository the drilling fluid that is normally carried back to the surface will mechanically entrain some of the saturated waste and backfill and carry it to the surface (Fig. 1).

A borehole of typical diameter might carry about 45 $m^3$ of fluid in the drill stem (pipe) alone. Calculations by Sandia Labs (Anderson, 1987) show that the radioactivity released by only 15 $m^3$ of waste slurry discharged at the surface is sufficient to exceed environmental standards set forth in EPA 40 C.F.R. 191, Part B. No loss of circulation is expected in a

borehole that penetrates a pressurized and water-saturated chamber and several times the 15 $m^3$ volume of slurry will be in the drill pipe before radioactivity is detected at the surface. In this event, if an uncased well is not being monitored for radioactivity and drilling continues for some time, several times the volume of slurry that exceeds environmental standards could be released. We conclude, therefore, that a saturated mine may release enough radionuclides to exceed environmental standards.

The above best-case analyses assumes a repository in which there is no build up of pressure. The possibility of having more liquid in the mine, however, can lead to another more serious outcome. If liquid is in the repository then the weight of the overlying rocks (lithostatic pressure) is transferred to the incompressible liquid through the creep of the salt. This squeezing action, in conjunction with gas and possible thermal effects, is capable of driving liquid waste to the surface through a borehole. One can appreciate the driving force available by examining the natural pressurized brine reservoirs that have been encountered in the Delaware Basin. Ten such natural brine reservoirs have been encountered during oil and gas exploration and during characterization of the WIPP site. All but one have been overpressured and have flowed brine at the surface (Register, 1981).

These large pressurized natural reservoirs are at the large end of a continuum of pressurized brine pockets that derive brine from regional hydrologic saturation, especially from the Salado Formation. For example, Griswold (1977) reports a pocket of 100,000 gallons from a unit in the Salado and there have been many smaller encounters of pressurized brine during potash mining. Apparently almost any isolated pocket held open for any length of time is likely to fill with brine and reach lithostatic pressure. The pressurized natural reservoirs are clearly capable of bringing large volumes of brine to the surface. For example, at ERDA 6 borehole (abandoned WIPP site) the pressure was sufficient to drive the column of drilling mud up the pipe in 12 minutes. At the Belco occurrence, drilling mud with a density of 14 lbs/gallon was insufficient to contain the pressure within the brine reservoir.

A pressurized release of brine is a possible consequence in both the natural reservoirs and the artificial brine reservoir being created at WIPP because similar forces will be acting upon the enclosed liquid. The compressibility of the artificial chamber can be expected to be greater than for the natural reservoirs because the natural reservoirs are partly supported by the strength of more rigid anhydrite. In addition, the large volume of cellulose in the waste drums will probably generate far more gas than produced in the natural reservoirs.

Drilling into the repository is likely to stop when an eruption of brine (waste slurry) is encountered. However, the termination of drilling will not stop the flow unless the well is capped. Well drilling operations in the Delaware Basin that have encountered pressurized brine have generally allowed the brine to flow to depletion or near depletion. The actual volume of brine available for release from WIPP would depend upon the volume of accumulated brine in a sealed section and also upon the integrity of seals between sections of the excavation. If some sections in the mine are interconnected, waste from more than one sealed section may be available for transport.



Finally, the natural brine reservoir that is now known to lie in the anhydrite beds beneath the site must be mentioned and its relationship to a wet repository needs to be considered. This natural and pressurized reservoir is close to and probably connected to the 17,000,000 barrel reservoir encountered at WIPP 12. If a borehole at some time in the future should penetrate both the waste repository and the natural reservoir, the waste in a water-saturated repository could combine with the larger discharge from the natural reservoir through an uncased well. The total capacity for flow, in this event, would be several million gallons which could carry with it a substantial amount of radionuclides from the repository.

**Natural Release Scenarios**

A tightly sealed mine means that the liquid waste will be under lithostatic pressure and could escape. A leaky mine would reduce the problem of transport by reducing lithostatic to hydrostatic pressure. Conceivably, the mine could be allowed to leak slowly, bleed off the overpressure, and allow the liquid waste to escape into the Rustler aquifer. However, this strategy is undesireable because reducing the pressure through leakage cannot be assured at a fixed or slow rate and the Rustler aquifer could become unacceptably contaminated. Examination of this strategy, however, does illustrate the pathways available for "natural" release.

At WIPP the strategy for containment is to isolate drums in the rooms behind a backfill of crushed salt and allow the creep of salt to seal the drums in a compacted and impermeable backfill. However, if a sufficient quantity of brine is in the repository at the time of closure and pressurization, the permeability of the backfill will remain high. There could be open communication between rooms, tunnels, and vertical shafts except where impermeable barriers to brine migration (Stormont and Howard, 1987) are constructed.

These constructed barriers, however, may be bypassed by regions of increased permeability. For example, a bed of anhydrite 2 1/2 feet thick (Marker Bed 139) lies only 4 1/2 feet below the floor of the repository and appears to be the main pathway for bringing brine into the excavations (Deal and Case, 1987). This anhydrite bed has accumulations of clay at the upper and lower contact with salt, indicating some dissolution and water movement. In addition, the anhydrite bed has wide fractures that are partially filled with halite, sure evidence of past water movement (Borns, 1985). Experience in solution mining (Dowhan, 1976) shows that brine can move over distances of hundreds of meters through similar fractured strata. Brine under high pressure could move through the fractured anhydrite bed and around the constructed barriers. Hence, we conclude that there is a significant potential for liquids that accumulate in the repository to bypass the seals between sections of the mine and reach the vertical shafts that lead to the Rustler aquifer (Fig. 1).

Concrete plugs in the shafts will attempt to isolate the Rustler aquifer by pouring a brine-saturated concrete within and below the active

zone of salt dissolution that occurs at the base of the Rustler Formation (Fig. 1). This same zone was sealed with grout shortly after the main shaft was constructed. By 1987, however, water had bypassed this seal and flowed from the Rustler into the mine at a rate of about 1 1/2 gallons per minute before evaporation (Chaturvedi, telephone communication, 1987; this water is not seen by a visitor to the mine because it is collected in a drip ring and piped to sections of the mine where it is used to settle salt dust and is subsequently evaporated by the ventilation system). Fractures and wash-out zones in the lower part of the Rustler were observed in the walls of the main waste-handling shaft at WIPP during construction. These fractures had become enlarged into solution channels several centimeters wide and obviously had carried a significant flow of water (see Plate 1 in Chaturvedi and Channel, 1985). It is probably the flow of unsaturated water through these and other solution channels in the dissolution zone that made it difficult to obtain an effective seal because alternate pathways of flow can be quickly established in soluble beds.

Open solution channels in the Rustler aquifer suggest that any liquid waste that finds its way past the seals will be injected directly into the Rustler. The solution channels that were observed in the main shaft quite probably connect to the observed area of high hydrologic transmissivity that has been identified in the Rustler aquifer and that leads southward from the site. A network of solution channels in the Rustler means that the travel time for radionuclides that enter the aquifer may be fast, with estimates as short as 15 years for the movement of radionuclides to water wells located south from the site (Chaturvedi and Channel, 1985). Even these fast travel times are conservative estimates because only average flow and not the faster flow through individual channels is considered. We conclude that the Rustler aquifer is not an effective barrier (see discussion in Chaturvedi and Channel, 1985).

The accepted strategy for containment of nuclear waste is based, ideally, upon the concept of having multiple barriers between the toxic radionuclides and the biosphere. Our discussion has shown how a water-saturated repository in bedded salt successively eliminates the effectiveness of each barrier, beginning with the container, then the solid waste form, the backfill, and finally the constructed seals. We cannot say positively that these seals will hold or whether failure would be an advantage or a disadvantage. We can say, however, that the multiple barrier approach has been abandoned at WIPP and that there is a significant potential for a natural release of liquid waste through the highly permeable Rustler aquifer.

The ability of a water-saturated repository to effectively isolate radionuclides rests primarily upon the plugging and sealing program, considered in the next section.

## PLUGGING AND SEALING PROGRAM

Our review of available reports and documents, in light of a water-saturated and pressurized repository, indicates that any confidence in engineered barriers is premature. Almost no specific information is available about plugging and sealing rooms in the repository, about sealing the vertical shafts and wellbores, or about isolating the overlying Rustler





Aquifer from the repository. Specific designs for seals and plugs have not been made because sufficient data have not been collected. Experiments have been requested (Stormont, et al, 1987) to investigate the problems of grouting in areas of dissolution, to determine the amount of fracturing produced by mining the shafts, and to estimate the potential for bypassing fluids around the plugs through fractures in the wall rock. More recently, Nowak and Stormont (1987) call for experiments to determine the effect of inflowing brine in the vertical shafts on consolidation and permeability.

Until these measurements are made, uncertainties remain about the flow characteristics of the backfilling materials and of the formations surrounding the storage rooms, wellbores, and shafts of the repository. For example, a recent report (Stormont et al., 1987) states:

> Host rock permeability is a fundamental parameter required to assess the suitability of the potential repository. The permeability represents the formation's fundamental isolation capabilities, and is required input to performance assessments which describe postulated fluid flow through and radionuclide migration away from the underground repository. Permeability is an important consideration in sealing strategy and designs, because flow through a seal system is partially dependent on host rock permeability. Formation permeability affects the buildup and dissipation of natural and waste-generated gasses in the repository, and may also be important in determining the influx of brine from the surrounding rock.

This same report explains how these uncertainties preclude a reasonable assessment of the performance of WIPP. Similarly, the NAS WIPP Panel (1984) asks that it be shown that the sealing of the repository is sufficient to preclude unacceptable hydraulic conductivity.

Forty wellbores and 3 shafts have currently been identified for plugging. The research program to develop and demonstrate the effectiveness of seals and plugs is just getting under way. In fact, preliminary design criteria are not scheduled for development until FY88 (Stormont, 1984). This schedule probably reflects the fact that in a dry mine plugging and sealing is not a major consideration. The FEIS claims no serious health consequences even for an unplugged borehole. However, the only mechanism considered in the FEIS for bringing waste to the surface was diffusion, and no flow was assumed through the repository for 1000yr after emplacement of the waste. The failure scenarios in the FEIS do not take into account that a driving force, internal to the repository, may be available to bring liquid waste to the surface. Thus, in a wet repository it is imperative that engineered barriers function reliably.

In addition to sealing shafts, it is necessary to backfill rooms and passageways with crushed salt and erect barriers to isolate sections of the mine. A wet repository places added importance on the integrity of these barriers; and the technology is largely untested. Again, the FEIS does not take into account important information in evaluating the dangers associated with failures of these barriers. In a wet mine the degree of surface contamination from drilling into the repository depends upon the

degree of interconnection between sealed sections of the repository. This places an unexpected burden on the sealing program.

Flow of groundwater through the beds used for repository is another mechanism for transporting radionuclides into the biosphere, and until now the primary function of a plug was to limit groundwater intrusion and subsequent flow out of the facility (Stormont et al., 1987). This is still a major concern. Separation of an overpressurized cavity from the overlying Rustler aquifer must be maintained by materials that have low transmissivity and cement grouts and plugs must have a long life in a difficult environment. The enormity of this task is seen in the inadequacy of grouts currently used between the aquifer and the liner in the mine shafts. Leakage has been estimated at more than 2000 gallons per day (7.6 $m^3$/day), (Chaturvedi, telephone communication, 1987).

The pressure in a wet repository that calls for effective seals also increases the likelihood that waste will escape into the Rustler aquifer. The assumption that it would take 1000yr for any waste to reach the Rustler (FEIS, 1980) is no longer reasonable in a repository that will probably be pressurized in less than 200 years. The half-lives of the many isotopes that will be present in WIPP range from 13 to 387,000 years. Plutonium 239 has a half-life of 24,000 years and provides 94% (by weight) of the radioactive elements that make up TRU waste. Thus, the pressurized chamber is formed almost immediately, compared to the necessary life expectancy of WIPP. Under these conditions seals must not only keep groundwater from entering the mine, they must also limit the flow of waste-containing slurry out of the mine and into the Rustler aquifer. The large pressure difference across seals that could exist in a wet repository was unanticipated in preliminary reports outlining the sealing strategy.

Four potential flow paths are associated with engineered seals in the mine - the intact geologic formation, the region damaged by excavation, the seal/rock interface, and the seal material itself. These flow paths must be considered in connection with both vertical shafts and horizontal penetrations. The following sections briefly outline the present status of the plugging and sealing program in these areas.

### Sealing of Shafts and Boreholes

Current strategies include sealing water-bearing aquifers above and below the mine to protect the crushed salt in the mine and shafts from dissolution until it consolidates. It is planned that sections of shafts and boreholes in these water-bearing zones be sealed with concrete and grouted with a freshwater grout. The sealing zone will extend downward into the Salado Formation between the aquifers where a salt-compatible grout will be used. The region between the concrete plugs will be filled with a salt-based material (Stormont, 1984).

Specific problems relate to shafts and boreholes separately. Narrow boreholes are plugged remotely and it is necessary to check that plugging is complete and sound contacts with the sides are made. More serious concerns exist regarding shafts. Shafts are larger and provide direct access between the Rustler aquifer and the storage region. The larger diameter plug allows for potentially greater flow both through the plug and





through the rock/seal interface. Flow through the disturbed zone around the shafts is proportional to the perimeter of the opening. A large concrete plug generates more heat during hydration and is susceptible to cracking, separation from the side walls, and sinking.

To address these problems, multiple sealing components are proposed for shafts: caps, bases, seals, bulkheads, and fills. Specific designs for these components have not been made. Factors to be considered are the length of seals necessary for structural integrity and for preventing leakage, and mechanical and geochemical stability of materials. The fills between the various seals and plugs need to have a low permeability and not settle significantly. The salt-based fills contemplated for the Salado Formation provide chemical and mechanical compatibility but could also provide a preferential flow path (Stormont, 1984) and only recently have attempts been made to estimate the effects of brine inflow from the Salado on salt-based fills in the shaft (Sjaardema and Krieg, 1987) and to predict the behavior of cement plugs (Sambeek, 1987).

The rock/seal interface and adjacent rock also provide avenues for increased flow and effective grouts have not been demonstrated. Field tests of grouts proposed for use at WIPP have exhibited surface cracking of about 1 mm (Gulick et al, 1981). Hence the grouts could allow some initial amount of unsaturated flow to produce enlarged fractures where unsaturated brine is in contact with salt. Such a condition may account for the failure of grout to contain water from the Rustler in the main shaft.

### Sealing Rooms and Sections

The rooms of the repository lie entirely in the Salado salt beds, so proposed sealing of horizontal penetrations is in the form of bulkheads and fills. Special considerations include: plug emplacement near the roof of drifts, proximity to the waste, permeability of the disturbed zone, and highly permeable anhydrite beds. Since the cross sectional area of tunnels is about the same magnitude as the shafts, the same size considerations come into play; but gravitational settling in the horizontal geometry has more of an impact since it affects bonding near the roof (Stormont, 1984).

The current concept calls for multiple component bulkheads including cement to provide a short-term barrier to flow, and salt-brick which is expected to consolidate from pressure in the closing tunnels and provide a long-term barrier (Stormont, 1984). Salt consolidation, the principle component in this seal design strategy, could be compromised with sufficient brine inflow from surrounding rock, preventing the necessary isolation of the rooms and sections within the repository and providing a significant conduit for flow (Stormont et al, 1987).

### Effects of Excavation

A primary concern of the sealing program is that the geologic formation could provide a path through which fluid could bypass the engineered seals. Excavation produces a disturbed zone with enhanced flow characteristics, and separations or fractures in the interbed anhydrite

layers. The thin layers of salt on the roof or floor between the interbed layers may also fracture. These fractures could become a connected network of high porosity regions throughout the storage facility (Stormont et al, 1987). The present plan for temporary storage of waste at WIPP over the next 5 years calls for remining the rooms at the end of that period to remove salt that has already begun to close the rooms. This additional mining could provide additional fractures and avenues for communication through the formation and around erected barriers.

Fractures in salt may "heal" with time since porosity decreases with deformations due to creep, but this process could be retarded by pressurized gas that enters the mine from surrounding rock or that is generated by the wet waste. The gas may also fracture adjacent rock if sufficient pressure is generated (Stormont, et al., 1987). In addition, if sufficient gas is generated before closure and complete pressurization the escaping gas may help establish pathways through fill or around barriers.

This brief survey of the sealing program highlights the extent of unsolved problems at WIPP that must be resolved before the emplacement of waste. The unexpected intrusion of brine and the difficulties of sealing illustrate the pitfalls of moving the WIPP project to final development on the basis of inadequate information and points to defects in scientific and public policy which are explored in the next section.

## WIPP POLICY ISSUES

In addition to scientific and technical questions about the advisability of proceeding with nuclear waste emplacement at WIPP as discussed above, the policies that regulate the selection, design, and management of the site are a matter of concern to us. Review and analysis of the history of WIPP-related policy reveals four major types of policy irregularities.

### Intergovernmental Relations and Responsibility

In the case of nuclear waste storage policy intergovernmental relations have been particularly unstable and conflicted. Specifically, the relations between the state of New Mexico and the federal government have been reinterpreted and renegotiated with each change in both national and state administrations, resulting in a lack of continuity in assignment of power and responsibility for decisionmaking about WIPP. A flexible and experimental approach to intergovernmental relations is perhaps appropriate in some policy areas, but in the case of a long-term storage site for hazardous materials inconsistent policy leads to a potentially dangerous confusion over accountability. Constant renegotiation of the rules and terms that apply to WIPP has done little to clarify and improve the definition of the mission of the project, has not established clear and rational lines of authority and oversight responsibility, and has not provided an orderly and systemic assessment of the long-term consequences of waste storage at WIPP. Public input to the decisionmaking process has been restricted and diminished. As an indirect result, WIPP has been exempted from important procedures and research requirements.



### Exemption of WIPP from Major Federal Regulations

The ad hoc approach to accountability for WIPP policy has led to the exemption of the site from two major federal laws that govern nuclear waste disposal. WIPP was specifically excluded from the restrictions placed on waste disposal by the 1982 Nuclear Waste Policy Act. The NWPA allows states and tribes to veto the President's designation of a repository site and mandates extensive DOE consultation with states or tribes whose lands are selected for waste disposal sites. It also requires the Nuclear Regulatory Commission (NRC) to license such sites. WIPP, by virtue of its exempt status, is not subject to NRC oversight and the power of the state in decisionmaking is similarly unspecified by the law. Exemption of WIPP from NWPA provisions has contributed to the unclear federal-state relations described above.

Among the New Mexico congressional delegation there is currently a dispute over whether or not the WIPP should be required to meet Environmental Protection Agency (EPA) standards before the emplacement of any waste is undertaken. The EPA standards, vacated last year by the First Circuit Court of Appeals on grounds that they do not adequately protect the health and safety of the public, are nonetheless the most rigorous explicitly-stated standards in the law. The exemption of WIPP from NWPA and the possibility that waste emplacement will begin without EPA oversight further exacerbates the problem of insuring adequate accountability for safety of the site.

### The Role of the Scientific Community in the Policymaking Process

Elsewhere we describe reasons for believing that there are several important technical questions about WIPP that have not been adequately addressed by scientific research. WIPP has been considered a special case by policymakers, appropriately treated in a more flexible fashion than is normally acceptable, because it is intended as an experimental pilot project. Thus one of its major declared purposes was to provide the scientific community with data about nuclear waste storage that would permit the selection and development of facilities for other permanent storage sites. However, the larger scientific community has had almost no role in decisions about the disposal of nuclear waste at WIPP. Only in October, 1987 were brief abstracts and two talks on the inflow of brine into the repository presented to a meeting of the Geological Society of America. Neither of these talks considered the consequences of the brine inflow. The NAS (1984) recognized this deficiency in participation by the science community and called for efforts to correct the situation. DOE and WIPP researchers have been slow to respond.

Some information about the geological characteristics of the site have been supplied by the U. S. Geological Survey (USGS), but they are not empowered to make recommendations on the suitability of the site. Apart from scientists employed by DOE and its contractors, the only group of scientific reviewers involved in regular assessment of the progress of the project are those in the New Mexico Environmental Evaluation Group (EEG). The EEG has been responsible for forcing studies that have revealed

important problems with the site, especially the hydrology of the Rustler aquifer and the problem of inflowing brine. EEG's contribution should not be minimized. However, EEG is under political pressures at both the state and national level and the state has made agreements that drastically restrict EEG's role. Furthermore, EEG is now in upheaval because of the pending transfer of personnel to Carlsbad.

The NAS has established a review panel on WIPP at the request of the DOE. At times the NAS has presented formal testimony at hearings and in court to the effect that WIPP will perform according to expectations. The NAS's task, however, formally excludes "approval or disapproval of the specific plans for WIPP or any of its component parts" and the review panel has a limited role related to evaluating design criteria. Thus, the only sustained technical review of the scientific research, by the EEG and NAS, has been explicitly and deliberately restricted.

Rational decisionmaking about policies with high technical content demands extensive and unquestionably reliable research, especially where there is a potential for negative long-term consequences. Furthermore, extensive input from the scientific community would seem essential for a project that has been exempted from federal law and regulations on the grounds that scientific research demands more flexibility than the law allows.

### Public Opinion and the Policy Process

Decisionmaking about WIPP has taken place with as minimal opportunity for public input. There have been only three congressional hearings since the site was designated in 1975; the only DOE hearing in the last 7 years was forced by the state and allowed no role for a public response to WIPP in the decisionmaking process. Support for WIPP among citizens of Carlsbad, and by the current state administration, seems to be based largely on anticipated economic benefits rather than specific knowledge about the project. However, the most recent congressional hearing revealed a substantial variety of concerns by members of the local community and representatives of communities through which nuclear waste will be transported to the site. At least some members of the congressional panel were apparently unaware that WIPP could be a water-saturated repository and of the implications of this development.

This lack of public knowledge and information can lead to acceptance of the project in the short run but may also prove to be a disadvantage to the nuclear waste program and effective government in the long run. Just as rational decisionmaking about WIPP requires impartial scientific analysis and review, democratic decisionmaking demands extensive and meaningful opportunity for public input and reaction. A failure in public policy to assure an orderly and tested scientific process is partly responsible for a failure to recognize the early signs that water from the surrounding geologic formation could enter the repository in significant amounts. The consequences of this oversight, for national and even foreign policy, as yet unexamined, might be severe.





## CONSEQUENCES OF WIPP POLICY EXEMPTIONS

### History of the Oversight of Brine Inflow at WIPP

As early as 1952 the concept that certain materials were impermeable was being challenged in workshops in the U. S. Geological Survey; a common expression being: "there is no such thing as an impermeable rock". By the early 1970's, before WIPP was conceived, there was a body of literature in hydrology, some of it specific to the Delaware Basin, that could have been used to challenge the contention that salt beds of the Salado Formation were impermeable to water. Griswold (1977) in referring to brine pockets in the Salado states: "However, the presence of these fluid accumulations needs to be cited to correct the impression that salt beds are completely dry." At that time, however, the connection between water in the salt and permeable hydrologic flow at WIPP had not been made.

The first drill stem tests (DST's) in 1976, of borehole AEC 7, and of borehole ERDA 9, which is adjacent to the main waste-handling shaft for WIPP, showed that the beds to be used for the repository had anomalously high permeability; higher than beds above or below; up to 2.1 X $10^{-3}$ darcy. Interpretations of these data suspected imperfect equipment or attributed the higher values to local fracturing associated with drilling (Peterson et al., 1981). Only short-term DST's were run in the belief that longer tests were not needed, that pressures would soon be depleted, and that only small volumes of fluid would be produced (Mercer, 1987).

Further testing was initiated in 1981 and an anomalous buildup in formation pressure to 472 psi was found at WIPP-12. A similar buildup in pressure to 390 psi was encountered in a two-day test in Cabin Baby-1 at about the same time. These high formation pressures, measured over long time-intervals, indicated that hydrologic flow in the Salado was persistent and that the Salado Formation was capable of moving a significant quantity of water over a long interval of time. The anomalous pressure at Cabin Baby-1 was considered questionable and not investigated further (Beauheim et al., 1983). By 1984, however, an additional buildup at Cabin Baby-1 had confirmed the high formation pressures. Even so, it was concluded that the rate of movement was imperceptable and would not significantly affect the integrity of the facility (Mercer, 1987). The first challenge to the belief that the salt beds at WIPP were essentially dry was made by Bredehoeft (1987), apparently sometime in 1984, after the initial excavation and construction was completed and after preliminary data of brine inflow in the mine was available. Bredehoeft suggested the alternate hypothesis of a regionally saturated and slightly permeable system that would lead to a water-saturated repository.

In hindsight, reports giving evidence for persistent and significant flow of brine through the Salado were available in late 1981, before the WIPP facility was constructed. In 1979, if longer-term drill stem tests at

AEC 7 had been carried out after high permeability was measured, the information needed to interpret saturation and flow in the Salado might have been available. Through 1982, when decisions were being made to proceed to construction, the connection between anomalous formation pressures and saturated conditions in the repository was overlooked. This small oversight was rooted in the larger one of accepting without question the premise that salt was dry; a concept that is only generally, and not specifically, true. The connection was made only after the repository was constructed and evidence called for an explanation (Chaturvedi, 1988).

**Effects of the Brine Oversight on the WIPP Project**

Had it been recognized in 1979 or 1981 that a nuclear waste repository would become saturated with water, decisions to construct WIPP might have been reconsidered. At a minimum, the project would have been delayed several years by extensive and long-term hydrologic testing. Also, some of the research expense connected with other salt-bed projects, such as the site in the Palo Duro Basin, might have been questioned.

Early in the nuclear waste program it was agreed by all concerned and mandated by law that all permanent disposal of nuclear waste would be in a solid form. Technically, the material to be placed in WIPP is solid. But in a wet repository its almost immediate contact with water violates the spirit if not the letter of the law. During the decades when much of the nuclear waste disposal program was committed to burial in salt, a theory of waste disposal was evolving based upon the concept of multiple barriers. This strategy relies upon a suite of 4 or 5 successive barriers to prevent toxic nuclides from reaching the biosphere. A solid waste form is the first barrier, followed by a durable cannister, absorbent packing materials, and finally an impermeable geologic formation. If an aquifer is present, then slow travel times for nuclides constitutes a sixth barrier. A wet repository at WIPP systematically eliminates every one of these barriers (see Technical Review Summary, p. 25). If a connection had been made between the anomalous test results and a saturated repository in 1981 it would have been possible to compare the cost and safety factors of changes needed to accommodate potential water saturation at WIPP with other nuclear waste disposal strategies.

In retrospect, the disposal strategy at WIPP is being reexamined today because the policy exemptions given to WIPP freed the project from a rigorous program to characterize and interpret geotechnical properties before decisions were made to proceed with design and construction. Had such a program been in place sufficient information might now be available to narrow the window of uncertainty regarding brine inflow. Also, critical review of primary data might have led to more complete testing and the identification of a water-saturated repository at an earlier stage and before construction.





**FUTURE POLICY**

The belated recognition that WIPP could be a water-saturated repository now leaves the project and the science community in a difficult situation. A first priority should be to determine the range of uncertainty in permeability, brine inflow, and in the complete isolation of waste from brine inflow. If the uncertainty cannot be reduced, alternate engineering and packaging designs should be designed and tested to determine reliability. Typically, engineering measures and changes forced by circumstance and not derived from careful planning require years of testing and the negative consequences of alternate plans are rarely recognized at the time of conception. The cost of alternative solutions should be estimated and compared to other methods and strategies for containing or storing nuclear waste.

A major change in decisionmaking is called for and several responses are demanded by the recognition that WIPP may be a water-saturated repository. Final decisionmaking authority for WIPP should be removed from the sponsoring agency. But a more immediate response is needed to assure that steps taken within the next year do not commit WIPP to an irreversible strategy and a plan that fails to recognize the reality and difficulties of a wet repository. Present plans call for, and pending legislation allows, 120,000 drums to be stored in WIPP until final disposal and backfilling. The EPA (40 C.F.R. 191, Part B) requires the sponsoring agency for a waste repository to demonstrate minimal consequences for a release of nuclear waste through a borehole for 10,000 years after burial. It should be acknowledged that the present plan for packaging the waste will not suffice in a water-saturated repository and there is a real possibility that any waste stored in the mine will have to be removed.

There are apparently no scientific reasons and no published documents justifying temporary storage of waste. There appear to be no experiments, such as the evolution of gas from the waste, that could not be carried out under more controlled conditions above ground and with much smaller volumes of waste. Other experments, such as the crushing of drums by creep, reaction of drums with backfill, or efficiency of handling the drums could more easily be carried out with dummy waste in the drums. Reassurances have been given that the waste will be removed if WIPP cannot comply with EPA standards. We are unaware of any current estimates of the costs and health risks of rehandling the waste and removing 120,000 barrels of waste from the mine. Hence, proposed legislation for WIPP, by allowing interim storage, does not acknowledge the possibility of a water-saturated repository and the attendant difficulties and costs of complying with EPA standards. Furthermore, the legislation does not specifically exclude a waiver that will allow the waste to remain in place in a water-saturated mine. The prudent decision at this time, in view of the uncertainties of water saturation, is to defer legislation until the technical matter is resolved.

The real challenge that arises from the possibility of a water-saturated nuclear waste facility will be not to minimize the problem. The investigation after the Challenger disaster revealed that even a formal system of internal checks and approvals within NASA was inadequate for a

project subjected to the pressures of haste, the budget, and political goals. Long-term goals were sacrificed in a gamble for the short-term benefit that did not pay off. The consequences debilitated the space program. Similar pressures exist for the WIPP project at a time when a careful rethinking of the disposal strategy at WIPP is most needed. Testimony after the failure of the Challenger mission revealed managerial attitudes that challenged skeptical engineers on the shuttle project to "prove it won't fly"; an impossible task and a demand that reversed the important role that criticism plays in science. Only a new and fully independent review process with final decisionmaking authority outside the sponsoring agency will assure that future decisons are sound and in keeping with an evolving national strategy for the disposal of nuclear waste.

The nuclear waste program has a confused history that has long failed to inspire public confidence. We note the concern over this problem expressed recently in a column by Jack Anderson and Joseph Spear (Albuquerque Journal, October 14, 1987). The House Energy Committee is considering legislation to establish a technical review board of scientists for nuclear waste which would review all aspects of waste disposal. In addition, the General Accounting Office (GAO, 1987) presented testimony on the proposed Nuclear Protections and Safety Act (S. 1085) that cites a pressing need for independent scientific review and review authority over DOE projects. We strongly endorse this concept and these efforts and urge that WIPP be included under its provisions.

Given the history of WIPP, we see an urgent need for removing the final judgment of compliance with environmental standards from the jurisdiction of the sponsoring federal agency. A change in jurisdiction and additional review will mean a delay of the WIPP project. It is a delay, however, that is not artificial and one that should have been imposed earlier by the requirements for research on the salt-bed environment. In the short run the public might not be reassured by the delay of an already troubled nuclear waste program. However, a justifiable delay to resolve questions and concerns about a water-saturated repository and to insure compliance with environmental protection standards would be evidence that public safety is the prime concern of the project and its sponsors.

In the long term, if future studies cannot give a clear answer to the consequences of a water-saturated repository, we may have to contemplate a reduced mission for WIPP. Loss of the original premise that salt is dry may require solutions at WIPP that are prohibitively expensive. An orderly and logical policy suggests that no more excavation be done at WIPP until the window of uncertainty about brine inflow is reduced. If WIPP is developed as a wet repository without full testing of the hydrologic system, and with disregard for the potential consequences of the inflowing brine, the mission of WIPP may engender public fears and mistrust of industry and government for centuries, not only in New Mexico and the U.S., but for our international neighbors as well.





## CONCLUSIONS

The corrosive brine now entering the WIPP repository compels reconsideration of the strategy of disposal of nuclear waste at WIPP. Estimates of brine inflow should be based on a comprehensive testing program of the entire area to be excavated. Moreover, a wide safety margin that includes a careful assessment of the higher values of permeability must be demonstrated. The consequences of a miscalculation are so great for future generations that the results should have the concurrence of an independent panel of the nation's leading hydrologists. Engineering designs at all levels must be reevaluated to determine their ability to adequately contain liquid waste. The pathways of brine flow in geologic units, both into the mine and out again under pressure, must be precisely known before it can be assumed that seals will not be bypassed.

At this time it is not known if waste isolation through the use of engineered barriers and seals can actually be achieved at WIPP. A realistic assessment of performance with respect to environmental standards is not possible until the special problems of a water-saturated repository are studied in detail. In short, the decision to put waste into the repository, even as interim storage, is premature. A "business as usual" approach that would put approximately 120,000 barrels of waste in the mine over the next 5 years does not take into account the seriousness of the problem or the difficulty of its resolution.

We must resist the temptation to seek a short-term, partial solution which would make the project a one-time experiment with an uncertain outcome. The pressure for haste in demonstrating our ability to solve the problem of nuclear waste disposal will continue. However, patience is required to avoid the risk of leaving future generations with a legacy of unwise decisions and unsuspected danger. It is in this spirit that we ask for a hold on the interment of waste in any form at WIPP and make the recommendations presented on the next page of this report.

## GENERAL SUMMARY

The panel has examined pertinent information on WIPP and evaluated problems related to the unexpected movement of brine into the WIPP repository. We believe, on the basis of test results, that the underground disposal facility could contain an appreciable volume of water. The commingling of water and nuclear waste creates a slurry of waste that invalidates the strategy of disposing of nuclear waste in "dry" salt beds at WIPP. The creep or "self sealing" property of salt is a liability when brine is present because it squeezes the slurry and becomes a means for driving liquid waste to the surface. Waste in a liquid form is likely to carry radioactive material to the biosphere in quantities that exceed environmental standards in the release scenarios required by the EPA.

The inability to close seepage channels to inflowing brine and the build up of pressure in the repository require fail-proof methods for containing the waste. Our examination reveals a largely untested sealing program. We conclude that there is no assurance that the proposed barriers will isolate and contain liquid waste for the time interval required by environmental standards. We agree strongly with the NAS panel on WIPP that it must be demonstrated that the safety of the repository will not be affected by the inflow of brine and by the potentially rapid movement of radionuclides.

A water-saturated repository means that the disposal methods to be used at WIPP must be reevaluated. The belated discovery of a wet mine at WIPP makes imperative the following recommendations.

## RECOMMENDATIONS

1. **A Hold on Operations**

Present plans for the disposal of nuclear waste at WIPP are precluded by a water-saturated repository. Therefore, a hold must be placed on all mine construction, excavation, and nuclear waste storage operations until disposal methods are demonstrated that will isolate waste within a wet repository, and until an effective program for reducing or permanently containing the slurry of waste in bedded salt is available and tested.

2. **Legislation**

Present disposal methods, when used in a wet mine, can lead to releases of radioactivity that exceed environmental standards. The wording of proposed legislation that permits interim storage of waste in drums therefore must be changed. Future legislation should specify that all waste will comply with EPA standards set forth in 40 C.F.R. 191, Part B.

3. **Independent Review and Approval**

Final approval of WIPP should not be a decision of the sponsoring agency and should be given only after a fresh look at the problem by a new and independent review panel composed of scientists and engineers carefully selected for objectivity and broad expertise.





## TECHNICAL REVIEW SUMMARY

Water is "weeping" into the underground excavation at WIPP at a slow but steady rate. Measurements of permeability cover a broad range of values and estimates of brine inflow, within a reasonable window of uncertainty, indicate that a significant volume of brine could enter the waste-filled repository before it becomes pressurized by the creep of salt. The new class of problems encountered, should this happen, includes the following events and consequences.

1. Soft-steel waste containers will disintegrate within their certified life of 20 years in the corrosive brine and the waste and brine will commingle to produce a slurry of waste that is available for transport.

2. Organic material in the waste and metal from the drums, exposed to brine, will be decomposed bacterially and chemically and release hydrogen sulfide and other gasses.

3. The creep or self-sealing property of salt, an advantage in a dry mine, will close the mine until it encapsulates the liquid waste. At this point the waste slurry will become pressurized at lithostatic pressure and will contain dissolved gas.

4. Even without pressurization, intrusion by a borehole will encounter water-saturated waste and normal drilling operations will bring solid and dissolved waste to the surface in quantities where consequences are likely to exceed environmental protection standards. If the repository reaches lithostatic pressure, additional waste can be driven to the surface through the borehole.

5. The creep of salt into the excavation produces fractures and thereby increases the permeability of salt and fractured anhydrite beds above and below the repository. No barriers have yet been designed and tested that can demonstrate that liquid waste in a pressurized mine can be isolated within sections of the mine or from the vertical shafts.

6. Hydraulically driven liquid waste will seek escape around engineered barriers and through permeable tunnels and shafts. Initial attempts at cementing the main shaft from the Rustler aquifer have been unsuccessful and have allowed water to bypass and enter the shafts (1 1/2 gallons per minute), suggesting that seals and plugs may not isolate the aquifer.

7. The Rustler aquifer contains soluble beds that have been involved with near-surface dissolution and these beds have developed a solution-channel hydrology with high transmissivity and a possibility of fast travel time for radionuclides.

As a result of the seven items above, a wet repository at WIPP defeats the multiple-barrier strategy recommended for the disposal of nuclear waste. It releases radionuclides in quantities that may exceed environmental standards in a recognized failure scenario, and it relies for containment upon a largely undesigned plugging and sealing program.

REFERENCES CITED

Alcorn, S. R., Occurrence of brine "weeps" in the WIPP facility: Memo to D. K. Shukla, Oct. 3, 1983, WD:83:02910, USDOE, Albuquerque, NM., 17 p.

Anderson, D. R., 1987, Presentation before NAS WIPP Panel, Idaho Falls, ID, and document at Senate Hearing for Land Withdrawal, Carlsbad, NM.

Beauheim, R. L., Hassinger, B. W., and Klaiber, J. A., 1983, Basic data report for borehole Cabin Baby-1: Deepening and hydrologic testing: DOE TME-020, Albuquerque, NM: DOE/AL, 1983.

Borns, D. J., 1985, Marker bed 139: a study of drillcore from a systematic array: SAND85-0023, 32 p., Albuquerque N M, Sandia National Lab.

Bredehoeft, J. D., 1987, Is WIPP salt "dry" -- An alternative hypothesis: Unpublished ms, 13 p.

Case, J. B., and Deal, D. E., 1987, Preliminary hydrologic and geomechanical evaluations of brine inflow from bedded salt to a nuclear waste repository: Geol. Soc. America, Abs, v. 19, No. 7, 614-615.

Chaturvedi, L, and Channell, J. K., 1985, The Rustler Formation as a transport medium for contaminated ground water: EEG-32.

Chaturvedi, L., 1988, Statement submitted to Radioactive Waste Consultation Task Force, 13 January, 1988, Santa Fe, NM. (see also: Albuquerque Journal, 14 January, 1988).

Deal, D. E., and Case, J. B., 1987, Brine sampling and evaluation program: Phase I Report: DOE - WIPP 87-008, 46 p. and appendices.

Deal, D. E., 1987, Brine occurrences in the Permian Salado Formation as observed in the underground workings for the Waste Isolation Pilot Plant (WIPP) Project, southeastern New Mexico: Geol. Soc. America, Abs, v. 19, No. 7, 637-638.

Dowhan, D. J., 1976, Test drilling to investigate subsidence in bedded salt: BASF Wyandotte Corp., Wyandotte, MI, 13 p.

PEIS, 1980, Waste Isolation Pilot Plant, U. S. DOE, Vol. 1.

GAO, 1987, Key elements of effective independent oversight of DOE's nuclear facilities: GAO/T-RCED-87-32, 13 p.

Griswold, G. B., 1977, Site selection and evaluation studies of the Waste Isolation Pilot Plant (WIPP), Los Medanos, Eddy County, NM: SAND77-0946, Albuquerque N M, Sandia National Lab.,

Gulick, C. W., Jr., Boa, J. A., and Buck, A. D., 1982, Borehole plugging materials and development program, Report 3: SAND81-0065, Albuquerque N M, Sandia National Lab., 24 p.

Holcomb, D. J., and Shields, M., 1987, Hydrostatic creep consolidation of crushed salt with added water: SAND87-1990, Albuquerque N M, Sandia National Lab.

Mercer, J., 1987, Compilation of hydrologic data from drilling the Salado and Castile formations near the WIPP site: SAND86-0954, Albuquerque N M, Sandia National Lab.

NAS, 1956, Report of disposal of radioactive waste on land: Washington, DC, National Academy of Sciences, 141 p.

NAS, 1984, Review of the Criteria for the site suitability, design, construction, and operation of the proposed Waste Isolation Pilot Plant (WIPP): National Academy Press, Washington DC.

Nowak, E. J., and Stormont, J. C., 1987, Scoping model calculations of the reconsolidation of crushed salt in WIPP shafts: SAND87-0879, Albuquerque N M, Sandia National Lab.







Nowak, E. J., 1988 (undated), Assessment of brine inflow to WIPP disposal rooms: Sandia National Laboratories, Albuquerque, NM, 6 p.

Peterson, E. W., Lagus, P. L., Broce, R. D., and Lie, K., 1981, In situ permeability study of rock salt: SAND81-7073, Albuquerque N M, Sandia National Lab.

Peterson, E. W., Lagus, P. L., Brown, J, and Lie, K., 1985, WIPP horizon in situ permeability measurements: A final report: SAND85-7166, Albuquerque N M, Sandia National Lab.

Peterson, E. W., Lagus, P. L., Brown, J, and Lie, K., 1987, WIPP horizon free field fluid transport characteristics: SAND85-7166, Albuquerque N M, Sandia National Lab.

Register, J. K., 1981, Brine pocket occurrences in the Castile Formation, southeastern New Mexico: USDOE, TME 3080, Albuquerque, NM, 14 p.

Sambeek, L. L., 1987, Thermal and thermomechanical analysis of WIPP shaft seals: SAND87-7039, Albuquerque N M, Sandia National Lab.

Sjaardema, G. D., and Krieg, R. D., 1987, A constitutive model for the consolidation of WIPP crushed salt and its use in analysis of backfilled shaft and drift configurations: SAND87-1977, Albuquerque N M, Sandia National Lab.

Stein, C. L., and Krumhansl, J. L., 1986, Chemistry of brines in salt from the Waste Isolation Pilot Plant (WIPP), southeastern New Mexico: SAND85-0897, Albuquerque N M, Sandia National Lab., 38 p.

Stickney, R. G., 1987, Results of an accelerated borehole closure testing program at Avery Island, Louisiana: BMI/ONWI - 655.

Stormont, J. C., 1984, Plugging and sealing program for the Waste Isolation Pilot Plant (WIPP), SAND84-1057, Albuquerque N M, Sandia National Lab., 49 p.

Stormont, J. C., and Howard, C. L., 1987, Development, implementation, and early results: Test series C of the small-scale seal performance tests: SAND87-2203, Albuquerque N M, Sandia National Lab.

Stormont, J. C., Peterson, E. W., and Lagus, P. L., 1987, Summary of observations about WIPP facility horizon flow measurements through 1986: SAND87-0176, Albuquerque N M, Sandia National Lab., 31 p.

Torres,T. M., 1986, Preliminary evaluation of drift closure and closure rate response with respect to the effects of gas occurrences within the Waste Isolation Pilot Plant: SAND86-1059, 27 p.


GLOSSARY

Anhydrite: A brittle rock composed of calcium sulfate that can develop open fractures and is often interlayered with beds of rock salt (halite).

Aquifer: A permeable bed or layer of rock beneath the surface through which water flows.

Backfill: Rock material such as crushed salt that is to be packed around the drums of waste and placed in the tunnels and shafts before the mine is sealed.

Bentonite: A type of clay that can absorb an appreciable amount of water.

BSEP: Brine Sampling Evaluation Program. A series of tests in which holes are drilled into the ceiling, floor, and walls of the mine and monitored to determine the rate of inflow of brine.

Darcy: A unit of intrinsic permeability that measures the flow of water (a rock that gives a measurement of $10^{-6}$ darcy is more permeable and will transmit more water than one that measures $10^{-8}$ darcy).

DST: Drill stem test: a test where part of a geologic formation is isolated by placing "packers" in a borehole and measuring the rate at which fluids enter the hole.

EEG: Environmental Evaluation Group. A New Mexico state agency, funded by DOE, and created to evaluate the safety of WIPP.

EPA: Federal Environmental Protection Agency. Legally empowered to set standards and determine the performance of WIPP.

FEIS: Final Environmental Impact Statement (1980).

Grout: Cement that is poured or injected into fractures and empty space.

High-level waste (HLW):
Heat-generating nuclear waste, generally in the form of fuel rods from nuclear reactors.

Lithostatic pressure:
Pressure developed deep underground by the weight of the overlying rock. At the WIPP mine, lithostatic pressure is about 2000 psi (pounds per square inch).

NAS: National Academy of Sciences. A national organization of scientists; in this case commissioned and indirectly funded by DOE to review the design criteria for WIPP.

Permeability: The intrinsic capacity of a material (rock) to transmit water through interconnected pore space. (Often measured in darcys).

Porosity: The volume of empty space or void space within a rock or other material.

psi: Pressure in pounds per square inch. (psig is pressure at the gauge).

Rustler aquifer: The water-carrying geologic layers or beds that lie above the repository at a depth of about 700 feet (see Fig. 1).

Scenario (Release Scenario):
A sequence of reasonable events that could occur to breach the repository and carry nuclear waste to the surface.

Transuranic (TRU) waste:
Artificially produced nuclear waste that gives off alpha particles and may generate some heat; includes plutonium.





January 27, 1988

**SCIENTISTS REVIEW PANEL ON WIPP**
c/o Reuben Hersh
Department of Mathematics and Statistics
University of New Mexico
Albuquerque, NM 87131
(505) 277-4903; 277-1639

**Panel Members:**

Seymour S. Alpert, Ph.D.
Dept. of Physics, UNM

Roger Y. Anderson, Ph.D.
Dept. of Geology, UNM

Colston Chandler, Ph.D.
Dept. of Physics, UNM

Milan H. Cobble, Ph.D.
Dept. of Mechanical Engineering
NMSU (Retired)

Reuben Hersh, Ph.D.
Dept. of Mathematics and
Statistics, UNM

Debra C. Rosenthal, Ph.D.
Dept. of Political Science, UNM

Jay Sorenson, Ph.D.
Dept. of Political Science, UNM

Zane Spiegel, Ph.D.
Ground-water Hydrologist
Santa Fe, NM

Deborah Sulsky, Ph.D.
Dept. of Mathematics and
Statistics, UNM

Bob Watt, Ph.D.
Nuclear Physics (Retired)
Los Alamos, NM

William J. Zimmer, Ph.D.
Dept. of Mathematics and
Statistics, UNM

Acknowledgments:

The panel has obtained comments and information from many sources during the preparation of this report and we wish to thank all those that have contributed to its clarity and accuracy. We also wish to thank several geologists and hydrologists for constructive comments on technical aspects presented in an early draft of this report including: Mary P. Anderson, University of Wisconsin; John D. Bredehoeft, U.S. Geological Survey; Lokesh Chaturvedi, New Mexico EEG; Lynn Gelhar, MIT; and Tom Gustavson, Texas Bur. Econ. Geol. Given the controversial nature of the subject matter we wish to emphasize that the observations and opinions expressed in this report are those of the panel alone.

Scientists Review Panel on WIPP

EVALUATION OF PRELIMINARY DRAFT OF THE RADIOACTIVE WASTE EXPERIMENT

(PANEL ONE MONITORING PLAN)

WASTE ISOLATION PILOT PLANT

10 May, 1988





SCIENTISTS REVIEW PANEL ON WIPP
c/o Reuben Hersh, Department of Mathematics and Statistics
University of New Mexico, Albuquerque, NM 87131
(505) 277-4903; 277-1639

New Mexico Congressional Delegation
Members of Congress
Washington, DC

10 May, 1988

Dear Congressional Representative,

Enclosed is a copy of a report by Scientists Review Panel on WIPP (SRP) evaluating the proposed radioactive waste experiment at WIPP, along with our recommendations for a course of action.

We present this report to you with urgency because its contents should be considered before any further action is taken to revise or pass legislation related to WIPP.

Specifically, we call your attention to a profound contradiction between conditions at the WIPP repository that prohibit a valid experiment and the wording of proposed legislation that will enable radioactive materials to be stored in the mine. We maintain, and we believe that subsequent review by other independent scientific bodies will confirm, that the proposed experiment with radioactive waste is not credible.

Inasmuch as legislation, as proposed, cannot be justified on scientific grounds, neither can the hazards and expense of handling and rehandling the radioactive waste which would be placed in the mine. We fear that the problems of rehandling 4 rooms of radioactive waste (26,000 drums), once emplaced in the mine, will become a strong arguement for seeking an exception for waste already interred and a permanent waiver of disposal standards. This contingency can be avoided most simply by recognizing that the proposed experiment is unnecessary.

We ask that you carefully consider our evaluation. If you have any question as to its accuracy, we suggest that before a final decision is made you seek an additional evaluation from agencies, without a history of contribution to WIPP, who are equipped to provide independent analysis. We would be pleased to help clarify the technical issues at a hearing on this important matter.

Respectfully submitted,

Reuben Hersh
For SRP

EVALUATION OF PRELIMINARY DRAFT OF THE RADIOACTIVE WASTE EXPERIMENT (PANEL ONE MONITORING PLAN) WASTE ISOLATION PILOT PLANT

## SUMMARY

A description of the experiment with TRU radioactive waste at WIPP, that is being used to justify a waiver of EPA disposal standards, may not be released by DOE before the experiment and the waiver are authorized by Congress (H.R. 2504). Therefore, Scientists Review Panel on WIPP (SRP) is releasing this review of the experiment in order to inform Congress and the public, before legislation is enacted, that a waiver of EPA standards cannot be justified on scientific or technical grounds.

The proposed experiment essentially repeats experiments described in published reports and the information to be obtained is already largely available. Furthermore, conditions underground (lack of sealing of bulkheads, dilution of gas, non-duplication of disposal environment) will provide data of questionable accuracy and value. The description provides no methods for analysis of data collected under difficult experimental conditions and presents no plan for terminating the experiment and recovering the waste.

The time period for observation prohibits an experiment that exposes radioactive waste to the environment of entombment (backfill, contact with brine, etc.). These data can only be obtained in the laboratory where accelerated experiments can simulate reactions and produce data for use in predictive models across the range of expected and possible disposal environments. Therefore, the proposed experiment will contribute no significant data for predicting compliance with EPA disposal standards. The data that are required for determining compliance can and will be obtained from other experiments (brine seepage, room closure, etc.) that do not use radioactive waste.

**Recommendation:** The radioactive waste experiment in the Panel One Monitoring Plan cannot be justified on technical grounds and should be abandoned in favor of controlled experiments in the laboratory. Pending legislation (e.g. H.R. 2504) that now authorizes the unjustified experiment with radioactive waste should be deferred until data obtained from other underground experiments, that do not employ radioactive waste, assure compliance with EPA disposal standards.

## INTRODUCTION

The Waste Isolation Pilot Plant (WIPP) will permanently dispose of transuranic (TRU) nuclear waste and must comply with safety standards of the Environmental Protection Agency (EPA; 40 C.F.R. 191, Part B). The Department of Energy (DOE) has asked for legislation (H.R. 2504 and substitute) that temporarily waives EPA standards and allows radioactive waste to be placed underground for experimental purposes before showing that WIPP can comply with EPA standards.





The Panel One Monitoring Plan (DOE, 1988) is, therefore, a key factor in justifying legislation sponsored by the New Mexico congressional delegation (S. 1272; H.R. 2504) that now temporarily exempts WIPP from EPA standards for disposal on grounds that experiments with radioactive waste are necessary. The pending legislation allows a significant volume of waste (about 26,000 drums) to be placed underground before compliance. The National Academy of Sciences (NAS) has called for scientific justification before any radioactive waste is used in an underground experiment at WIPP (NAS, 1988).

The history of the proposed experiment reveals a reluctance to describe the experiment and subject it to critical scientific review. For example, the Panel One Monitoring Plan, and a description of the radioactive waste experiment, was made available to review groups by the Department of Energy (DOE) only after repeated requests by the New Mexico Environmental Evaluation Group (EEG), a strong public appeal by Scientists Review Panel (SRP), and finally, after an endorsement of the SRP appeal by the National Academy of Sciences (NAS, 1988). **The reluctance of DOE to disclose specific details, and the large volume of waste exempted from standards, has led observers of DOE and WIPP to infer that the experiments are a means for opening the facility and committing waste to permanent disposal without complying with environmental standards for disposal.**

SRP recognizes that the legislation to authorize experiments with radioactive waste may be enacted before any other scientific body has had a chance to critically examine and issue a statement on the validity of the proposed experiments. The description of the Panel One Monitoring Plan, for example, is not scheduled for release until about 15 June, 1988. For this reason, and to fully inform Congress and the New Mexico delegation before legislation is enacted, SRP has prepared these preliminary observations and conclusions on the draft of the proposed radioactive waste experiments.

## BRIEF SUMMARY OF THE EXPERIMENT

The Panel One plan proposes to monitor the release of gas from drums of TRU waste in 4 rooms, to monitor room closure from salt creep, and to measure the seepage of brine into one room in the mine. We concur with the NAS recommendation that DOE gather accurate data on brine seepage and mine closure. These factors must be known to predict the environment of entombment. These studies, however, as outlined in the Panel One plan, are unrelated to the use of radioactive waste. The radioactive waste experiment proposes to seal the 4 rooms and monitor the volume and composition of gas that is released from the drums at ambient (mine) temperature and humidity in what is called a "relevant environment." However, unlike the configuration of entombment, the drums will not be surrounded by a backfill of crushed salt. Trenches will be used to draw brine-seepage away from the drums so that contact with corrosive brine is avoided to the extent possible. No drums will be crushed nor their contents exposed to brine. Under these conditions almost no gas will be derived from anaerobic decomposition of organic waste and the gas generated will be derived almost entirely from radiolysis of the waste. Gas will escape through vents in the drums and be circulated by fans. Radioactive particles are to remain in the drums behind filters placed in the vents.

CRITIQUE OF THE EXPERIMENT

Conducting an experiment with radioactive waste in an excavated mine presents difficulties. Fractures produced by mining and the creep of salt, for example, create special problems of sealing and gas exchange, as explored in the discussion below. Because of these special problems, and because of the expense, an overriding need must be demonstrated for data and results that cannot be obtained in any other way.

1. **Need for the Experiment:** The radiolysis-gas experiment described in the Panel One plan has, essentially, already been the subject of previous studies that have measured the evolution of gas from radiolysis of a range of waste types (see bibliography in DOE, 1988). Although these earlier experiments used a smaller total volume of waste, the results can be extrapolated to larger volumes. The justification given for repeating the experiment at WIPP is that a larger sample will provide more representative information. However, nearly equivalent information for use in model predictions can be obtained by applying the results from the previous studies to an accurate inventory of the waste.

2. **Accuracy of the Experiment:** The experiment described fails to discuss the problem of gas leakage in and out of sealed rooms. The description says that rooms will be sealed "to the maximum extent practical", acknowledging that the seal will not be tight. Bulkhead design apparently does not allow for significant shear loading between the bulkhead and the walls of the rooms and without such a design air and gas leakage can be expected. As a result, weekly changes in atmospheric pressure, which normally is in the range of 2 - 3%, can be expected to "push and pull" a significant volume of air past the bulkhead and dilute the gas with ordinary air.

A comparison can be drawn to the air in the tightly sealed funerary barks room (National Geographic, 1988). In that case the "sealed" air turned out to modern Cairo air. Without a complete seal, we estimate that only about 0.6% of the original air and gas in the neon "spike" that is used to measure dilution could remain in the room by the end of the experiment. The monitoring plan does not discuss a method for data reduction for this large volume of air exchange or what the effects will be on the accuracy and applicability of the results.

**The failure to achieve an effective seal, and the need for the use of a "spike" of tracer gas calls into question the validity of a large-scale underground gas experiment and calls for a detailed comparison with a similar experiment that would be carried out on the surface where more effective controls could simulate a range of conditions.** SRP does not recommend this type of experiment, however, because the information that is needed for modeling and prediction can be obtained from existing data and the expense of other than selected laboratory experiments cannot be justified.

2. **Relevant Environment:** The underground gas experiment, because the waste must be recoverable, will be carried out under conditions that do not simulate entombment. The drums will remain dry and uncrushed, with no contact of the organic or other contents with backfill or brine or the





aqueous environment that might be expected shortly after disposal. Hence, no information will be provided about the volume and rate of gas generation by aqueous bacterial decomposition or the effects of gas generation and brine on gas volume, waste element solubilities, and the source term for the repository.

Justification for the gas monitoring experiment itself is unfounded because of limitations that are apparently unforseen in the plan. The experiment is to give "information — on the gases that will initially be present —". **However, the moisture conditions and the reactions observed will not duplicate those that take place after disposal and the initial gases released will be unrepresentative of conditions after disposal.** Hydrogen-oxygen yields in a water-saturated system, for example, could be much greater.

The experiment is to give information on "Types of gases generated or consumed" and "rates of gas generation and consumption." **These data will be of little value because air exchange during atmospheric pressure cycles will prevent conditions from approaching those in a sealed repository.** The plan proposes that gas monitoring "-- will allow an assessment of any interaction of gases occurring between different waste forms due to venting of the individual containers (drums/boxes) in the rooms." **This objective cannot be realized because air exchange will produce gas concentrations far below those in a sealed repository.**

A key point is that information sought, that is not already available, can be obtained more effectively in the laboratory. For example, data on solubilities of various isotope mixtures exposed to a particular gas, or their mixtures, under a range of conditions, can be obtained much more quickly, cheaply, and accurately with laboratory experiments. Also, the interactions of barrel "head gases" from various drums and waste types are better studied in the laboratory where specific mixtures of gases can be measured and controlled. For the several reasons expressed above, the **prime justification for the experiment - that the experiment simulates a "relevant environment", is seriously flawed and unfounded.**

3. **Relevant Time-scale:** A limitation for any experiment with radioactive waste that is to be carried out in the mine, and one that cannot be avoided, is imposed by the time factor. Experimentation is limited to a few years time by the structural and economic constraints of room closure. The significant experiments that would put waste in an entombment configuration, and that could provide the in-situ data needed for modeling and prediction, would require years for relevant conditions and reactions to develop. Given the time-frame available before room closure, this type of experiment is impractical. Experimental data that could be used to improve predictions can be obtained, however, by accelerating the expected gas-brine-waste reactions under a range of controlled conditions in the laboratory.

In the final analysis, **the only realistic experiment available will be the disposal of the waste itself and it must be done correctly the first time.** The experimental plan, however, does not define the uncertainties or show why the experiments proposed will provide better data than alternate laboratory methods which offer better control over a range of conditions that more closely simulate the expected environment of disposal.

4. Cleanup: The Panel One plan does not describe the termination or clean-up of the proposed radioactive waste experiment. The configuration of the experiment avoids contact with backfill and brine and isolates the waste from the mine environment. However, if expected conditions differ, such as rapid closure of a room, spills, defective drums, ineffective filters in the vents, etc., the cleanup of waste that has been mixed with brine and penetrated into fractures could present unexpected hazards that would argue for leaving the drums in rooms without the protection of backfill, thereby reducing the ability of the facility to comply with EPA disposal standards.

## CONCLUSIONS

Defects in the Panel One Monitoring Plan, as outlined in the above analysis, support our earlier inference that a reluctance to release a description of the proposed experiment with radioactive waste was based upon a lack of scientific justification. Conditions in the mine, arising from an inability to effectively seal the rooms, as well as the need to protect the waste from environment of the mine, do not support the claim of a "relevant environment." Most likely, the data to be obtained will be of less value in modeling studies than data which is already available. The proposed experiment, if it were justified, could be done without the potential problems of clean-up in a sealed building above ground with simple thermostatic and humidity controls.

We strongly agree with the recommendation by Zen (1988) to other members of the NAS that a significant experiment should "duplicate as nearly as possible the actual conditions, including the use of backfill." This type of experiment, and the use of backfill, however, are prohibited by time constraints and cannot be done in the mine until the amount of brine seepage is known and compliance with EPA standards is confirmed. Therefore, the only practical means for obtaining the data needed for predictive models from radioactive waste is to simulate the range of environments expected in the sealed repository under conditions controlled in the laboratory.

**Brine seepage has introduced an important and inescapable unknown into the design for safe disposal at WIPP. Only after it is established that EPA standards can be met, will it be possible to conduct limited experiments with radioactive waste that refine and improve the safety margin.** It should be be recognized by DOE that the question of brine seepage must be resolved first; before any radioactive waste can be used in an experiment. The 4 rooms that are to be committed to an unjustified radiolysis-gas experiment should be part of a larger effort to determine permeability and brine inflow. No attempt is made here to evaluate the limited plan for monitoring brine-seepage. However, no part of the mine should be committed to another purpose until the question of brine seepage is resolved.

Pending legislation for land withdrawal enables DOE to put a significant volume of waste in the mine (~26,000 drums) for an unjustified experiment before the question of brine seepage is resolved and before conformance with EPA disposal standards is demonstrated. Because the unwarranted experiment is the sole basis for implementing land withdrawal at this time, we make the following recommendations:





1. A land withdrawal bill (e.g. H.R. 2504) should not be considered until it is demonstrated that the facility will comply with EPA standards for permanent disposal of TRU radioactive waste.

2. All underground rooms and facilities should be made available as needed to help resolve the question of brine seepage.

3. No experiments with drums of radioactive TRU waste sould be conducted in the mine until it is established that the facility will comply with EPA standards for permanent disposal. No experiments should be designed that do not accurately represent conditions to be expected after entombment, provide data useful for improving performance, and are accompanied by a detailed plan for recovery.

**Finally, we fear that the proposed plan to store radioactive waste underground is being dictated, not by a requirement for orderly and systematic research, but by timetables and priorities that lie outside of science. During the course of our reviews SRP has had difficulty in obtaining information about experiments with radioactive waste, found a reluctance to implement truly independent review of controversial problems, and encountered a haste to push forward, without public hearings or technical review, legislation that would waive well-conceived safety standards. These strategies may bring WIPP on line, on schedule, and under budget. However, they work against the interests of science, the long-term safety of future generations, and public confidence in government.**

## REFERENCES CITED

DOE, 1988, Panel One Monitoring Plan for the Waste Isolation Pilot Plant: WIPP 8408, U. S. Dept. of Energy, Carlsbad, NM.

National Geographic, 1988, Finding a Pharaoh's Funeral Bark, April, p. 513.

NAS, 1988, Report on Brine Accumulation in the WIPP Facility: 3 March, 7 p.

Zen, E-an, 1988, Letter to Board of Radioactive Waste Management, National Academy of Sciences, 15 March.

**Scientists Review Panel on WIPP**
c/o Reuben Hersh
Department of Mathematics and Statistics
University of New Mexico
Albuquerque, NM 87131
(505) 277-4903; 277-1639

Scientists Review Panel on WIPP

PRESSURIZED BRINE BENEATH THE WIPP FACILITY
AS A THREAT TO COMPLIANCE WITH EPA STANDARDS

June, 1988





PRESSURIZED BRINE BENEATH THE WIPP FACILITY
AS A THREAT TO COMPLIANCE WITH EPA STANDARDS

SUMMARY

**A recent study by a DOE contractor has revealed the presence of a reservoir of pressurized brine about 800 feet beneath the WIPP nuclear waste repository. The presence of a pressurized brine reservoir significantly increases the likelihood that WIPP, as designed, will not comply with EPA standards for nuclear waste disposal. It is recommended that authorization of WIPP, through legislation for land withdrawal (SB 1272), be deferred until analysis of available data demonstrates that the facility will comply with EPA standards.**

INTRODUCTION

Recently, exploration at WIPP (ETC, 1988) has revealed that a large pressurized brine reservoir lies beneath the WIPP repository. Earlier exploration for oil and gas in the vicinity of the WIPP site encountered several other large reservoirs of pressurized brine. These reservoirs contain millions of barrels of brine and all are under high pressure so that brine erupts and flows at the surface when the reservoir is penetrated by a borehole. Typically, several million gallons of brine flows to the surface before a reservoir is capped or depleted. The pressurized reservoir beneath WIPP is important because it provides a vehicle (brine) and a driving force (pressure) for carrying substantial quantities of radioactive waste to the surface (Fig. 1).

The EEG, the State Environmental Evaluation Group, estimates that 4.2 boreholes will penetrate WIPP in the control period of 10,000 years required by EPA. Hence, EPA standards require that WIPP be designed to assure minimal consequences from a human breach of the repository. The pressurized reservoir of brine beneath WIPP makes the consequences of a breach scenario more serious and this SRP report gives a brief account of the history of pressurized brine reservoirs, examines the brine reservoir beneath WIPP in terms of EPA compliance, and recommends a course of action that will assure long-term safety for the public.

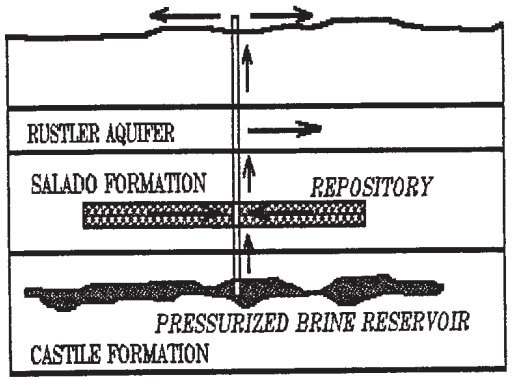



Fig. 1. Cross section of WIPP showing location of repository and pressurized brine reservoir in the underlying Castile Formation. Penetration of the repository and the brine reservoir by a borehole will carry radioactive waste to the surface or into the Rustler aquifer.





**HISTORY OF PRESSURIZED BRINE AT WIPP**

1. In 1975, the first site selected for the WIPP facility was abandoned when borehole ERDA #6 encountered pressurized brine and a nearly vertical geologic strata. Although the geologic structure was cited as the reason for abandoning the site, the pressurized brine was also a factor. Subsequently, 3 other sites within the Delaware Basin were quickly evaluated for a new location for WIPP. The Final Environmental Impact Statement (1980) notes that site #3 was eliminated because it was "near three deep holes...that...had brine flows...described as 'strong'" (20,000 to 35,000 barrels per day). Of the two remaining sites, the present site at Los Medanos (site #1) was selected and exploration began in 1975.

2. In 1981, seismic investigations revealed that site #1 was underlain by a geologic structure that probably contained a pressurized brine reservoir. DOE had no plans to test for pressurized brine and a group of independent geologists appealed to Governor King, the State Radioactive Task Force, and Attorney General Jeff Bingaman to press for further exploration of the suspected brine reservoir. The Attorney General filed a suit for the State and negotiated a stipulated agreement. Although the stipulated agreement required additional geologic exploration, it failed to specify testing for the brine reservoir beneath the site. DOE did agree to an "alternate task" of deepening a borehole one mile north of WIPP (WIPP-12) to the depth of the suspected brine reservoir. In late 1981, renewed drilling at WIPP-12 encountered the suspected reservoir and several million gallons of brine flowed from the well at the surface, until the well was capped several days later. The capacity of this reservoir was estimated to be 17,000,000 barrels of brine at a pressure of about 2000 psi.

3. In 1982, the Environmental Evaluation Group, concerned about the volume and extent of the WIPP-12 reservoir, calculated the consequences, in terms of radiation doses, of having such a reservoir beneath WIPP. The consequences were serious enough for EEG to request that the planned repository be moved farther from the brine reservoir at WIPP-12. Subsequently, and before excavation, the layout of the mine was rotated 180 degrees to the south of the main shaft and away from the WIPP-12 brine reservoir.

4. After 1982, improved geophysical methods provided a means for detecting the presence of brine in the subsurface without the use of a borehole and EEG asked DOE to conduct such a survey at the WIPP site. The report (ETC, 1988), completed in August, 1987, released in March, 1988, but not yet published, shows that the WIPP-12 brine reservoir extends beneath the waste disposal area of the WIPP site (Fig. 2).

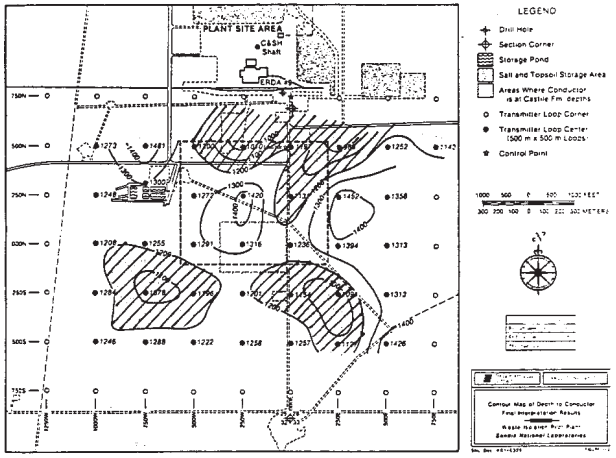



Fig. 2. Depth to the top of brine in the Castile Formation. Dotted line is the waste disposal area. Note that about 40% of the disposal area is underlain by indications of brine (striped area on map). It cannot be assumed that the striped area defines the fracture network or the limits of the brine reservoir and a borehole anywhere in the repository area might intersect the pressurized repository.





**CONSEQUENCES OF THE WIPP BRINE RESERVOIR**

Several of the boreholes that are expected to penetrate the WIPP repository within the 10,000-year control period will encounter the underlying reservoir. Brine under pressure will then be flushed through part of the repository, carrying radioactive waste to the surface (Fig. 1). The consequences of a breach may be increased significantly by the recently revealed brine seepage at WIPP (SRP, 1988a). The presence of brine will increase the leaching of radionuclides and provide a mobile form of waste that will be carried to the surface by brine from the pressurized reservoir (see account of brine seepage in Chaturvedi et al., 1988). In addition, information obtained since 1982 further increases estimated radiation doses expected from a breach. For example, the curie content of waste loadings is higher than earlier estimates. Also, travel time to the biosphere for radionuclides in the Rustler aquifer are significantly shorter and the absorption of radionuclides will be lower than originally assumed. The effect of these developments is to increase earlier estimates of radiation doses from a breach of the repository and the brine reservoir (Channel, 1982; Bard, 1982; Woolfolk, 1982).

Published studies have yet to determine if such a breach will release sufficient waste to exceed EPA standards. However, now that information is available about brine seepage and properties of the aquifer, it is possible to obtain realistic estimates of the likelihood of compliance under a range of conditions. Sandia Labs (D. R. Anderson, 1987), for example, assumed a degree of water saturation of the WIPP facility and calculated that movement to the surface of as little as 15m$^3$ of waste slurry is sufficient to exceed EPA standards. This small volume could be expected to be carried to the surface by ordinary drilling operations, with no connection to the underlying brine reservoir. With a connection to the pressurized brine reservoir, the radiation doses reaching the biosphere can be expected to several times greater.

It is prudent, at this juncture in the development of WIPP, to ask... what courses of action are open if the WIPP facility, owing to pressurized brine and brine seepage, fails to meet EPA standards? The options include (1) WIPP could be abandoned as a viable project, but at this late stage of development this option would encounter significant resistance. (2) An engineering "fix", such as the repackaging of waste to inhibit entrainment by pressurized brine, might be used to bring the facility within reach of standards, and (3) EPA standards could be waived or modified to put WIPP in compliance. These options raise an equally important question... how does the enabling legislation for WIPP (SB 1272) affect these options?

**RELATION OF THE PRESSURIZED BRINE RESERVOIR TO LAND WITHDRAWAL LEGISLATION**

Original WIPP legislation, drafted by the New Mexico congressional delegation, was prepared with little or no knowledge of the conditions of brine seepage or of a pressurized brine reservoir beneath the WIPP site. It was apparently assumed, on the basis of assurances by DOE, that WIPP would meet EPA standards and therefore the facility could be used to temporarily store a significant volume of transuranic (TRU) waste (120,000 drums) before compliance was demonstrated. Disclosure of the brine seepage problem, and, more recently, the pressurized brine reservoir, make compliance with EPA standards far less certain and removes justification for the temporary storage of waste. A waiver of EPA disposal standards, for purposes of temporary storage and experimentation, cannot be scientifically justified (see SRP, 1988b and confirmation by Chaturvedi and Neill, 1988).

Sufficient information is now available to perform preliminary calculations to determine the extent of engineering changes that might be required for EPA compliance (Chaturvedi, see Chaturvedi and Neill, 1988). If given top priority, preliminary estimates of compliance could be available in less than a year. Failure to publish credible and reviewable assurances of EPA compliance, now that sufficient data are available, will raise questions about the reason for the delay and will lead to the presumption that compliance is not possible.

Given uncertainties about the safety of WIPP and its ability to comply with EPA standards, legislation that would turn the WIPP project over to DOE is premature. Enactment of the revised land-withdrawal legislation[1], without assurance of compliance with EPA standards, will remove a strong incentive for DOE to devise engineering alternatives that could bring the facility into compliance and assure a safe repository. Furthermore, the proposed legislation cannot be scientifically justified on the basis of published information. DOE should be required to present its analysis of complaince to the EEG and the scientific community before it is given authority over WIPP as stated in the following recommendation.

**RECOMMENDATION**

**The enactment of legislation for land withdrawal (SB 1272) should be deferred until it is reasonably certain that the WIPP project can be brought into compliance with EPA standards for the permanent disposal of TRU waste.**





[1] The original version of SB 1272 has been revised by Domenici and Bingaman and contains the following provisions which weaken effective compliance with EPA standards:

1. WIPP land is permanently withdrawn and placed under DOE jurisdiction before compliance with EPA standards for waste disposal (EPA 40 C.F.R. 191, Part B) [see note below].

2. The revised version of the legislation has yet to designate a final authority for determining compliance with EPA standards. According to DOE policy (DOE. 1988) "The DOE Headquarters will determine whether or not WIPP complies with the standard." Prudent policy dictates that this judgement should be made by a separate and independent agency.

3. DOE, after consultation with and approval by EEG, can place high-level waste (HLW) and transuranic (TRU) waste in the WIPP repository without meeting standards for permanent disposal.

[Note: Scientists Review Panel submitted previous reports on brine seepage and radioactive waste experiments to senators Domenici and Bingaman. These reports presented scientific reasons to support strong recommendations that compliance with EPA standards be demonstrated before enactment of enabling legislation. Neither senator has responded to SRP's specific recommendation and at this time both appear to be committed to commissioning WIPP without EPA compliance in place].

**SCIENTISTS REVIEW PANEL ON WIPP**
**c/o Reuben Hersh**
**Dept. of Mathematics and Statistics**
**University of New Mexico**
**Albuquerque, NM 87131**
**(505) 277-4903; 277-1639**

REFERENCES CITED

Anderson, D. R., 1988, Preliminary performance assessment calculations of releases resulting from selected drilling scenarios: Presentation to National Academy of Sciences WIPP Panel, Sept. 22, 1987.

Bard, S. T., 1982, Estimated radiation doses resulting if an exploratory borehole penetrates a pressurized brine reservoir assumed to exist below the WIPP repository horizon: New Mexico EEG, EEG-15, 21 p.

Channell, J. K., 1982, Calculated radiation doses from radionuclides brought to the surface if future drilling intercepts the WIPP repository and pressurized brine: New Mexico EEG, EEG-11, 41 p.

Chaturvedi, L., Channell, J. K., and Chapman, J. B., 1988, Potential problems resulting from the plans for the first five years of the WIPP project: Proceedings, Waste Management '88 Symposium, Tucson, AZ, 12 p. + figs.

Chaturvedi, L. and Neill, R, 1988, comments quoted in Albuquerque Tribune, 25 May, 1988.

DOE, 1988, Waste Isolation Pilot Plant compliance strategy for 40 CFR Part 191: DOE-WIPP 86-013, 52 p.

ETC, 1988, Final report for the time domain electromagnetic (TDEM) surveys at the WIPP site: Golden, Co., Earth Technology Corporation; SAND87-7144, 29 p.

FEIS, 1980, Final environmental impact statement, Waste Isolation Pilot Plant, v. 1, p. 2-12.

SRP, 1988a, Evaluation of the Waste Isolation Pilot Plant (WIPP) as a water-saturated nuclear waste repository: Albuq., NM., Scientists Review Panel on WIPP, 29 p.

SRP, 1988b, Evaluation of preliminary draft of the radioactive waste experiment (Panel One Monitoring Plan), Waste Isolation Pilot Plant: Albuq., NM., Scientists Review Panel on WIPP, 6 p.

Woolfolk, S. W., 1982, Radiological consequences of brine release by human intrusion into WIPP: TME-3151, July, 1982.



SCIENTISTS REVIEW PANEL
c/o Reuben Hersh
Department of Mathematics and Statistics
University of New Mexico
Albuquerque, NM 87131
(505) 277-4903; 277-1639

16 May, 1989

To: Jack B. Tillman, Project Manager
Waste Isolation Pilot Plant Project Office
P. O. Box 3090
Carlsbad, NM 88221

and to: Colleagues and Observers of WIPP

Re: Review of U. S. Department of Energy's "Draft Plan for the Waste Isolation Pilot Plant Test Phase: Performance Assessment and Operations Demonstration."

In response to concerns raised by the Scientists Review Panel (SRP) and others regarding the safety of the WIPP repository, your office agreed to prepare an experimental plan for addressing WIPP safety-related issues. The plan was to contain detailed descriptions of scientific and technical data necessary to determine whether to proceed with the disposal of radioactive waste at WIPP and means for obtaining such data. In addition, the plan would specify the amount of waste, if any, necessary for underground experiments. The first draft of such a plan appeared in March, 1988 and after reviewing the plan SRP concluded that DOE had failed to justify its planned underground experiments and that more meaningful data could be obtained in an above-ground laboratory setting. The State Environmental Evaluation Group (EEG) and the National Academy of Sciences (NAS) also considered the plan inadequate.

In April, 1989, DOE released a revised version of the plan under the title "Draft Plan for the Waste Isolation Pilot Plant Test Phase: Performance Assessment and Operations Demonstration." This plan adds a number of litre-scale experiments with radioactive waste that are to be conducted in a laboratory, as well as experiments in "bins" or boxes that are to be sealed and stored underground. In addition the plan will proceed with room-scale tests to measure the generation of gas from radioactive waste. The total amount of radioactive waste to be used for bin-scale and room-scale experiments is about 7,100 drums, or about 0.8% of repository capacity. The plan also proposes to use 60,500 drums of CH-TRU and 50 canisters of RH-TRU radioactive waste in operations to gain experience in moving and storing the drums.

The revised plan states that the purpose of the test phase is to "demonstrate the safe disposal of defense wastes.." and that the revised plan is to "guide the completion [of programs] in the test phase". The plan also states:

"Specific project documents have been, *or will be* [italics added] developed to provide the details necessary to implement this phase."

Details that are most critical to DOE's case for the use of radioactive waste in room-scale experiments underground are not presented in the revised plan, are not currently available, and are promised in a forthcoming draft of a "Test Plan for WIPP Room-scale CH-TRU Tests." SRP has examined the incomplete plan and finds no significant change from the first plan with respect to room-scale experiments and, therefore, still finds no scientific or technical justification for the underground use of radioactive materials.

The revised experimental plan gives two reasons why radioactive materials are needed for underground room-scale experiments: 1) Gas generated by TRU waste must be measured in a realistic, post-operational environment, and 2) no credible alternative exists for the use of radioactive materials. In our previous review of room-scale experiments, SRP identified a condition whereby the creep of salt prevents effective sealing of the bulkheads in experimental rooms. Without an effective seal, waste gases would exchange with the atmosphere and, hence, would alter reactions and be impossible to measure accurately. The revised DOE plan acknowledges the serious nature of this problem and states that "alternate sealing plugs and concepts are under consideration" and proposes to overcome the problem by sealing the rooms with an "inflatable plug". SRP notes that there is no description of the technology to be used and no documentation in the plan to indicate that an inflatable plug will prevent gas exchange through fractures in the floor, roof, or walls. Inability to effectively seal the experimental rooms is only one of several reasons why the described experiments may be flawed and are unlikely to represent true conditions of disposal and yield accurate data.

The rate of gas generation is significantly greater than previously estimated and will have a large effect on WIPP repository performance (EPA compliance). As stated in the plan, "At present, the limited data and combined uncertainties in net gas behavior result in broad uncertainty in the expected gas pressure history of the repository" (p. 2-14; 2.3.3). Substantial uncertainty arises in the complex and unpredictable nature of microbial reactions which can be successional and may take years to develop. Yet, nowhere does the experimental plan consider or even mention expected rates of microbial reactions in room-scale experiments, and we are skeptical of the brief (less than 5-years) duration of the proposed experiments.

Continued scrutiny of DOE's experimental plans by SRP and other review groups has reduced the volume of waste proposed by DOE from 15% to 8% to 4.4%, and finally, to 3%. A new figure of 0.8% is now suggested as acceptable to DOE. We cannot accept unscientific reasoning that says that poorly designed experiments that use only a small amount of waste might be of some value and "can do no harm."

SRP is extremely concerned that the proposed experiments will yield invalid and unverifiable data. We believe that unverified data, because they are specific to the site, are likely to be substituted for more generalized but proven data that can be used within a framework of conservative assumptions. SRP also believes that data obtained from such non-repeatable experiments will be accepted by DOE if they appear to support the WIPP mission. The dangers in poorly conceived, one-time experiments are potentially great and, no matter what the scale, it is vital that no experiments be performed that are not critically reviewed and fully justified scientifically.





With regard to the plan's assertion that there are no alternatives to using radioactive waste underground, SRP continues to believe that only experiments conducted in a rigidly controlled laboratory setting can yield valid data. Furthermore, the boxes used in the proposed bin-scale experiments are to be isolated and tightly sealed and are non-reactive with the mine environment. Therefore, there is clearly no need for these experiments to be conducted in anything other than a laboratory. We also believe that such tests should have been initiated in 1984 after initial excavation revealed brine seepage and the serious nature of problems related to gas generation. Failure to conduct such tests in a timely manner does not support the claim (p.2-110; S.1.3.3-1) that bin-scale tests are now needed underground for the evaluation of the effect of gases on release scenarios. Because bin-scale experiments are to be set up in laboratories at the source of the waste, there is no reason to increase the potential for exposure by transporting the bins to WIPP for observation.

As regards the proposed "operational" tests with CH- and RH-TRU wastes, SRP can find no scientific justification for the use of radioactive materials. Tests and training for waste-handling operations need not create a potential for unnecessary exposure to hazardous materials and therefore this part of the program can and should be performed with drums using simulated waste.

SRP's purpose in reviewing DOE's experimental plan is to affirm that a proper analysis of relevant WIPP safety issues will be performed and that any planned underground tests with actual radioactive waste are scientifically justified. As stated above, we find that the revised experimental plan presents no new information bearing upon this issue and that for both operational and experimental purposes DOE has still failed to produce credible reasons for using radioactive waste. Equally important, technical information needed to resolve the most important questions related to EPA compliance and WIPP safety is either less detailed than in the original draft or is missing in the revised plan. Without these details, a critical review and approval or disapproval of the plan, by SRP or by any other review group, is not possible.

Release of this impressive-looking, 300-page document was accompanied by statements to the press to the effect that emplacement of radioactive waste at WIPP was necessary to assure a scientifically safe WIPP project. The experimental plan does not support this assertion. Because premature and unreviewed claims can undermine the credibility of science, in general, and the WIPP project in particular, we trust that release of the final experimental plans will be accompanied by public statements that are fully supported in the documents.

Sincerely,

Reuben Hersh

Reuben Hersh, for
SCIENTISTS REVIEW PANEL

· University of New Mexico

ıment of Economics
Roma NE/Economics Bldg.
uerque, NM 87131
one 505: 277-5304

June 4, 1989

Mr. Don Hancock
Southwest Research and Information Center
P.O. Box 4524
Albuquerque, NM 87106

Dear Don:

Thank you for your letter of June 2, 1989, and for the copies of the Draft Supplement EIS for the WIPP. In what follows, I respond to your request for comments regarding the Supplement as well as to the specific questions set out in your letter. As an aside, this letter is printed on University stationary. I feel that requests by New Mexico citizens for opinions of faculty on public documents is a legitimate function for university professors; particularly in this case where this department conducted a state-sponsored research project dealing with a socioeconomic assessment of the WIPP. In any case, I should make explicit the caveat that the following comments reflect my personal assessments, and do not necessarily reflect the opinions of others at the university.

1. As you point out, there is little in the Supplement which addresses, in any depth, the socioeconomic aspects of the WIPP. The description of impacts given on pp. 5.3-5.6 are standard estimates for "multiplier" effects which might be associated with the direct expenditures by the DOE at the WIPP site. The estimated total effects of $160.5 million per year, along with 1,610 jobs per year are surely high for the following reasons.

a. the I/O models on which the estimates are based overestimates impacts for a region like the Eddy-Lea County area because: it does not (and cannot, without substantial costs) take into consideration the large amounts of excess capacity extant in the depressed two-county area; secondly, but related to the preceding remark, the fix-coefficient I/O model contains the counterfactual assumption that new investments and employment patterns will trace those of the economy at the time that the coefficients were estimated; and finally, the I/O model which they use assumes an interindustrial structure which does not exist in this two-county area.





The University of New Mexico

Department of Economics
1915 Roma NE/Economics Bldg.
Albuquerque, NM 87131
Telephone 505: 277-5304

2. I see little to be gained from arguing over the employment/income effects of the WIPP considered in the Supplement. They are high, without question, but we could argue about any estimate concerning future effects. A great deal more needs to be done in the area of post-project validations of pre-project estimates before meaningful debate on this issue can be possible.

The real issues for assessments of the WIPP are those implied by your three questions. In these regards, one must be disappointed with the extraordinarily narrow focus of the Supplement (as in the earlier FEIS). In what follows, I sketch but a few of these.

3. Estimates for risk (summarized on Table S-1) are based on the assumption that "best available technology" is available and is used in the transportation and operations phases of the project. It is likely, arguably, that such might be the case at the WIPP site. But in the transportation of the wastes to the site? For this to be the case, the following conditions would be required--conditions which would require the expenditure of large sums of monies which the federal government seems less than anxious to provide.

a. a compelling case would have to be made that the selection of transport modes and routes is risk minimizing, and that, where appropriate, bypasses of major traffic areas are in fact in place. Given the existing technology for assessing route selection (geo-coded models, for example, which have been developed by transportation engineers), a great deal could be done by the DOE in these regards. Of course, a good part of analyses such as these involves the identification of investment expenditures required in order to upgrade routes to levels which minimize risks.

Analyses concerning route selection must go well beyond accident rates--qualitative aspects of route segments may be much more important. In this regard, proximity of candidate routes to vulnerable (particularly, in terms of rapid evacuation) populations may be critical: schools, hospitals, retirement homes, etc.. Timing of deliveries is also relevant: e.g., will entry of waste-carrying vehicles to an urban area coincide with traffic of children going to (coming from) schools?

b. most troublesome, perhaps, is the lack of focus on risk management. As pointed out in our 1981 study, substantial

: University of New Mexico

tment of Economics
Roma NE/Economics Bldg.
uerque, NM 87131
hone 505: 277-5304

expenditures are required for training and equipment if all parties to accident response--firemen, policemen (state and local), hospitals, and hospital staff, ambulance personnel, morgue facilities and personnel--are to be trained and equipped at levels consistent with the "best available technology" level upon which the Supplement's risk estimates are based.

c. we are told that radiation releases from transportation are minimal, and that the resulting threat to health and safety are minimal. Monitoring of radiation levels at the site is a standard procedure. At relatively small cost urban populations along transport routes could be afforded the same consideration: monitoring of radiation levels in efforts to assure affected populations that all is well.

d. finally, I agree that a comprehensive study should at least address the issues of compensation to injured individuals, as well as the issue of cleanup and cleanup costs.

4. Intuitively, one would surely think that an accident--particularly a well publicized one--close to any of the state's major tourist sites (and particularly, around Santa Fe) would deal the state's tourism industry a major blow. Unfortunately, we do not have the data which would allow for the quantitative estimation of such effects under alternative accident scenarios. Studies of the effects on tourism of, e.g., the Three Mile Island accident yielded confused results--some of which suggested that the accident improved(!) tourism. At this point in time, such considerations have to be taken into account in route selection studies--one simply puts large costs on routes which involve the transportation of wastes near major tourist areas (much like one handles proximity to vulnerable populations). This is clearly inadequate, but the best that one can do given the current state of the art.

5. One major issue remains: what are the non-market costs on New Mexico residents which are associated with "perceived" risks associated with the WIPP? One cannot say--indeed, the DOE does not say--that there are no risks associated with the operation and, particularly, the transportation aspects of the WIPP. The "risk environment" in the State of New Mexico is unquestionably increased. What of the costs of this change in the State's risk environment?





*The University of New Mexico*

Department of Economics
1915 Roma NE/Economics Bldg.
Albuquerque, NM 87131
Telephone 505: 277-5304

Considerable progress has been made since the early 1980's in this area of quantifying costs/benefits associated with commodities (things) which do not have obvious, market prices: the value of clean air, clean water, more/better national parks, improved safety, the value of life, etc.. One method, the "Contingent Valuation Method", is being used extensively by federal agencies such as the EPA for evaluating benefits and costs associated with regulations and policies which have the effect of changing risks to public health and safety; in this regard, see the recently published book Cummings, Ronald G., David S. Brookshire and William D. Schulze, Valuing Environmental Goods: An Assessment of the Contingent Valuation Method, Roman and Allenheld, Totowa, N.J., 1986. Thus, methods exist which allow for the derivation of estimates for the monetary costs of changes in the risk environment which attend projects like the WIPP--Santa Fe's concerns mentioned in your letter is particularly relevant in this regard. By Executive Order 12229, federal agencies, in considerations of regulations or other actions, are required to compare benefits and costs of such regulations/action on effected populations. The EPA, the Department of the Interior (see Principles and Guidelines for land and Water Projects), as well as other federal agencies use methods like the Contingent Valuation Method for assessing non-market impacts (costs and/or benefits) associated with their activities. One must surely wonder why the Supplement ignores these aspects which are of some moment to New Mexicans, particularly those outside of the Eddy-Lea county area.

That's about it for my first pass at the Supplement. If further information would be useful to you, give me a call.

Best personal regards,

Ronald G. Cummings,
Chairman

RGC:dp

LLER
overnor

STATE OF NEVADA

ROBERT R. LOUX
Executive Director

AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE
Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

May 8, 1989

DOCUMENTS PUBLISHED BY
NEVADA AGENCY FOR NUCLEAR PROJECTS/
NUCLEAR WASTE PROJECT OFFICE

SOCIOECONOMIC REPORTS

-- NWPO-SE-001-88. Retirement Migration and Military Retirement. By Planning Information Corporation (June 1988).





-- NWPO-SE-002-88. Characteristics of the Las Vegas/Clark County Visitor Economy. By Planning Information Corporation (June 1988).

-- NWPO-SE-003-88. Current Target Industry Analysis: Las Vegas Metropolitan Area. By M. Ross Boyle, Growth Strategies Organization (June 1988).

-- NWPO-SE-004-88. Business Profile of Metropolitan Las Vegas. By M. Ross Boyle, Growth Strategies Organization (June 1988).

-- NWPO-SE-005-88. Nevada State Revenues Analysis. By Planning Information Corporation (June 1988).

-- NWPO-SE-006-88. Nevada Local Government Revenues Analysis. By Planning Information Corporation (June 1988).

-- NWPO-SE-007-88. The Effects of Human Reliability in the Transportation of Spent Nuclear Fuel. By Seth Tuller, Roger E. Kasperson and Samuel Ratick, Center for Technology, Environment and Development, Clark University (June 1988).

-- NWPO-SE-008-88. Risk Management and Organizational Systems for High-Level Radioactive Waste Disposal: Issues and Priorities. By Jacque Emel, Brian Cook and Roger Kasperson with Halina Brown, Robert Goble, Jeff Himmelberger and Seth Tuller, Center for Technology, Environment and Development, Clark University (September 1988).

-- NWPO-SE-009-88. Distributional Equity Problems at the Proposed Yucca Mountain Repository. By Roger E. Kasperson and Sassan Abdollahzadeh, Center for Technology, Environment and Development, Clark University (July 1988).

-- NWPO-SE-010-88. Potential Retrieval of Radioactive Wastes at the Proposed Yucca Mountain Repository: A Preliminary Review of Risk Issues. By Robert Goble, Dominic Golding and Roger E. Kasperson, Clark University (June 1988).

-- NWPO-SE-011-88. Postclosure Risks at the Proposed Yucca Mountain Repository: A Review of Methodological and Technical Issues. By Jacque Emel, Roger E. Kasperson, Robert Goble and Ortwin Renn, Center for Technology, Environment and Development, Clark University (June 1988).

-- NWPO-SE-012-88. The Accident at Gorleben: A Case Study of Risk Communication and Risk Amplification in the Federal Republic of Germany. By Hans Peter Peters and Leo Hennen, Center for Technology, Environment and Development, Clark University (June 1988).

-- NWPO-SE-013-88. New Mexico's Waste Isolation Pilot Plant (WIPP): An Historical Overview. By Ronald G. Cummings, University of New Mexico (June 1988).

-- NWPO-SE-014-88. The U.S. Department of Energy's Attempt to Site the Monitored Retrievable Storage Facility (MRS) in Tennessee, 1985 - 1987. By Michael R. Fitzgerald and Amy Snyder McCabe, Energy, Environment and Resources Center, University of Tennessee (May 1988).

-- NWPO-SE-015-88. Goiania Incident Case Study. By John S. Petterson, Impact Assessment Incorporated (June 1988).

-- NWPO-SE-016-89. Assessment of the Impact of a Nuclear Waste Repository at Yucca Mountain on the Economic Development Potential of Las Vegas, Clark County, and the Surrounding Area. By M. Ross Boyle, Growth Strategies Organization (January 1989).

-- NWPO-SE-017-89. Summary of Background Fiscal Data and Analysis for the Nevada Socioeconomic Study to Date. By Planning Information Corporation (January 1989).

-- NWPO-SE-018-89. Assessing the State/Nation Distributional Equity Issues Associated with the Proposed Yucca Mountain Repository: A Conceptual Approach. By Roger E. Kasperson and Samuel Ratick, Center for Technology, Environment and Development, Clark University (June 1988).





-- NWPO-SE-019-89. A Framework for Analyzing and Responding to the Equity Problems Involved in High-Level Radioactive Waste Disposal. By Roger E. Kasperson, Sam Ratick and Ortwin Renn, Center for Technology, Environment and Development, Clark University (June 1988).

-- NWPO-SE-020-89. Nevada State and Local Government Comments on the U.S. Department of Energy's Report to Congress Pursuant to Section 175 of the Nuclear Waste Policy Act, as Amended. Prepared by the Nevada Agency for Nuclear Projects and Affected Local Government (March 1989).

-- Yucca Mountain Socioeconomic Project Interim Report (scheduled for release in May 1989).

'HWEST RESEARCH AND INFORMATION CENTER

TESTIMONY ON

DOE's SUMMARY OF THE RESULTS OF THE EVALUATION OF THE WIPP SITE

AND PRELIMINARY DESIGN VALIDATION PROGRAM

BEFORE THE

LEGISLATIVE RADIOACTIVE MATERIALS COMMITTEE

In Santa Fe, New Mexico

April 19, 1983

By Don Hancock

BOX 4524 ALBUQUERQUE NEW MEXICO 87106 505 - 262-1862

UTHWEST RESEARCH AND INFORMATION CENTER

Good morning, Mr. Chairman and members of the Committee. I am Don Hancock, Information Coordinator at Southwest Research and Information Center in Albuquerque. As you are aware, the Center has been involved in issues related to nuclear waste management and WIPP for the past eight years. I appreciate this opportunity to give you a preliminary discussion of my views on the Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program (WIPP-DOE-161).

SUMMARY

This Summary Report was prepared by DOE as a requirement of the July 1, 1981 Court Stipulation between the State of New Mexico and DOE. Paragraph 2 of that Stipulation requires that DOE

> "shall prepare and provide to the State of New Mexico and the public a formal, public document containing a summation of the results of all experiments and studies conducted during the SPDV phase and site validation phase of the WIPP project at least sixty (60) days prior to any decision as to whether the information obtained from the SPDV program and site and design validation tests warrants the commencement of construction of the permanent facility for the full WIPP repository which decision is now estimated to be no earlier than September of 1983."

It is important to note that while DOE's timeframe for this report was accelerated by at least five months, most of the technical reports to support the Summary Report have lagged several months behind schedule. If the original schedule had been adhered to, more technical information would be available and more time would be available for the State and the public to review the technical information contained in the reports required by Appendix B and C of the Stipulation. This apparent rush to make the decision to

O. BOX 4524 ALBUQUERQUE NEW MEXICO 87106 505 - 262-1862

construct WIPP is shown in the Summary Report where various unresolved geotechnical issues, especially related to deep dissolution, brine reservoirs and natural resources, are said to be resolved but without adequate technical information to support such determinations.

My conclusions are the following:

1) The WIPP site has not been evaluated against reasonable technical criteria that any other repository will be legally required to meet.

2) The WIPP site does not meet reasonable technical criteria and the safety of the site has not been demonstrated.

3) Any decision to construct WIPP is at best premature because the fundamental decision about the mission of WIPP has not been decided.

4) The DOE Summary Report does not adequately comply with the requirements of the Stipulation regarding analysis of the unresolved geotechnical issues that were the focus of the Appendix B and C reports.

My recommendations to DOE are that it stop the WIPP Project because the site does not meet adequate technical criteria or to hold the site (as can be done until 1990 under the existing land withdrawal) and postpone a decision to proceed with construction until the mission of WIPP is clear. Such a determination of WIPP's mission cannot occur until a decision is made as to what repository will be used for defense high-level waste disposal.

Before proceeding with WIPP construction, DOE must first issue for public and state comment a supplement the WIPP Final Environmental Impact Statement (FEIS) which includes results of the SPDV program that DOE says "has added greatly to our knowledge of the site"[1], provides new consequence analysis evaluating the impact of brine-driven releases from all potential wastes, including high-level, and provides adequate discussions of deep dissolution, alternatives and transportation.





INTRODUCTION

My comments on the Summary Report will be limited to the section on Site Suitability because geotechnical issues are fundamental to the safety of any repository site. This is not to say that the cursory treatment given in the Summary Report to transportation and other issues has satisfactorily addressed these concerns. Rather it is to again emphasize that such issues should be addressed in a supplement to the WIPP FEIS.

My detailed testimony today is in three parts. First, I will discuss the inadequacies of the technical criteria being used for WIPP. Second, I will discuss specific inadequacies of the DOE summary report. Third, I will discuss additional information that is needed about WIPP's mission before any reasonable decision to construct WIPP can be made.

I. The inadequacies of technical criteria used for WIPP

The first fact about scientific criteria is that WIPP is not required to meet any criteria that are independently established and evaluated. WIPP would be the only repository constructed in the U.S. not required to meet the licensing requirements of the Nuclear Regulatory Commission (NRC). The 21 "site qualification" criteria used in the Summary Report are DOE's alone, not those being established by the Environmental Protection Agency (EPA) or the NRC or the DOE that all other geologic repositories are legally required to meet. This lack of criteria to protect public health and safety that are independently arrived at, independently evaluated, and legally enforceable is sufficient reason for the State of New Mexico to reject WIPP.

This concern about technical criteria is not just of academic interest but is important because WIPP does not meet several of the technical criteria for all other repositories. While the EPA[2], NRC[3] and DOE[4] criteria which any

repository must meet have been issued only in draft form and are not yet finalized, WIPP clearly does not meet these essential minimum criteria already proposed. I would also note that these draft criteria themselves are too weak in some respects and should be strengthened before being applied to any repository.

EPA's criteria are found in Title 40, Subchapter F, Part 191, Subparts A & B. Section 191.01 states that these standards apply "to radiation doses received by members of the public as a result of the management (except for transportation) and storage of spent nuclear fuel, high-level, or transuranic radioactive wastes...." Section 191.02 (c) defines transuranic wastes as "containing more than 100 nanocuries of alpha emitting transuranic isotopes, with half-lives greater than one year, per gram of waste." Since the much of the waste to be emplaced at the WIPP site falls within the EPA definition, the site should be required to meet the final EPA requirements.

EPA standards include containment requirements (Section 191.13) which the WIPP site has not been proven to meet since DOE has yet to do an adequate worst case analysis of potential releases from WIPP during the operations phase or from brine reservoirs bringing wastes to the surface or into the Rustler aquifer. Moreover, to meet the containment requirements a site must also meet seven assurance requirements (Section 191.14). One of these requirements is:

> "(f) Disposal systems shall not be located where there has been mining for resources or where there is a reasonable expectation of exploration for scarce or easily accessible resources in the future. Furthermore, disposal systems shall not be located where there is a significant concentration of any material which is not widely available from other sources."





This EPA criteria reflects a long-standing scientific concern that mineral resources would jeopardize the integrity of any repository because such reserves would encourage exploration activities at the site. The substantial and proven langbeinite ore and natural gas reserves within the bounds of the WIPP site clearly disqualify the location under this EPA assurance requirement. This is especially true of the langbeinite reserves which are not widely available elsewhere.[5]

While Public Law 96-164 established WIPP as a project exempt from Nuclear Regulatory Commission (NRC) regulation, NRC's technical criteria are designed to protect public health and safety and should therefore be applied to WIPP. These repository criteria are found in 10 CFR Part 60, Subpart E and are related to both high-level and transuranic waste.

NRC's criteria include performance objectives (Section 60.111), siting requirements (Section 60.122) and design requirements (Section 60.130-137). Regarding the performance requirements, the criteria require reasonable assurance that radiation exposures and releases are within limits set under Part 20, and that EPA environmental standards are met. DOE cannot demonstrate either of these assurances since, as already noted, it has yet to do an adequate worst case analysis.

Further, DOE plans for only a 5-year retrievability period for TRU wastes, so DOE cannot meet the criteria that requires that wastes "could be retrieved on a reasonable schedule starting at any time up to 50 years after waste emplacement operations are initiated." (Section 60.111(b)(1)). Retrievability of wastes at WIPP will be limited by the facts that the containers are not designed to last for such long timeframes and the salt creep which will gradually close up the repository would make retrievability expensive and difficult, if not impossible.

"Potentially adverse conditions" included in NRC's siting requirements include human activities and natural conditions. One of the potentially adverse human activities is that:

> "(18) Potential resources within the site that have greater gross value, net value, or commercial potential than the average for other areas of similar size that are representative of and located in the geologic setting."

The WIPP site has this adverse condition because of the langbeinite and natural gas reserves at the site.

Among the "potentially adverse natural conditions" are:

> "Evidence of dissolutioning, such as breccia pipes, dissolution cavities, or brine pockets." (Sec. 60.122(c)(12)

This condition also exists at the WIPP site.

Public Law 97-425, the Nuclear Waste Policy Act of 1982, requires in addition to the EPA and NRC standards that DOE develop general guidelines that

> "shall specify detailed geologic considerations that shall be primary criteria for the selection of sites in various geologic media. Such guidelines shall specify factors that qualify or disqualify any site from development as a repository...." (Section 112(a))

The congressional intent is clearly that repository criteria include factors that qualify or disqualify a site. Therefore, criteria applied to WIPP should also include qualifying and disqualifying factors. Yet, the "site qualification" criteria used in the Summary Report do not generally include such disqualifying factors.

I will not discuss DOE's specific proposed guidelines here because they have been subjected to much criticism by SRIC,[6] various state governments and other organizations, and they must be substantially changed before they are finalized.





II. Specific technical inadequacies of the WIPP site

A. Mineral resource conflict

The existence of important mineral resources at the WIPP site has been of concern to Sandia for many years, as acknowledged in the Summary Report. (p. 7). In the Report, however, various intellectual contortions are used to try to avoid disqualifying the WIPP site because of this conflict.

First, the report states that since DOE will allow mining in Zone IV and also allow exploration for hydrocarbons beneath Zones I, II and III below 6,000 feet, that "only resources within Zones I, II, and III and at depths less than 6000 feet need be considered with respect to resource values in conflict with the WIPP." (p. 24) Such an attitude flies in the face of criteria of the EPA, NRC and National Academy of Sciences,[7] which seek to avoid significant natural resources for a very fundamental, important reason--mineral resources will likely attract future generations to drill and mine in the area.

DOE apparently believes that if these resources can be developed other than by drilling straight through the repository, it will be done. However, there is certainly no guarantee that future generations will use deviated drilling from outside Zone III. Even if these resources are developed soon through such drilling techniques, as resources become more scarce it is quite possible that future generations will return to areas of previous development, whether or not hydrocarbons actually remain at such locations.

Second, the potash resources within Zones I, II and III are admittedly "not insignificant," (p. 24) but elsewhere the Report says that "possible future potash extraction or exploration would not adversely affect the WIPP

site integrity since it would take place about 400 feet above the facility level." (p. 13) Such argument again begs the issue of the irreconcilable conflict with mineral resources, and the argument that 400 feet is sufficient buffering is also not supported by EPA or NRC technical criteria.

Third, the final argument is that "[i]t is therefore concluded that the site should not be ruled unacceptable because of potential resource conflicts; this potential is outweighed by the very favorable hydrologic regime at WIPP." (p. 25) This is absurd on its face, since the hydrologic regime would not prevent radionuclides from rising to the surface through the drillhole(s) from exploration, especially considering the known presence of at least one pressurized brine pocket at the WIPP site.

The argument, therefore, is really that if the site doesn't meet criteria, such criteria can be offset (avoided) by other supposed favorable characteristics. In my view this is another example of how DOE sets its own rules, but still changes them at any time circumstances dictate. Such changes have previously occurred related to the distance of a site from boreholes. However, such changing of criteria when a site doesn't meet those standards certainly cannot be called a scientific approach.

In summary, WIPP does not meet the reasonable technical criteria of avoiding mineral resources, so the presence of these natural resources should disqualify the site because site integrity to prevent potential dangerous releases of radioactivity cannot be demonstrated.

B. Deep Dissolution

As was noted above, evidence of dissolution is a potentially adverse condition under NRC's draft technical criteria. Dissolutioning is of concern





for several reasons. Most important, such dissolution, and especially any that is not well understood, makes impossible any reasonable consequence analysis to determine impacts of potential releases from the repository.

Neither DOE nor Dr. Weart have advanced an acceptable explanation of deep dissolution and the related problem of brine. DOE's Final Environmental Impact Statement (FEIS) on WIPP did not complete a consequence analysis of a brine pocket connecting the repository and the Rustler aquifer because "brine pockets of the size assumed in this example [49,000 barrels] are extremely unlikely near the repository."[8] Testifying under oath at the preliminary injunction hearing on October 7, 1981 in the lawsuit brought by Southwest Research & Information Center and four individuals, Dr. Weart supported the FEIS tried to counter testimony of Dr. Roger Anderson and Dr. George Griswold that deep dissolution and brine were related and that these factors constituted a significant potential threat to the integrity of the site.[9] Less than seven weeks after Dr. Weart's court testimony over 59,000 barrels of pressurized brine flowed to the surface at WIPP-12! The "extremely unlikely" had become 100% certain!

Despite the evidence from these and other experts, the Summary Report does not even discuss brine reservoirs and deep dissolution as related concerns. However, the issue is not which scientists are correct. Rather, the real issue is whether deep dissolution is a well enough understood phenomenon to exclude its being a threat to the integrity of the repository. Since the Salado formation, the chosen WIPP repository horizon, has experienced enormous dissolution in the Delaware Basin, including areas in the center of the basin near the WIPP site,[10] and elsewhere, with no adequate explanation by DOE of the processes causing it, such dissolution must be

considered as a disqualifying factor at WIPP. This demonstrated lack of understanding of deep dissolution, brine pockets and the relationship between them, the absence of an explanation of why large areas of the lower Salado are missing in boreholes in the WIPP site area, and the lack of a worst-case analysis for brine-driven releases into the Rustler aquifer or to the surface indicate that no faith can be placed in the consequence analysis done for WIPP.

C. High-Level Waste discussion

The Summary Report states that "[t]he more recent site studies have not examined the needs or consequences of HLW disposal at WIPP because HLW disposal was removed from the WIPP mission by Congresional authorization." (p. 8) Interestingly then, the discussion of the lithology criterion states that the WIPP site "would be acceptable even for HLW emplacement." (p. 14) This statement is surprising and apparently has no scientific basis since "the needs ... of HLW disposal" have not been considered!

III. The need to know the real mission of WIPP before construction begins

The references to high-level waste in the Summary Report perhaps indicate that DOE is still interested in the WIPP site for high-level waste disposal. Furthermore, the passage of two laws since the 1979 WIPP authorization have changed the circumstances surrounding nuclear waste disposal, increasing the likelihood that high-level waste will be disposed of at WIPP.

Public Law 97-90 passed in 1982 requires that the President submit to the Senate and House Armed Services Committees by June 30, 1983 "his plans for the permanent disposal of high-level and transuranic wastes resulting from atomic





energy defense activities." As part of our lawsuit on WIPP, my organization obtained a copy of the February 1983 draft of The Defense Waste Managment Plan in a deposition of Mr. Herman Roser, DOE's Assistant Secretary for Defense Programs, on March 2, 1983.

The draft Plan shows that WIPP is scheduled and budgeted as the only defense waste repository. Thus, WIPP would receive all transuranic waste not left at existing sites, which could exceed the 6.2 million cubic feet considered in the WIPP FEIS.[11] The draft Plan's reference method for disposing of defense high-level waste is in a geologic repository. The total cost for defense waste management through 2015 is 17 billion taxpayer dollars. (p. 6-3) Since repository costs are highly uncertain, but estimates range from DOE's $14.8 billion to the Congressional Budget Office's estimates of up to $38.5 billion,[12] adding a second defense repository besides WIPP could at least double the total cost of the defense waste management program.

Public Law 97-425, the Nuclear Waste Policy Act of 1982, requires the President to determine by no later than January 1985 whether there will be separate repositories for commercial and military waste. (Section 8) Thus, the President apparently has only three options:

1) to put military high-level waste in a commercial repository,

2) to put military high-level waste in a separate military repository, or

3) to put military high-level waste at WIPP.

A separate military repository should be far and away the more expensive option for the taxpayers.

While no one knows what President Reagan will decide, at the very least there currently is the possibility of WIPP being a high-level waste repository. I do not believe that any reasonable decision can be made about

constructing WIPP without knowing what its mission will be so as to allow for a realistic evaluation of the risks involved. Even the Summary Report admits that recent studies at WIPP have not been to determine that WIPP is acceptable for HLW disposal.

CONCLUSION

In summary, WIPP does not meet basic technical criteria that all other repositories will be required to meet. WIPP should be disqualified because of the dangers posed by the conflict with natural resources and salt dissolution. Thus, the WIPP site has not been and cannot be proven to be safe.

Furthermore, since the mission of WIPP is not certain, a decision to construct a repository now is premature at best.

Therefore, I do not believe that the Summary Report meets the requirements of the Stipulated Agreement, which intended that outstanding geotechnical issues be well understood before construction of a permanent WIPP repository begins. Certainly the conflict with natural resources and the impact of deep dissolution and brine reservoirs remain unresolved problems for the WIPP site, especially given the fact that WIPP's mission is still not determined.

Finally, while I welcome this hearing as a beginning step for public involvement, I do not feel that it allows for adequate public input into the State's decisionmaking on WIPP for several reasons. First, this is a daytime hearing in Santa Fe, which therefore primarily limits attendance to Santa Fe residents not working in the daytime. Second, the hearing is being held less than 3 weeks after the release of the summary document and less than 2 weeks after many people have received it, which is too short a timeframe for





complete review of the report and its references. Third, the hearing has not been widely publicized and therefore some interested persons have likely not been notified. Thus, I am pleased that at the Governor's request there will be a public hearing in Albuquerque on May 16, which will provide a better opportunity for public input. I believe that additional public hearings should be held in Carlsbad, Las Cruces and along primary transortation routes to allow for more people to be involved. Though some would say that hearings are time-consuming and expensive, a project of WIPP's magnitude, which can affect the citizens of the State for many years, certainly requires every reasonable attempt to assess the public acceptability of the Project before permanent construction begins.

Thank you for this opportunity to testify, Mr. Chairman.

Comment C-131, Page 298 of 345

# DOE Defends Planned WIPP-Site Tests

By Chuck McCutcheon
JOURNAL STAFF WRITER

A top Department of Energy official on Wednesday defended his agency's plans to put radioactive waste at the Waste Isolation Pilot Plant before the plant meets federal environmental standards — even though DOE doesn't know how long it will take to meet those standards.

The question of whether the nation's first permanent nuclear waste dump should open before meeting federal Environmental Protection Agency standards is one of the key issues that has delayed WIPP's opening.

Arlen Hunt, deputy manager of WIPP, said unless the experiment in nuclear waste storage is conducted on a limited scale, there is no way of knowing whether it will work safely.

"This has never been done before," Hunt said.

The environmental standards would guarantee that the plant near Carlsbad would pose no threat to public safety for 10,000 years. The main radioactive element in WIPP waste, plutonium, has a half-life of 24,000 years.

Energy Department officials released a draft plan Wednesday that they said marks a start toward meeting the EPA's standards for waste disposal.

Hunt said the Energy Department can't say whether the plant can meet federal standards during the initial five-year period it plans to conduct on-site experiments on waste.

The so-called "five-year plan" for WIPP calls for two phases of experiments that will give researchers enough information to determine whether nuclear waste can be permanently stored at WIPP.

The experiments involve placing waste underground in rooms in salt beds to study levels of

MORE: See OFFICIAL on PAGE A3

# Official Defends Plans for Tests at WIPP Site

CONTINUED FROM PAGE A1

gas generated by decaying waste products, as well as such things as the effects of brine seeping from the salt beds.

"I can't tell you at what point we will have enough data to determine whether we're in compliance (with EPA standards)," Hunt said at a news conference.

Later, Hunt said that "it may not be five or even 10 years" before WIPP meets EPA standards because the necessary data on gas generation at WIPP "just isn't available yet."

"Until we can do the experiments, we don't know when we can meet the standards," he said. " . . . And we have to do the experiments."

That position, however, is in contrast to one taken by Rep. Bill Richardson, D-N.M., and various environmental groups.

They have argued that no waste should be put at WIPP without first meeting federal standards for both temporary and permanent storage. They say DOE can perform experiments away from WIPP without having to place barrels of waste underground.

## DOE May Hold More Public Hearings

Department of Energy officials are considering whether to add more cities to a schedule of public hearings on a draft environmental impact study of WIPP, department spokesman Ben McCarty said Wednesday.

Also being considered is whether DOE should lengthen its 60-day comment period on the study, which some environmentalists feel is too short.

McCarty said he hoped to know by next week whether the comment period would be lengthened or if more cities would be added.

Public hearings on the study currently are scheduled during May and June in Atlanta; Denver; Pendleton, Ore.; Pocatello, Idaho; Albuquerque and Santa Fe.

Although the Idaho hearing originally was to have been held in Boise, its location has been moved, McCarty said.

"Our attitude has been, when you meet the standards, then you can put in the waste," said Don Hancock of Albuquerque's Southwest Research and Information Center, a leading WIPP critic. "But if you can't meet the standards, then you can't."

Richardson battled other members of New Mexico's congressional delegation last year over the EPA standards. Disagreements ultimately killed legislation that would have transferred land at the WIPP site to DOE.

The legislation has been re-introduced in Congress this year by Rep. Joe Skeen, R-N.M. If it is not passed by this fall, DOE plans to transfer the land administratively — a move that could lose New Mexico some $250 million earmarked for road improvements and mineral rights compensation.

Comment C-131, Page 297 of 345

NOTES

[1] WIPP-DOE-161, Romatowski cover letter, March 28, 1983, p. 1.

[2] 47 Federal Register 58196 (December 29, 1982).

[3] 45 Federal Register 31393 (May 13, 1980), 46 Federal Register 35280 (July 8, 1981), however, quotations used are from the NRC staff revised draft, dated July 2, 1982.

[4] 48 Federal Register 5670 (February 7, 1983).

[5] DOE, Final Environmental Impact Statement on WIPP, DOE/EIS-0026F, October 1980, p. 7-61 and Dean A. Nyffeler, "Geology and Mineral Occurrence in the Proposed Department of Energy Site Preliminary Design of [sic] Validation Program for the Waste Isolation Pilot Plant (WIPP) Site, September 22, 1981, in Garrey E. Carruchers, Report to Congress on WIPP withdrawal, March 23, 1982.

[6] Don Hancock, "Comments on DOE Proposed General Guidelines for Recommendation of Site for Nuclear Waste Repositories," April 4, 1983.

[7] National Academy of Sciences, Committee on Radioactive Waste Management, "Geologic Criteria for Repositories for High-Level Radioactive Wastes," 1978, pp. 13-15.

[8] WIPP FEIS, p. 9-134.

[9] Federal District Court in New Mexico, Civ. 81-0537, October 7, 1981, Transcript pp. 510-521.

[10] Roger Y. Anderson, "Deformation-Dissolution Potential of Bedded Salt, Waste Isolation Pilot Plant Site, Delaware Basin, New Mexico," in Scientific Basis for Nuclear Waste Management V, Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste Management, held June 7-10, 1982, in Berlin, Germany, pp. 449-456.

[11] WIPP FEIS, p. 2-17.

[12] Congressional Budget Office, "Financing Radioactive Waste Disposal," September 1982, p. 26.

14

BENNETT, FLA.
STRATTON, N.Y.
S, ALA.
L, VA.
MONTGOMERY, MISS.
WIS.
DELLUMS, CALIF.
CHROEDER, COLO.
KAZEN, JR., TEX.
WON PAT, GUAM
MCDONALD, GA.
BYRON, MD.
MAVROULES, MASS.
D, N.J.
M, MO.
ATH, TEX.
ROY, OKLA.
FOGLIETTA, PA.
K, MD.
HERTEL, MICH.
LOYD, TENN.
ISISKY, VA.
AY, GA.
RATT, JR., S.C.
OSKEY, IND.
NTT, N.C.
P. ORTIZ, TEX.
COLEMAN, TEX.

U.S. House of Representatives
COMMITTEE ON ARMED SERVICES
Washington, D.C. 20515

NINETY-EIGHTH CONGRESS

MELVIN PRICE (ILL.), CHAIRMAN

WILLIAM L. DICKINSON, ALA.
G. WILLIAM WHITEHURST, VA.
FLOYD SPENCE, S.C.
MARJORIE S. HOLT, MD.
ELWOOD H. (BUD) HILLIS, IND.
ROBERT E. BADHAM, CALIF.
BOB STUMP, ARIZ.
JIM COURTER, N.J.
LARRY J. HOPKINS, KY.
ROBERT W. DAVIS, MICH.
KEN KRAMER, COLO.
DUNCAN L. HUNTER, CALIF.
THOMAS F. HARTNETT, S.C.
DANIEL B. CRANE, ILL.
DAVID O'B. MARTIN, N.Y.
JOHN R. KASICH, OHIO

JOHN J. FORD, STAFF DIRECTOR

September 7, 1983

Honorable Toney Anaya
Governor of New Mexico
Santa Fe, New Mexico 87503

Dear Governor Anaya:

This is to acknowledge the receipt of your letter, dated August 29, 1983, enclosing copies of recent correspondence between officials of the State of New Mexico and officials of the U. S. Department of Energy regarding the Waste Isolation Pilot Plant (WIPP).

I note, with some concern, that the documents provided to the committee with your letter apparently refer to long term storage or disposal of radioactive wastes. This interpretation of the function of the WIPP is contrary to the clear intent of the Congress when it enacted Section 213 of Public Law 96-164 in December of 1979. That section directed the Secretary of Energy to proceed with the WIPP as a defense program of the Department of Energy, ". . . for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." Thus, the WIPP cannot be the "first national repository for radioactive waste," as noted in your letter. Neither the Nuclear Waste Policy Act of 1982 (Public Law 97-425), nor any other law has amended Section 213. Section 213 also provides that the Secretary of Energy shall consult and cooperate with appropriate officials of the State of New Mexico with respect to public health and safety and that the Secretary shall consider such concerns and coordinate with New Mexico officials in resolving those health and safety concerns. It should be noted, however, that the Secretary's efforts to consider the State's concerns and to coordinate with State officials must be consistent with the overall goal of the Congress to proceed with the WIPP project.

As I understand Public Law 97-425, the President is required to study the issues involved and report to the Congress his recommendations on whether radioactive wastes generated by Defense programs should be disposed of in national repositories built for commercial radioactive waste or disposed of in a special Defense waste repository. It is also my understanding that a Defense waste repository would require licensing and regulation by the Nuclear Regulatory





Commission. If the WIPP, at some point in the future after serving its purpose as a demonstration facility, were to be proposed as a national repository or as a Defense waste repository, specific authorizing legislation would be required.

I have asked the committee staff to inquire into the technical matters that you have brought to the committee's attention.

Sincerely,

Melvin Price
Chairman

MP:ako

Carpenter and Goldberg, P. A.
*Accidental Injury, Product Liability and Commercial Litigation*

WILLIAM H. CARPENTER
JOSEPH GOLDBERG
RAYMON B. ELY
EDWARD L. CHAVEZ
DAVID J. STOUT

1600 UNIVERSITY BLVD., N. E., SUITE B
ALBUQUERQUE, NEW MEXICO 87102-2124
(505) 243-1336

January 24, 1989

Mr. Bruce G. Twining, Manager
Albuquerque Operations Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Twining:

I am writing on behalf of the Committee to Make WIPP Safe. As you may be aware, the Committee is composed of professionals concerned about public health and safety regarding the Waste Isolation Pilot Plant (WIPP). The Committee believes that the WIPP site and waste transportation should be as safe as possible.

We are pleased that DOE has agreed to issue a supplement to the 1980 WIPP Environmental Impact Statement (EIS) and to comply with the Resource Conservation and Recovery Act (RCRA). We also believe that WIPP should comply fully with the Environmental Protection Agency (EPA) requirements for waste repositories before any wastes are brought to WIPP.

I and other representatives of the Committee would like to meet with you at your earliest convenience to discuss these issues. Because we especially want to discuss the substantive content of the EIS supplement and the public review and comment procedures that you will use, we hope that the meeting will occur before you make final decisions about those EIS issues.

Regarding the scope and content of the draft supplement, we believe that the supplement must address, at a minimum:

* Geologic and hydrologic information, developed since 1980, about the site (especially including brine seepage, brine reservoir, and groundwater travel time);

* transportation issues, including routing and bypasses, shipping containers, modal mix, emergency response training and equipment, and impacts of accidents;

* Capacity of WIPP, including types and amounts of wastes from various DOE facilities, updated from 1980 to reflect the changed definition of TRU wastes to 100 nanocuries per gram;





* waste characteristics, including nature of the mixed wastes and amounts of organic materials and gas generation potential, and any plans for processing wastes;

* plans for experiments, storage or disposal of high-level wastes;

* purpose and need for an experimental program using wastes at the WIPP site, types and amounts of wastes necessary, data that would be generated from such experiments, and the duration of the experimental program;

* alternatives to WIPP for waste storage or disposal;

* socioeconomic impacts of WIPP;

* compliance with requirements of RCRA and the EPA repository standards;

* any other changes since the 1980 EIS.

Regarding public comment procedures, we believe that hearings should be held on the draft supplement in several cities and towns throughout New Mexico (and other affected states). In some cities we believe that the number of interested citizens will require that full-day hearings be held. We would also be willing to discuss plans for release and distribution of the draft supplement, scheduling of hearings and related issues.

I look forward to your early response.

Very truly yours,

Joseph Goldberg
Committee to Make WIPP Safe

APPENDIX D

IN THE UNITED STATES DISTRICT COURT FOR
THE DISTRICT OF COLORADO

Civil Action No. 88-Z-1524

COLORADO PUBLIC UTILITIES COMMISSION and the STATE OF COLORADO,

Plaintiffs,

v.

LAWRENCE H. HARMON and the UNITED STATES DEPARTMENT OF ENERGY,

Defendants.

---

BRIEF OF AMICUS CURIAE
THE ENVIRONMENTAL DEFENSE FUND
IN SUPPORT OF PLAINTIFF'S MOTION FOR
SUMMARY JUDGMENT

---

Introduction

EDF and its members have a substantial, legally protectable interest in the subject matter of this action. EDF is a national non-profit environmental organization dedicated to the protection and wise management of the nation's natural resources, including the establishment of a system which ensures, to the extent reasonably possible, release-free transport of hazardous and nuclear materials across the country. EDF members, 2000 in the Rocky Mountain region, live and work near, and travel on the interstate highways which traverse Colorado, Wyoming and New Mexico. Thus, the safety of these highways, and the absence of accidents involving vehicles transporting nuclear materials is of direct interest to EDF and its individual members.





ARGUMENT

I. COLORADO HAS THE RIGHT TO LEGISLATE TO ENSURE THE SAFE TRANSPORT ACROSS ITS HIGHWAYS OF AN INHERENTLY UNSAFE MATERIAL LIKE NUCLEAR WASTE.

A. Where there is uncontroverted evidence that the activity is unsafe, the state may regulate such unsafe activity.

Notwithstanding federal legislation governing shipments of hazardous materials, the Courts have upheld additional state regulation of such materials' transportation as not preempted where the state demonstrates that the activity being regulated is unsafe and that the additional regulation enhances safety, so long as such demonstration is not rebutted.

For example, in National Tank Truck Carriers v. City of New York, 677 F.2d 270 (2nd Cir. 1982), the City proferred evidence regarding the safety hazards of transporting compressed hazardous gases, while appellant truckers failed to demonstrate that their cross-city hauling of such gases was safe. As a result, the Circuit Court affirmed the district court opinion holding the City's compressed gas routing requirements constitutional because they were "based on a legitimate local safety interest and do not impose a disproportionate burden on interstate commerce." Id., at 273, citing City of New York v. Ritter Transportation, Inc., 515 F.Supp. 663, 672 (S.D.N.Y. 1981).

In contradistinction, the Supreme Court in Raymond Motor Transportation, Inc. v. Rice, 434 U.S. 429, 436 (1979), struck down a state regulation which banned the use of certain double trucks while allowing long single trucks. The Court found this

regulation to impose a burden on commerce disproportionate to its slight and speculative contribution to local highway safety. The State had utterly failed to contradict extensive evidence introduced by the truckers demonstrating the comparative safety of 65 foot double to 55 foot single trucks.

The National Tank Truck Carriers Court cites Raymond Motor as being "one of those rare cases" because courts usually uphold legitimate local safety interests as a constitutional exercise of state police power against a commerce clause challenge. However, to carry the burden of demonstrating a state regulation's legitimacy the state must prove an actual relationship between the rule and protection of health, safety, and welfare against a legitimate threat to citizens and the environment. Then, to survive a holding of non-preemption, the trucker must not only rebut the safety evidence, but prove that the regulation imposes a "disproportionate burden on interstate commerce". National Tank Truck Carriers, supra, 677 F.2d at 273.

Applying these well established legal principles to the case at bar, Colorado's Nuclear Materials Transportation Act (CNMTA) and pendant regulations are clearly not preempted. The record demonstrates that the transportation of nuclear materials presents a legitimate safety risk to Colorado citizens and its environment which the state's legislative and regulatory scheme is designed to address. Thus, this Court should uphold Colorado's regulations because there is no evidence in the record to suggest that, in fact, the state has misperceived the





activity or seen a risk to public health and safety where none exists. To the contrary, as set forth below, the federal scheme for ensuring safe transport of nuclear materials relies almost entirely on maintaining the integrity of the transportation container, although history suggests that the federal agencies have not exercised sufficient control to achieve this goal. In light of the extraordinarily dangerous nature of the materials being transported that Colorado is seeking to regulate, coupled with the federal government's inability to ensure container reliability across the board, Colorado's inspection and permitting program will be an integral part of protecting the state's and the region's citizens.

B. Containers being used to transport hazardous and nuclear materials are not so safe as to be a security system unto themselves.

The danger involved in transporting route controlled quantities of nuclear materials on the nation's highways results from the highly radioactive nature of the cargo itself. A truck loaded with one metric ton of spent nuclear fuel, even fuel out of the reactor core for 10 years, is carrying 400,000 curies of radioactivity. If the Department of Energy (DOE) eventually builds a repository for spent fuel disposal in Nevada, roughly 500 truck shipments would traverse Colorado on a yearly basis for 25 years, if DOE shipped all fuel by truck. The trucks loaded with plutonium-contaminated (transuranic) wastes bound for DOE's WIPP in New Mexico are expected to carry an average of 12,000 curies per load. Although the curie content is substantially

less for these shipments of which about 1000 will travel I-25 annually starting as early as late 1989, because one need inhale only one one millionth of a curie of plutonium (or, about three one millionths of a gram) to have a 50/50 chance of developing cancer, these shipments are also far from benign.

Recognizing the extremely hazardous nature of a nuclear waste cargo, the Nuclear Regulatory Commission (NRC) requires that both spent fuel and transuranic waste be shipped in solid form and in massive, double walled, unvented packages, denominated "Type B" containers. 10 CFR 71. The operating assumption is that these containers, built to withstand serious accidents without releasing their contents, will protect the public and surrounding environment in the event of almost all accidents. See, e.g., Office of Technology Assessment, Transportation of Hazardous Materials, U.S. Government Printing Office, Washington, DC 1986 (OTA Report), p. 89. Excerpts of this report are attached hereto as Appendix A. Unfortunately, despite the extreme durability of the containers as designed, evidence indicates that the projected risks of nuclear materials transport are in fact higher than would occur under model conditions for several reasons. First, DOE's risk projections do not adequately account for human error. Audin, L., A Review of the Effects of Human Error on the Risks Involved in Spent Fuel Transportation, prepared for the Nebraska Energy Office, 1986, rev. 1987 (Audin; attached hereto as Appendix B.) Second, the federal agencies are not well enough staffed to ensure that the





containers (a) are properly designed, (b) are built as designed, or (c) are maintained in top condition throughout their useful lives. It is because of these chinks in the container safety program's armor that Colorado's added regulations are not only warranted, but are necessary for a comprehensive safety system.

Basic defects in several casks have been discovered after the casks have been in use. See, Audin, pp. 19-23. Some cask design defects occur because NRC may certify casks on the basis of computer simulated and small scale models' responses to severe accidents instead of actual, full scale physical testing results. Yet, a critical component of cask certification is the container's ability to withstand a series of four severe accidents. 10 C.F.R. 71. 1/ For example, despite successful

---

1/ The credibility of the certification process is also sullied by the widespread occurence of the use of incomplete or outdated documentation in certification applications. In a recent report on Radioactive Materials Packaging, the General Accounting Office (GAO) found serious documentation problems with DOE's nuclear weapons packages. GAO found three package designs that were used for several years without ever being certified, and four package designs that had only 60-day approvals, but had been available for use for nine to 11 years. For their review GAO randomly selected 14 of the 42 Type-B nuclear materials packages for weapons. GAO found that seven of these 14 files did not fully demonstrate that the packages met standards equivalent to those prescribed by the NRC. GAO, Nuclear Health and Safety: DOE Needs to Take Further Actions to Ensure Safe Transportation of Radioactive Materials, GAO/RCED-88-195 (1988); this report is attached hereto as Appendix C. Although DOE ships weapons on its own trucks with its own drivers so that such shipments are exempt from regulation under the HMTA, 49 C.F.R. 173.7(b), the GAO's findings still illustrate the often careless manner in which DOE selects shipping containers. Under such circumstances, additional state inspections and safety requirements should be welcomed.

computer runs and model results, when DOE tested a full-scale TRUPACT, the container designed originally for WIPP shipments, it failed after the fire test. Fortunately, TRUPACT had never been used, in contrast to the LLD-1, a package DOE has used to make over 100 shipments before seeking its NRC certification in 1975. As a result of NRC questions about the container's structual strength, tests were performed in which the cage holding the plutonium collapsed. Nonetheless, DOE continued to make shipments in the LLD-1 for over a year. Audin, pp. 34-35.

The second problem with Type B containers is that they are not always built as designed. Although this type of slip betwixt cup and lip has yet to cause a release during transport, the potential created for such a release is disturbing in and of itself and must serve as a warning. Take, for example the NAC-1, a cask made in 1974 and used extensively for a five year period to ship hazardous and nuclear waste. In a two week period in June, 1977, among three casks then in service, inspectors discovered 5 open vent valves and one open drain valve. One NRC inspector concluded these valve failures resulted from normal truck vibrations during transport because the valves had been incorrectly installed initially. This flaw had not been detected previously because neither NRC or the Department of Transportation required container inspectors en route or upon arrival. In 1979, two other NAC-1s were found to have bowed inner shells, a flaw that had either been built in or had occurred during their five years of use. Had a severe accident





occurred, this bowing could have led to buckling of the inner cavity, damage to the fuel rods, or opening of and venting of radiation through a pressure relief valve. Audin, pp. 43-44.

While there is undeniably a problem with design and structural safety of the casks themselves, the current inspection system exacerbates this problem in two distinct ways. First, by not providing enough inspectors to do an adequate job, the certification process is often completed in a hasty and careless manner. In 1986, the total number of inspectors responsible for hazardous materials transport at DOT was approximately 110 inspectors for all hazardous materials, including nuclear waste, travelling by all modes. See, OTA Report, p. 206. NRC has only six inspectors examining nuclear waste shipments. Id., p. 211. Even though there have not been that many shipments to date, these inspectors have not always identified occurring problems in a timely manner.

Based on this history, rather than protest, the federal agencies should welcome the additional, independent inspection procedures imposed by states such as Colorado upon nuclear waste shipments as likely to enhance the overall safety of transport.

II. REGULATION FOR THE PURPOSE OF PROTECTING HEALTH, SAFETY AND WELFARE IS A LEGITIMATE EXERCISE OF STATE POLICE POWER.

The Commerce Clause specifically authorizes Congress to regulate commerce among the several states. U.S. Const., art. I, sec. 8, cl. 2. While the Commerce Clause places limits on state regulatory power, it does not act to bar state action affecting

interstate commerce. Indeed in matters of local concern, such as are traditionally regulated by the states, state regulation may unavoidably involve some regulation of interstate commerce. Thus, a balance between state and federal regulation must be struck, particularly in areas of such subtlety and complexity as highway regulation. The Tenth Amendment to the U.S. Constitution also mandates such a balance of powers. However, both Congress and the Courts have struggled in articulating the limits that federalism imposes on state authority.

State autonomy is a recurrent theme in commerce power litigation. National League of Cities v. Usery, 426 U.S. 833 (1978), was the first case in 40 years to find that a federal law exceeded congressional powers. The Court stated:

> "[t]here are attributes to sovereignty attaching to every state government which may not be impaired by Congress, not because Congress may lack an affirmative grant of legislative authority to reach the matter, but because the Constitution prohibits it from exercising authority in this manner."

Id., at 845.

The four dissenters in Usery became the majority in several cases of the early 1980's that theoretically limit the 10th Amendment approach of Usery. Most recent of note is Garcia v. San Antonio Metro. Transit Authority, 469 U.S. 528 (1985), where the Court specifically asked the parties to address 10th Amendment principles. There, the Court applied the Fair Labor Standard Act to local Transit Authority employees, thus preempting state regulation in this area. Justice Powell, in





dissent, accurately observed: "By usurping functions traditionally performed by the States, federal overreaching ... undermines the constitutionally mandated balance of power between the States and the Federal government, a balance designed to protect our fundamental liberties." Garcia, supra, at 572.

Although Garcia could be seen as having tipped the balance definitively back towards federal supremacy, in the field of transportation regulation, where the lower courts must perform their analyses under the commerce clause, the Garcia opinion appears to have made few inroads into traditional state primacy. See, City of New York v. U.S. Dept. of Transportation, 700 F.Supp. 1294 (S.D.N.Y. 1988); Ruiz v. Com'r of Dept. of Transportation of City of New York, 679 F.Supp. 341 (S.D.N.Y. 1988); Environmental Encapsulating Corp. v. City of New York, 666 F.Supp. 535 (S.D.N.Y. 1987). Courts' resistance to allowing federal government usurpation of the traditional state role in highway regulation has an inherent populist tone as well; thus, one commenter noted, "[t]hrough expansive readings of such constitutional provisions as the commerce clause and the supremacy clause, the [federal] government ha[s] been able to dominate politics and government in this country." Cooper, The Demise of Federalism, 20 Urban Lawyer 239, 283 (1988).

One important reason why lower courts have not followed Garcia closely in the area of transportation is that, "few subjects of state regulation are so peculiarly of local concern as is the use of state highways." South Carolina State Highway

Dept. v. Barnwell Brothers, Inc., 303 U.S. 177, 187 (1938). "States ha[ve] primary and immediate concern in the safe ... administration [of their highways]." Id. Indeed, most states are better positioned, both in personnel and in proximity, to deal with incidents on highways within their borders.

One reason is that there is no federal highway patrol in the field; implementing such a system would be redundant given the existing state system. For this and other reasons, courts have readily acknowledged that it is more appropriate for the states to regulate and manage the highways within their own borders than it would be to implement a federal scheme. Thus, in Bibb v. Navajo Freight Lines, Inc., 359 U.S. at 524 (1959), the Court proclaimed, "[T]hose who would challenge state regulations said to promote highway safety must overcome a strong presumption of their validity." Also, in Raymond Motor Transportation, Inc. v. Rice, supra, 434 U.S. at 443 (1978), the Court strongly defended the notion that "in no field [has] deference to state regulation been greater than that of highway safety (citations omitted)." Lower courts continue to recognize that this area of the law is incontrovertible. See, National Tank Truck Carriers v. City of New York, 677 F.2d 270 (2nd Cir. 1982); Environmental Encapsulating Corp. v. City of New York, 666 F.Supp. 535 (S.D.N.Y. 1987); Ruiz v. Com'r of Dept. of Transportation of City of New York, 697 F.Supp. 341 (S.D.N.Y. 1988).

To maintain the balance between state and federal authority, this Court should uphold the validity of the CNMTA against the





limited preemption requirements of the HMTA. 49 U.S.C. sec. 1811(a), specifically provides that "any requirement, of a state or political subdivision thereof, which is inconsistent with any requirement set forth in [the HMTA] or in a regulation issued under [the HMTA] is preempted." While this language is express, it is partial. See, Cantrick, The HMTA: Preemption of State and Local Laws, 15 Colo. Law. 2216 (1986). Thus, "the HMTA does not forbid states to regulate in a manner consistent with its objectives." N.H. Motor Transport v. Flynn, 751 F.2d 43, 46 (1st Cir. 1984) (citing DOT Inconsistency Ruling, IR-3, 46 Fed.Reg. 18918, 18919 (March 26, 1981)("Congress did not intend ... to occupy the field of hazardous materials transportation so as to preclude any state or local action")). 2/

The CNMTA is consistent with the objectives of HMTA because they both address the need to adequately protect health and the environment against risks which are inherent in transportation of hazardous materials in commerce. Furthermore, the provisions of the CNMTA neither pose a physical impossibility nor a disproportionately burdensome obstacle to compliance with the HMTA. See, Ray v. Atlantic Richfield Co., 435 U.S. 151 (1978), N.H. Motor

2/ Consistent with this view is section 112(b) of the HMTA, 49 U.S.C. sec. 1811(b). Although not at issue here, this section establishes a procedure which clearly evinces Congressional intent not to preempt state health and safety regulations which go beyond federal requirements. Congress authorized DOT to forego making an administrative finding of inconsistency if (1) the state regulation affords equal or greater protection than the federal and (2) the state regulation does not unreasonably burden interstate commerce.

Transport v. Flynn, 751 F.2d 43 (1st Cir. 1984), and National Tank Truck Carriers v. City of New York, 677 F.2d 270 (2nd Cir. 1982) for instructive analysis on "burden on commerce." The CNMTA is merely an additional insurance of safe transportation through careful regulation and inspection. The CNMTA is simply not inconsistent.

Furthermore, state regulations, such as the CNMTA, which go beyond DOT's regulations are specifically authorized under HMTA's regulatory structure. "Congress did not intend HMTA regulations to maximize public safety," as is evident by Congress having written into the HMTA "a procedure whereby local jurisdictions could apply for a non-preemption ruling for their own [more stringent] regulations." City of New York v. U.S. Dept. of Transportation, 715 F.2d 732, 740 (2nd Cir. 1983); regarding the referenced procedure, see footnote 2, supra. Also see, S. Rep. No. 1192, 93rd Cong., 2nd Sess. 37 (1974). Thus, if the local regulation affords an equal to or greater protection and does not unreasonably burden commerce, the preemptive force of the federal regulations must be limited "to secure more stringent [local] regulations." S. Rep. No. 1192, supra, at 38.

It would be a tragic mistake on the part of the courts to view environmental protection as an area where federal interests should always prevail. Indeed, some environmental concerns present uniquely regional issues, reflecting the peculiar array of the natural resources available to and ecologic limitations of the individual states. Unquestionably, the CNMTA is structured





to ensure protection of the fragile and pristine environment of the Colorado Rockies, as well as the health of Colorado residents and highway travellers. In the National Environmental Policy Act of 1969, 42 U.S.C. sec. 4321 et seq., Congress declared that, "the federal government [shall cooperate] with state and local governments to use all practicable means and measures ... in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony ..." 42 U.S.C. sec. 4331. However, principles of federal preemption in the environmental context have historically been applied in an erratic and inconsistent manner, which has lead to "uncertainty [and] frustrat[ion in] both state and national environmental policy." Comment, Preemption Doctrine in the Environmental Context: A Unified Method of Analysis, 127 U. Pa. L.Rev. 197 (1978).

EDF urges this Court to take a cooperative federalist approach in the pending case. Often, EDF takes a positive position regarding federal oversight of state programs, and generally encourages federal/state cooperation. Indeed in the case before the court, EDF is clearly advocating a cooperative approach between the federal and state regulatory schemes, to ensure the safest means possible for the transportation of this incredibly dangerous material. EDF is not urging the court to nullify the HMTA, but merely to find that the HMTA does not, expressly or impliedly, nullify additional state regulations which are the direct result of health, safety and welfare con-

cerns of the states. In doing so, this Court will be reestablishing the constitutionally mandated balance of power between the federal and state governments on this issue. In restoring the proper roles of states within the federal system, "the national government and the states [must] work together in redefining the meaning of federalism. It is also important that all parties to the federalism debate bear in mind the meaning of principle. To be credible, a principle must be applied consistently and faithfully, even if its application may lead to results contrary to a preferred political agenda." Lieberman, Modern Federalism: Altered States, 20 **Urban Lawyer** 285, 299 (1988).

**Conclusion**

It is undisputed, both in this litigation and historically, that the containers used to ship nuclear waste are not adequately protective; additional transport regulation is necessary. The goal of the CNMTA, like the HMTA, is to ensure safe nuclear materials transportation. The two statutes are complementary, not in conflict. Therefore, this Court should hold that the CNMTA is not preempted by the HMTA and is a valid exercise of state police power under the Tenth Amendment.

Respectfully submitted this 27th day of April, 1989.

Melinda Kassen, Senior Attorney
Eugenia Morezzi, Legal Intern
Environmental Defense Fund
1405 Arapahoe Avenue
Boulder, CO 80302
(303) 440-4901





APPENDIX A

Page 1 of 11 pages
Case No. 6610
Decision No. CB7-1002
July 17, 1987

RULES AND REGULATIONS GOVERNING THE TRANSPORTATION OF NUCLEAR MATERIALS WITHIN COLORADO

STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE

On May 23, 1986, Senate Bill 19 was signed into law amending Title 40, Colorado Revised Statutes, 1984 Repl. Vol., as amended, to add a new Article 2.2, entitled "Transportation of Nuclear Materials" (Sections 40-2.2-101 through 40-2.2-213, C.R.S.).

It was determined that nuclear materials create a potential risk to the public health, safety, and welfare of the people of the State of Colorado and that, as an origination point of nuclear waste and a corridor state through which nuclear materials pass, the State has a duty to protect its citizens and environment from all hazards created by the transportation of nuclear materials within its borders. Moreover, it was determined that the State and the public should be involved and participate in the development of a plan to deal with the transportation of nuclear materials. Section 40-2.2-105, C.R.S., states, "The Commission shall promulgate rules and regulations for the safe transportation of nuclear materials by motor vehicle. Such rules shall not be inconsistent with any federal rule or regulation governing the transportation of the nuclear materials subject to this article. Such rulemaking authority shall be in addition to the authority created in § 40-2.1-103."

Section 40-2.2-204, C.R.S., states, "The Commission is authorized to promulgate reasonable rules and regulations which are necessary or desirable in governing the issuance of permits if such rules and regulations are not in conflict with or inconsistent with federal rules and regulations."

Section 40-2.2-209, C.R.S., states, "The Commission is authorized to promulgate rules and regulations for the implementation of this section which are not inconsistent with federal rules and regulations."

The purpose of these rules is to establish the procedures to be followed by the transportation of nuclear materials and the procedures for inspection of the shipments.

NT 1
DEFINITIONS:

(a) Carrier means any person transporting goods or property on the public roads of this state into, within, through, or out of this state, whether or not that transportation is for hire.

(b) Motor vehicle means any self-propelled vehicle which is designed primarily for travel on the public highways and which commonly is used to transport persons and property over the public highways: trailers, semitrailers, and trailer coaches, without motive power, except: motorized bicycles, as defined in § 42-1-102(47)(b), C.R.S.; vehicles which operate only upon rails or tracks laid in place on the ground or that travel through the air or that derive their motive power from overhead electric lines; farm tractors, farm trailers, and other machines and tools used in the production, harvesting, and care of farm products; and mobile machinery, self-propelled construction equipment, or industrial machinery not designed primarily for highway transportation.

(c) Vehicle means any motor vehicle as defined in paragraph (b) of this section.

(d) Nuclear Materials means highway-route-controlled quantities of radioactive materials as defined in 49 C.F.R. 173.403(l).

(1) Nuclear Materials include radioactive materials being transported to the waste isolation pilot plant in New Mexico and radioactive materials being transported to any facility provided pursuant to section 135 of the federal "Nuclear Waste Policy Act of 1982," 42 U.S.C. 10101, et seq., or any repository licensed by the United States Nuclear Regulatory Commission that is used for the permanent, deep, geologic disposal of high-level radioactive waste and spent nuclear fuel.

(2)(i) Except as provided in subparagraph (1) of this paragraph (d), Nuclear Materials do not include radioactive materials used in national security activities under the direct control of the United States Department of Defense, nor does it include radioactive materials under the direct control of the United States Department of Energy which are used in carrying out atomic energy defense activities,





as defined in the federal "Nuclear Waste Policy Act of 1982," 42 U.S.C. 10101, et seq., or wastes from mining, milling, smelting, or similar processing of ores and mineral-bearing material.

(2)(ii) The phrase "direct control" as used in NT 1(d)(2)(i) here, shall mean situations in which the motor vehicle equipment being used for the transportation of the radioactive materials is owned or leased by the United States Department of Defense or the United States Department of Energy and the drivers are employees of the Department of Defense or the Department of Energy.

(3) Notwithstanding the provisions of subparagraph (1) of this paragraph (d), Nuclear Materials do not include ores or products from mining, milling, smelting, or similar processing of ores, or transportation.

(4) Nuclear materials do not include nuclear materials used for research or medical purposes within Colorado.

(e) Designated Emergency Response Authority as used in these regulations shall be the authority designated according to § 29-22-102(3)(a), C.R.S.

NT 2
APPLICABILITY:

(a) These rules and regulations shall apply to all carriers, shippers, companies or persons, and their drivers, agents, and employees who transport or ship, or who cause to be transported or shipped, any nuclear materials over the streets and highways of the State of Colorado in intrastate or interstate commerce.

(b) Intrastate carriers holding authority from this Commission as a common or contract carrier will be subject to these rules when transporting nuclear materials and also will be subject to all rules of the Commission governing common and contract carriers.

NT 3
MISCELLANEOUS REQUIREMENTS:

(a) The telephone number of the Colorado State Patrol (CSP) shall be carried with the other shipping papers within the cab of every motor vehicle with instructions to the driver or person in charge of the vehicle to call that number in the event of any incident, accident, or breakdown of equipment.

(b) Motor vehicles transporting nuclear materials shall operate with their headlights turned on at all times and shall schedule trips through all Colorado municipalities of over 50,000 in population so as to avoid rush-hour traffic whenever possible.

(c) Motor vehicles transporting nuclear materials shall be equipped with a mobile telephone equipped with multiple channels which would allow contact with CSP offices along the route of travel.

NT 4
VIOLATIONS--CIVIL PENALTIES:

(a) Any person who violates any provision of Article 2.2 of Title 40, C.R.S., or these rules and regulations, except for the violations enumerated in subsection (3) of § 40-2.2-108, and of § 40-2.2-205, C.R.S., shall be subject to a civil penalty of not more than $10,000 per day for each day during which the violation occurs.

(b) Any person who commits any acts enumerated in § 40-2.2-108(3), C.R.S., shall be subject to the civil penalties listed in § 40-2.2-108(3)(a) through (x), C.R.S.

(c) Any person who violates any of the provisions of Rule NT 8 of these rules, shall be subject to the civil penalties listed in § 40-2.2-205(1)(a) and (b) and § 40-2.2-205(2), C.R.S..

(d) Any person who violates any of the provisions of Rule 9 of these rules shall be subject to a civil penalty of not less than $500, nor more than $10,000.





(e) Any person who violates a compliance order of the Colorado Public Utilities Commission (Commission) which is not subject to a stay pending judicial review and which has been issued pursuant to § 40-2.2-110(1), C.R.S., shall be subject to a civil penalty of not more than $10,000 per day for each day during which the violation occurs.

NT 5
INSPECTION REQUIREMENTS:

(a) Shipments entering the state.

All motor vehicles carrying nuclear materials and entering the state on public roads shall be inspected by personnel of the Port of Entry (POE) or officers of the CSP at the POE weigh station nearest the point at which the shipment enters the state or at a location specified by the CSP.

(b) Shipments originating within the state.

All motor vehicles carrying nuclear materials shipments which originate within the state shall be inspected by the CSP at the point of origin. See Nuclear Transportation Rule 9 for prenotification requirements.

(1) All drivers, motor vehicles, and cargo shall be in compliance with Parts 171, 172, 173, 177, and 178 of 49 C.F.R. in effect as of November 1, 1986, and Parts 390 through 398 of 49 C.F.R. in effect as of October 1, 1986, and Rule NT 7 of these rules.

(2) Inspection procedures by POE or CSP shall be in accordance with the Appendices of the Commercial Vehicle Safety Alliance Driver/Vehicle Examination Procedures and Standards as set forth in the October 1986 Commercial Vehicle Safety Alliance Memorandum of Understanding. This rule does not include later amendments to, or editions of, the material incorporated here.

(3) An inspection for each driver, motor vehicle, or cargo shall be valid for a single trip into, within, through, or out of this state and shall not be valid for more than 72 hours.

(c) Notification of Incidents.

(1) The driver or person in charge of the vehicle shall give immediate notice to the nearest CSP office of:

(i) any accident involving the motor vehicle;

(ii) any fire, breakage, spillage, breach or suspected breach of the shipping container;

(2) If the incident results in a breach or suspected breach of the shipping container, the telephone report shall include the following:

(a) Name of person reporting the incident;

(b) Name and address of carrier involved;

(c) Phone number where person reporting incident can be contacted;

(d) Date, time, and location of incident;

(e) Extent of injuries, if any;

(f) Classification, name, and quantity of nuclear materials involved;

(g) Type of incident, and;

(h) Whether a continuing danger to life exists at the scene.

(3) A copy of the incident report shall be submitted to the CPUC by the CSP within 30 days.

(4) After an incident, the vehicle and cargo shall be reinspected at the scene or, at the determination of the responding officer, may be moved to an area where the reinspection will be performed.

(5) The original vehicle-inspection report and any subsequent inspection report, necessitated by an incident, shall be retained in the vehicle while transporting nuclear materials into, within, through, or out of this state.





(6) The driver or person in charge of the vehicle must furnish any inspection report to the holder of the nuclear materials transportation permit.

(7) The permit holder will acknowledge receipt of the inspection report and verify the repair of any defect noted there by signing the report and returning it to the issuing agency within 15 days of the inspection date.

NT 6
AUTHORITY TO INSPECT VEHICLES, BOOKS, AND RECORDS:

(a) The authorized personnel of the POE and CSP may at any time inspect any vehicle, driver, cargo, shipping papers, nuclear-materials transportation permit and any other papers as required by law or rule carried when transporting nuclear materials on the streets and public roads in the State of Colorado.

(b) Upon discovery of violations of the regulations as set forth in Rule NT 5(b)(1) of these rules, which make the vehicle, cargo, or driver unsafe for further travel on the streets or public roads in the State of Colorado, authorized personnel of the POE or CSP may immobilize, impound, or effect a disposition of the vehicle, cargo, or driver that is appropriate for the circumstances involved.

(c) Representatives of the Commission may at any time inspect any and all books and records connected with the shipment of nuclear materials by any carrier, shipper, or person who transports, ships or who causes to be transported or shipped any nuclear material within the State of Colorado.

NT 7
APPLICATION OF 49 C.F.R.:

(a) Except as may be indicated in Title 40, Article 2.2, C.R.S., and in Nuclear Transportation Rules 1 through 10 here, the Commission adopts and incorporates by reference the provisions of Parts 171, 172, 173, 177, and 178 of 49 C.F.R., as revised November 1, 1986, and Parts 390 through 398 of 49 C.F.R., as revised October 1, 1986, with the following modifications:

(1) Section 390.16 shall not apply.

(2) The exemptions listed in the table and accompanying note contained in § 390.33, Subpart b of Part 390, shall not apply unless otherwise specifically provided for in these rules.

(3) Section 391.2(a) and (b) shall not apply.
(4) Section 392.1(c) shall not apply.
(5) Section 393.1(b) shall not apply.
(6) Section 396.1(b)(1) shall not apply.
(7) Section 397.1(c) shall not apply.

(b) Appendices A, B, C, and D of 49 C.F.R., Chapter III, Subchapter B in effect on October 1, 1986, are adopted and incorporated by reference.

(c) References in the incorporated material in NT 7(a) and (b) here, to Department of Transportation (DOT) or Interstate Commerce Commission (ICC) personnel means Colorado Commission personnel. References in the incorporated material in NT 7(a) and (b) here to federal enforcement personnel means either CPUC, POE, or CSP personnel.

(d) Certified copies of the complete text of the incorporated materials are available for public inspection during regular business hours at the Public Utilities Commission offices at 1580 Logan Street, Denver, Colorado 80203. For information regarding how the incorporated material may be obtained or examined, contact the Chief of Transportation, 1580 Logan Street, OL 1, Denver, Colorado 80203, or the Supervising Transportation Representative, same address. Certified copies of the material incorporated shall be provided at cost upon request. References to incorporated material do not include later amendments to, or editions of, the material incorporated here.

NT 8
PERMIT REQUIRED:

(a) No carrier shall transport nuclear materials into, within, through, or out of the State of Colorado until a permit authorizing such transportation has been issued by the Commission or its designee.

PERMIT APPLICATION:

(b) Each carrier desiring to transport nuclear materials by motor vehicle shall submit a permit application to the Public Utilities





Commission, 1580 Logan Street, OL 2, Denver Colorado 80203, prior to beginning such transportation. (See Appendix B-A for permit application form.)

PERMIT FEES:

(c) The annual permit fee shall be $500 and each permit will be valid from the date of issuance until the following July 1.

SHIPMENT FEES:

(d) In addition to the annual permit fee, each carrier shall pay a $200 fee for each shipment that is transported. Shipment fees shall be paid by mail (postmarked seven days prior to the date the shipment is made) or at the time the shipment enters the state, at the POE weigh station nearest the point at which the shipment enters the state. If a regular schedule or shipment is to be made, the carrier may make arrangements with the Commission to pay shipment fees on a monthly basis.

If the shipment originates within the state, payment shall be made at the POE weigh station nearest the point of shipment origination, mailed as provided in (d) above, or paid to the CSP officer making the inspection.

If paid by mail, checks shall be made payable to the Colorado Public Utilities Commission and sent to the Public Utilities Commission, 1580 Logan Street, OL 2, Denver, CO 80203.

SINGLE TRIP PERMITS

(e) A carrier transporting nuclear materials who enters the state without having obtained the permit as required here, may obtain a single trip permit at the POE nearest the point it enters the state. The fee for the permit shall be the same as indicated in NT 8(c) and (d) here. However, the carrier must complete its application for a permanent permit filing within 30 days of the date that the single trip permit was issued. If the permanent permit application filing is made within the 30 days, the fee collected for the single trip permit will be credited to the permanent permit application.

PERMITS AND SHIPPING PAPERS:

(f) Each person transporting nuclear materials within this state shall carry a copy of the shipping papers required in 49 C.F.R., Part 172, Subpart C, as revised November 1, 1986, and a copy of the nuclear materials transportation permit issued by the Commission in the motor vehicle.

NT 9
PRENOTIFICATION REQUIREMENTS:

(a) Each person transporting a shipment of nuclear materials into, within, through, or out of this state shall give advance notice to the Governor or his designee. The notice, if delivered by mail, shall be postmarked at least seven days before transport of a shipment. If the notice is delivered by messenger, it must reach the office of the Governor or his designee at least four days before transport begins. Notice shall include:

(1) The name, address, and telephone number of the shipper, carrier, and receiver;

(2) A description of the kind, quantity, and physical properties of the nuclear materials to be transported;

(3) The transport index, as defined in 49 C.F.R., Part 173.403(bb), as revised November 1, 1986, of the nuclear materials to be transported;

(4) A listing of routes to be used within Colorado. (Please refer to the Colorado Department of Highways' designated routes. No other routes may be used.)

(5) For shipments originating out of the state, the estimated date and time of departure and the estimated arrival date and time into Colorado, and;

(6) For shipments originating within the state, the estimated date and time of departure.





(b) Governor's designee for the purpose of prenotification is the Colorado State Patrol, 700 Kipling Street, Denver, Colorado 80215. The telephone number is (303) 239-4540.

(c) Upon specific request, the advance information provided under NT 9(a) herein, shall be made available to authorized emergency response authorities.

NT 10
ROUTING:

(a) Section 40-2.2-208, C.R.S., provides that: "The executive director of the State Department of Highways shall have the authority to adopt rules to designate which state highways shall be used and which shall not be used by motor vehicles transporting nuclear materials in this state."

The Colorado Department of Highways, 4201 East Arkansas Avenue, Denver, Colorado 80222, shall be contacted at (303) 757-9261 for information regarding designated routes.

(b) When forced to deviate from the designated routes because of emergency conditions that make the route unsafe, or if the route is closed due to road conditions, road construction or road maintenance, contact the CSP at (303) 239-4540 for alternate routing or for designation of the nearest location where the vehicle may be parked pending termination of the emergency conditions.

nrg:1176G

FILED
UNITED STATES DISTRICT COURT
DENVER, COLORADO
JUN 26 1989
JAMES R. MANSPEAKER
CLERK
BY DEP. CLERK

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

Civil Action No. 88-Z-1524

COLORADO PUBLIC UTILITIES COMMISSION and THE STATE OF COLORADO,

Plaintiffs,

v.

LAWRENCE H. HARMON, in his official capacity as the Director of the Transportation Management Division, Office of Defense Waste and Transportation Management, Defense Programs, and the UNITED STATES DEPARTMENT OF ENERGY,

Defendants.

---

ORDER

---

This matter was before the Court on June 23, 1989, for oral argument on Defendants' Motion To Dismiss Proceedings and plaintiff's Motion For Summary Judgment. The Court heard the arguments and statements of counsel and made oral conclusions of law which are incorporated herein by reference as if fully set forth. Accordingly, it is

ORDERED that Defendants' Motion To Dismiss, Or In The Alternative, For Stay Of Proceedings is denied. It is

FURTHER ORDERED that plaintiff's Motion For Summary Judgment is granted, except that the words "within Colorado" shall be stricken from 4 C.C.R. § 723-25 NT 1 (d)(4); nuclear materials used for medical or research purposes shall be excluded regardless of whether or not they are used in Colorado. It is

FURTHER ORDERED that the Court declares and adjudges that the statute and supporting regulations are not unconstitutional, are not inconsistent with the Hazardous Materials Transportation Act, and do not violate the commerce



clause except as to the one exception, delineated above, which shall not be enforced.

DATED at Denver, Colorado, this 26th day of June, 1989.

BY THE COURT:

ZITA L. WEINSHIENK, Judge
United States District Court

June 26, 1989

Civil Action No. 88-Z-1524

CERTIFICATE OF MAILING

The undersigned hereby certifies that on the above date copies of ORDER entered by Judge Zita L. Weinshienk and filed on June 26, 1989, were mailed to the following:

Peter J. Stapp
Assistant Attorney General
Regulatory Law Section
1525 Sherman Street, 3d Floor
Denver, CO 80203

Florence J. Phillips
Special Assistant Attorney General
Regulatory Law Section
303 East 17th Avenue, Suite 400
Denver, CO 80203

William G. Pharo
Assistant United States Attorney

Dennis G. Linder
Thomas Millet
Attorneys, Civil Division
Department of Justice
Room 3515
10th & Pennsylvania Ave., N.W.
Washington, D.C. 20530

Henry Gill, Esq.
Madelyn Creedon, Esq.
Office of General Counsel
Department of Energy
Forrestal Building
1000 Independence Ave., SW
Washington, DC 20585

Melinda Kassen
Senior Attorney
Environmental Defense Fund
1405 Arapahoe Avenue
Boulder, CO 80302



Certificate of Mailing
Civil Action No. 88-Z-1524
Page Two

Henry H. Voigt
Leonard M. Trosten
Mindy A. Buren
LeBoeuf, Lamb, Leiby & MacRae
Suite 1100
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

Henry W. Swainston
Deputy Attorney General
State of Nevada
Capitol Complex
1802 N. Carson Street
Suite 252
Carson City, NV 89710

Andrea Sheridan Ordin
Susan L. Durbin
Theodora Berger
Attorney General's Office
3580 Wilshire Blvd., Suite 600
Los Angeles, CA 90010

Robert Ruiz
Michelle Jordan
Attorney General, State of Illinois
100 W. Randolph St.
Twelfth Floor
Chicago, IL 60601

Charles C. Schettler, Jr.,
Assistant Attorney General
State of Michigan
640 Law Building
525 W. Ottawa
Lansing, MI 48913

Jocelyn F. Olson
Assistant Attorney General
State of Minnesota
520 Lafayette Rd.
St. Paul, MN 55155

Gini Nelson
Special Assistant Attorney General
1190 St. Francis Drive
Room N4050- Herald Runnels Bldg.
Santa Fe, NM 87503

Certificate of Mailing
Civil Action No. 88-Z-1524
Page Three

E. Dennis Muchnicki
Assistant Attorney General
State of Ohio
30 E. Broad St.
Columbus, OH 43215

Renea Hicks
Special Assistant Attorney General
Nancy Olinger
Assistant Attorney General
State of Texas
P.O. Box 12548
Austin, TX 78711-2548

Jeffrey Amestoy
Attorney General
State of Vermont
Pavilion Office Building
109 State St.
Montpelier, VT 05602

Patrick A. O'Hare
Sr. Assistant Attorney General
Supreme Court Building
101 North Eighth St.
Richmond, VA 23219

Charles B. Roe, Jr.
Sr. Assistant Attorney General
Mail Stop PV-11
Olympia, WA 98504

Carl A. Sinderbrand
Assistant Attorney General
State of Wisconsin
P.O. Box 7857
Madison, WI 53707-7857

JAMES R. MANSPEAKER, Clerk

By _____
Deputy Clerk



APPENDIX E

# ENVIRONMENTAL DEFENSE FUND

1405 Arapahoe Avenue
Boulder, CO 80302
(303) 440-4901

July 5, 1989

Secretary James D. Watkins
Department of Energy
Washington, D.C. 20585

Re: WIPP draft Supplemental Environmental Impact Statement (SEIS)

Dear Secretary Watkins:

In light of your June 27, 1989 announcement that the opening of the Waste Isolation Pilot Plant (WIPP) will be postponed indefinitely, Concerned Citizens for Nuclear Safety, the Environmental Defense Fund, the Natural Resources Defense Council, Southwest Research and Information Center, and the State of Texas request that you withdraw DOE's draft SEIS for the WIPP.

Such action would, of course, not lead to DOE discarding all information collected on the WIPP to date. In fact, we recommend that DOE use all oral and written comments received on the draft SEIS, along with other technical and regulatory documents in developing a new draft SEIS to use for your revised decision making on the WIPP project. The withdrawal of the draft WIPP SEIS is consistent with, and indeed necessitated by your decisions of last week.

You stated, "I have ... been surprised to learn that the Department relies on insufficient scientific information in making its decisions and in developing public policy." Regarding NEPA, you stated that you intended to establish "a uniform policy on a site-by-site basis for implementing NEPA so that preliminary NEPA decisions involve the Secretary of Energy from the outset and are fully coordinated with the Governors of the States that host our facilities .... In the future, if the Department is to err in its judgement as to extent of NEPA review required of new projects, it will err on the side of full disclosure and complete assessment of potential environmental impacts." You also stated, "WIPP is a classic example of the crying need to re-establish a well-aired and documented baseline of understanding."

National Headquarters
257 Park Avenue South
New York, NY 10010
(212) 505-2100

1616 P Street, NW
Washington, DC 20036
(202) 387-3500

1655 College Avenue
Oakland, CA 94618
(415) 658-8008

2108 East Main Street
Richmond, VA 23219
(804) 780-1297

128 East Hargett Street
Raleigh, NC 27601
(919) 821-7793

100% Recycled Paper

We agree with these sentiments whole-heartedly. Further, we concur with your suggestion that WIPP become a major focus in DOE's efforts to correct its systemic scientific and NEPA problems of which you have apparently only recently become aware. Most of the signatories to this letter have already testified that the draft SEIS was not based on sufficient scientific information. In fact, several of the baseline scientific documents for WIPP do not even exist yet. For example, there is still no DOE-approved Final Safety Analysis Report, no NRC-approved Final Safety Analysis Report for Packaging on the TRUPACT-II, no NRC-approved Final Safety Analysis Report for Packaging of the WIPP RH-TRU shipping container, no DOE-approved WIPP Test Phase Plan.

The draft WIPP SEIS did not include a discussion of several reasonable alternatives, including alternative interim and long-term storage sites and options available if WIPP does not meet newly promulgated EPA disposal standards (40 CFR 191). A new draft SEIS could correct this fatal flaw. Because of the time that it will take to correct all of the problems with the WIPP project, both technical and regulatory, we were heartened by your statement that you would "not be driven by any previously set schedules or management decisions which still do not answer emerging questions as to the soundness of technical data or completeness of reviews." Given the problems of brine seepage, rapid salt closure and rock cracking, pressurized brine reservoirs, ground water travel time, characteristics of the waste inventory including mixed wastes and gas generation, and integrity of seals, among other concerns, technically sound data regarding WIPP is not yet available. It is therefore appropriate to delay opening the plant.

The scientific information necessary to demonstrate that WIPP is (or is not) safe and can (or cannot) comply with all appropriate environmental, public health and safety requirements should be developed through an open public process, including the participation of independent scientists. Once the necessary scientific data is available, DOE can then issue a new draft SEIS and a final SEIS as the basis for you to use in making your decision on the WIPP project in a manner which takes environmental, public health and safety concerns into account as is required by NEPA. As we stated in our March 21, 1989 Notice of Intent to Sue letter, we believe that WIPP should not open until compliance is demonstrated with the EPA disposal standards and with the provisions of the Resource Conservation and Recovery Act.





We agree with many of your statements on June 27. Actions necessary to support those statements include the development of adequate scientific information about the WIPP site itself, the various waste streams' characteristics, and the transportation issues. Your withdrawal of the draft WIPP SEIS until such information is available will demonstrate that you are serious about this stated change in DOE's WIPP strategy. We urge you to do so promptly.

We thank you for your consideration and again restate our wish to meet with DOE officials as soon as possible to discuss the agency's compliance with NEPA, RCRA, and the EPA radioactive waste disposal standards at WIPP.

Sincerely,

Melinda Kassen
Senior Attorney
Rocky Mountain Regional Office
Environmental Defense Fund
1405 Arapahoe Avenue
Boulder,CO 80302

Dan W. Reicher
Senior Project Attorney
Natural Resources Defense Council
1350 New York Ave., N.W.
Suite 300
Washington, D.C. 20005

Don Hancock, Director
Caroline Petti, Legislative Director
Nuclear Waste Safety Project
Southwest Research and Information Center
P.O. Box 4524
Albuquerque, NM 87106

Jim Mattox
Attorney General of Texas
Renea Hicks
Nancy Olinger
Asst. Attorneys General
Environmental Protection Division
P.O. Box 12548
Austin, TX 78711-2548

Douglas Booth
Legal Counsel
Concerned Citizens for Nuclear Safety
712 Calle Grillo
Santa Fe, NM 87501

APPENDIX F

Natural Resources Defense Council

1350 New York Ave., N.W.
Washington, DC 20005
202 783-7800

March 21, 1989

The Honorable James D. Watkins
Secretary of Energy
U.S. Department of Energy
Washington, DC 20585

Re: Notice of Intent to Sue

Dear Admiral Watkins:

Pursuant to Section 7002 of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6972, the Natural Resources Defense Council, the Environmental Defense Fund, Southwest Research and Information Center, Concerned Citizens for Nuclear Safety and the State of Texas hereby notify you that emplacement of hazardous waste in DOE's Waste Isolation Pilot Plant (WIPP) that has been generated at DOE's Rocky Flats Plant near Denver, Colorado, and at other DOE facilities, would violate RCRA requirements applicable to hazardous waste generators and analogous requirements of state law. As explained below, the violations involve RCRA manifest requirements and the land disposal prohibitions of RCRA.

You are also hereby notified that DOE must comply fully with Subpart B of the U.S. Environmental Protection Agency's (EPA) radioactive waste standards, 40 C.F.R. 191, as finally repromulgated by EPA, prior to emplacement of any wastes at WIPP.

Additionally, we understand that a decision has been made to prepare a Supplement to the Environmental Impact Statement (EIS) on WIPP prepared in 1980. We intend to insure that there is full opportunity for public comment during preparation of the Supplemental EIS, that the final document considers all relevant issues, and that it is considered in the decision-making process prior to any operation of the facility.

The current crisis in the DOE nuclear weapons production complex stems in large part from the Department's longstanding and intense resistance to compliance with federal environmental and safety requirements. For years, DOE has sought to avoid laws and regulations that private industry has been asked to meet. As the first major new facility in the complex in a quarter century, WIPP presents DOE with the opportunity to avoid the mistakes of the past. As a start, this means meeting the requirements of RCRA,

cled Paper

New York Office:
122 East 42nd Street
New York, New York 10168
212 949-0049

Western Office:
90 New Montgomery
San Francisco, CA 94105
415 777-0220

New England Office:
850 Boston Post Road
Sudbury, MA 01776
617 443-6300

Toxic Substances
Information Line:
USA: 1-800 648-NRDC
NYS: 212 687-6862





the EPA radioactive waste standards, and NEPA before any operations commence at WIPP.

I. RCRA

At the Rocky Flats Plant (RFP) and other facilities, DOE generates wastes that are radioactive and hazardous as defined by EPA in its RCRA implementing regulations. See 40 CFR Part 261. These "mixed" wastes are subject to RCRA regulation to the extent RCRA requirements are not inconsistent with applicable requirements of the Atomic Energy Act of 1954. See 52 Fed. Reg. 15937 (May 1, 1987).

As a generator of hazardous waste at the RFP and other facilities, DOE must comply with EPA's RCRA generator regulations codified at 40 CFR Part 262, and analogous state regulations. Among the requirements applicable to DOE is 40 CFR 262.20(b), which specifies that DOE must designate the facility that will receive any offsite waste shipment from the RFP on the Uniform Hazardous Waste Manifest accompanying the shipment. Significantly, 40 CFR 262.20(b) stipulates that the facility designated on the manifest be "permitted" to receive the RFP-generated waste.

EPA has defined the term "designated facility" as used in this context in 40 CFR 260.10. According to this provision, a designated disposal facility is a facility operating under an EPA RCRA permit, under interim status, or under a RCRA permit issued by an authorized state. As you know, the WIPP facility has not received a RCRA permit from EPA nor has it obtained interim status. In addition, although New Mexico is an authorized state, WIPP is exempt from hazardous waste regulation under New Mexico law and New Mexico is not yet authorized to regulate mixed wastes. Therefore WIPP has not received a RCRA permit from New Mexico either. Consequently, since WIPP is not subject to appropriate RCRA regulation, it cannot be considered a "designated facility", and the shipment of RFP-generated and other hazardous wastes to WIPP constitutes a violation of 40 CFR 262.20 and analogous state requirements.[1]

As a generator of hazardous wastes at RFP and other facilities, DOE must also comply with the land disposal prohibitions of RCRA. See 40 CFR 268.1(b). Under these

[1] In the event DOE intends to manage RCRA-regulated waste intended for WIPP at another location, it must do so at an authorized facility.

land disposal prohibitions, wastes must be treated prior to disposal in a manner that reduces substantially the toxicity or mobility of the wastes. See Section 3004(m) of RCRA. The prohibitions are phased in according to a schedule developed by EPA and the Congress. See Sections 3004(d)-(g) of RCRA; 40 CFR 268 Subpart B.

Since WIPP is a "salt dome formation, salt bed formation, underground mine or cave", the placement of wastes in WIPP constitutes "land disposal" as defined in Section 3004(k) of RCRA. Accordingly, in the absence of an exemption or variance from the land disposal prohibitions, RFP-generated wastes for which the prohibitions are already in effect (i.e., solvent wastes and the so-called "California wastes" as specified in 40 CFR 268 Subpart C) must meet applicable treatment standards prior to placement in the WIPP. Indeed, pursuant to 40 CFR 268.7, DOE officials must certify that the RFP-generated waste shipped to WIPP for disposal meets applicable treatment standards, based upon sampling or DOE's knowledge of the waste. The submission of a false certification can result in a fine or imprisonment. Without a valid certification, DOE cannot ship RFP-generated waste presently subject to the land disposal prohibitions to the WIPP for disposal.

However, to the best of our knowledge, DOE cannot properly certify that the RFP-generated waste presently subject to the land disposal prohibitions meets applicable treatment standards because the agency has not performed adequate testing to make such determinations, or the agency possesses insufficient knowledge of the wastes to make such determinations. Furthermore, to the best of our knowledge, DOE only very recently applied for and has not obtained an exemption or variance from the land disposal prohibitions for RFP-generated waste destined for disposal at the WIPP. Therefore, the disposal of RFP-generated waste presently subject to the land disposal prohibitions of RCRA at the WIPP constitutes a violation of statutory provisions of RCRA, including but not limited to Section 3004(e), and EPA's implementing regulations, including but not limited to 40 CFR 268.1, 268.7, 268.30, and 268.40.

II. EPA Radioactive Waste Standards

EPA has promulgated regulations which apply to the management of wastes at WIPP. 40 CFR 191. Subpart A of the standards, 40 CFR 191.01-.05, limits human exposure to radiation from the management, storage and preparation of





wastes for disposal. Subpart B is designed to limit radiation releases after the wastes have been disposed.

In July, 1987 the First Circuit Court of Appeals, in cases brought by NRDC, two other environmental organizations, and the States of Texas, Maine, Minnesota, and Vermont, determined that two standards in Subpart B setting limits on the exposure of individuals and contamination of ground water were inadequate, in part because they did not limit exposure of individuals and contamination of ground water as stringently as required under the Safe Drinking Water Act. See NRDC et al. v. EPA, 824 F.2d 1258 (1st Cir. 1987). EPA is currently repromulgating Subpart B.

You are hereby notified that the Department must comply with Subpart B, as finally repromulgated, prior to any waste emplacement at the WIPP facility.[2] Subpart B applies to disposal of radioactive wastes. According to EPA, Subpart B "must be implemented in the design phase for [a] ... disposal system[ ] because active surveillance cannot be relied on" in the future. 50 Fed. Reg. 38070 (September 19, 1985). According to the agency, Subpart B is "needed for modeling repository performance which would generate information relevant and appropriate to the decisions that will be made by the implementing agencies." The performance of the repository must be analyzed to "provide a reasonable expectation" that the facility as designed will meet the quantitative release and exposure limits in Subpart B. 40 CFR 191.13(a). This is demonstrated through a "performance assessment" which is essentially a computer model "which estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events." 40 CFR 191.12(q). The repository must also be judged against "assurance requirements" in Subpart B which provide a qualitative backup to the numerical limits. These analyses must be accomplished before waste emplacement occurs in order to ensure that the goal of the standards -- minimizing adverse effects on human health and the environment -- is achieved. Subpart B is the only independent regulatory check on the safety of WIPP for the disposal of radioactive wastes, especially since WIPP is exempt from Nuclear Regulatory Commission oversight.

[2] DOE has already indicated that it plans to apply Subpart A upon receipt of any waste at WIPP. See "WIPP Compliance Strategy for 40 CFR Part 191," March 17, 1988, DOE-WIPP 86-013 at 7.

Emplacement of waste in WIPP before demonstrating compliance with Subpart B will subject present and future generations to the very risks the standards were intended to avoid. The fact that DOE may at some point in the future apply Subpart B to WIPP does not change the fact that in the interim large quantities of dangerous wastes could be emplaced in a system never judged to be safe under any objective set of criteria. Moreover, if the repository is ultimately determined not to meet the Subpart B standards, modifying it while wastes are emplaced or attempting to remove the wastes may be technically infeasible or prohibitively expensive.

Because the original Subpart B standards have been vacated, DOE must demonstrate compliance with the repromulgated standards once they are issued in final form. The First Circuit Court of Appeals found that the original Subpart B failed to protect individuals and ground water as stringently as mandated under the Safe Drinking Water Act. Demonstrating compliance with the vacated standards, as some have suggested, or not demonstrating compliance at all until the new standards are issued, would permit operation of WIPP in conflict with the requirements of the Safe Drinking Water Act. Where repromulgated regulations are required to be stricter than the ones they replace, it cannot be that the Court which vacated the original regulations intended the interim period to be a "free-for-all" for parties and projects otherwise subject to the regulations.

III. NEPA

The regulations implementing NEPA indicate that an agency "[s]hall prepare supplements" to either draft or final environmental impact statements if "[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts" or "[t]he agency makes substantial changes in the proposed action that are relevant to environmental concerns." 40 CFR §1502.9(c). Both of these conditions are met with respect to WIPP and therefore a supplement must be prepared.

We understand that the Department has decided to prepare a supplement. In light of this, we hereby notify you of our intention to insure that all applicable NEPA requirements are met. These include, inter alia, full opportunity for public review and comment, a full and fair discussion of all relevant issues, and consideration of the final





document in the decisionmaking process before any operation of the WIPP facility. Issues which must be addressed in the Supplement include, but are not limited to: 1) waste transportation including routes, bypasses, shipping containers and methods of transport; 2) geologic and hydrologic information developed since the original EIS was issued; 3) WIPP capacity including types and amounts of wastes from various facilities; 4) waste characteristics including nature and composition of mixed wastes; 5) plans for experiments; 6) alternatives to WIPP for waste storage and disposal; 7) socioeconomic impacts; 7) compliance with EPA radioactive waste standards, 40 CFR 191, and RCRA; 8) any other significant new circumstances or information relevant to environmental concerns and bearing on the operation of WIPP or its impacts. In addition there should be ample opportunity for public participation including hearings on the draft Supplemental EIS at multiple locations in each of the affected states.

IV. Conclusion

Recent revelations of safety and environmental problems at DOE facilities across the nation underscore the importance of complying with federal and state environmental laws and regulations in the operation of the nuclear weapons complex. WIPP presents DOE with a unique opportunity to avoid the mistakes of the past. Accordingly, we intend to ensure that DOE complies fully with RCRA, the EPA radioactive waste standards and NEPA and will pursue litigation to this end, if necessary.

In light of your recent expressions of an increased commitment to the protection of human health and the environment, we hope that we can avoid unnecessary and costly litigation. We would welcome the opportunity to meet with DOE officials as soon as possible to discuss the agency's compliance with RCRA, the EPA radioactive waste standards and NEPA, in regard to the operation of WIPP. We look forward to hearing from you at the earliest possible time.

Sincerely,

Dan W. Reicher
Senior Project Attorney
Natural Resources Defense Council
1350 New York Ave., N.W.
Suite 300
Washington, D.C. 20005

Melinda Kassen
Senior Attorney
Rocky Mountain Regional Office
Environmental Defense Fund
1405 Arapahoe Avenue
Boulder, CO 80302

Don Hancock,
Director
Caroline Petti
Legislative Director
Southwest Research & Information Center
105 Stanford, S.E.
P.O. 4524
Albuquerque, NM 87106

Jim Mattox
Attorney General of Texas

Renea Hicks
Assistant Attorney General
Nancy Olinger
Assistant Attorney General
Environmental Protection Division
P.O. Box 12548
Austin, TX 78711-2548

Douglas Booth
Legal Counsel
Concerned Citizens for Nuclear Safety
418 Cerrillos Road, Suite 28
Santa Fe, NM 87501



CONCERNED CITIZENS FOR NUCLEAR SAFETY
NEW MEXICO PHYSICIANS FOR SOCIAL RESPONSIBILITY
SOUTHWEST RESEARCH AND INFORMATION CENTER

May 29, 1996

Harold Johnson, NEPA Compliance Officer
Mailstop 535
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221 VIA MAIL AND FAX (505) 224-8030

Dear Mr. Johnson:

Having reviewed the WIPP SEIS-II Implementation Plan (IP) and the "Stakeholder Consultation and Coordination Draft Plan for Public Comment and Hearings" (Draft Plan), we have several concerns which we wanted to bring to your attention prior to decisions being made and announced regarding the draft SEIS-II.

Public comment period
The SEIS-II Milestones chart on page 3-3 shows that the comment period would be less than 75 days. We believe the public comment period should be at least 120 days. The comment period on the original WIPP EIS in 1979 was 141 days. The comment period on the SEIS-I in 1989 was 90 days. It is unconscionable for the SEIS-II to have a shorter comment period than the two earlier EIS's especially since the SEIS-II will cover many more sites and will consider a wider range of alternatives. Thus, we believe that the schedule must be revised to provide at least a 120-day comment period.

Notice of public hearings
We believe that no hearings should be held without at least 60 days notice in order to allow the public to read the draft SEIS-II, gather other information, and prepare for the hearings. The Milestone chart on page 3-3 of the IP appears to provide 30 days or less of notice for some public hearings. More than 60 days notice is required if, as the Draft Plan states (p. 4), CAO requires two months advance notice to obtain space for the "informational meeting" the evening before the hearing.

Location of public hearings
In addition to the planned New Mexico public hearings in Carlsbad, Albuquerque, and Santa Fe, we believe that hearings should also be scheduled in Roswell, based on the historic and current interest of people in that area and the fact that there has not been a public hearing in Roswell on the previous EISs. Because of the expected high level of interest in Albuquerque and Santa Fe, we believe that at least two days should be allowed for hearings in those two cities.

Format for public hearings
We do not object to the proposed seating arrangement in that it would allow speakers to face most of the audience; we have previously objected to arrangements where speakers have their backs to the public. However, we strongly feel that an adequate opportunity for formal statements from the public and on-the-record responses from DOE officials must be provided. Therefore, we would request that time periods should be set aside for responsible DOE officials to respond to questions that have been raised by previous speakers, rather than having such answers reduce the time that people have to speak (Draft Plan, p. 11, #4).

Regarding pre-registration, we object to the prohibition on a group pre-registering several of its members (Draft Plan, p. 10, #2). There are times that individuals would like to speak in a particular order or at a particular time in relation to other speakers. In such circumstances, to allow a group to pre-register several people at a time would be more efficient for DOE and much more satisfactory to the public.

Public hearings in other states
In 1979, hearings on the draft EIS were held in Idaho, New Mexico, and Texas. In 1989, hearings on the draft SEIS were held in Georgia, Idaho, Colorado, Oregon, New Mexico, Texas, and Utah. We understand that the current plans are to hold hearings on the draft SEIS-II in Washington, Idaho, Colorado, Tennessee, and South Carolina. We believe DOE should consult now with citizen groups, not just state and regional officials about where other hearings should be held. We are concerned that no hearings are being planned in many states with existing storage sites and many states that will be heavily impacted by transportation. The large areas designated to be served by some of the hearings is ridiculous since citizens in California certainly do not feel that they are served or that many could attend hearings in New Mexico. In addition, areas affected by WIPP in New York and Pennsylvania are not even mentioned for proposed hearing locations (Draft Plan, p. 2).

Thank you for your consideration. We strongly encourage further discussions regarding these issues before decisions about the public comment processes are made and announced.

Yours truly,

Lee Lysne
CCNS

Don Hancock
SRIC

Janna Rolland
New Mexico PSR



# The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
PHONE (208) 238-3700
(208) 785-2080
FAX # (208) 237-0797

FORT HALL BUSINESS COUNCIL
P. O. BOX 306
FORT HALL, IDAHO 83203

February 25, 1997

Mr. Harold Johnson, NEPA Compliance Manager
Attn: SEIS Comments
Box 9800
Albuquerque, NM 87119

Re: Comments on the *Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Draft Supplemental Environmental Impact Statement*

Dear Mr. Johnson:

Attached are the comments of the Shoshone-Bannock Tribes regarding the above-mentioned EIS. The Tribes endorse the opening of WIPP but insist that all transuranic waste, not just post-1970 waste, should be emplaced at the WIPP facility. The Tribes also insist that an alternative route that would bypass the Fort Hall Reservation entirely be formulated and seriously considered.

Furthermore, the Tribes stress the need for a meaningful government-to-government relationship with the Federal Government regarding transportation issues and emergency response.

Sincerely,

Keith Tinno, Chairman
Fort Hall Business Council

cc: Bill Moore, Public Safety
Chris Rule, Attorney
Richard Suckel, Tribal/DOE Director
Administration
file

## SHOSHONE-BANNOCK TRIBES
## COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

## FINAL

### GENERAL CONSIDERATIONS

The Shoshone-Bannock Tribes maintain their home on the Fort Hall Reservation located only a few miles from the Idaho National Environmental Engineering Laboratory (INEEL). Originally, the land currently occupied by the INEEL was part of the Tribes' aboriginal homeland, and such lands are very important to the past, present and future generations in preserving the culture and tradition of the Shoshone-Bannock Tribes.

The Shoshone-Bannock Tribes are guaranteed certain rights under the Fort Bridger Treaty entered into with the United States Government on July 3rd, 1868. As such, the Tribes hold these treaty rights as inviolate, and insist that treaty rights be upheld and respected in regard to all of the federal government's present and future activities at INEEL.

Since the early 1950's, the INEEL has generated, imported, processed and stored nuclear waste and spent nuclear fuel on our aboriginal lands above the Snake River Plain aquifer, one of the world's most productive. The aquifer provides not only for the needs of the Shoshone-Bannock Tribes, but for all people who live on and along the Snake River Plain.

1 It is the Tribes' position that all nuclear waste and spent nuclear fuel should be removed from the INEEL, and that clean-up of contaminated areas, including the aquifer, be effected as soon as possible. The opening of WIPP for the receipt of transuranic (TRU) waste will be a step to that end.

2 Currently, the proposed route for the movement of waste from INEEL to WIPP is I-15 which cuts through the Fort Hall Reservation. As a preliminary matter, the Tribes insist that an alternative route that would bypass the Fort Hall Reservation entirely be formulated and seriously considered. In the event that the Tribes agree to permit the transportation of nuclear waste across the Reservation, the following conditions, among others, must be met. The issues listed below are not intended to be, and shall not be construed to be, an exclusive list of the Tribes' demands with respect to transportation of nuclear waste and spent nuclear fuel across the Reservation.

3 As an initial condition, the Tribes must be assured that all necessary measures are taken to ensure that the safety of the Tribes as a whole will be safeguarded to the maximum extent possible from the consequences of an accident involving a TRU waste carrier on the Reservation. The Reservation is the last remnant of a vast domain that the Shoshone-Bannocks once occupied. In fact, the tribes still retain the rights, guaranteed by treaty, to hunt on unoccupied lands of the United States. We hold the Reservation in sacred trust for our children and our children's children for all time to come. It is our home, and our solemn duty to protect that home to the best of our ability. This duty must also be honored by DOE with respect to any shipments across the Reservation.

4 As a separate condition, all Tribal laws, ordinances, and regulations must be recognized and honored in the movement of nuclear waste across the Reservation. The Federal Government also must work closely with Tribal Emergency Response, Public Safety,

5 police and fire department personnel. In the event of a worse-case accident involving nuclear waste on the Reservation, the Tribes want to know specifically how such a spill would affect their homeland. What evacuation plans are in effect that would address



SHOSHONE-BANNOCK TRIBES
COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FINAL

5 such an accident? Where would the Tribes be relocated if a spill created long-term contamination that made evacuation of tribal members necessary?

6 It cannot be repeated often enough that the Shoshone-Bannock Tribes comprise a sovereign nation and have a government-to-government relationship with the Federal Government of the United States. We hold that recognition of the government-to-government relationship is the most efficient and timely way for the Federal Government to move nuclear materials, whether on or off the Reservation. Accordingly, the Tribes hereby reserve the right to make additional comments, and take such other actions as may be appropriate, with respect to WIPP shipments or any other shipment or storage of nuclear material which many in any way impact the Reservation.

### TECHNICAL CONSIDERATIONS:

In studying the Draft Supplemental EIS, the Tribes offer the follow observations, comments, questions and suggestions:

7 First of all, the Tribes are at a lost to understand why the federal government would spend billions of dollars and two decades of time to construct a facility that would be a repository for only a portion of the TRU waste. If the Proposed Action is accepted, only post-1970 waste would be disposed at WIPP, leaving behind an additional vast inventory of TRU waste at INEEL and other generator/interim-storage sites. WIPP would then be closed. The Tribes would like to know what DOE proposes to do with the additional inventory. To start all over finding another repository site will entail preparing the obligatory NEPA documentation, the expenditure of millions, if not billions, of dollars, and who knows how much time. The Tribes suggest that it much more practical, economical, and efficient to expand WIPP as necessary and change existing laws so that *all* TRU waste can be disposed of. If encapsulation in salt beds is a preferred disposition for some TRU waste, why not all TRU waste?

With the above considerations in mind, the Tribes would like to offer the following comments about the Proposed Action verses Action Alternative 2A:

According to EIS-II, the Proposed Action will send 143000 $m^3$ of contact-handled (CH) waste and 7080 $m^3$ of remote-handled (RH) waste to WIPP, leaving 142,500 $m^3$ of CH waste and 43000 $m^3$ of RH waste at the generator/interim-storage sites. Action Alternative 2A, however, would reduce *all* TRU waste, including basic inventory, PCB co-mingled and additional inventory to a post-treatment volume of 107000$m^3$ of CH waste and 19000 $m^3$ of RH waste for a total of 126000 $m^3$, some 24000 $m^3$ less than just the basic inventory slotted for disposal under the Proposed Action. A summary of the two actions is given in tabular form below:

## SHOSHONE-BANNOCK TRIBES
## COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

### FINAL

| | PROPOSED ACTION | ALTERNATIVE ACTION 2A |
|---|---|---|
| CH Waste to WIPP | 143000 m3 | 107000 m3 |
| RH Waste to WIPP | 7080 m3 | 19000 m3 |
| PCB Waste to WIPP | ? | Included |
| CH Waste Remaining | 142500 m3 | None |
| RH Waste Remaining | 43000 m3 | None |
| PCB Waste Remaining | ? | None |

8 The question marks in the Proposed Action column are there because footnote (a) on pg 3-3 states that Basic Inventory volumes take into account potential thermal treatment at some sites, however, "The thermal treatment does not necessarily include PCP-commingled waste." Accordingly, the Tribes question whether PCB waste will be included in the Basic Inventory.

Some of the disadvantages of Action Alternative 2A as given in EIS-II are ambiguous, misleading and just plain wrong. Some examples:

9 • First, in the box on pg. 3-19 it is stated that "the waste volumes to be disposed of under the action alternatives would be much greater that the Proposed Action". The data in the above table dispute that assertion.

10 • Second, on pg 3-20 it is stated that it will take twelve years to design and construct a treatment facility for Action Alternative 2A. An Advanced Mixed Waste Treatment Facility has already been contracted at INEEL.

11 • Third, a total of 150 years is given for the disposal of waste under Action Alternative 2A. Depending on where you look in the EIS-II, this time period is predicated on different contingencies:

> First, on pg. 3-20, the 150 years is based on "...the time needed to emplace the total volume of RH-TRU waste, assuming maximum emplacement rate of 356 $m^3$ per year..." Because Alternative 2 would dispose of a total of 19000 $m^3$ of RH waste, then an emplacement rate of 356 $m^3$/yr would require only 53.4 years for disposal of the entire inventory.

> Second, on page 3-28 it is stated that 12 panels would be required for CH waste, and 63 panels for RH waste, and the construction of these 75 panels, at a construction rate of two years per panel, will take 150 years. It is difficult to understand how the number of panels were arrived at since, on page 3 -11, it is stated that "Each disposal panel would accommodate approximately... 16,700 $m^3$ of CH waste". If that is the case, only 6.4 panels, not 12, would be required for the 107000 $m^3$ of CH waste proposed for Alternative 2. However, assuming these numbers are correct and that 75 panels would be required, it is difficult to understand how it would take





SHOSHONE-BANNOCK TRIBES
COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FINAL

11 two years to excavate a panel, particularly in light of the fact that DOE - Carlsbad via oral correspondence has said it takes only 49 days of round-the-clock work to construct a 7-room panel.

12 • Fourth, costs: The Proposed Action projects undiscounted costs for waste treatment at 11.82 billion and transportation costs at 1.59 billion. By comparison, Action Alternative 2A projects waste treatment costs of 27.7 billion and transportation costs of .723 billion, regular class rail. (It is interesting to note that the number of rail shipments projected for 2A are more than 10000 less than the number of shipments projected for the Proposed Action.) The total of waste treatment and transportation costs for the Proposed Action is therefore 13.4 billion and Alternative 2A combined costs are 28.4 billion. Granted, the costs for Alternative 2A are 2.1 times the cost of the Proposed Action, but 2.2 times the amount of waste is being processed.

As far as WIPP operational costs are concerned, Alternative 2A would necessitate the need for more funds because of a longer time needed to emplace all waste, but the 150 year time frame projected in the EIS-II certainly does not seem credible in light of the reasons given above. Even so, once again, the additional costs represent the emplacement of *all* TRU waste. To start the process over by finding a repository for the additional inventory left under the Proposed Action, and paying for the construction of a new facility and the emplacement of waste therein, would surely equal or exceed the costs of expanded operations at WIPP required to handle waste under Action Alternative 2A.

13 • Fifth, Action Alternative 2A is not in compliance with current laws and agreements pertaining to WIPP. The facts as given in EIS-II and elaborated on above point to Alternative 2A as being the most practical of all the other alternatives including the Proposed Action. Because of that, Congress should look at enacting new laws and agreements that will support Alternative 2A.

The following comments and questions refer to specific sections of the EIS. A page number preceded by a lower-case "s" is from the main document, whereas a number preceded by an upper-case "S" is from the separate summary document. To the extent of the questions posed below, the Tribes would greatly appreciate a written response from DOE to such questions.

14 pg. s-1-The 1990 ROD on EIS-I committed DOE " to prepare SEIS-II prior to a decision to dispose of waste at WIPP...", yet the 1981 ROD on the original EIS called for a phased development of WIPP and full construction. It also determined that "the adverse environmental impacts of the phased development of WIPP would be minor and there would be minimal risk of any release of radioactivity to the environment" (pg. 1-3) . It would seem the 81 ROD had already made the decision to use WIPP. The Tribes question how firm is DOE's resolve to open WIPP regardless of the EIS-II? In other words, will the EIS-II make that much difference in influencing DOE's stated objective of disposing of TRU waste at WIPP via the "Proposed Action", especially in light of the fact that the action alternatives may be in conflict with existing laws (pg, 3-14)? Is DOE already committed to the proposed action? What would it take to convince DOE to accept an alternative action?

## SHOSHONE-BANNOCK TRIBES
## COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

### FINAL

15 pg. s-7 What would it take to change the Land Withdrawal Act and agreement with New Mexico to increase the limits on the volumes of waste permitted at WIPP?

16-17 pg. 1-1 - Footnote has a typo. Also what is Public Law 104-201?

18 pg. 1-4- Although the 1981 ROD called for a phased development, the underground test phase was scraped, with aboveground tests performed instead. What are these tests? What have they determined?

19 pg. 2-14 - PCB contaminated waste cannot currently be emplaced in WIPP because that would require a permit under the Toxic Substances Control Act (TSCA), which WIPP does not plan to obtain. What would it entail to obtain this permit?

20 pg. 3-12 Under the proposed action, WIPP would receive and dispose of TRU waste for 35 years. What about TRU after 35 years?

21 pg. S-5, Background, 2nd para., last sentence - It is stated that the WIPP repository was originally designed for 175, 600 cubic meters of CH waste *plus* 7,080 cubic meters of RH waste, but in other places (fig S-3 and pg. S-14) it is indicated that the total capacity of WIPP (both CH and RH) is 175,600 cubic meters . Please clarify.

22 pg S-14, last bullet - It is stated that "For the purpose of analyses in SEIS-II, the volume of the drum or cask is used." But, for actual storage of waste in WIPP, will the maximum capacity volume be based on waste only or on the containers containing the waste?

23 pg S-39 - It is surprising that the LCFs resulting from the breach of a TRUPACT-II (which is understood to be CH waste only) with a maximum radionuclide inventory is exactly the same as the LCFs resulting from the breach of RH-72B with maximum radionuclide inventory. Even more surprising is the much, much lower LCFs associated with breach of an RH cask with average concentrations of radionuclides as compared to the breach of a TRUPACT-II with average concentrations of radionuclides . With RH waste being hotter radioactively it would seem that such waste should pose more of a risk. Please explain.

24 Pg S-56, paras 4 & 5 - These statistics are often confusing. For example, paragraph four states that the LCFs "for a hypothetical family farmer over the seven sites analyzed" are from .2 to 7. Yet, the next paragraph states that the "estimated lifetime chance of an LCF to an MEI from environmental release of contaminants originating from buried and surface-stored wastes at the seven generator-storage sites is 8x10e-7 to 7x10e-3". Would not the hypothetical farmer be the MEI in this scenario? So why the wide discrepancies in LCFs?

25 Pg S-56, last section - What possible scenarios can DOE see that would necessitate the "removal of all of the waste from the repository after closure and after the salt would have reconsolidated, breaching the TRU waste containers"?

26 Pg S-58 through S-60 - The additional deaths are given for each alternative. Are these deaths solely radiation-related or do they include trauma casualties from the accidents themselves?





SHOSHONE-BANNOCK TRIBES
COMMENTS ON WIPP DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FINAL

#### CONCLUSION

1 In conclusion, the Shoshone-Bannock Tribes support shipment of transuranic waste to the WIPP facility. It is the position of the Shoshone-Bannock Tribes that all shipments of nuclear waste should be transported from INEEL to WIPP along transportation corridors that do not cross the Fort Hall Reservation. In addition, the Tribes contend that *all* waste should be moved, not just post-1970 waste as contemplated under the Proposed Action. The Tribes strongly suggest that Action Alternative 2A be carefully considered as a means for solving the problem of permanent disposal of transuranic waste. Finally, the Tribes stress that, regardless of the alternative that is ultimately selected, any movement of nuclear waste across the Fort Hall Reservation must be subject to the laws, regulations and ordinances promulgated by the Fort Hall Tribal Business Council, and must be accomplished within the spirit and the letter of the Fort Bridger Treaty.

**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

Bonnie (First Name (please print)) | M | Bonneau (Last Name)

Santa Fe (Location) | 1-17-97 (Date) | 2:05 (Time)

Legacy of Living Light (Representing?)

**Specific Comment(s) (Summarize & be concise on this form)**

1 If WIPP opens, you need to know how much radiation will stay with each truck. It will accumulate and each vehicle will become more toxic but they will do it at various amounts dependant on the content of each drum, time length & other variables of exposure. After sometime a truck may become hot enough to cause radiation sickness in the driver. Are there any plans to test these vehicles and drivers or to remove residual radiation from TRU-PACS and the vehicles. How will this be done and under what controls? What testing has been done around this issue. What questions have been addressed, how and by whom? (more 3pg)



add to form - page 1

2 There have been at least three incidents of large salt slabs dropping from ceilings into storage chambers. And, I want to know what information was sought about the effects of this mining on the salt bed. The slab that fell might have A) left a void or cavern, B) been replaced by liquid (from where)* C) been replaced by salt or D) some things not considered here. In case "C" as in "B", where did the salt come from? How much motion, how deep in the formation, was observed? Were any observations made as to the results of these falling slabs on the salt formation? Did they create fissures, cracks, caves, rivers? Were all three of the same or did the results differ in each incident? How were these studies done and by whom? Do you believe they were thorough?

3 Battelle has at least one site with waste destined for WIPP and is a perennial DOE contractor which cannot provide independant review or non-prejudiced decission on an issue of this import. The Columbus lab has 580 cu/metres of "RH-TRU", which is one of the issues not properly addressed in the SEIS II.

4 Until RH-TRU transport, packaging and handling is explained and clarified, this whole project should be put on hold. What is the time line for answering RH-TRU questions?

5 There seems to be a conflict of ~~interest~~ interest here!

add to form – page -2

You must perform a full scale
scientific hearing with an open minded
panel of experts from the many fields
which weave together into the concept
you expect to work together at WIPP.
① I've heard that salt melts at
less than 200°F and that the RH-TRU
may be not enough to liquidate the
site?
② Exactly what are the plans for RH-TRU?
When will these plans be finalized? What
will be the process for introducing & recovering them?
③ Can this part of the program be eliminated?
It seems like another project all together.
④ How will existing plans have to change
if RH-TRU goes on last rather than first?
⑤ As transport trucks accellerate, stop, round
curves and hit bumps the contents of each
tin will mix and blend. Travel will also
expose these tins to heat changes from
below zero to over 100°F and there will be
many different effects & scenarios. How much
research and what experiments have been
done on the possible reactions in transit?
⑥ You need to thoroughly study and examine
the testimony of Richard H. Phillips, Ph.D. about
geology & hydrology at WIPP. He puts many
hours of research and effort into understanding
the complex karst formation and you need
to seek peer review of his work from
independent / non-prejudiced experts in this field!
⑦ You need an appendix of the peer review
process and the expertise & objectivity
of the folks you get to look at all your
data and assumptions. Also they need
freedom to visit, probe and explore the
geography & geology of the site.
Thanks for reviewing this document,
yours, Bonnie Bennett

1pg encl.



**THE TRUTH ABOUT WIPP GEOLOGY AND HYDROLOGY**

**by Richard Hayes Phillips, Ph.D.**

1. **The WIPP site is wet.** It was supposed to be dry. This was the rationale behind disposing of nuclear waste in salt beds. The very fact that salt beds still exist is proof that they have been isolated from circulating groundwater ever since they were deposited. But the salt beds of the Salado Formation were formed when an ancient sea evaporated, leaving the salt behind. Trapped within the salt beds are pockets of brine that never evaporated. These brine pockets migrate toward areas of low pressure. As soon as the WIPP tunnels were excavated, brine began seeping into the roof and walls. This was unexpected.

2. **The waste brought to WIPP would be buried in steel drums placed in direct contact with the salt beds.** Those fancy containers you have heard about are for transportation only. When the waste gets to WIPP, the DOE will unpack the transportation containers and bury the waste in steel drums, just like they always do. Brine will continue to seep into the WIPP repository. In a matter of years the steel drums will corrode, and the brine will begin dissolving the waste, creating a slurry of radioactive waste and salt water.

3. **The WIPP site is already breached.** The Salado salt beds are deep underground, beneath the water table. When the DOE drilled the WIPP access shafts, they had to drill through groundwater aquifers in order to reach the salt beds. Also within the WIPP site are four deep boreholes penetrating deeper than the waste repository. These shafts and boreholes are ready-made pathways for contaminated water. DOE must be able to seal the shafts and plug the boreholes perfectly, forever, and we doubt that they can do it.

4. **There is pressurized brine beneath the WIPP repository.** This is not to be confused with the brine pockets in the Salado Formation. This is a brine reservoir, beneath the Salado, in the Castile Formation. When this brine reservoir was encountered at a borehole called WIPP-12, located one-half mile north of the waste repository, 1500 barrels a day flowed for forty days, all the way to the land surface. This is because the brine is under artesian pressure, and it is the geologic mechanism, the driving force, which could bring the slurry of radioactive waste and salt water to the overlying aquifers or to the land surface.

5. **The WIPP site is vulnerable to human intrusion.** There are extensive deposits of oil, gas and potash at the WIPP site. Oil and gas wells now surround the site, and the oil and gas fields extend directly beneath the waste repository. As long as DOE controls the site, oil and gas exploration can be prevented. But when institutional controls fail, someone searching for oil will drill directly through the waste repository and into the pressurized brine reservoir, creating an instant breach of containment. The brine will flow to the land surface if the oil well is cased, and into the groundwater aquifers if the oil well is not cased.

6. **The WIPP site is in karst.** In most cases, groundwater moves through porous rocks, like sandstone, flowing uniformly and predictably. The problem with karst is that groundwater flows more rapidly through less space, through fractures enlarged by solution, or through underground caverns. The aquifers above the Salado Formation, both the Rustler Formation and the Dewey Lake Redbeds, are karst, with caverns in dolomite and gypsum, even in sandstone and shale. The caverns get larger with time; and the larger the caverns, the less the amount of radiation that sticks to the rocks as contaminated water flows through them.

7. **Drinking water will be contaminated.** There are wells in the Dewey Lake Redbeds and the Rustler Formation, within and near the WIPP site, that contain potable, drinkable water. These aquifers discharge in Nash Draw, where salt lakes will be contaminated, and they will overflow eventually into the Pecos River.

8. **The WIPP site will get worse over time.** As more and more potash is mined in the Salado Formation, the overlying aquifers will slump and fracture. Every major rainstorm will recharge the Rustler Formation with fresh water to dissolve more dolomite and gypsum. The waste will be radioactive for a very long time. Ice ages, which are cyclical, are inevitable. The climate will change when the glacier advances. There will be more rainfall, less evaporation, and more groundwater, and the rocks will dissolve more rapidly.

*Richard Hayes Phillips holds a Ph.D. in karst geomorphology and hydrology from the University of Oregon. His dissertation is entitled: "The Prospects for Regional Groundwater Contamination due to Karst Landforms in Mescalero Caliche at the WIPP site near Carlsbad, New Mexico." During his field work he camped at the WIPP site for eight months and dug one thousand auger holes and ten backhoe trenches, exposing holes of all sizes in the Mescalero caliche and demonstrating that rainwater readily reaches the Dewey Lake Redbeds.*

Comment C-134

Feb 22, 1997

Dear the U.S. Department of Energy,

1 I strongly oppose the opening of the WIPP site. I support storing of the waste safely where it is. Please, do not allow our nephews to become laden with this deadly nuclear legacy! Thank you for hearing a citizens opinion.

Jessica A. Giglio
1505 9th St
Boulder Co 80302
303-444-7582

Comment C-135, Page 1 of 3

**Friends of Oak Ridge National Laboratory**
Post Office Box 6641
Oak Ridge TN 37831-6641
24 February 1997

Mr. Harold Johnson
NEPA Compliance Office
Post Office Box 9800
Albuquerque, New Mexico 87119

Subject: Waste Isolation Pilot Plant (WIPP) Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS), DOE/EIS-0026-S-2, November 1996.

Dear Mr. Johnson:

The Friends of Oak Ridge National Laboratory, an organization comprised of former and present staff members of ORNL and of other citizens who are interested in the future welfare of the Laboratory and the community, wishes to comment on the WIPP SEIS referenced above.

1 We strongly concur with the rejection of the two "No Action" alternatives, which would dismantle WIPP and preclude its use to isolate TRU wastes from the environment. The concerns of which we are aware about the integrity of isolation seem to us to range from the highly unlikely to bordering on fantasy. Certainly the dangers are minuscule in comparison to the present distribution of the wastes in various forms in many areas around the country.

2 For many years, it has been understood that WIPP would take essentially all of the Remote Handled-Transuranic Wastes (RH-TRU) on the Oak Ridge Reservation, and plans for management of them have been based on this assumption. The preferred alternative in the SEIS however projects disposing of only 1100 $m^3$ of RH-TRU from here. It also projects that substantial quantities of this class from Battelle-Columbus and Bettis will be received and prepared for WIPP incarceration in Oak Ridge. The amount projected for acceptance at WIPP is only about 20% of the volume that would be here after preparation to meet acceptance criteria, and in fact is only a little more than that contributed by the other sites to the inventory in Oak Ridge.

The remainder (most of which comes from the Melton Valley Storage tanks) would have to be processed to a dry solid form and stored on site. The pro-

2 cess would have to produce a form that can be stored safely and indefinitely in the wet climate of East Tennessee. Probably the required process would be one much more expensive than that required merely to meet WIPP waste acceptance criteria. Otherwise the Laboratory will be open to enormous regulatory pressures, which may cause curtailment of vital operations, e.g. of the High Flux Isotope Reactor.

3 To us the alternatives seem clear. Either send all RH-TRU waste to WIPP (the alternative most acceptable to us) or insure that the waste to remain at ORNL is properly processed into a fully stabilized form suitable for long term and safe storage on site (on the doubtful assumption that the State of Tennes-
4 see would agree to permanent storage here). Obviously, the increased cost of such processing and storage must be included in the estimate of the cost of the preferred option; it does not appear to be included in the referenced draft.

5 There is another relevant Oak Ridge consideration. All of the Action Alternatives require that RH-TRU from other sites be received and treated at Oak Ridge. In addition, Oak Ridge now treats mixed wastes from other places at the TSCA incinerator. We believe that the acceptance of these wastes from elsewhere for treatment in Oak Ridge will be opposed more actively by people in local communities and across the state (as evidenced by articles in the Nashville Tennesssean) when there is no quid pro quo. In our opinion, none of the alternatives provide an adequate quid pro quo, and particularly the preferred option does not. That is, the overall problem of permanently sequestering RH-TRU wastes stored at Oak Ridge will not have been solved in any reasonable time frame. Consequently, DOE may well be faced with an increasingly hostile public and likely uncooperative Tennesse regulators.

6 The other action alternatives project much larger volumes in WIPP, which would presumably eventually include all transuranium waste from Oak Ridge. However, their time tables stretch out from a century and a half to two centuries. Such schedules would in all probability require expense comparable to the preferred alternative for on-site stabilization and storage. The very long time frames make all of these alternatives look very unattractive.

3 We strongly recommend that the preferred alternative be modified to incorporate the prior understanding that all RH-TRU wastes from Oak Ridge, those originated here or shipped in from other sites, be accepted by WIPP. We understand that projections of RH-TRU volumes from Hanford have been substantially lowered from those in the SEIS, and this should make the modification feasible.





Respectfully,

William Fulkerson
President

Copies:
Don Sundquist, Governor of Tennessee
Fred Thompson, U.S. Senator from Tennessee
William H. Frist, U.S. Senator from Tennessee
Zach Wamp, U.S. Congressman, 3rd District, Tennessee
Earl Leming, Director, DOE-Oversight Division, Tenn. Dept Env. & Conservation

Comment C-136, Page 1 of 2

To Whom It May Concern,

I have studied the pamphlets and other materials sent to me about W. I. P. P. The idea of burying nuclear waste in our Earth Still horrifies me. I think the proposed plan has many downfalls. First, it is only 2100 feet deep?! I know of some Artisan wells close to this depth. 1

Second, the proposed sites are, many of them, too close to major cities. Especially 2
the are here in Colorado, 16 miles from Denver. Thirdly, many of the 3
sites contain endangered species and prehistoric sites. Forthly, according 4
to the S.E.I.S. booklet gas could be generated in the repositories making 5
it a possible necessity to pressurize them. Wouldn't we then have a bomb waiting to explode?! Fifthly, it would 6
mean more nuclear waste being transported on our highways.

None of the material sent to me have succeeded in changing my mind. I think this is a terrible way of disposing nuclear waste. Of course, I think making nuclear weapons, devices, etc. is a horible, horrible thing to do

Comment C-136, Page 2 of 2

in the first place. The use of nuclear weapons will undoubtedly destroy our planet and thus our civilization eventually, due to greed and power-hungry individuals. To myself and others who do not support nuclear anything, we are owed at least a 7
way to disarm these radioactive materials, if not a complete stop of making them!

In short, I believe the best solution to nuclear waste lie in No Action Alternative #2. We should treat all 8
nuclear waste (i.e. - hi-level, commercial, TRU, etc.) the best our technology allows and store it until such time that a way to disarm these radioactive materials is discovered. Under no circumstances should the planet, (our only planet!) be poisoned even more by throwing nuclear "trash" into it.

Sincerely,
V. Watson

## Comment C-137

To whom it may concern,

It seems to me that the waste sitting in barrels in your warehouses is a constant reminder that something needs to be done with it. The most logical answer is obviously to completely stop creating nuclear waste and figure out how to detoxify it. I don't feel that stashing it away out of sight into the earth will lead us to any solutions to make it safe. Out of sight out of mind will no doubt be the result of this proposal.

I do not agree with the locations of your burial spots. Why choose a location 16 miles from Denver that's populated with over a million. Why not just pour the waste into their water supply? Colorado artesian wells have been found close to your proposed dump depths.

I also don't agree with transporting your waste via highways. The risk is too high. We cannot afford even one accident. Why do you feel it necessary to put us at risk on our roadways any more than we already are?

I feel that if you absolutely must throw your waste into the trash can we call earth (currently the only planet that is capable of sustaining human life), you need to find ways to treat it first. Leave the barrels in your warehouses until you find a safe treatment for your waste. If the issue of funding is holding you back from alternative ways to dispose or treat this waste, then you need to lobby for some of the funding that is going toward creating the waste.

## Comment C-138

TO; MR. HAROLD JOHNSON
NEPA COMPLIANCE OFFICER
SEIS II
PO. BOX 9800
ALBQUERQUE, NEW MEXICO
87119

RPM 2
& ASSOCIATES

FROM; JEFF MOYERS
RPM² BUILDING SERVICES LTD.
1122 PORTLAND PLACE, STE. 206
BOULDER, CO. 80304

DEAR MR. JOHNSON;

1 I AM A RECENT FIRST TIME PURCHASER OF A HOME IN LONGMONT, CO. PART OF THE REASON I CHOSE THIS CITY IS THAT IT HAS NOT BEEN NEGATIVELY IMPACTED BY ROCKY FLATS. OTHERWIZE, I WOULD HAVE CHOSEN THE DENVER METRO. I WOULD BE INTERESTED TO HEARD DOE'S ANALYSIS OF AFFECTS OF A NUCLEAR ACCIDENT ON REAL ESTATE VALUES TO GOLDEN, ARVADA, AND SIMILAR NEIGHBORHOODS CLOSE TO ROCKY FLATS. ROUGH NUMBERS SUCH AS BILLIONS IN LOSSES WILL BE SUFFICIENT. WE DO NOT NEED TO COUNT "PENNIES" ON THIS ISSUE.

2 INSURANCE IS ANOTHER UNADDRESSED ISSUE IN CASE OF NUCLEAR ACCIDENT. WE ALL KNOW AS BUSINESS INSURED'S AND HOMEOWNER ISSUED'S THAT NUCLEAR ACCIDENTS ARE NOT COVERED BY PRIVATE INSURANCE. WILL THE USA / DOE INSURE AGAINST DAMAGES DUE TO SPILLS, TRUCK WRECKS, FIRES, BLOWING CONTAMINATION FROM ALL CLEAN-UP AND REMOVAL OPERATIONS ? OR IS IT ANOTHER SITUATION WHERE THE "LITTLE GUY" PAYS FOR THE "BIG GUYS" MESS ? LETS SEE SOME FIGURES ON THIS.

3 ONE OF THE OTHER GLARING PROBLEMS NOT ADDRESSED IN THE "DRAFT SUPPLEMENT" IS THE PROBLEM OF OUTLAWING THE TRANSPORTATION OF WASTES BY STATES. WHAT IS DOE'S SOLUTION TO WASTE DISPOSAL IF ALL THE STATES AROUND WIPP AND OTHER SIMILIAR FACILITIES OUTLAW TRANSPORTATION OF THESE WASTES INTO THEIR STATES ? OF COURSE, THIS IS ALREADY HAPPENING AND PRETTY SOON NO STATE WILL ALLOW TRANSPORTATION OF THESE WASTES ACROSS THEIR BORDERS. THEN, WE ALL START STORING THE WASTE INTRASTATE, RIGHT ? RIGHT !

4 I ALSO NEED TO SEE EVACUATION PLANS FOR ALL CITIES CLOSE TO WIPP AND ON ROUTES TO WIPP. THATS ALL ROUTES !! ALL CITIES, TOWNS, BURG.'S, HAMLETS, AND EVEN METRO AREAS. FOR INSTANCE, WHAT IS THE DENVER METRO AREA GOING TO DO IF ONE OF THE WASTE TRUCKS CRASHES AND BURNS SAY UPWIND FROM DENVER ON A WINDY DAY ? HOW DOES ONE COMMUNICATE THIS INFORMATION WITHOUT CAUSING A STAMPEDE ?? INTERESTING PROBLEMS HUH !! I NEED ALL OF THE STUDIES AND COMMUNICATIONS IN REGARD TO THIS LAST PARAGRAPHS ISSUES.

SINCERELY, JEFF MOYERS

## Comment C-139

Author: Vyogin@aol.com at ~internet
Date: 2/27/97 7:15 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: SEIS II COMMENTS
---------- Message Contents ----------

To Whom This May Concern:

1 I wish to comment on my complete opposition to the disposal of radioactive waste near Carlsbad New Mexico.

2 1. The fact that by-pass roads have not been created, which would mean radioactive waste traveling down St. Francis Drive, a main artery in Santa Fe is madness.

3 2. The site itself is not safe, it has not been shown that the waste will not seep and contaminate the Pecos River as well as the ground and water table.

4 3. There needs to be some solution to the safe transport and storage of this waste. Why not consider trains for transport, which have amuch lower accident rate and could be routed away from inhabited areas.

There is much more that I could say, but for brevity, please record my comments and my opposition to such an unsafe proposal.

Sincerely,

Judy Herzl
1804 Tewa Road
Santa Fe, NM 87505
505.982.2576

## Comment C-140

Feb. 28, 1997

Attention: Mr. Harold Johnson, SEIS II Comments
U.S. Department of Energy
P.O. Box 9800
Albuquerque, N.M. 87119

Mr and Mrs John E. Fitzharris
5236 Pounds Drive South
Stone Mountain, Ga. 30087
770-469-6311

Regarding the following question:
Should the U.S. Department of Energy (DOE) dispose of defense-generated transuranic radioactive waste near Carlsbad, New Mexico?

YES: It is better to permanently dispose of transuranic waste at the WIPP rather than leave it in temporary storage at generator sites such as the Savannah River Site in South Carolina.

1

We own property not too far from the Savannah River Site. Our biggest concern is contamination of ground water and wetlands. Any accident there could pose a threat on either side of the river all the way to the Atlantic.

Also, the Savannah River Plant has been accepting waste from all over the U.S. for years and within the last year or so from overseas. South Carolina is a small state and I think it is time someone else accepted the responsibility of storing waste products. Give it to New Mexico.

Barbara H Fitzharris

**Comments on**

**The Waste Isolation Pilot Plant Disposal Phase**

**Draft Supplemental Environmental Impact Statement (SEIS II)**

**submitted by**

**Concerned Citizens for Nuclear Safety (CCNS)**

prepared by
Margret Carde
February 27, 1997

1 The Department of Energy (DOE) proffers this draft SEIS II document under the pretense that DOE intends to seriously consider public comment on its proposed action as well as the alternatives presented. However, DOE has already submitted its Compliance Certification Application (CCA) to the Environmental Protection Agency (EPA). The CCA only considers WIPP disposal under the proposed action. CCNS objects to DOE's submission of the WIPP CCA before completion of the SEIS II process on at least two grounds. First, the CCA, by inappropriately relying on an incomplete SEIS II document, cannot itself be considered complete. Second, at the very heart of the National Environmental Policy Act (NEPA) is a commitment to public involvement. By submitting the CCA in advance of DOE's response to public comment on the SEIS II, DOE trivializes the importance of the public involvement and degrades its NEPA process.

**WIPP's contribution to waste management on-site at generator facilities appears to be negligible.**

2 Under the proposed action, WIPP will not rid generator sites of most of the RH-TRU nor of approximately half of the CH-TRU waste. For New Mexicans, the scenario is particularly bleak. For example, Los Alamos National Laboratory's (LANL's) Ten Year Plan touts a $76 million savings as a result of LANL waste shipments to WIPP. However, for every cubic meter shipped, new waste is projected for existing storage. Indeed the production





3 numbers indicate that despite WIPP waste shipments, existing storage facilities will be inadequate, requiring new construction. The Ten Year Plan concludes with the prediction that nuclear waste production is expected to be ongoing. According to the Ten Year Plan, New Mexicans can expect ongoing storage of waste at LANL throughout WIPP's 35 year operational lifetime, and

4 continued nuclear waste disposal at LANL beyond WIPP's life. In other words, New Mexicans can expect two permanent nuclear waste disposal facilities, not one. Instead of alleviating waste disposal sites, WIPP would only seem to add one more site to existing sites.

5 Although DOE is silent about how long generator sites will continue to produce nuclear waste, the SEIS II gives no indication that DOE is considering a limit to nuclear waste production. Nevertheless, the SEIS II considers waste production plans for only 35 years of future waste production without ever considering waste production beyond this time. Absent some proposal for an end to waste production or some projection of production beyond 35 years, DOE's four questions to the public cannot be answered. The 35 year window

6 gives no indication of the scope of waste problems at generator sites and no real perspective on how significantly WIPP would reduce these waste problems. However, the SEIS II clearly indicates that any transportation, whether to WIPP or to consolidate waste at regional facilities for treatment,

7 adds to the cost and danger of this waste to the public. **CCNS, therefore, recommends that nuclear waste no nuclear waste be shipped under current conditions. In the future, if DOE can demonstrate that shipping nuclear waste will significantly improve public safety, CCNS recommends that DOE use the safest, which would appear to be rail transport.**

**CCNS proposes an additional alternative to DOE's SEIS II alternatives.**

8 DOE's six alternatives, with variations, are deficient. None provides a comprehensive solution to the overall contamination at DOE sites or even the TRU waste accumulation, much less a plan for future waste production beyond 35 years. For this reason **CCNS cannot endorse any of the action or no-action alternatives presented in the SEIS II. We present instead the following alternative.**

8 * WIPP should not open in 1998. Too many unresolved questions remain about health and safety issues concerning transportation, waste form and treatment, WIPP design, geology, hydrology and ability to deter future inadvertent human intrusion.

9 * Generator sites must take responsibility for safe, long-term storage of waste generated in the past and future. Current storage in unstable facilities, with inadequate waste characterization analysis, and poor packaging regulated by the WIPP WAC is dangerous and indefensible. State and local governments, Indian Tribes, and people living in communities around each generator site should participate in choosing what type of treatment and storage is most appropriate for securing the site's radioactive and hazardous waste for long-term storage on-site. Given the current lack of scientific and technological understanding of permanent nuclear waste disposal, generator sites should consider long-term storage to mean over 100 years.

10 * Because of environmental and health concerns, research and development into thermal, shred and grout, and other waste treatments should continue, but on a limited scale. Before implementing large scale treatment facilities, health and safety standards for each kind of treatment facility and final waste form must be in place. The SEIS II is clear that before adopting any of the suggested treatment options, further research is necessary to improve emissions and operational safety for workers and surrounding populations.

11 * WIPP operations should be scaled back pending a determination that opening WIPP will significantly contribute to solving the waste problems at generator sites, both now and in the future. DOE has ill advisedly excavated panel one, and may now face the necessity of abandoning this panel because of its age. To prevent further dissintegration, DOE must take a more realistic view of the time needed to determine WIPP's viability. Until WIPP has been approved, no new panels should be excavated.

12 * Without clear-cut determination of when waste production will end, future accumulation of waste a generator facilities will render WIPP's contribution to waste management at generator sites negligible. If WIPP only





12 adds another permanent radioactive waste site to DOE's existing sites, without actually eliminating any sites, WIPP cannot be considered a solution. Under these circumstances, DOE cannot justify exposing local communities in 21 states and 14 Indian reservations to the dangers of WIPP transportation.

**While not endorsing any of DOE's proposed alternatives, CCNS nevertheless offers the following comments on the alternatives.**

13 Because of the CCA commitment to the proposed action, CCNS does not seriously believe that our comments will deter DOE from its predetermined path. However, the SEIS II, more than any previous document prepared by DOE about WIPP, shows that the proposed action will

14 not accomodate the radioactive and hazardous waste which currently exists at generator sites, much less provide a solution for the waste which DOE intends to produce indefinitely into the future. The alternatives included in

15 the SEIS II are not credible for various reasons. Some propose actions that are illegal, some assume abandonment of institutional control after 100 years, some suggest waste treatment options which have little technical support.

However, because WIPP, especially under the proposed action, will not alleviate the nuclear waste problem at generator sites, CCNS suspects that some elements of the alternative actions presented in this SEIS II will be part of DOE's future waste plans, perhaps even incorporated into a redefined WIPP. Indeed, the ill-fated Waste Management Programatic Environmental Impact Statement (WM-PEIS) contains some of the same material offered in the SEIS II. CCNS, therefore, takes this opportunity to comment on the contents of the SEIS II.

**The SEIS II data does not adequately support DOE's risk assessment conclusions.**

16 DOE admits that "[r]isk analyses require knowing the radionuclide inventory at each site and combined figures for waste that would be disposed of at WIPP." A-30. Yet DOE's radionuclide inventory both of waste at each site as well as the combined amounts of waste bound for WIPP remains uncertain. The inaccuracy inherent in DOE's approximated radionuclide

inventories is particularly apparent in DOE's site adjustment formula which attempts to create a single figure from discrepencies between estimated waste volumes and radionuclide concentrations in the WM-PEIS and the SEIS II. Equation B-1, B-9.

16 The discrepencies which exist between radionuclide content in the SEIS II and WM PEIS are inevitable. Such discrepencies have occurred in other documents. For example, a comparison of the estimated stored CH-TRU waste volume estimates for LANL show a discrepency of 3,230 cubic meters between the SEIS II and the National TRU Waste Management Plan issued in September 1996. The discrepencies are inevitable because DOE insists on arriving at radionuclide waste characterization figures by reviewing the literature of past estimates provided by generator sites rather than actually conducting inventory reviews. Past estimates have very little credibility, because no quality assurance procedures existed for accuracy, consistency between facilities, or even consistency of the inventory process from year to year. The Environmental Evaluation Group has decried DOE's waste inventory figures as providing serious contradictions in the volume and radioactivity of the existing and projected TRU waste inventory.

No amount of statistical adjustment can render this poor quality data believable. If cost or danger to workers prevents DOE from being able to determine accurate volume and radionuclide content of the nuclear waste to be sent to WIPP, then DOE must admit that it cannot assess the real risk of implementing any alternative which would send nuclear waste across the nation's highways to be disposed of at WIPP.

17 The problem becomes even more accute when considering additional waste inventories. DOE admits that its waste characterization figures are particularly uncertain for environmental restoration and decommissioning activities. **DOE's continued inability to accurately determine waste characterization of WIPP waste invalidates DOE's risk assessment figures. Inaccurate waste characterization continues to be a primary reason for CCNS's refusal to support WIPP's opening.**

18 In addition, risk assessment is a relatively new field which admits to deficiencies such as its dependence on methodological value judgments and inability to provide benchmarking between models. Current risk assessment models used in the SEIS II are limited in that they cannot accurately yield data which assesses on-site dangers of releases to workers. Figures from both





18 MEPAS and GENII models become more uncertain the closer one gets to a release.

**DOE's WIPP CCA is incomplete, indicating that DOE does not yet have enough information to conclude that WIPP can contain nuclear waste for 10,000 years.**

On December 19, 1996, the EPA sent DOE a letter confirming that DOE's WIPP CCA is incomplete. CCNS's preliminary analysis of the CCA confirms EPA's letter. In addition to the aforementioned reliance on an incomplete SEIS II, CCNS believes the CCA is scientifically incomplete because of the following:

19 * Culebra transmissivity, although of concern for many years, is not resolved. Such issues as shallow dissolution, deep dissolution, and groundwater flow and transport, as well as groundwater basin modeling remain unfinished and unresolved.

20 * Final shaft design selection has not been finalized and seal performance data are incomplete.

* Expert judgment included in the CCA (for example for quantitative credit for passive institutional controls) is not documented as required by 40 CFR 194.26.

21 * Resolution of concerns about oil and gas drilling, well injection scenarios (the Hartman scenario) and subsequent subsurface flows are incomplete.

22 * Accurate figures for microbial degradation of plastics and rubber have not been determined.

20 * The decision to use MgO as backfill is not supported by data on its interaction with other materials at the site its impact on water at the site.

22 * The relationship between Salado permeability and gas generated pressures must be more accurate to validate the accuracy of predictions for radioactive emissions from human intrusion.

23 * Failure to model colloidal velocity is not justified.

24 * RH-TRU waste has not been included in models and may significantly alter synergistic effects.

20 * Borehole plug performance has not been verified by experimental data.

25 * Plans for institutional controls beyond WIPP's operational lifetime are unresolved.

20 * Compliance with 40 CFR 191 requirement for engineered barriers has not been demonstrated.

26 * Peer review for passive institutional controls, conceptual models, waste characterization analysis, and engineered barriers is incomplete. Peer review for conceptual models relates to different models than those used in the CCA.

**The SEIS II must assess the risk of transportation dangers.**

27 * Transportation, whether to WIPP or to consolidate waste at regional facilities for treatment, remains dangerous. Even under normal conditions with no breach of waste casks, DOE estimates latent cancer fatalities and deaths from transportation related accidents. The SEIS II does not even include non fatal or genetic harm from chemical and radiation exposure during transportation to WIPP. **Unless we can be certain that WIPP is a safe site and that WIPP will actually contribute to solving the nuclear waste problems experienced at nuclear weapons sites, transporting waste to WIPP is unjustified.**

28 * The corridor between LANL and I-25 is one of the most dangerous roads in the nation (see appended newspaper articles). The State of New Mexico recognizes the grave dangers of any transportation along the Pojoaque corridor, yet is not likely to address the problem in time for WIPP's scheduled opening.

29 Moreover, by opening WIPP in 1998, any shipments from LANL to WIPP will travel through downtown Santa Fe on St. Francis Drive. During the 1995 calendar year alone, the New Mexico State Highway and Transportation Department reported approximately one accident per day along St. Francis Drive in Santa Fe which involved at least one vehicle and entailed damages of $500 or more. Although many of these accidents were minor, they did involve slowing or stoppage of traffic. Currently DOE has no





alternate route for WIPP trucks stuck on St. Francis as a result of a traffic tie-up. Given DOE's own analysis that the largest contributor to collective population dose would be from accident-free doses to members of the public at stops, 5-12, WIPP trucks pose a danger to Santa Feans. **DOE's generalized assessment of traffic dangers to the public do not take into account the predictable dangers of accidents along the Pojoaque corridor or from stoppage of WIPP trucks on St. Francis Drive , nor do they consider the excessive risks posed by New Mexico roads, drivers and weather.**

30 * The WIPP Land Withdrawal Act and the Consultation and Cooperation agreement between New Mexico and DOE both contemplate construction of a Santa Fe bypass before any WIPP waste would be shipped from LANL to WIPP. DOE's change in plans which have escalated LANL-to-WIPP waste shipments has precipitated WIPP waste shipments down St. Francis Drive in contradiction to all negotiated agreements. WIPP can open without taking waste from LANL. **In order to avoid unnecessary risk to the public, CCNS recommends that no shipments of WIPP waste be allowed** from **LANL until safety improvements are in place on the Pojoaque corridor and a safe bypass which avoids WIPP waste shipments down St. Francis Drive is complete.**

31 * Nationwide, local communities ill equipped to respond to an accident involving release of radioactive waste. Even in New Mexico where DOE has concentrated emergency response efforts, DOE's satellite tracking alert system requires from one to five hours for regionalized staff to arrive at the accident. Providing adequate training, equipment, education and hospital facilities for all local communities may be prohibitive. Including an emergency response team with each shipment is also costly. **DOE's current transportation system by truck inadequately protects local communities. DOE must analyse the costs and benefits of rail transportation in comparison with escorted truck transportation which would include medical and emergency response personnel and equipment with each truck shipment.**

**DOE fails to consider the economic consequences of an accident involving nuclear waste transportation.**

Santa Fe businesses experienced a 30% drop in tourism business due to the perception of danger from the Hanta virus, which was detected hundreds of miles away from Santa Fe in Farmington, New Mexico. A WIPP related accident in New Mexico, even with no radioactive or hazardous release, could have devastating economic consequences. **DOE must analyse and consider the economic impact of the public's reaction to accidents involving radioactive waste.**

32

**DOE is not ready to ship RH-TRU waste.**

No RH-TRU shipping container nor even a base RH canister has been approved. The SEIS II should propose eliminating all RH-TRU shipments to WIPP in the face of this state of unreadiness. **Failing the elimination of RH-TRU shipments, DOE must drastically revise its shipping time schedule in recognition that CH-TRU disposal must wait for the emplacement of RH-TRU in each panel before the CH-TRU can be emplaced.**

33

34

**Untreated WIPP waste poses unnecessary transportation and disposal hazards.**

WIPP waste includes 141 radioactive elements, 47 organic and 13 non-organic contaminants of concern (CoC's). An individual exposed for one hour to organic and inorganic CoCs at concentrations meeting emergency response 3 (ERG3) guidelines would develop or experience a life-threatening effect. Exposure to ERG2 concentrations for one hour result in an individual "experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action." Although exposure time for SEIS II accident scenarios is considered to be less than 30 minutes, the ERG guideline concentration values indicate how dangerous these chemicals are. DOE's failure to consider exposure to these chemicals beyond a 1/2 hour limit seriously underestimates real dangers which could occur underground.

35

In addition, exposure to radioactivity is also dangerous whether from an external exposure from a TRUPACT or from inhalation or ingestion due to breach of a container.

**Waste treatment reduces the likelihood and consequences of exposure to radioactive, organic, and inorganic releases from spills, fires and earthquakes at generator sites, during transportation, and during emplacement operations and long-term disposal at WIPP. Both thermal treatment and shred and grout treatment provide safer waste forms for transportation and long-term disposal. However, the technological level of**

36





**expertise is not advanced enough to protect either workers at treatment sites or surrounding populations.**

36

**1. The proposed action cannot be endorsed because WIPP WAC standards do not provide adequate waste characterization, packaging and treatment.**

* DOE requires minimal analysis of the drum contents, using process knowledge (identification of waste contents based on estimates from records stating what process produced the waste) and Real Time Radiography (x-ray analysis) which has been known to miss free liquids.

37

* Original drums are repackaged in waste boxes and labeled for WIPP.

* WIPP WAC standards may change. Currently the WAC limits pyrophoric metals (like Plutonium which will spontaneously combust) and free liquids. No limit exists for hazardous metals.

* Because the WAC standard simply packages waste and does not bind or treat it, the WAC's usefulness is undercut by the high level of uncertainty for identifying the drum contents.

**2. DOE's plans for thermal treatment do not specify whether plasma torch/electric arch treatment, vitrification, or molten salt processes will be used. Nevertheless, the SEIS II analysis reveals the following problems with current thermal treatment technologies.**

38

* Thermal treatment is dangerous for workers and populations surrounding treatment facilities.

* Emissions from thermal treatment technologies cannot be fully controlled.

* Because of the high temperatures and pressures, danger exists from steam explosions.

* DOE's proposed thermal treatment plans involve increased transportation to consolidate wastes.

**3. DOE's proposals for shred and grout treatment are inadequate for the following reasons.**

39

* Shred and grout treatment Increases volume of waste and therefore the number of transportation shipments to WIPP.

* Shred and grout treatment involves consolidation of waste, thus increasing risks from transportation.

39 * Although no specific process has been identified, the shredding process has a high risk of fire because of the pyrophoric content of WIPP waste.

* Shred and grout treatment poses emissions dangers to workers and surrounding populations.

**As is often the case with DOE's plans, these SEIS II treatment alternatives need work. While CCNS endorses waste treatment before any waste is shipped to WIPP, we cannot support current proposals. We recommend research and experimentation of these and other waste treatments at a small scale to perfect waste treatment before full scale implementation of any treatment technology.**

**DOE must include the potential for human error into its risk analysis.**

SEIS II considers three accident scenarios to model the danger of exposure to individuals and general populations.

a. Spill of radioactive and hazardous waste from a waste drum is considered to be a relatively high probability with low consequence results.

b. Fire in a waste drum is a lower probability but higher consequence event.

40 c. Earthquake which exceeds site design projections is considered a low probability high consequence event.

**These accident scenarios assume that human error, admittedly a high probability occurrence, will yield low consequence results, whereas scenarios not dependent on human error, and less probable, will yield the higher consequence. The SEIS II fails to justify this assumption. Three Mile Island was a result of human error, but arguably had high consequences. Unless DOE revises the scenarios to include a high probability high consequence event, the SEIS II is inadequate.**

Thank you for this opportunity to comment on the SEIS II.





DANGEROUS HIGHWAY

EDDIE MOORE/FOR THE JOURNAL

**Gov. Gary Johnson held a news conference on Friday along U.S. 84-285 north of Santa Fe to explain a proposed bond issue for highway improvements. In the background, rescue workers deal with an accident that happened just before the conference.**

# Road Plea Tops $1 Billion

ALBUQUERQUE JOURNAL NORTH 2/8/97

*■ Two crashes preceded a news conference by officials who were stumping for highway improvement funds*

BY TOM SHARPE
*Journal Staff Writer*

Gov. Gary Johnson and two Cabinet secretaries gathered along a treacherous stretch of U.S. 84-285 near Santa Fe on Friday to dramatize their bid for a bond issue of more than $1 billion for highway improvements.

As if on cue, two accidents occurred in sight and within two hours of the news conference.

As police and rescue crews worked to clear the latter — an apparent rear-end collision for which an ambulance was called — Highway and Transportation Secretary Pete K. Rahn said the incident "just points out how dangerous New Mexico's roads are.

"This corridor from Pojoaque into Santa Fe is one of the most congested areas in New Mexico," Rahn said, adding that casinos along U.S. 84-285 at Tesuque and Pojoaque pueblos are aggravating the traffic problems.

Johnson said if the Legislature would fund his Citizens Highway Assessment Task Force's recommendation to float $1.2 billion

PAGE 1 *See* **FUND** *on* **PAGE 3**

# Fund Plea for Roads Tops $1 Billion

*from* PAGE 1

in bonds to improve roadways statewide, $78 million would be available for improvements to the 14-mile corridor between Santa Fe and Pojoaque within 18 months.

"More than 40,000 vehicles a day travel from Santa Fe to Pojoaque, and that number is expected to increase to 80,000 trips by the year 2015," Johnson said. "In the last five years, 100 to 140 accidents occurred along this corridor and 14 fatalities have been reported. This is not acceptable. ...

"Five out of the 20 most dangerous roads in the United States are identified as being in New Mexico. Investing in roads means better jobs, better incomes, more personal freedom for all of us. It's an issue that really isn't partisan. It's not pork. It's just practical."

Rahn said he did not have a complete list of the five roads, but among them were the U.S. 84-285 corridor between Santa Fe and Pojoaque, NM 44 between Bernalillo and to near Farmington and U.S. 666 in the Navajo Reservation.

A Santa Fe Democrat later countered that there are other ways to pay for road improvements and that Rahn is trying to "blackmail" the Legislature by threatening to turn over roads to the counties.

Public Safety Secretary Darren White said at Friday's news conference that the state has one of the highest traffic-fatality rates in the nation, despite efforts to promote the use of seatbelts and discourage drunken driving and speeding.

"All those are good steps and we're proud of the steps that we've taken," White said. "However, we still continue to rise in the area of traffic fatalities on our roadways and we believe that is due, in part, to the condition of our roadways. ...

**PROBLEM ROADS:** After the news conference, Highway and Transportation Secretary Pete K. Rahn talks about the state's plans for some of the problem roads.

EDDIE MOORE-FOR THE JOURNAL

We don't want our roads to be one of the hazards that our drivers have to face."

Rosalie Weil, an area resident who has lobbied for improvements to the intersection of Camino de la Tierra and U.S. 84-285 since 1988, said at the news conference that highway department officials recently notified her that bids would be let in March and construction would begin in July for a temporary stoplight at the intersection.

"Some of the lives lost and accidents that occurred could have been prevented if the highway department would have had the improvements they wanted to," Weil said. "I would strongly urge the Legislature to allocate the much-needed funding. With adequate funding, the roads and highways would be in much better condition than they are today."

Rahn said implementation of the task force recommendations would save 40 lives and prevent 777 serious injuries over the next five years.

"Roads are not just asphalt and concrete," Rahn said. "The 14 deaths that this highway has seen in recent years, most of those could have been prevented if the highway was designed and constructed the way we know it should be."

State Rep. Luciano "Lucky" Varela, a Santa Fe Democrat, said Thursday that the governor's administration is using the safety issue to push a debt onto New Mexicans for the next 20 years. Varela said there are "pay-as-you-go" methods of improving roads.

"I don't like being blackmailed by the highway secretary by him saying that he's going to turn roads over to the county if we don't give him what he wants," Varela said. "I don't think the Legislature is ignoring the issue, but there's got to be another way of doing it."

Varela said Johnson's plan calls for using about $70 million dollars in annual revenues from the 3½ percent excise tax on automobile sales, now allocated for other purposes, and by withdrawing about $17 million a year now spent on visitors' centers.

Photos by Craig Fritz/The New Mexican

**Highway Secretary Pete K. Rahn speaks during a news conference in front of the southbound lane of U.S. 84/285 Friday. Rahn and Sherman McCorkle, chairman of the Governors Business Advisory Council, stand on extra construction signs to stay out of the mud.**

# Plan would improve unsafe road

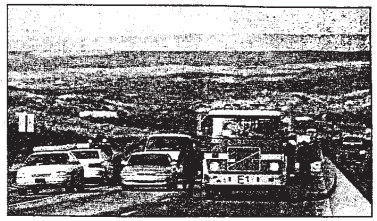
▶ *Gov. Johnson proposes spending $78 million to upgrade one of the nation's most dangerous stretches of highway*

2/8/97 A-1

By MONICA SOTO
The New Mexican

Gov. Gary Johnson unveiled a proposal Friday that would spend $78 million to upgrade the highway in the Pojoaque corridor and build overpasses along a road considered to be one of the 20 most dangerous stretches in the United States.

Minutes before Johnson stood on the west roadside of U.S. 84/285 near Tano Road to present his plan, two Chevrolet pickups and a Plymouth Neon were involved in a fender bender just north of there. Four people complained of minor injuries. It was the second accident in less than three hours.



**Before the news conference started, an accident occurred involving three cars. The traffic was backed up because one lane was closed for the media event. Once the governor heard the tires squeal, he had the pylons taken down to open the second lane, but by that time it was too late.**

"It's an issue that's not partisan, it's not pork," Johnson said. "It's just practical."

Under the proposal, U.S. 84/285 — which connects Santa Fe to Pojoaque — would include controlled access with interchanges and frontage roads at Guadalupe Street, Tano Road, Camino Encantado, the north and south Tesuque interchanges, Tesuque Flea Market, the Camel Rock interchange, the Tesuque Pueblo entrance and the Cuyamungue/south Pojoaque entrance.

It would also pay for new frontage roads, wider shoulders and improvements to existing lanes.

Tano Road residents for years have written the state Highway and Transportation Department requesting it lower the speed limit near Tano Road and build an acceleration lane to cut down on excessive traffic accidents and fatalities in the area.

"It's a terribly dangerous situation," said resident Mario Vanni, who has written the state since 1988 to push improvements. "You try to get on Tano (Road) at a quarter to eight in the morning and it's almost suicidal."

Peter Rahn, secretary for the state Highway and Transportation Department, said residents'

Please see ROAD, Page A-2

**Legislature 97**


- Lawmakers consider forming commission to decide early prison releases. Page A-4
- Attorney general says drive-up window compensation is a bad idea. Page A-4

THE NEW MEXICAN Saturday, February 8, 1997

# ROAD

Continued from Page A-1

concerns pushed the state to look into changes in the road design.

A night before he met with area residents last October, a tourist was killed when her husband tried to turn west on to Tano Road from U.S. 84/285.

The other vehicle was not visible from his line of sight and his Ford Taurus was gnarled in the accident, his 64-year-old wife killed.

The governor created the Citizens Highway Assessment Task force, to target road improvements. The group's recommendations are before the Legislature.

The National Transportation Safety Board listed, in addition to 84/285 to Pojoaque, U.S. highways 44 from Bernalillo to Bloomfield, 666 in the Navajo reservation in the northwest corner of the state and Interstate 40 west of Tucumcari as four of the 20 most dangerous highways in the nation.

**The National Transportation Safety Board listed U.S. 84/285 to Pojoaque as one of the 20 most dangerous highways in the nation.**

According to a study conducted by Louis Berger and Associates of Albuquerque, traffic accidents in the area increased from 103 in 1990 to 136 in 1993, or nearly 10 per mile annually.

On average, between 34,000 to 41,000 cars pass through the southern portion of the highway. They expect traffic volumes to increase to as many as 81,000 vehicles per day by 2015.

National Transportation Department guidelines call for a stretch of road to be redesigned if there are more than two accidents a year per mile on that stretch. Last year, the corridor produced more than 100 accidents and 14 fatalities.

Add commuters traveling at speeds ranging from 60 to 72 mph and the severity of the accidents increase, said Charlie Trujillo, design division director for the Highway Department.

"It's the type of accident, not necessarily the number of accidents," Trujillo said. The proposed changes "eliminates that conflict from happening."

If legislation is passed, Trujillo said the first project would be completed in 18 months, with the entire 15-mile road improvement plan finished in two to three years.

**CORRECTIONS**

*The New Mexican* will correct factual errors in its news stories. Errors should be brought to the attention of the city editor at 986-3034.



NEW MEXICO'S LEADING NEWSPAPER

ALBUQUERQUE JOURNAL

MADE IN USA HOME-OWNED AND-HOME-OPERATED DAILY 50¢

117th Year, No. 30 ■ 50 Pages in 5 Sections Thursday Morning, January 30, 1997 ■ Copyright© 1997, Journal Publishing Co. NORTH ****

# State Threatens To Dump Roads on Counties

## Funds Lacking For Proper Maintenance

By Pat Butler
*Journal Staff Writer*

The highway department has warned lawmakers and county officials that it might turn over 4,115 miles of state roads to the counties to maintain unless it gets more money from the Legislature.

The shift could mean further deterioration of roads because counties don't have the maintenance funds either, without raising taxes, said local officials trying to head off the move.

Pete Rahn, the New Mexico Highway and Transportation Department secretary, said the agency is asking the Legislature to return more than $100 million a year in road funds that now are diverted to the general fund.

If that doesn't happen, highway officials might have to shift the cost of maintaining the roads to the counties, Rahn said.

"We need to provide more funding or make the system smaller. That's where we're at," he said. "We've reached a point where the courts are holding us to a standard of maintenance that's unattainable."

Rahn pointed to a recent court case in Alamogordo in which the state was sued for not having a traffic light at an intersection where an accident occurred. "The judge ordered us not to use lack of resources as a defense" and the plaintiff eventually was awarded approximately $90,000, he said.

Rahn said the highway department manages 11,600 miles of state roads, but only can provide "a minimal level" of maintenance to about 7,500 miles with its current annual budget of $500 million.

That means the counties would find more than 4,000 miles dumped in their laps, which Sandoval County Manager Debbie Haye called "ludicrous."

"How do they expect us to get it done?" she said Wednesday. "It's robbing Peter to pay Paul. I don't see what it accomplishes except to put an additional burden on the counties. I understand they're in a bind, but it doesn't help the citizens of this state to pass the buck."

Donna Smith, executive director of the New Mexico Association of Counties, said many of the roads would continue to deteriorate or possibly be destroyed if they were given to the counties.

See HIGHWAY on PAGE A2

# Highway Dept. May Give Roads to Counties

*from* **PAGE A1**

"They could turn those roads over to us legally, but we can't maintain them," she said. "The last time this happened, some counties simply tore them up."

Rahn agreed the proposal would burden counties. However, he said that unless the Legislature approves his proposal, the department might have no choice but to "certify," or give the roads, to the counties.

"What we're really attempting to do is explain the point we're at with the roads and to clearly state this is an option we'll have to consider if we live with the existing dollars going to roads," Rahn said.

"The 4,000 miles we're talking about are the least-used roads in the state," he said. "But the consequences to the people along those roads would be phenomenal. There might not be anyone to plow their roads when it snowed or to fix potholes."

Rahn has submitted legislation requesting that $102 million in road funds be returned to the department in phases by 2001 and that the money no longer be diverted. The $102 million includes $85 million raised by a 3 percent tax charged when a vehicle is sold in the state.

The other $17 million is gasoline tax money. Rahn said the department wants to use that money to secure $1.3 billion in revenue bonds that would be used to "meet the state's most critical construction and maintenance needs."

"It won't solve all of our problems because our total needs are about $6.8 billion to bring our system up to national standards," he said.

The highway department currently has an annual budget of $500 million, according to Ron Gaines, a deputy with the department. The state's 17-cent-a-gallon gasoline tax and various fees generate approximately $300 million. The rest of the money comes from the federal government.

Because Gov. Gary Johnson has ruled out any tax increases this year and Congress wants to reduce the federal deficit, Gaines said highway officials don't expect new sources of revenue.

Rahn estimated the highway department has lost approximately $130 million in gasoline taxes since the money first was diverted to the general fund in 1987. Losses from the excise tax were more difficult to estimate because "it's a tax that's bounced back and forth over the years," he said.

Rep. Judy Vanderstar Russell, R-Rio Rancho, said Rahn briefed House Republicans last month on the situation. She said she will support returning the funds to the highway department.

"I believe that when people are taxed for a specific purpose, it shouldn't be removed and sent another purpose," she said.

**MILES STATE MIGHT SHED**

| COUNTY | MILES |
|---|---|
| Bernalillo | 126.202 |
| Catron | 189.569 |
| Chaves | 201.852 |
| Cibola | 119.073 |
| Colfax | 190.573 |
| Curry | 154.219 |
| DeBaca | 95.272 |
| Dona Ana | 93.969 |
| Eddy | 126.343 |
| Grant | 102.023 |
| Guadalupe | 81.113 |
| Harding | 61.501 |
| Hidalgo | 100.411 |
| Lea | 142.573 |
| Lincoln | 162.071 |
| Los Alamos | 13.930 |
| Luna | 67.089 |
| McKinley | 94.853 |
| Mora | 105.418 |
| Otero | 90.909 |
| Quay | 165.984 |
| Rio Arriba | 197.238 |
| Roosevelt | 149.087 |
| San Juan | 68.392 |
| San Miguel | 198.400 |
| Sandoval | 82.989 |
| Santa Fe | 105.028 |
| Sierra | 164.491 |
| Socorro | 233.383 |
| Taos | 65.369 |
| Torrance | 115.013 |
| Union | 198.862 |
| Valencia | 50.037 |
| **TOTAL** | **4,115.236** |

SOURCE: State Highway and Transportation Dept.

JOURNAL

**INSIDE STORY**

# Roaring Hilltop Traffic Turns Tano Turnoff Deadly

BY ARNE CONSTABLE

A New Jersey woman traveling north on U.S. 84/285 was killed instantly last week when her husband tried to turn left onto Tano Road. Their car was broadsided by a southbound driver as the couple crossed in front of oncoming traffic barreling over the crest of Tesuque Hill on the way into Santa Fe.

The intersection of Tano Road and U.S. 84/285, located on a curve at the top of the hill overlooking the city, is one of the most dangerous in Santa Fe. "We know to gun it, but these were just tourists," said Lois Goodman, a member of the Tano Road neighborhood association.

The crash was the second fatality at this location in six months. Another traffic death occurred last year just south of the Tano Road intersection at Camino La Tierra. The number of accidents in recent years ranges from a high of 15 in 1993 to a low of four each in 1994 and 1995. But there are so many near-misses, said Tano property owner Mario Vanni, that "people don't want to drive up Tano Road."

Motorists entering Tano Road must swallow their fear and cross two lanes of vehicles traveling as fast as 80 mph as they crest the hill into Santa Fe. By the time the southbound traffic is visible at the crest, the window of opportunity to cross is mere seconds. Motorists exiting Tano Road toward Santa Fe also are required to perform death-defying stunts. They must make a right turn onto the highway into the same line of high-speed traffic. The turn is complicated by trucks that frequently are parked on the dirt shoulder and by a seven-foot drainage ditch called the "elephant pit."

"We have a lot of geriatrics living here. We're not that quick any more," Vanni said.

There are no signs to warn speeding southbound drivers on the highway that they are approaching a dangerous and congested area.

Residents of the area have complained for years to the State Highway Department. They repeatedly have asked that the speed limit, officially 55 mph at the intersection, be lowered to 45 mph. They point out that from 1987 until recently there was a 45 mph advisory plaque posted north of the intersection because it does not meet American Association of State Highway and Transportation Office standards for sight distance. A study by Berger & Associates, a consultant to the Highway Department on the Pojoaque corridor, suggests that the design speed of the road at various locations, including this one, is 40 mph.

Neighbors urged the department to lower the speed limit at a public meeting on Sept. 17 and again two days before the fatal accident when they met with Highway and Transportation Secretary Pete Rahn. That meeting was arranged by state Sen. Roman Maes, D-Santa Fe. They also have recommended a formal on and off ramp at Tano Road, bans on left-hand turns from Tano Road and on parking at the intersection, and a barrier and reflectors around the drainage hole adjacent to the intersection. The weekend following the fatal accident, highway workers installed reflectors, but no further action has been taken.

**There are so many near-misses people don't want to drive up Tano Road.**

Arbitrarily reducing the speed limit won't slow traffic down, the Highway Department argues. "People drive at the speed they are most comfortable with, whatever the speed limit," said Robert Romero, the department's Pojoaque project engineer. This "comfort level" is one of the factors used in setting the speed limit. Highway officials look at the maximum speed used by 85 percent of the motorists. If the speed limit is set well below this, Romero said, some motorists will drive the posted limit while others continue to drive their comfort level. The result will be serious rear-end accidents. Tano Road's Vanni questioned that reasoning. "Why have speed limits at all?" he asked.

Highway Department officials also have maintained that it is actually safer and easier for motorists entering the stream of traffic when the cars are moving faster. At higher speeds, there are more spaces created between packs of cars. Vanni said, "This doesn't make sense to me either."

Various scenarios from widening the highway to six lanes to lowering Tano Road by 18 feet and building a bridge/overpass have been proposed to make the corridor safer. But there is no money in the state budget for improvements to this intersection or to the many other dangerous roadways in New Mexico, department officials say. The state has a backlog of $6.8 billion in needed improvements but funds only $220 million a year. "The gap keeps getting wider and wider," Highway Department official Charlie Trujillo said.

Maes has vowed to keep trying. If there is no relief for Tano Road residents forthcoming, he says he will appeal to the State Highway Commission to lower the speed limit. "Safety comes first," he said. Meanwhile, traffic congestion will only get worse. Major new developments in the northwest sector will adds thousands of new cars daily to the highway. And the opening of the Waste Isolation Pilot Plant project near Carlsbad may mean that some vehicles will be carrying nuclear waste. ■

B-4 THE NEW MEXICAN Friday, February 21, 1997

# New Mexico in brief

## 12-car pileup stalls traffic on U.S. 84

A 12-car pileup on U.S. 84/285's Santa Fe Hill stalled southbound traffic for about two hours during Thursday morning's rush to work.

According to Capt. Ron Madrid with the Santa Fe Sheriff's Department, the driver of a Dodge truck slowed while passing in the southbound left lane and was rear-ended by another vehicle shortly before 8 a.m. The collision led to a chain reaction involving 10 more vehicles slamming into each other in a line behind the original accident, he said.

Officers closed one southbound lane for about two hours after the incident, causing a backup in traffic.

Two people, Andrew Beveridge, 53, of Cuyamungue, and Joan Cruz, 43, of Española, were taken to St. Vincent Hospital for treatment to minor injuries and released, Madrid said. No others were hurt.

Madrid said the driver of the Dodge was not at fault but that citations will be issued to several of the drivers for "following too close."



THE SANTA FE NEW MEXICAN

Thursday, November 7, 1996

The West's Oldest Newspaper
Founded 1849
Robert M. McKinney, Editor and Publisher
Billie Blair, Associate Editor and Publisher

William W. Waters, Editorial Page Editor
Robert Dean, Managing Editor

202 E. Marcy St. · Santa Fe, N.M. 87501-2048

# Española-road dangers demand action now

State highway officials know darn well that the Santa Fe-Española highway is a dangerous one: They've begun a long planning process aimed at easing the traffic load and reducing the risk of accidents on U.S. 84-285.

That's fine, as far as it goes — but it goes nowhere toward saving lives between now and the time that heavily traveled route is a six-lane superhighway, or four lanes supplemented by frontage roads, or whatever the highway planners come up with.

Among the possibilities for one of that route's worst stretches, the top of Opera Hill coming in to — or leaving — Santa Fe is paring away the summit, giving drivers a longer look down the road. Interchanges are another — expensive — idea. Between citizens speaking out at public meetings and engineers' ingenuity, we're sure some good plans will emerge.

Those plans, however, will be too late for Joan Goldfisher, who died in a collision late last month at the highway's intersection with Tano Road. Will they also be too late for others who take their lives in their hands day in and day out on 84-285?

Northern New Mexico needs more than creative thinking at long range; we also need it *now*.

Is the speed limit too high? Fifty-five mph, moving to 65 down the hill, may be too many mph for today's dangerous conditions — which include bumper-to-bumper traffic during rush hours.

Perhaps some stark warning signs would help — not the usual bland cautionary black-on-yellow diamonds, but some with eye-catching language warning drivers of potential hazards.

Our suggestion: Signs saying something like "Crossing traffic; daytime headlights advised."

We're not totally sold on the Nadderesque trend toward full-time "driving lights," which are as likely to blind oncoming traffic as warn drivers of other cars' presence. In high-hazard areas, however, motorists should be warned to turn on their headlights — and to keep them dimmed.

To do nothing but say "Gee, it's a dangerous road — but it'll be better when we fix it," would be negligence bordering on criminal.

Surely, there are some sharp engineers out at highway-department headquarters who would like to earn their spurs as lifesavers.

To the drawing-boards, folks — there's no time to lose!

11-13-96
SF Reporter

### It's Scary

I must respond to the Inside Story [Nov. 6: "Roaring Hilltop Traffic Turns Tano Turnoff Deadly"] concerning traffic on U.S. 84/285 at Tano Road. I drive this section every weekend, and it's scary when I am driving five or 10 miles over the 55 mph speed limit and am passed by pinheads going 70 or 80 mph. And many times, if these clowns can't pass me right away, they tailgate me until they can pass. I know that I am driving safely and responsibly and that they are breaking two laws — speeding and tailgating. I wonder, why isn't there a police officer pulling these hotdogs over and giving them expensive tickets?

And this highway engineer, making statements that people will drive their comfort level" no matter what the speed limit and if someone is driving the speed limit there will be serious rearend accidents — how irresponsible can you get?

This guy is supposed to make the highways safe, not encourage and condone hazardous driving. No wonder that section of highway is so dangerous if that's the level of thought and attitude coming from the highway engineer. Shame on him and shame on those who speed.

JACK L. PRESSLER
*Santa Fe*



# Crash Injuries Fatal to Woman

*Journal Staff Report*

A 27-year-old Tesuque woman died Monday as a result of head injuries she suffered in a Saturday morning auto accident on U.S. 84/285, Santa Fe police said.

Beatrice Winger apparently lost control of her 1993 Toyota 4Runner at 7:08 a.m. just north of Alamo Street, said Sgt. Tim Gallegos.

Winger was pronounced dead at St. Vincent Hospital on Monday, Gallegos said. He said Winger underwent surgery for massive head injuries on Saturday, and family members and relatives flew in from Germany to see her at the hospital.

Police think Winger might have lost control because she was driving in a mixture of rain and snow, Gallegos said. She was wearing a seat belt, he said.

Anyone who witnessed the accident is asked to call police at 473-5080.

Journal North
11-19-96

# Planned road improvements wouldn't include Santa Fe bypass

11/13/96

By KAREN PETERSON
The New Mexican B-1

The state Highway and Transportation Department on Tuesday received preliminary approval to issue $100 million in bonds for road improvements, despite criticism from legislators concerned about the rising level of state indebtedness.

Most of the money would be used to finish widening U.S. 285 from Chaves Corners to the Waste Isolation Pilot Project near Carlsbad from two lanes to four lanes. None of the money would be used for a Santa Fe bypass, which would route waste bound for the planned underground plutonium-contaminated waste storage site around the city.

The state Legislature approved the bonds 19 years ago, but they were never issued because of delays in opening WIPP. Now, however, the nuclear waste storage site could open as early as November 1997, and on Tuesday, the state board of finance gave preliminary approval to the bond sale.

But with the state facing both budget shortfalls and more than $150 million in new debt to finance prison construction, several legislators say issuing the highway bonds now could compromise the state's credit rating.

Legislators also expressed outrage at a request — expected in Republican Gov. Gary Johnson's 1998 budget — to approve $1.25 billion in additional road construction bonds to fund highway projects across the state.

"We're flirting with the undertaker here," said Rep. Max Coll, D-Santa Fe.

Highway Department Secretary Pete Rahn told Legislative Finance Committee members that the bonds would, in effect, be second and third liens on the state road fund, with repayments covered by payments from the federal government and from increased road-fund revenues.

The $100 million in WIPP-route bond money would be financed, at least initially, by the first, $20-million installment on a projected $200-million payment, spread over 15 years, from the federal government. The first installment is committed to WIPP road construction, but subsequent installments go to the governor of each state involved in WIPP and can be spent at his discretion, Rahn said.

Legislators said that if future governors decide not to earmark the money for roads, then future payments on the WIPP bond issue may have to come from the state road fund.

Johnson plans to repay the $1.25 billion bond issue by returning to the road fund $17 million in gasoline tax revenues currently diverted elsewhere. Johnson also would give the road fund all revenues from the state's 3 percent vehicle excise tax. Currently, those revenues go to the general fund.

Johnson made a similar proposal to the Legislature last year. The measure failed to pass, although the Legislature did send the governor a bill that would have allowed Johnson to issue the bonds if he raised gasoline taxes. Johnson vetoed the measure.

Senate President Pro Tem Manny Aragon said Johnson's plan to divert money from the general fund in a year when the state faces a possible $80 million shortfall in the Medicaid budget as well as slower revenue growth because of a downturn in the economy "just is not a very good plan."

Johnson should consider raising taxes instead, Aragon said.



CARLSBAD CURRENT-ARGUS

November 2, 1996 Serving Eddy County, New Mexico 18 Pages

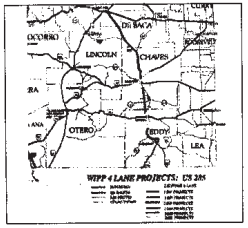
# State to get big road funds

## $300 million project will make U.S. 285 four-lane highway

By YONI WALKER CHIRI
Current-Argus staff writer

Current-Argus Photo/Alfred J. Hernandez

New Mexico Gov. Gary Johnson delivers a speech during an announcement Friday of a new road project which will widen U.S. 285 from Chines Corners to Carlsbad.




CARLSBAD — Gov. Gary Johnson announced Friday that $300 million in road money provided by the Department of Energy for WIPP transportation routes will be used to widen U.S. 285 to a four-lane highway from here to Chines Corners.

Johnson joined Sens. Pete Domenici, R-N.M., Jeff Bingaman, D-N.M., Rep. Joe Skeen and members of the state Highway and Transportation Department and the state Highway Commisson at the WIPP bypass road north of town for the announcement.

Johnson said he chose to use all of the money for the four-lane highway and "really make a difference" rather than "spread it out" among different projects.

The money - $20 million a year for the next 15 years - must be used on transportation routes to the Waste Isolation Pilot Plant.

The five-year project is expected to cost $241 million, Johnson said, adding the state will use the $20 million a year to support bond issues for the project.

"I think you (Johnson) made a very, very wise choice in the use of these road funds," said Domenici.

"Great things are happening in Carlsbad and Eddy County," Domenici said, giving praise to "great local leaders" who have tirelessly worked in support of the WIPP.

Skeen garnered hearty applause from the crowd of about 25 people at the event following a spirited statement: "Isn't it wonderful when a good plan comes to fruition?"

"Thanks to the people here," he said, "who came to Washington time after time after time," lobbying for WIPP and WIPP money. "We're a can-do people, not a can't-do people."

Bingaman also gave credit to the governor for his decision.

"This will be a great boon not just to waste transportation to WIPP, but for economic development in southeast New Mexico," he said.

> "This will be a great boon not just to waste transportation to WIPP, but for economic development in southeast New Mexico."
>
> U.S. SENATOR JEFF BINGAMAN

Pete Rahn, secretary for the Highway and Transportation Department, plans to have five projects under contract by May, including the Carlsbad relief route and the so-called "bridge to nowhere" north of town.

Construction on U.S. 285 from Carlsbad to Artesia is slated for 1997 and 1998. Rahn prioritized construction based on highway condition - the worst stretches of highway repaired and expanded first.

William Kaiks of Artesia, chairman of the Greater Artesia Chamber of Commerce Economic Development Committee said the highway gives southeastern New Mexico the ability to compete for industry.

"We have so many advantages, so many resources, but our lack of transportation infrastructure has restricted our ability to grow," he said.

Highway Commissioner Sid Strebeck of Clovis said this is probably the first time in history southeast New Mexico has received this much money for roads.

Current-Argus Photo/Alfred J. Hernandez

Pictured from left, U.S. Representative Joe Skeen, U.S. Senator Jeff Bingaman and U.S. Senator Pete Domenici listen in as New Mexico Governor Gary Johnson delivers his announcement of a new road project to make U.S. 285 a four-lane highway from Carlsbad to Chines Corners.

# Bonds OK'd for U.S. 285 Widening

## Lawmaker Says $100 Million Plan Threatens State's Credit Rating

By Peter Eichstaedt
*Journal Capitol Bureau*

11/13/96
C3

SANTA FE — The State Board of Finance on Tuesday gave preliminary approval to the sale of $100 million road construction bonds, but one legislator said the move is irresponsible.

Gov. Gary Johnson, acting as chairman of the board, said Tuesday the money would be spent to make U.S. 285 a four-lane road from Clines Corners to Carlsbad.

Johnson said the project is a "top priority" with him. The project will expand the highway for the planned opening of the Waste Isolation Pilot Plant and open up southeastern New Mexico for economic development, he said.

But Rep. Max Coll, D-Santa Fe, said the bond project threatens the state's financial rating as one of the top three most sound states in the union and, if Johnson proceeds, he should be removed from office.

"We're flirting with the undertaker to do this. I think it does jeopardize our credit rating," Coll said. "We ought to impeach him if he ruins our credit," Coll said of Johnson. Coll made his remarks at a meeting of the Legislative Finance Committee, of which he is the vice-chairman, which was meeting on the road bond issue at the same time the board was approving the sale.

Coll said the bond sale stretches the state's credit too far and will use up money that future Legislatures and future governors may want to spend on other projects.

Coll said it may be illegal for the Johnson administration to make such a large commitment that will require a payoff over the next 15 years.

Johnson's spokespeople were unavailable late Tuesday for comment on Coll's remarks.

John Kormanik, director of the Board of Finance, said the proposal would use the $20 million per year in federal road improvement funds that has been committed to the state for the WIPP project to pay off the bonds.

But Kormanik said that in order for the state to get a good bond rating, it needed to agree to pay off the bonds using the state's Road Fund in case the federal money did not materialize. The state's fund gets about $116 million per year from New Mexico's 17-cents per gallon gasoline tax and about $37 million per year from the motor vehicle registration fees, he said.

Final approval of the bond sale won't come until the board meets in mid-December, Kormanik said.

Pete Rahn, secretary of the state Highway and Transportation Department, said the proposed bond sale is "a very flexible arrangement."

On a separate matter, the committee also heard comments from Robert Desiderio, chairman of the state's Tax Policy Committee, who said the committee is not proposing a tax increase for the state.

Desiderio, a University of New Mexico law professor, said the committee has been studying the state's tax system and plans recommend changes to make it more fair and equitable.

Among those changes are to eliminate about 75 deductions and exemptions from the state's gross receipts taxes. This would raise about $260 million, he said. It would also allow the state to reduce the gross receipts tax rate by at least 1 percent or more, he said.

Removing these exceptions, such as the tax on out-of-state goods that are sold to New Mexicans via catalogs, would help many small businesses who must pay gross receipts taxes on their sales.



2-18-97 NewMexican

## Road money

Anyone who drives Highway 84/285, commonly known as the "Pojoaque Corridor," knows the highway is in dire need of repair, but why spend state money when consideration should be given to using federal funds coming to the state for improvements to WIPP routes?

The Transportation Secretary and Department of Public Safety director listed the Pojoaque Corridor as one of the Highways targeted for improvement by the Citizens Highway Assessment Task Force (CHAT) formed by the governor in 1995.

Remember the Pojoaque Corridor is a major Waste Isolation Pilot Project (WIPP) route. I am amazed that the governor chose to not include this stretch of highway among those roads to be upgraded with the $100 million federal money authorized to improve WIPP routes. Instead, the governor plans to use the entire $100 million for improving the WIPP route (Highway 285) south from I-40 at Clines Corners to Carlsbad.

Why would the governor, who recognizes the Pojoaque Corridor as a dangerous road with needed improvements, not allocate some of the federal WIPP funds for the Corridor? Instead the governor's proposal to improve roads based on CHAT recommendations, will take a significant amount of money from the General Fund.

That's a terrific impact on education funding from the state. Estimates show the governor's proposal for highway improvement will impact the General Fund by about $2.6 billion in 20 years and impact Education by $I. 7 billion in 20 year.

For every dollar the governor takes from the General Fund for the State Road Fund, education for our students in New Mexico will be impacted by at least 65 cents. Out of the $2.6 billion, about $1.7 billion for education will be hit directly. Therefore, I would ask that the governor's priorities for the federal WIPP money include the improvements for Highway 84/285, the Pojoaque corridor.

**Rep. Ben Lujan**
Majority Whip
House of Representatives
Nambé

Craig Fritz/The New M

**Melissa Salazar uses her rear-view mirror to keep an eye on both the road and her son Jonah, who rides in back in a child safety seat. The travel the corridor several times a week between Española and Santa Fe.**

# DRIVE

**Continued from Page A-1**

air bags," she said.

The state Highway Department in 1988 began to study the 14-mile road between Alamo Drive in Santa Fe and Camino Villarrial in Pojoaque. By 1990, consultants came up with plans for a complete overhaul of the interchange at the heart of the corridor — the point where U.S. 84/285 and N.M. 502 to Los Alamos meet.

The interchange at Pojoaque is the first of three phases planned for the Santa Fe-Española corridor.

The second phase of the project will focus on the area north of the interchange and will include building frontage roads and widening an existing bridge over the Tesuque River on County Road 84.

The new frontage roads will improve local traffic access to businesses in Pojoaque without entering U.S. 84/285.

Expected to cost $4 million, the second phase likely will begin this summer.

The third phase, for which there is no funding, consists of two new signal intersections on U.S. 84/285 and frontage roads on both sides of the highway. It will also include closing some existing highway entrances.

Another planned project includes completion of the Santa Fe Relief Route, a highway bypass around Santa Fe's west side that will ease access to U.S. 84/285 from Interstate 25. The new road will reduce congestion through Santa Fe and connect with U.S. 84/285 at Camino La Tierra, south of where the highway corridor intersects with Old Taos Highway.

Although the relief route has been designed, it could take years to complete.

The department is still considering other options to alleviate traffic congestion, such as the implementation of a park-and-ride system for commuters or widening the road from four to six lanes. New interchanges have already been planned for several highway entrances, including those at Tano Road and Camel Rock Casino.

The entire corridor from Santa Fe to Española carries about 40,000 cars a day. That figure is expected to double in the next 20 years.

A state study will examine alternatives to increasing road capacity and help establish a master plan, said Charlie Trujillo, design division director with the Highway Department.

The study also will examine water and air quality and safety issues, as well as any potential cultural impact road work will have.

"Basically, it is establishing the purpose and needs for improvements, and what those improvements are going to look like," he said.

The Santa Fe City Council is expected to vote Wednesday on its preferred option for the Pojoaque corridor study.

Gov. Gary Johnson recently held a roadside news conference to push a $78 million proposal to upgrade the highway through the year 2000. The money would go toward improving the road surface along the entire corridor and to build new traffic interchanges.

The funding plan has been introduced in the state Legislature this year and is pending before a committee.

The money, officials said, would go a long way to provide much-needed improvements.

Federal guidelines call for the redesign of roads that have more than two accidents a year per mile. Last year, the Pojoaque corridor produced more than 100 accidents.

Between 1991 and 1996, there were 13 automobile accidents with 14 fatalities. Ten of those were at intersections.

Robert Romero, a project engineer with the state Highway and Transportation Department, said the combination of high speeds and several intersections make for dangerous situations.

Cars entering the highway sometime create a danger in places such as at Tesuque, where drivers crossing into southbound lanes rush into traffic.

"You come upon them, and they don't seem to wait in the waiting lane," said Barbara Serna, who commutes between Santa Fe and Española six days a week. "They just cut right into the highway."

And some residents of Tano Road say entering U.S. 84/285 is a risky proposition — and crossing the highway even more dangerous.

"We've all had close calls," said Mario Vanni, who has lived on Tano Road for 15 years. "If your car coughs while you're making that turn, you're dead."

The highway crests a hill at the Tano Road intersection, which reduces visibility for vers along U.S. 84/285.

Vanni, a former president the Tano Road Association, s he would like to see a traffic nal or warning lights installe slow drivers — and reduce potential accidents — along t section of highway.

"It's hair-raising," he said. you try to get on the highwa around 8 in the morning whe lot of state employees come down the road, it's almost su dal."

Amado Summers said he h seen traffic grow exponentia in the 35 years he has lived o Tano Road, on which there a now almost 200 households.

"That intersection is a real killer," he said. "It's a real th getting in and out with my h trailer."

Debra Wyand, current pres dent of the Tano Road Associ tion, has attended several pu meetings about the corridor. would like to see changes co more quickly.

"We'd just like to live long enough to see the improvements."

## Hazardous highways

Four stretches of road in New Mexico are listed among the 20 most dangerous in the nation, according to the National Transportation Safety Board:

- U.S. 84/285 between Santa Fe and Pojoaque.
- U.S. 44 between Bernalillo and Bloomfield.
- U.S. 666 in the Navajo reservation in the northwest corner of the state.
- Interstate 40 west of Tucumcari.

SANTA FE Connections

where friendship, romance & adventure are on call

See Pasatiempo and Sunday's paper

THE SANTA FE NEW MEXICAN

*Once a Year!*

Floor Clearance

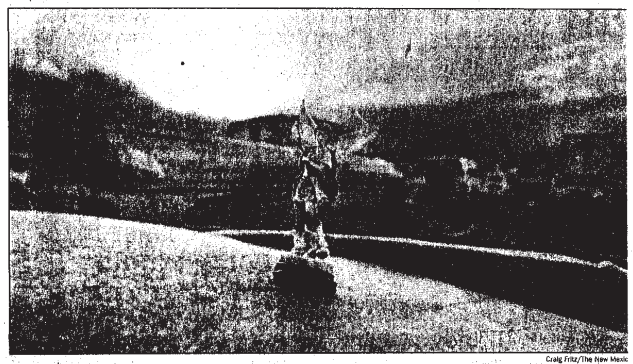
Home delivery rate $3.25 wk



*For many commuters, negotiating the 'hair-raising' stretch of highway between Española and Santa Fe is 'almost suicidal'*

Santa Fe New Mexican 7/13/97

# Drive of faith



Craig Fritz/The New Mexic

**A figure of St. Michael sits on the dashboard of the car that Melissa Salazar drives in rush-hour traffic between Española and Santa Fe.**

*▶ After finishing Pojoaque interchange, state looks at adding frontage roads, interchanges — and for money to do it*

By BRUNO J. NAVARRO
The New Mexican

**■ Highway chief says state is 'behind the curve' on road maintenance. Page A-2**

Geri Galván's daily commute between Española and Santa Fe takes a bit of faith.

The highway she drives each morning and afternoon — U.S. 84/285 — is listed by the federal government as among the 20 most dangerous roads in the nation.

Galván, a state employee who car pools with her husband, Dennis, and her sister, has had three accidents on the highway herself during 18 years of commuting.

"I say a prayer every morning before we get on the highway," she said.

This summer, the state expects to complete a new $10 million interchange at Pojoaque, an area that some commuters call the most dangerous part of the highway — and the site of two of Galván's accidents.

When completed, the project will result in a faster, safer drive between Española and Santa Fe.

However, the highway still needs more improvements that are threatened by a lack of state money, state officials said.

Housing developments north of Santa Fe in recent years have added traffic and changed driving patterns.

"It's just scary," said Galván, who has had two accidents by Pojoaque and one by what is known as Opera Hill. "It's not a relaxing drive anymore."

Melissa Salazar deemed the drive dangerous enough to warrant buying a newer, safer car.

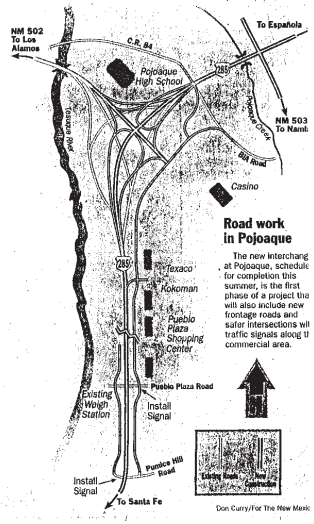
Salazar, a state employee who commutes from Española to Santa Fe several times a week, drives her 2-year-old son, Jonah, to a day-care center on her way to work.

Her previous vehicle, a 1984 GLC Mazda, was adequate for driving the corridor alone, but Salazar said it did not feel safe enough once she started driving with her son.

Now, her son rides in a 1994 Nissan Altima strapped into a child safety seat.

"He's still too small to be in the front seat because of the

Please see **DRIVE**, Page A-2




Don Curry/For The New Mexic

Comment C-142

2/13/97

COMMENT FORM

If you would like to make a statement or express an opinion on the Waste Isolation Pilot Program ( WIPP), but would prefer not to speak up during the meeting, we would like to hear from you. Please take a few minutes and express your opinion. Your opinion is important to us. Thank you for your interest.

Name: Morris B Pongratz

Address: P.O. Box 30
Los Alamos, NM

1 WIPP - Just do it!

Comment C-143, Page 1 of 2

My name is Roger Wishau I am a resident of Los Alamos. On behalf of my family, including my wife and our four children ages 9, 8, 5 and 1 I would like to address the issue of Waste Isolation Pilot Plant.

First, I thank the County Council for sponsoring this meeting on this important subject. My remarks are in support of the opening the WIPP. I am a student at the University of New Mexico and am presently enrolled in a class called Radioactive Waste Management CE 539. Here I learned about the detailed design and planning, research and development that went into the WIPP. Today constructed in Carlsbad stands the world's

1 most advanced deep geologic waste repository. The WIPP is a state-of-the-art facility engineered to solve a real problem for the world we live in " disposal of transuranic radioactive waste (TRU)."

This problem is a national problem, as well as, a New Mexico problem and it's a Los Alamos problem. Today, thousands of drums of transuranic waste are stacking up at interim storage sites. Many of the nations drums

2 are right here in our own home town of Los Alamos and we must do something. Drums that are stacked in a casino tent-like structures are not a long term solution to the problem.

WIPP is a long term solution. I encourage the Council to support completion of the WIPP. I encourage the Council to support the DOE and to support the completion of the remaining EPA certification steps

Comment C-143, Page 2 of 2

1 because I care about our community and our environment. I support the WIPP because I care about my children and God willing my children children and greatgrand children. I know this Council cares to therefore I my plea you will do everything in your power to also support the timely completion and operation of the Waste Isolation Pilot Plant. Thank you.

Comment C-144

2/13/97

**COMMENT FORM**

**If you would like to make a statement or express an opinion on the Waste Isolation Pilot Program ( WIPP), but would prefer not to speak up during the meeting, we would like to hear from you. Please take a few minutes and express your opinion. Your opinion is important to us. Thank you for your interest.**

**Name:** ROBB MINOR

**Address:** 103 ROVER

LOS ALAMOS, NM 87544

1 I feel it has been proven, conclusively, by the scientific community that risk of TRU-waste storage at the WIPP is minimal. Therefore, I heartily endorse the WIPP EIS and support WIPP operation as soon as possible.

## Comment C-145

*Concerned Citizens of Cerrillos, POB 245, Cerrillos, NM 87010*

SEIS-II on WIPP
P.O. Box 9800
Albuquerque, NM 87119

Feb. 25, 1997

Re: Comments from Concerned Citizens of Cerrillos: SEIS-II on WIPP

AFTER REVIEWING the SEIS II on the WIPP, and after having followed this issue for years, we are under the opinion that none of the proposed six alternatives (SEIS-II) are now apropos.

The WIPP continues to be, instead of a solution to our N-waste problems, a tremendous waste of money. Since it has not been determined that opening WIPP will really help contribute to safely solving the N-waste problems, we think that this operation should be slowed down. Since the DOE puts no deadline of when N-waste production will end, future accumulation of waste would make the WIPP essentially of little value as a long term solution to a continuing problem.

The WIPP should probably never be opened. It continues to be geologically and hydrologically suspect. It has long appeared to be too connected with the biosphere via water and should not be, for that reason alone, considered for the long term storage of long lived nuclear waste. Also the alternatives proposed in the SEIS II do not address the larger nuclear waste contamination problems at DOE sites, nor the accumulations of TRU waste. As has repeatedly been the case, the proposed solutions appear short sighted. The time frame under consideration of 35 years of future waste production does not consider the continuing of waste production beyond this time period.

Nuclear waste transport too becomes suspect in light of these uncertainties. We believe most nuclear waste should be put in long-term storage at the facilities in which they are generated. The people who live around these facilities and have the most to loose should have some choice in the care and security of these wastes while we continue as a people to research for a solution that is not so questionable and irreversible. DOE must make room for an option for stopping all N-waste production.

WIPP should not soon be opened because of the unresolved health and safety issues, the questionable geology and hydrology issues regarding the location and consequent design of the WIPP. It is therefore also not justifiable to transport waste through the biosphere to a site with so many uncertainties.

This site was chosen not for reasons of geologic suitability but for political expedience. It is our observation that the "site selection process" was flawed from the beginning. As an article in the Albuquerque Journal of April 9, 1978 expressed it: "Failing Potash Firm Started Push for Carlsbad Disposal Site".

Ross Lockridge, President

Ross Lockridge

## Comment C-146

Feb. 25, 1997

To: WIPPSEIS
P.O. Box 9800
Albuquerque, NM 87119

FROM: W.L. HAMPSON
8145 Roe Ln
Boise, ID 83703

Subject: WIPP Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS-II)

COMMENTS ARE AS FOLLOWS:

1
- No Action is totally unacceptable

2
- The Proposed Action seems reasonable however the schedule should be accelerated and the use broadened ASAP!
- Transportation should not be a decision factor since experience to-date has been excellent. Of course, continued vigilance and close surveillance, to insure regulations are met, must be continued and probably enhanced where analysis indicates that to be necessary.

1
- Good Luck with the acceptance and utilization of this very important and overdue project!

Sincerely,

Walter L. Hampson
PH: 208 853 0814
FAX: " " 7528

## Comment C-147

To Whom it May Concern:

Dear Sirs,

1 We, as citizens of Denver are very disturbed about your plan for hauling nuclear waste down I-25. Please think of the terrible consequences and leave it safe in above-ground storage. Thank you,

Nena HOeprich

Nena HOeprich
1061 So. Ames
Lakewood, C.O .

## Comment C-148, Page 1 of 3

US Dept. of Energy
WIPP Draft SEIS II
PO Box 9800
Albuquerque, NM, 87119

February 26, 1997

Dear Official,

The following are some comments on the Waste Isolation Pilot Plant (WIPP) draft Supplemental Environmental Impact Statement, volume II (SEIS-II).

1 1. The impacts of storing medium level radioactive waste at WIPP on nearby aquifers have not been adequately assessed. The WIPP site was originally chosen in the 1950's because geologists believed that no aquifers occured on site. This assumption has since been proven wrong. The storage of radioactive waste at WIPP will likely result in leaching of plutonium into the water supply surrounding the proposed WIPP site. An aquifer contributing to the Pecos river as well as an underground salt reservoir underlying the site are transport mechanisms for radioactive material to contaminate larger water bodies, such as the Pecos, which runs into the Rio Grande, which feeds the Gulf of Mexico. The possibility of radioactive contamination of affected water bodies has not been adequately assessed by the Dept. of Energy (DOE) in the SEIS-II.

2 2. The DOE claims that the agency will be able to warn people of the dangers of digging around the WIPP site for the duration of the period of radioactive waste neutralization, which is estimated at approximately 260,000 years. It is uncertain at this time whther the English language will even be understood this far in the future. The agency can in no way guarantee that future generations of the next quarter million years will be adequately warned of the dangers of disturbing earth at the WIPP site. I am opposed to WIPP because its

3 use as a radioactive waste dump will certainly endanger the lives of future generations, as well as current ones.

4 3. The probability of and response to accidents during transport of radioactive waste to the WIPP site have not been clearly presented or thoroughly analyzed in the draft SEIS II by DOE. The

5 shipping of three truckloads per day of radioactive material through Denver or its outskirts for the next thirty or so years presents an

5 extreme public health hazard. The Denver metropolitan area is densely populated and the DOE cannot predict the consequences of a radioactive spill. Local volunteer fire departments along the route to WIPP do not have adequate training to deal with the immediate
4 impacts of a radioactived waste spill. Also, the turnover of volunteer fire people in rural communities is relatively high, so fire people who are trained one year to clean up an accident site may not be volunteer fire people the next year.

4. Crash tests on the radioactive waste containers were inadequate and inconclusive. Interestingly, DOE refused to perform a crush test on the "TRUPACT II", the type of container designated to carry the waste should WIPP open. The absence of a crush test and
6 the agency's refusal to perform a crush test on TRUPACT II indicate that the container is flawed and will not sustain a crash if it is damaged severely. Even the International Atomic Energy Agency requires their transport containers for radioactive materials to undergo a crush test. WIPP should not receive approval until this test is performed and the TRUPACT II is determined to be safe enough to haul three truckloads daily of radioactive material through Denver to the site.

5. WIPP sets a negative precedent for use of public lands because it relies on the WIPP Land Withdrawal Act of 1992 to operate. Taking land out of the public domain and placing it under the permanent jurisdiction of DOE is undermining the public interest. Congress used its powers to pass the WIPP Land Withdrawal Act to
7 ensure that DOE would have control of the site. This Act violates the Multiple Use Sustained Yield Act of 1976 because it excludes all other activities besides dumping from this area. The effects of radioactive waste on the soil will impair the productive nature of the soil and resource extraction in the area will be discontinued. The opening of WIPP poses an economic threat to the public because the Land Withdrawal Act permanently appropriates the WIPP site to DOE, restricting public access and eliminating commercial extraction opportunities.

8 6. The WIPP site is inappropriate because oil and gas drilling is occuring in close proximity to the site. The effects of exploratory drilling on the structure of the site have not been adequately
9 assessed in the SEIS II. Future impacts of oil and gas drilling or mineral exploration in the vicinity of the WIPP site have not been
8 analyzed adeqautely. If exploratory drilling continues while WIPP is



8 being filled with radioactive waste, the consequences of damage to the site would allow for the release of radioactive waste from the site, threatening contamination of nearby communities.

7. WIPP will perpetuate the production of nuclear weapons in the United States. Once scientists and the Defense Department can safely state that they have a means of disposal for radioactive waste, these industries and agencies will be able to justify the continued increase
10 of our nuclear arsenal. Given the stockpile which exists already, the continued production of nuclear weapons for supposed defense purposes is futile. The United States has claimed to be a leader in disarmament but if WIPP opens and the DOE and Department of Defense are able to justify continued production of nuclear bombs, other nations will lose faith in the United States' commitment to disarmament and international public safety will be increasingly threatened.

3 Thank you for your impartial consideration of these comments.
11 Please withdraw the SEIS II and plans to open WIPP. Please spend taxpayer dollars on monitored and retrievable storage options for radioactive waste.

Sincerely,

Landi Fernley
1707 22nd St. #303
Boulder, CO 80302

Comment C-149

Libby Lyman
2251 Hooker Street
Denver CO USA 80211

SEIS-II, P.O.Box #9800, Albuquerque, New Mexico 87119
Fax# 505-224-8030

Dear Persons

1 We would like to state our strong opposition to the Department of Energy's plan to open the Waste Isolation Pilot Plant by Fall of 1997. WIPP may
2 never be adequate to safely isolate plutonium contaminated waste from contact with the environment or human beings or animals, at least during the 24,000 years it will remain dangerous.

1 We also oppose the shipments to WIPP of these deadly wastes over the nation's already dangerous highways. We understand that 28,000 shipments will be passing through Colorado on I 25 .

Thank you for carefully considering and registering our position.
Thank you also for extending the comment date.

Sincerely yours

Linda Lyman

Terrance J. Teis

26 February 1997

303-455-6006

Comment C-150, Page 1 of 3

From : RMPIC (505)887-6970 P.11
PHONE No. : 3034446523 Feb. 27 1997 5:39PM P01

Mury Olson, Nuclear Information & Resource Service
1424 16th St. NW Suite 404 Washington, DC

1 The question is, what protection does the Federal Government owe the individual, or any given community for that matter? If someone commits murder, the jury is not instructed to consider the victim as the average member of the entire US population and consider that the murder is in fact insignificant compared to all the birth and death in the nation at that time. And yet, the Department of Energy is allowed to launch massive shipping campaigns carrying some of the most deadly and environmentally devastating materials, knowing that there will be accidents, (likely even dirty ones) but the verdict is that accident consequences will be "insignificant."

2 We are talking about a program -- the transport of transuranic wastes to a facility -- WIPP -- distant from where the materials are now, with tens of thousands -- or more -- shipping miles over a number of years. It is a very reasonable supposition that there is a good chance that at some point in this process there will be an accident that involves both the breach of a container and a fire. This extremely bad case scenario goes to the category of worst-case scenario if it is in a populated area. Then there may be multiple cases of plutonium -- possibly other TRU waste -- inhalation and contamination.

3 How many heavily contaminated victims can the hospital in this community handle? What about a scenario where this accident occurs
4 on a beltway in rush hour? Will it be possible for incidental exposures to be prevented if there is no possibility of moving the clogged vehicles. More may be backed up because of the accident. Even if there are agreements about routes and hours of travel for
5 these shipments, there are likely to be exceptions. How many times in the last 50 years have exceptions been made in DOE nuclear waste shipment? When, where, and why?

5 The conditions that are most likely to cause exceptions to rules-inclement weather, local or regional disturbances, construction, and schedule constraints-- can also be contributing factors to accidents and incidents.

6 So here is the sad picture of a WIPP shipment smashed up on the road and in flames. The road and the immediate surround is irreparably contaminated and will soon be hauled away as nuclear waste. There are millions of dollars worth of contamination in the community downwind of the accident. The plutonium laden plume is traveling across a crowded road and over a populated community. There are

1

From : RMPJC (505)887-6970 PHONE No. : 3034446523 P.12 Feb.27 1997 5:30PM P02

dozens of inhalation victims at the scene and it is difficult for them to get away. Emergency responders are also at risk as they approach the scene to attempt to contain the situation and put the fire out.

The plume travels with the wind. In a few hours plutonium will drop in rain as fallout on other communities down wind, contributing to the long-term 'body burden' of the planet as it is washed into crop land -- our food -- forest lands and surface waters and eventually the ground water. Some of it may circulate and even end up in the jet stream.

As is well documented, plutonium has an array of health effects. In this scenario there are immediate ones that are tied to level of exposure -- these may include lung damage and immuno-suppression
6 with a host of symptoms that appear to elevate other common health problems within the community. There will elevated sterility, miscarriage and birth defects. More long term there will be cancers, and possible genetic damage. Very little is known about the impacts on second, third or fourth generations due to the concentration of plutonium in the gonads.

And what does the Department of energy call such possible consequences?

Insignificant.

Why? Because when such affects were assessed, they were averaged over the entire population of the United States. When one does this, consequences of an accident, even involving tens or hundreds of thousands of victims, do get lost.

The 'average community' was unaffected.

But THIS community, were it to bear the brunt of such an accident would make a different finding.

So I ask you today, to recognize that the only thing 'insignificant' in this picture is the Department of Energy's ability to provide protection for individuals and communities in a program like shipping TRU waste to WIPP.

Creating a series of new national sacrifice zones is not acceptable.





From : RMPJC (505)887-6970 PHONE No. : 3034446523 P.13 Feb.27 1997 5:29PM P02

Thank you very much for this opportunity to comment. I recommend that
7 the Department suspend this program BEFORE there is a first catastrophic accident, for the people certainly will not stand for it after there is one, and it is not a reasonable to require dead bodies as the threshold for a reasonable decision. There are alternatives being offered, and I ask that you heed them.

STAND of Amarillo, Inc.

2/28/97

Harold Johnson
NEPA Document Manager
WIPP SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

Dear People,

These are STAND of Amarillo's (Serious Texans Against Nuclear Dumping) comments on the Department of Energy's (DOE) November, 1996 Waste Isolation Pilot Program (WIPP) Disposal Phase Draft Supplemental Environmental Impact Statement (DSEIS) . STAND of Amarillo has actively followed and commented on WIPP for years. STAND is concerned with both the national and regional implications of the WIPP project. These concerns focus on transportation, public participation, potential contamination of Texas surface waters and air, and the inadequacies of NEPA analyses.

STAND was unable to send representatives to the January public hearings, the closest of which were held in Albequerque, New Mexico. We are fully aware that those hearings demonstrated that strong public opposition ists to WIPP was expressed in New Mexico, Colorado, and Idaho. DOE is obligated to recognize these powerful public sentiments within the DSEIS.

## REGIONAL CONCERNS

***I. The Department of Energy did not adequately involve Texas citizens and regulators during the scoping sessions or draft hearings for this DSEIS.***

WIPP is located in New Mexico, but nuclear and hazardous wastes do not recognize geographical boundaries. DOE recognized this in the past, and held hearings in Texas on 10/1/79 and 6/26/89 for WIPP planning. Another meaningful effort to solicit input from the State of Texas and its residents should have been made for the following reasons:

1

- The WIPP site is only 40 air miles from Texas.
- Contamination from the repository will directly affect Texas. With prevailing SW winds, airborne contamination would track directly into Texas, and any groundwater contamination will migrate to the Pecos River, and ultimately to the Rio Grande River. The agricultural and human health of the region would be permanently affected.
- DOE estimates 4200 truck shipments through heavily populated portions of this state.
- The Pantex plant northeast of Amarillo will be generating new transuranic waste volume through its new mission of longterm storage of plutonium pits.
- The Pantex plant is a candidate for plutonium processing facilities that would generate still larger amounts of transuranic waste. This waste is already scheduled to go WIPP for disposal.

(806) 358-2622 7105 W. 34th Ave. Suite E - Amarillo, TX 79109 FAX (806) 355-3837



***II. The DSEIS does not address transuranic waste proposed for the Pantex plant in the Record of Decision (ROD) for the Storage and Disposition of Weapons Usable Fissile Materials Final Programatic Environmental Impact Statement (S&DPEIS).***

According to the DSEIS: "DOE would dispose of defense TRU waste that has been placed in retrievable storage and that would continue to be generated from plutonium stabilization and management....1998 to 2033." The DSEIS deferred from addressing the S&D PEIS because the S & D ROD had not been released. The DSEIS stated: "TRU waste may result from actions contemplated by this (S & D) PEIS; the extent of potential TRU waste generation would depend upon the alternative or alternatives selected in the ROD."

2

Now that the ROD has been released, we believe it is incumbent upon DOE to further supplement the DSEIS prior to issuing a final SEIS. This supplemental process would provide a perfect opportunity for DOE to hold public hearings in Texas to address the shipment of new transuranic waste volumes from Pantex as well as the estimated 4200 waste shipments already being proposed, by the DSEIS, to travel through Texas.

The DSEIS only addresses the 1 cubic meter of existing TRU waste inventory at Pantex, and a single TRU waste shipment to Los Alamos National Laboratory from Pantex. Since the S & D decision has been made, we know what DOE is estimating for new transuranic waste volumes at Pantex and the new volumes created by potential disposal options. Specifically, the issues are TRU waste generated by

- long term storage of plutonium pits at Pantex
- possible siting of a Plutonium pit disassembly/conversion plant at Pantex
- possible siting of a Mixed Oxide (MOX) Fuel fabrication facility at Pantex
- possible siting of other plutonium conversion facilities

a. Storage of Plutonium Pits at Pantex:

3

According to DOE, the storage mission will create an estimated 0.8 cubic meters of transuranic waste per year. This is relevant for three reasons. First, Pantex's existing reported inventory of transuranic waste, after 40 years of operation, is only 1 cubic meter. So the new waste volumes are, at this scale, actually a significant change at Pantex. Secondly, the DSEIS has set the precedent of addressing waste volumes at this scale. DOE is clearly obligated to address the transport of this new waste volume. Third, the S & D PEIS clearly states the TRU waste will be

4

shipped to WIPP, at a rate of one truck shipment every 11 years. This implies a different route than the Los Alamos route. What route will be used and will DOE analyze this route?

5

A number of questions arise from the possibility of the storage-generated TRU waste exceeding estimates. Since the S & D PEIS states that TRU waste will be generated from "damaged PCV's and contaminated glovebox panels, windows, and gaskets," does this imply that the waste will be generated from small accidents? Is this waste within the context of normal operations? If normal operations assume some accidental waste, then what is the possibility of increased waste

5 which exceed waste generated by normal operations? What is the possibility that more TRU waste will need to be transported than the S & D PEIS estimates?

**b. Plutonium processing: plutonium pit disassembly/conversion and Mixed Oxide Fuel fabrication facilities:**

Pantex is also a final candidate for these plutonium processing facilities, all of which will generate much larger waste volumes than the long term plutonium storage mission. DOE estimates for transuranic Waste and mixed transuranic waste for these facilities is provided in the following table.

| FACILITY | TRANSURANIC WASTE ANNUAL VOLUME | MIXED TRU WASTE ANNUAL VOLUME |
|---|---|---|
| PIT DISASSEMBLY/CONVERSION | 67 cubic meters | 4 cubic meters |
| MOX FUEL FABRICATION | 306 cubic meters | 4 cubic meters |
| TOTAL | 373 | 8 |

6 The waste management consequences of the facilities, according to the The S & D PEIS, "assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal." Pit disassembly/conversion would require an estimated eight truck shipments per year, and MOX Fuel fabrication would require an estimated 36 truck shipments.

We believe this potential mission should be analyzed in the DSEIS for the following reasons:

1. The new waste volume from the storage-generated waste already needs to be analyzed. The potential waste at Pantex should be analyzed within the same framework.

7 2. A controversial issue associated with plutonium processing is the subsequent transport of transuranic waste. A critical issue of whether to site plutonium processing at Pantex is the addition of tranuranic waste shipments, as well as treatment and storage, to existing Pantex operations. The omission of a Pantex to WIPP route in the current DSEIS provokes several questions. Does this route contain safety problems not found elsewhere? The weather in the Panhandle region is notorious for its extreme wind, icestorms, tornadoes, and major thunderstorms. Since this was not a major route, what is the additional cost of emergency preparedness, particularly for the more isolated portions of the region?

8

9 3. As Pantex is considered for plutonium processing and transuranic waste generation, it is imperative that DOE assess waste management within the proper NEPA document. The S & D PEIS states that:
"Depending upon decisions made in the ROD for the (WIPP disposal SEIS), 44 additional truck shipments per year.....would be required to transport the TRU and mixed TRU waste to WIPP."





9 Since the ROD does not address new storage and disposition missions for any site, at this time both documents refer to each other without answering any questions.
The DSEIS is clearly the most appropriate document to address these concerns. Even if MOX and pit conversion are not sited at Pantex, the waste stream will occur somewhere, result in hundreds of additional shipments, and needs to be addressed and analyzed.

***III. The SEIS does not fully address the risk and potential effects of possible contamination of the Pecos River or the Rio Grande River.***

10 The entire hydrological assessment is filled with vague modifiers such as "relatively", "undetermined", "probably", "may also," "likely," "unless," and "generally;" and phrases like "is conceivable", "could occur", "little or no ability," and "not yet resolved." Subjective, open-ended assessments such as these are incompatible with a permanent transuranic waste repository which is allegedly setting the standards for other radioactive waste repositories. We believe this lack of complete self-confidence in DOE's knowledge of the hydrology in the WIPP vicinity reflects serious potential contamination scenarios for the Pecos River Basin. We also know that groundwater pathways can change over time due to a number of natural phenomena.

In addition to these stated reasons, the DSEIS hydrologic assessment should be completely reworked for the following reasons:

11 a. The Pecos River Basin is within the WIPP vicinity, and the River itself is only 15 miles away. The DSEIS states that "river water is not used for human consumption. Irrigation and livestock watering are the primary uses of the water from the Pecos." This statement reflects a disconcerting lack of analysis regarding potential contamination of the Pecos and thus the Rio Grande; and a disturbing attitude within the DSEIS. DOE apparently has confused consumption with drinking water.

There is no shortage of DOE literature documenting contamination pathways. Irrigation of crops for human consumption, or watering of livestock for human consumption are clear pathways of contamination. Contamination of irrigation and livestock water supplies would have a major adverse health, environmental, and socio-economic impacts within the Pecos River basin and even the Rio Grande. The irrigation based agricultural economy could be permanently adversely affected by any contamination. These potential impacts need to be fully addressed and analyzed.

12 b. The DSEIS states that "intense local thunderstorms produce runoff and percolation," a fact that can be confirmed by even a short time area resident. Obviously, any contamination present during one of these normal events could easily migrate to the Pecos or result in contaminated soil, groundwater, and livestock or wildlife water supplies.

13 c. The DSEIS states that "the hydrologic and mechanical properties of the saltbeds surrounding WIPP are better understood than the regional hydrology." Yet, the saltbeds are cited as only "relatively impermeable," a description which implies permeability. At another point, permeability is described as "extremely low or no." How can it be both?

14 d. The DSEIS states that "only a few locations of groundwater recharge and discharge to and from the Rustler formation are known." In light of DOE's admission that understanding of the regional hydrology needs improvement, statements like these fail to support the premise that groundwater contamination will not occur. This statement implies that more knowledge is needed.

15 e. The Culebra dolomite is treated as a confined aquifer without any evidence that it is such. Since this is a potential pathway to the Pecos, this assumption is dangerous and unacceptable in a serious evaluation.

16 f. The DSEIS states that "Injected brine may or may not impact the hydrology in the vicinity of the injection well." Again, which is it? If the answer is "may", then the effects of potential contamination needs to be addressed. For a permanent repository, may or may not is simply an unacceptable, insufficient analysis.

## NATIONAL CONCERNS

*I. Transportation safeguards, both nationally and regionally, appear inadequate.*

17 The DSEIS states that rail transportation would result in 10 times lower exposures to the public and 100 times lower doses to workers than truck shipments, but DOE plans to ship only by truck. The rail option is not even addressed within the proposed action. We believe the rail option should receive full consideration within the proposed action.

18 We are also concerned that the shipments would not be escorted nor have emergency response personnel. Thus, local emergency responders (including thousands of volunteers) in more than 25 states need to be trained and equipped to handle accidents for the next 35 years. And hospitals would need trained and equipped medical personnel with special medicines to treat victims with radiation exposures. Further, the containers to transport highly radioactive,
19 remote-handled wastes to WIPP have not been approved and built, so their safety is highly uncertain.

20 The proposal to have DOE assist with accidents and make resources available for accident scenes is simply insufficient. This strategy will leave too much time between accidents and proper response. We believe that DOE should at least address and analyze the option of escorted shipments, with emergency personnel part of the escort. Drivers should be in constant radio contact with the escort party, and the escort party would be equally responsible for insuring the well being of drivers.

21 The DSEIS also leaves too many of the safety responsibilities to the carrier. The contract carrier must insure that the tractor and trailer are in safe operating condition, that vehicles are operated in a safe manner, and the safety record and qualifications of drivers are valid. The drivers themselves are required to make routine visual inspectins every 160 kilometers or every two hours, in addition to routine inspections by DOE, DOT and affected states.





21 This safety strategy simply leaves too much room for human error. Most carriers are already required to make, and do make, these same assurances, and no carrier would ever admit to employing unsafe drivers. Yet every day safe drivers operating safe vehicles jackknife, roll over, or otherwise have accidents. Every day there are unsafe vehicles on the road, drivers who are fatigued, and unpredictable road and weather conditions.

If there is one thing DOE should have learned these past fifty years, it is that contractors often place expediency above safety. We believe DOE must establish a more rigid, redundant, and accountable safety strategy for carriers, and not simply accept standards which are already the industry norm. The standards for nuclear waste shipments should greatly exceed industry norms.

22 *II. The alternative of closing WIPP and instead storing transuranic wastes at existing sites in an environmentally sound manner should be the preferred alternative within this DSEIS. The No Action Alternative 2 only addresses leaving the wastes under current management. A seperate alternative should be developed to address this valid option.*

This alternative would be the environmentally preferable alternative, could eliminate the deaths and injuries that would result from nuclear waste transportation, and would cost much less than the proposed action or any of the action alternatives included in the DSEIS.

23 DOE has spent $2 billion during the past 20 years on WIPP, and it has been trying to ship wastes since 1988. But WIPP is not open because of unresolved health and safety problems and DOE's inability to show that radiation releases would result in less than 1,000 deaths in 10,000 years.

24 The issues of the oil and gas wells and potash mines that surround the WIPP site also point to the need for this alternative. Mining those resources at the WIPP site would allow the wastes to
25 escape into the ground water or to the surface. Millions of barrels of pressurized brine underneath the disposal rooms could bring wastes to the surface. In addition, waterflooding
24 from oil wells outside the site could fracture the rock and bring millions of barrels of pressurized brine into the disposal rooms. DOE assumes that the four several-feet-diameter
26 shafts could be completely sealed for 10,000 years but small boreholes would not remain sealed for more than 200 years, thereby providing pathways for wastes to escape.

*III. Accident scenarios are based on wishful assumptions.*

27 In the case of accidents at the WIPP site, DOE consistently assumes that workers will exit the facility immediately and thus would escape intact. What if this assumption fails? Accidents by nature are chaotic and seldom follow any logical pattern. From a true public interest perspective, DOE should also analyze accident scenarios with the assumption that not all workers will exit immediately.

28 In the case of road accidents, DOE implies a logical chain of events which include prompt and orderly dispatching of emergency responders, drivers who follow proper operating procedures, and carriers making all of the proper contacts. This scenario is the antithesis of an accident.

Picture a typical accident: A semi-truck loses control on a hill, and in the process of trying to gain control sideswipes two passenger cars. The truck then goes off the road and rolls once on an embankment. The driver manages to climb out of the cab but is lightheaded from a slight concussion, and has a few broken bones. According to DOE, the driver is then going to find their cellular phone and make all the necessary calls, and then follow their training for package recovery procedures. Right.

28

DOE should answer the following questions What happens if a driver dies, goes into shock, or is knocked unconscious? What happens if a driver panics, emergency responders do not follow proper procedures, or safety officials make the wrong call?

The fact is that the DSEIS has a set of built in assumptions which are very unrealistic. The entire risk assessment is undermined by the simple fact that true accident scenarios have not been addressed.

SUMMARY

29 The DSEIS has left too many unanswered questions for the WIPP project to proceed. There are serious inadequacies in the NEPA evaluation process. Public participation was unnecessarily restricted. Viable, logical alternatives were not considered. The DSEIS needs to be reevaluated.

Thank you for this opportunity to comment.

Don Moniak
Program Director
STAND of Amarillo, Inc.

7

This page intentionally left blank.

ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

7007 WYOMING BOULEVARD, N.E.
SUITE F-2
ALBUQUERQUE, NEW MEXICO 87109
(505) 828-1003
FAX (505) 828-1062

Document # C-152

WIPP SEIS II Administrative Record ITEM# 473

February 27, 1997

Mr. George E. Dials
Manager
U. S. Department of Energy
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Mr. Dials:

The EEG review of the WIPP Disposal Phase Draft Supplemental Environmental Impact Statement, DOE/EIS-0026-S-2, is enclosed.

The 90 day deadline established by your office for our review did not give sufficient time for a thorough review and to check calculations. Hence, the absence of comments in specific areas should not be construed as concurrence with the SEIS.

Several key concerns of EEG expressed in our April 4, 1990 letter to the WIPP Project Manager on the 1990 SEIS were rejected by DOE. Subsequently, all were incorporated by Congress in the WIPP Land Withdrawal Act. They include

1) Bringing waste before demonstrating compliance with 40 CFR 191 Subpart B was not justified,
2) Emplacing waste for operational demonstration was not needed,
3) Justification for experiments in WIPP was not provided and,
4) Justification for not obtaining gas generation measurements at the generator sites was not provided.

Sincerely,

Robert H. Neill
Director

RHN:ss:js
Enclosure

*Providing an independent technical analysis of the Waste Isolation Pilot Plant (WIPP), a federal transuranic nuclear waste repository.*



Harold Johnson
NEPA Compliance Officer
P.O. Box 9800
Albuquerque, NM 87119

**PRELIMINARY**

EEG-64

# REVIEW OF THE WIPP DISPOSAL PHASE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT DOE/EIS-0026-S-2

Robert H. Neill
James K. Channell
Peter Spiegler

Environmental Evaluation Group
New Mexico

February 1997



## OUTSTANDING CONCERNS

EEG has published reviews of the previous DOE Environmental Impact Statements (EIS) on WIPP including

EEG-3 *Radiological Health Review of the Draft Environmental Impact Statement (DOE/EIS-0026-D) Waste Isolation Pilot Plant, U.S. Department of Energy*, August 1979

EEG-10 *Radiological Health Review of the Final Environmental Impact Statement (DOE/EIS-0026) Waste Isolation Pilot Plant, U.S. Department of Energy*, January 1981

EEG-41 *Review of the Draft Supplement Environmental Impact Statement, DOE Waste Isolation Pilot Plant*, July 1989.

Written comments also were provided to DOE on the Final 1990 Supplement to the EIS on WIPP in April 1990. The 1996 Draft Supplement to the EIS (SEIS-II), DOE/EIS-0026-S-2, was received on November 25, 1996 and this review contains our analysis of that document. The 90 day deadline for comments established by DOE is not adequate to do a thorough job since it is necessary to also review the final DOE Compliance Certification Application (CCA) as well as the Safety Analysis Report (SAR) in the same time frame.

**Our principal concerns are as follows**

1 • The long-term disposal impact of the Proposed Action is being addressed in much more detail through the DOE Compliance Certification Application (CCA) which provides one year for review. Evaluating alternatives to the Proposed Action outlined in the SEIS cannot be meaningfully addressed in sufficient detail in 90 days.

2 • Chapter 6 lists all regulatory agencies and the status of permits for WIPP. One regulatory agency is notably absent. It is DOE. The Department has the legal authority to self regulate operational activities at WIPP. The status of WIPP's compliance with DOE Orders or even a list of DOE Orders is conspicuously absent. Indeed, DOE has the authority to self-approve the Draft Supplement to the EIS but fails to describe the internal system to be used. As an example, the DOE long-term disposal calculations in the SEIS are approved by DOE and in the CCA by EPA.

3 • Parameters and analyses differ in the various DOE WIPP documents such as the SEIS-II, the Compliance Certification Application (CCA) and the Safety Analysis Report (SAR).

4 • The alternatives are not reasonably viable. As DOE notes, alternative #1 and alternative #3 are in violation of the WIPP Land Withdrawal Act. Alternative #2 exceeds the limits of RH-TRU in the NM/DOE C&C Agreement. The problems of underground stability in leaving the repository open for 150 to 190 years (which would also require new shafts and surface facilities) are not addressed. It would make more sense to complete WIPP and then propose a second repository, tailored to the unique needs of RH-TRU waste emplacement including limits on thermal loading and criticality. The SEIS should address this alternative.

5 • The alternatives include almost doubling the authorized waste volume, bringing non-defense TRU waste and commercial TRU waste. Increasing the curie inventory would increase the amount of transuranics allowed to be released.

6 • While several EEG documents are cited, there are a number of relevant EEG publications that the SEIS-II authors have either ignored or are not familiar with that are directly relevant to the environmental impact of WIPP.





7 • The text indicates that DOE has a need to dispose of all TRU wastes and does not consistently recognize that only defense TRU wastes can be disposed at WIPP according to law. Transuranic wastes generated by non-defense activities or civilian nuclear activities of the Department are not eligible for disposal at WIPP. (This point is recognized later by DOE on page 5-7, lines 5 and 6). To avoid confusion to the reader, non-authorized waste issues should be clearly identified.

8 • The document acknowledges that the expected quantity of RH-TRU waste of 35,000 $m^3$ far exceeds the WIPP design capacity of 7080 $m^3$. But the Basic Inventory Table for the Proposed Action shows 35,000 $m^3$ and the Draft PEIS shows all TRU waste as coming to WIPP. Since RH-TRU waste is not scheduled for shipment for several years, the effective capacity for RH-TRU will only be about 4,300 $m^3$ with the present design. SEIS-II makes no mention of the need to modify the waste emplacement design in order to accommodate 7,080 $m^3$ of RH-TRU. Again, footnotes indicate that only the authorized amounts would be disposed at WIPP but it is needlessly confusing.

9 • EEG is pleased that DOE is seriously considering treatment of radioactive wastes. For years EEG has noted that waste is respirable, soluble and confined by a carbon steel Type A drum. The 20 year longevity requirement for the drum has been deleted by DOE from the WAC as has the 1% limit on respirable particles. In contrast, certain low level wastes are required by NRC to have a 300 year design life for the waste container or the waste form. We believe that modifying the waste form through thermal treatment and shredding and grouting should be vigorously pursued to accommodate the anticipated volume of TRU waste which is twice the capacity of WIPP.

10 • The inhalation risks to people on the surface from future human intrusion were deemed inconsequential and not calculated in the SEIS-II despite earlier work by both

10 EEG (EEG-11) in January 1982 and DOE (TME 3151) in July 1982 that concluded inhalation is a significant concern.

11 • Unwarranted claims of conservatism for long-term performance calculations are made in the SEIS-II.

12 • EEG compared the results of the routine and accidental risks from truck transportation to WIPP with findings in EEG-46 ("Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) Wastes to WIPP Along Selected Highway Routes in New Mexico Using RADTRAN IV," Anthony F. Gallegos and James K. Channell, EEG-46, August 1990). Agreement was quite close when allowance was made for differences in miles traveled and other assumptions. Therefore we believe the assessment of transportation risks in SEIS-II is reasonable and adequately conservative.

13 • For over 20 years, the Department's policy has been to dispose of defense transuranic waste at WIPP rather than leave it at the generator sites indefinitely. The August 1995 DOE Draft Waste Management Programmatic Environmental Impact Statement provides calculations that indicate leaving the waste at the generating sites indefinitely rather than disposing at WIPP would result in fewer cancer fatalities, a smaller collective radiation dose, and a cheaper cost. The SEIS-II needs to explain the reasons why technical objections have not been raised by CAO on these 8/95 DOE conclusions. It is important for credibility that a detailed analysis of the basis of these diametrically opposed conclusions be provided. (SEIS-II, page 3-46 and PEIS, page 8-86).

14 • Calculations of the long-term consequences should use the analyses submitted in the EPA Application. SEIS-II used methods and data in the Draft Application. EEG had extensive comments on the draft and published them in EEG-61.





**SUMMARY**

EEG's review of the WIPP Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS-II) concentrated on the radiological aspects of the Proposed Action, including transportation. The alternatives were reviewed in less detail. Some calculations were checked, mostly for the Proposed Action. Because of time constraints, there was little review of Hazardous Chemicals, Economics, or other Environmental Assessments.

15 SEIS-II was written as a pre-decision document with the Alternatives all plausible and eligible to be selected. Also, the inventory of TRU waste for disposal went well beyond that portion of TRU waste that has been historically considered to be the WIPP inventory. This broadened scope is probably appropriate for an EIS but it is confusing to the reviewer who is aware of the statutory limits of wastes that are allowed to come to WIPP at the present time. EEG has attempted to keep the broadened scope of SEIS-II in mind during our review.

A number of calculations, logic, and perhaps typographical errors were found and are pointed out in the detailed comments. Also, omissions that we believe should be included are mentioned. The more important issues are discussed below.

**Alternatives:**

16 EEG is bothered by the choice of Alternatives considered. Compared to the Proposed Action, they deal with larger volumes of TRU waste, continue over a much longer period of time and have been evaluated in a more preliminary manner. There is a question whether these were intended to really be viable options. Certainly there is a need for real options to dispose of TRU wastes not included in the WIPP statutory limits.

EEG recommends that short-term, partial solution options be included in the Final SEIS-II and be considered in the Record of Decision (ROD).

**Related Documents:**

17 SEIS-II recognizes and refers to other important WIPP related documents such as the Compliance Certification Application (CCA), Baseline Inventory Report (BIR - Revisions 2 and 3), and the Safety Analysis Report (SAR). However, SEIS-II, which was published after the CCA and the latest SAR, does not incorporate the latest information or use the same methodology as these documents. The use of different methodology and results in DOE documents published around the same time is inconsistent, confusing and unnecessary. EEG recommends that the Final SEIS-II use methodologies and results from the CCA and the latest SAR because these documents contain more detailed and peer reviewed analyses.

**Transportation:**

18 EEG checked the transportation calculations in Appendix E and compared these results to those contained in EEG-46. It is concluded that the assessment of transportation risks in SEIS-II is reasonable and adequately conservative.

19 Analyses in SEIS-II indicated potential advantages to using rail rather than truck transportation for wastes. The rail analyses were not as rigorous as those for truck transportation. However, the findings were consistent with analyses in the FEIS, SEIS-I, and other documents. There appears to have been no serious re-evaluation of WIPP's "truck only" policy in the approximately 12 years since it was established. EEG believes that DOE should take this opportunity to seriously re-evaluate the merits of a "truck/rail mix" or a "maximum rail" policy for WIPP wastes.

**Questionable Assumptions**

There are a number of questionable assumptions, omissions, or errors in SEIS-II. These are mentioned in the page-by-page comments. The more important ones are given below. The page location in SEIS-II is given in parenthesis.

20 **Human Intrusion at 100 years.** The assumption is made that drilling into the repository 100 years after repository closure would lead to maximum consequences. This determination





20 cannot yet be made. Increased releases from higher pressures in the repository after 100 years may more than offset radionuclide reductions due to radioactive decay. (page 5-45).

21 **Use of 75th Percentile Values.** It is argued that the use of 75th percentile parameter values in modeling of long-term releases due to human intrusion will yield consequences that fall in the "upper tail of a full probabilistic analysis." In the actual analysis SEIS-II used median values for most of these parameters and come up with values of radionuclide releases to the surface that were identical to those with median values (Table H-24). We conclude that these are not upper tail releases. (page 5-40).

22 **Family Farm Scenario and Inhalation Doses.** The decision was made in SEIS-II that a family farm scenario and inhalation doses from resuspended drilling mud pit material was inappropriate. This is directly contrary with conclusions in SEIS-I as well as EEG and Westinghouse reports. (page 5-41).

23 **Modification of BRAGFLO Volumes.** The z distance in a two-dimensional grid was increased by factors of approximately 8 (see Table H-8) in order to accommodate the larger waste volumes in Action Alternatives 1,2, and 3. This violates the two-dimensional assumption of the BRAGFLO grid. A three-dimensional analysis may be needed to give reliable results. Table H-8 is confusing.

24 **Emplacement of RH-TRU wastes**. Values are given for the volumes of CH-TRU and (especially) RH-TRU wastes that will have to be put into Panels 9 and 10 in order to meet design capacity for the Proposed Action. There is no indication of whether such an increase is possible.(page 3-12).

25 **Conversion Error**. Numerous Figures in the Summary Chapter, Chapter 5, and appendix H show the wrong conversion factor from $Ci/m^3$ to pCi/l. The correct conversion factor is 1 $pCi/l = 10^{-9} Ci/m^3$. There is uncertainty about which value is used in the plots and this is potentially important. (pages S-51 and 5-43).

26 **RH-TRU Cask**. The statement is made that "The Department is currently awaiting NRC certification of the RH-72B cask. DOE had not yet submitted a design to NRC in Nov. 1996 for an RH-TRU shipping cask.





**Specific Comments**

GLOSSARY

27 **Page GL. Line 1.**
The definition of backfill as "materials placed in storage panels or drifts" is too ambiguous. CH-TRU waste and RH-TRU waste as well as the drums and containers are also materials placed in storage panels, but they do not qualify as backfill.

28 **Page GL-2. Line 4.**
The definition of background radiation does not include global fallout as it exists in the environment. Global fallout is considered to be man made radiation.

29 **Page GL-2. Line 12.**
The glossary should include a definition for the Becquerel since it includes a definition for the curie.

30 **Page GL-3. Lines 28-32.**
The definition of contact-handled transuranic waste should start with the term "TRU waste" instead of the word "waste".

31 **Page GL-3. Line 13.**
The spelling of sievert is incorrect. Also, the sievert is abbreviated as Sv.

32 **Page GL-5**. The definition of disposal should use the definition in the WIPP Land Withdrawal Act.

33 **Page GL-5.** The definition of disposal phase should use the definition in the WIPP Land Withdrawal Act.

**Page GL-5. Lines 33-36.**

34 The definition of absorbed dose should also include the mks unit known as the gray and abbreviated as Gy.

**Page GL-5. Lines 37 through 39.**

35 The definition of dose conversion factor should use "resultant dose equivalent" instead of "resultant radiation dose."

**Page GL-9. Lines 4 through 7.**

36 The definition of high-level waste should include unreprocessed spent fuel.

**Page GL-9. Lines 22 through 26.**

37 The definition of the phrase "immediately dangerous to health" only includes" maximum airborne concentration". The phrase also applies to a dose rate, e.g. 1,000 rem/hour.

**Page GL-14. Lines 16 through 20.**

38 The definition of remote-handled transuranic waste should start with the term "TRU waste" instead of the word "waste". Also, while the radiation level at the outer surface of the container is less than 1,000 rem/hour, there is a volume limit of 12,5000 cu ft for wastes that have radiation doses that are greater than 100 rem/hr at the outer surface.

**Page GL-18. Lines 1 through 4.**

39 The definition of WIPP should be changed. WIPP is no longer an experimental facility.





ACRONYMS

**Page AC-1. Line 19.**

40 Only BIR-2 is defined. BIR-3 should also be defined since it is described on page 1-8.

**Page AC-1. Line 42.**

41 The AC-section has an acronym for design-basis earthquake, but it does not have an acronym for design-basis criteria.

**Page AC-3. Line 46.**

42 PA stands for Performance Assessment. The acronym for Preliminary Performance Assessment would be PPA.

**Page AC-4. Line 15.**

43 At present the RH-72B cask is only a proposed RH-TRU shipping container. The design was not submitted by the DOE to the NRC until 12/96.

**Page AC-4. Line 33.**

44 The definition of SWIFT-II should indicate that it is computer software.

**Page MC-2. Table MC-1**

45 The table should include other conversion factors such as a conversion factor from Psi to Pa and conversion factors from darcy to other units of permeability.

SUMMARY CHAPTER

**Page S-1. Lines 40 and 41.**

46 The statement "DOE subsequently decided to perform the tests in aboveground laboratories instead of at WIPP" is misleading. Most of the tests planned for the test phase (e.g. the alcove tests, which comprised the majority of the wastes in the experiments) are not being performed anywhere.

**Page S-2. First Full Paragraph.**

47 The relation of SEIS-II to the Draft WMPEIS is described in this paragraph. DOE apparently believes they need to follow the approach of the WMPEIS and also to consider the disposal of all DOE TRU wastes. This goes beyond the portion of the Defense TRU wastes that has historically been considered for disposal at WIPP and includes commercial TRU as well as non-defense TRU. The desire of DOE to consider the universe of TRU waste is understandable and it could probably be argued that NEPA requires it. But it is confusing to the reader who is aware of the statutory limits of wastes that are allowed to come to WIPP at the present time. Also, additional wastes and alternatives have not been evaluated in the detail that the Proposed Action has been. It is realized that a Draft EIS is supposed to be written as a pre-decisional document.

**Page S-3. Related Documents.**

48 The major planning and compliance documents that are integrated with SEIS-II that are related to decisions on WIPP are listed and described briefly. A generic comment is that the contents of SEIS-II are not current with the latest DOE documents that were issued before the SEIS (e.g. the CCA and Baseline Inventory Report, Revision 3). Also, SEIS-II developed its own assumptions and methodology rather than using that developed in other official WIPP Project documents (e.g. WIPP Operational Accident modeling was different than that in the Safety Analysis Report). These differences are confusing and unnecessary.





**Page S-4. Comprehensive Disposal Recommendations.**

49 The Comprehensive Disposal Recommendations (in preparation, schedule uncertain) document will recommend "disposal options and the time tables for all TRU waste under DOE control." It is unclear how the ROD that is expected with the Final SEIS-II will relate to the Comprehensive Disposal Recommendations. Are these expected before Final SEIS-II? If not, wouldn't the ROD be preempting the Recommendations? Or, is SEIS-II the first step in preparing for the disposition of all TRU wastes under DOE control at WIPP?

**Page S-4. List of DOE Decisions.**

50 Although this is mentioned later, it would be helpful to mention here those potential decisions which could be made under current WIPP Authorization and those which would require new Congressional Authorization.

Extensive comments are made later on the truck vs. rail issue. It is hoped that this decision is open and will be seriously re-evaluated.

**Page S-9. Emplacement Volumes.**

51 The text and various tables give different values for emplaced volumes of waste in No Action Alternative 2. Table S-3 says 135,000$m^3$ CH, 35,000 RH (32,000 being treated). The text (page S-16) says 170,000$m^3$ total. Table 3-16 and the text (on page 3-42) say 135,000$m^3$ CH and 35,000$m^3$ RH. It is unclear what becomes of the additional 15,000$m^3$ of RH-TRU in NAA 2 (which is included in the Proposed Action as excess RH-TRU). This is confusing and needs to be clarified.

**Page S-13. Lines 19-20.**

52 The berm is to be constructed around the perimeter of the waste panel footprint (not of the Site).

**Pages S-13 to S-19. Alternative Actions**

A general conclusion on the alternatives evaluated is that they are so different from the proposed action as to stretch credibility. The entire TRU waste universe is included.

53 Implementation times of 150-190 years that use present-day technology are mind boggling and there is no indication that the SEIS-II analysis has seriously considered the problem of keeping the underground, shaft, and surface facilities at WIPP open until the latter half of the 22th Century. Nor have the institutional problems that might occur over such long time periods been mentioned.

Three of the Alternatives not considered (deep borehole disposal, greater confinement, and geologic repositories at sites other than WIPP) appear to be as reasonable as the ones chosen.

54 The concept of making piece meal decisions on solving the TRU waste disposal problem is as reasonable as the Alternatives listed here. For example: (1) make the decision of how to dispose of those wastes that are authorized to come to WIPP; (2) then evaluate how all or a portion of the remaining TRU wastes will be disposed of. It may be better to evaluate these remaining wastes in more than one category (e.g. RH-TRU as one category and buried waste as another).

**Page S-14. Textbox.**

See comments on this textbox (Conservatism of TRU Waste Inventory Estimate) under page 3-6.

**Page S-16**

It is noted that No Action alternative 1, which would have thermally treated wastes, provides

55 for overpacking of waste at 20-year intervals. No action Alternative 2, which does not have treated wastes, has no plans for repackaging. This is an example of how the alternatives provide different levels of assurance that must be kept in mind when making decisions between alternatives.





**Page S-23. Sixth Paragraph.**

The value of 0.3 LCF reported for the population dose around the Hanford Site is incorrect.

56 The Hanford Site Environmental Report for Calendar Year 1994 (PNL 10574) reports a total dose of 0.6 person-rem to the population of 380,000 persons. This would be 3 x $10^{-4}$ LCF. The values for INEL and NTS also seem to be too high but have not been checked.

**Page S-29**

See comments on this textbox (Long Disposal Periods and SEIS-II Results) under page 5-49.

**Page S-32. Noise.**

57 It would be useful to state the normal non-WIPP truck and traffic through Carlsbad as a comparison to the relative noise effect of WIPP traffic.

**Page 5-33. Socioeconomics.**

58 The life-cycle cost analyses for Action Alternatives 1, 2, and 3 apparently does not include the cost of exhuming the CH-TRU waste disposal before 1970.

**Page S-34. Table S-5.**

It is surprising that No Action alternative 2 Waste treatment costs are only 16% of those for the proposed Action. There is no itemized waste treatment cost in Appendix D for the No

59 Action alternative 2. However, NAA2 is planning to treat all newly generated waste to WAC standards (73,000$m^3$ CH and 32,000$m^3$ RH). The proposed action would treat 168,500$m^3$ CH and 50,000$m^3$ RH. This needs to be explained. The sum of the parts of the proposed action is $18.7B while the total cost is $19.1B. While rounding off is expected, this fails to account for $0.4B or 2.2% of total.

**Pages S-42 through S-44**

The analysis for Alternatives 1, 2, and 3 apparently do not include the radiological health

60 impacts from exhuming the pre-1970 disposed TRU waste, which is not considered in the WM PEIS either, and which in the past was considered important. These radiological health

60 impacts could be important when comparing Alternatives 1, 2, and 3 with the Proposed Action and No-Action Alternatives 1 and 2.

61 **Pages S-51 through S-55**

The conversion factor on Figures S-5 through S-9 relating $Ci/m^3$ to pCi/l is incorrect. The correct value is $1pCi/l = 10^{-9} Ci/m^3$. This is important. See comment under page 5-43.

62 **Page S-61 to S-68. Table S-7.**

This table summarizes all the calculated health and safety effects from transportation, routine treatment and disposal operations, and from accidents. Deaths from transportation and operational accidents, Latent Cancer Fatalities (LCFs) from radiation exposure, cancer incidence from hazardous chemicals, and fatalities from truck pollution are all considered. Presumably, this information will be used in deciding on alternatives. However, SEIS-II does not discuss the relative merits of the alternatives in light of these estimated health and safety effects. Neither is any indication given of how they will be used in decision making. We have several observations.

63 The estimated cancer incidence from exposure to hazardous chemicals is below 0.05 in all alternatives. This is less than 5% of the expected radiological LCFs in NAA2 and is less than 1% in all other alternatives. The effect of hazardous chemical exposure can be ignored in choosing between alternatives.

**EEG Summary of Health and Safety Effects.**

EEG has condensed from Table S-7 tabulation of the expected deaths (of all kinds) for each of the Alternatives is shown in Table 1. Also included are the more significant high consequence/low probability accidents (which are not expected to happen) and the consequences of long-term releases.





Table 1

EEG SUMMARY OF EXPECTED AND POSSIBLE DEATHS LISTED IN SEIS-II

| Effect | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Proposed | AA1 | AA2a | AA2b | AA2c | AA3 | NAA1a | NAA1b | NAA2 |
| Routine Radiation (LCFs) | | | | | | | | | |
| Truck Transportation | 3.3 | 12 | 5.4 | 5.4 | 6.6 | 15 | 0.11 | 0.57 | -- |
| Operations | 2.6 | 3.8 | 11 | 8.5 | 4.3 | 4.3 | 11 | 8.7 | 1.1 |
| Accidents | | | | | | | | | |
| Truck Fatalities | 6 | 19 | 9 | 9 | 12 | 25 | 0 | 1 | -- |
| Other Fatalities | 6 | 10 | 15 | 13 | 12 | 12 | 1.3 | 1.1 | 1.3 |
| Agg. Rad. (LCFs) Truck | 0.4 | 0.8 | 0.4 | 0.4 | 0.7 | 1.2 | .0068 | .02 | -- |
| TOTAL DEATHS | 18 | 46 | 41 | 36 | 36 | 58 | 12 | 11 | 2.4 |
| High Consequence | | | | | | | | | |
| Accident Deaths (LCFs) | | | | | | | | | |
| Storage Facilities | 2 | 300 | 10 | 10 | 2 | 10 | 10 | 10 | 300 |
| WIPP Disposal | 4 | 4 | 24 | 24 | 24 | 24 | -- | -- | -- |
| Long Term Releases | | | | | | | | | |
| (LCFs) | | | | | | | | | |
| 10,000 year Aggregate | <0.9 | -- | -- | -- | -- | -- | <2325 | <2325 | 2325 |
| Original Waste Volume($10^3 m^3$) | 218 | 336 | 313 | 313 | 313 | 312 | 313 | 313 | 170 |
| Deaths/$10^3 m^3$ | .084 | 0.14 | 0.13 | 0.12 | 0.11 | 0.18 | .040 | .036 | .014 |

All values from Table S-7, pages S-62 through S-68, SEIS-II.

If these estimates are assumed to reasonably reflect the differences between the Alternatives one can come to several conclusions:

- The Proposed Action disposes of waste at a lower expected death per volume of waste ratio than any of the Action alternatives. However, all of these ratios are within a factor of about two. The primary variables affecting the deaths/volume ratio are the miles of transportation and amount of treatment required;

- AA1 and NAA2 have very high consequence storage accidents. This is because of long-term above ground storage of waste treated only to WAC standards;

- The aggregate LCFs from long-term release for NAA2 are very high because of assumed loss of institutional control of WAC standard wastes stored above or near the surface. NAA1 LCFs were not calculated but would also be substantial. The thermal treatment of wastes would be expected to provide some reductions during the early part of the 10,000 year period because of greater waste stability.

64 The Health and Safety aspect of the decision on alternatives would seem to basically reduce to the trade-off between a few expected deaths during the disposal period and a possibility of a much larger number of future LCFs from accidents or environmental releases. A secondary consideration is whether some types of death (e.g. a transportation accident fatality rather than a radiation caused LCF) and he effects on some population groups (workers versus the general public) are more acceptable than others.

In making this decision one needs to keep in mind the uncertainly in these comparative estimates. Also, these various alternatives are not identical and provide different levels of assurance.





CHAPTER 1

65 **Page 1-1. Lines 5 through 16.**
The section does not make it clear that only defense TRU can be disposed at WIPP. Instead, the section discusses the need to dispose of all TRU wastes generated by the Department.

66 **Page 1-1. Lines 37 through 39 or Footnote 1.**
The footnote indicates that the DOE has sole authority to decide if waste should be disposed at WIPP. In 1992 Congress reassigned the authority to approve disposal at WIPP from the DOE to the EPA.

67 **Page 1-1. Box entitled TRANSURANIC WASTE.**
Since the description of TRU waste includes the maximum dose rate for CH-TRU waste, the description of TRU wastes should also include the maximum dose rate for RH-TRU waste, which is 1,000 rem/hour.

68 **Page 1-1. Box entitled TRANSURANIC WASTE.**
The material in the box defines transuranic waste but fails to incorporate the adjective "defense" to modify the noun. The inference is that non-defense DOE TRU waste is eligible for disposal at WIPP.

69 **Page 1-1. Section 1.2 OVERVIEW.**
Since the SEIS describes the history to TRU waste disposal, it should include the history of the unilateral decision by the DOE to redefine the threshold of TRU from 10 nCi/g to 100 nCi/g.

70 **Page 1-5. Table 1-2.**
The fifth WIPP NEPA document notes that a 1982 deviated gas well at WIPP was discovered by the DOE in 1991.

71 **Page 1-7. Footnote.**
Statement: "Overpacking involves placing the 55-gallon drums inside another container and essentially provides double containment of the TRU waste."

The statement is incorrect. Overpacking does not provide "double containment" of a Type A drum
71 in the context of the NRC packaging regulations 10 CFR Part 71.

**Page 1-8. Lines 23 through 26.**

The purpose of the WIPP/SAR is summarized, but does not do justice to the formal commitment by DOE and NM.

*Waste Isolation Pilot Plant Safety Analysis Report, Revision 1 (SAR)* Rev. 1 (DOE 1995 i)
72 "The intent of this document is to demonstrate the safe disposal of CH-TRU waste in compliance with DOE orders."

The Consultation and Cooperation Agreement between NM and DOE states that the SAR"... constitutes the most comprehensive document concerning WIPP both in general and specifically as related to public health and safety as well as other matters." Include this statement as well as a commitment for RH-TRU waste as well.





CHAPTER 2

**Page 2-1. Lines 9 through 19.**

The Geography of the nuclear weapon complex is described.

73 States that contain the 10 additional sites are identified in *Identification of Additional TRU Waste Generator Sites*. It appears that the TRU waste generated at the 10 additional sites is not defense TRU waste and is thus not eligible for disposal at the WIPP Under the current law.

**Page 2-2, Section 2.1.1 Introduction.**

74 The SEIS includes plans to dispose of non-defense TRU waste at WIPP which violates the existing laws. DOE should include a discussion on their plans to modify the law to include commercial and non-defense TRU wastes.

**Page 2-2. Section 2.1.1.**

75 The DOE states that the total inventory will now be almost double the amounts authorized for disposal under the WIPP Land Withdrawal Act. The total expected inventory is 312,500$m^3$. The authorized volume is 175,000$m^3$ Describe the plans for dealing with this excess volume, including amendments to the law.

**Page 2-2. Box entitled WASTE ACCEPTANCE CRITERIA (WAC). Lines 17 and 18.**

Statement: "For the purposes of SEIS-II analyses, all waste would be treated at a minimum to the current planning-basis WAC."

76 Since the current WAC does not require treatment of most wastes, it is misleading to describe untreated waste as "treated at a minimum to the current planning-basis WAC."

**Page 2-2. Box entitled WASTE ACCEPTANCE CRITERIA (WAC). Line 1.**

It is stated that the WAC was first developed in 1989.

77 The statement is incorrect. The first set of criteria were issued in 1979. There is no recognition of the work the EEG has done on the WAC. Report EEG-4, Little, Marshall S., *Review Comments on*

77 *the Report of the Steering Committee on Waste Acceptance Criteria for the Waste Isolation Pilot Plant* dated February 1980.

78 **Page 2-3. Section 2.1.2 TRU Waste.**
The section fails to show that there is a volume limit of 12,500 $ft^3$ for disposal at WIPP of RH-TRU waste between 100 rem/hour and 1,000 rem/hour.

79 **Page 2-3. Box entitled *TRU WASTE TRANSPORTATION PACKAGING.*** Lines 10 and 11.
Statement: "The Department is currently awaiting NRC certification of the RH-72B cask."

The statement is misleading, since the Department did not submit the design to the NRC for certification until December, 1996.

80 **Page 2-3. The text refers to a "specially adapted rail car".**
EEG is unaware of an existing rail car nor have we received plans of a design. Please provide them in text.

81 **Page 2-5. 1800 PE-Ci/Drum.**
It is correct that the WAC allows 1800 PE-Ci CH-TRU drums if the waste is over packed or solidified. EEG has expressed some reservations about this limit. Also, an 1800 PE-Ci drum could not be shipped in TRUPACT-II because the drum would exceed the 40 watt thermal limit.

82 **Page 2-5. Footnote.**
The text cites an August 1995 Draft PEIS which has not been issued in final form and an unidentified undated more recent estimate. Provide specifies.

83 **Page 2-6. Table 2-2.**
Statement: "There is uncertainty in the total waste volume figures presented in Table 2-2 and 2-3."

The discussion should include numbers that provide an indication of the uncertainties in the waste volumes of the six alternatives.





84 **Page 2-7. Table 2-3**
Commercial/Non-defense TRU waste is not eligible for disposal at WIPP and should be deleted from the Table.

CHAPTER 3

85 **Page 3-1. Lines 31 through 37.**
Statement: "Decisions based on SEIS-II may be a combination of the option presented within alternatives analyzed. This means that portions of two or more of the alternatives analyzed in SEIS-II may be combined and used by the Department for the management or disposal of TRU waste." It would help to clarify this statement if the Final SEIS-II provided hypothetical examples of how the different Alternatives might be combined. The textbox on page 5-51 does not provide this clarification.

86 **Proposed Action**
**Page 3-2**
While there is a clear understanding of the Proposed Action, the description includes activities not in the Proposed Action described in the SEIS. The RH-TRU waste increased considerably, from 7,000 $m^3$ to 35,000$m^3$, and the volume projections show thermal treatment of the waste reduces the volume. These are not included in the Proposed Action submitted by DOE to EPA in the 10/28/96 Compliance Certification Application. Revise this section on the Proposed Action to only include items that are in the Proposed Action.

87 **Page 3-2**
Paragraph 2. The text indicates that the proposed volume of RH-TRU is much less than that allowed by the WIPP Land Withdrawal Act. Not so. While the expected number of curies in RH-TRU are less than the LWA permits, the volume of RH-TRU is considerably greater and the WIPP repository's current design will not accommodate the greater volume.

88 **Page 3-5**
"All waste has been assumed to be treated and packaged to planning basis WAC." There are no requirements in the WAC to treat waste.





89 **Page 3-6. Textbox.**
The conservatism of TRU Waste Inventory Estimates textbox is limited to the volumes of estimated TRU waste. There is no discussion of the radioactive inventory (in curies or PE-Ci) and its uncertainty. Also, credit is taken for conservatism when the reverse is true. For example:

90 First bullet. It is more accurate to consider the inventory as uncertain, rather than overestimated. Also, overestimating the TRU waste volume (and of the alpha emitting inventory) permits a larger quantity of plutonium to be released in meeting the EPA 40 CFR 191 Containment Requirements. Update the reference from Rev. 2 to Rev. 3 of the BIR.

91 Second bullet. The additional Inventory includes TRU waste burial prior to 1970 when the definition of the threshold was 10 n Ci/g rather than the current 100 n Ci/g. Although DOE indicates that 80,000$m^3$ would be excavated from the 141,000$m^3$ that was previously disposed, no indication is provided whether it is the higher or lower concentration waste. Logically it would be the higher, making the calculation less conservative. No explanation is provided why 80,000$m^3$ of buried waste would be exhumed and 60,000$m^3$ of other buried waste left in place.

92 Third bullet. Assuming that 7,000$m^3$ of RH-TRU will be emplaced in the repository, when the available capacity may be only 4,300$m^3$, may overestimate the amount of actinides allowed to be released.

93 Fifth bullet. The assumption that 100% of the TRU waste would be treated as TRU mixed waste is no longer true.

94 **Page 3-8**
Since the text cites U.S. DOT regulations (49 CFR Part 391) for driver qualification, also cite the appropriate DOT regulations for routing (49 CFR 177) and the type A container certification (49 CFR 173).

95 **Page 3-9. 3.1.3.1**
"The Department estimates that it would require up to three years to excavate a panel."

95 Why would it take 3 years to excavate 7 rooms when 4 rooms were excavated in 6 weeks for the SPDV Program? Revise the estimate.

96 **Page 3-9**
"The facility would be inspected a minimum of 4 times a year by the Mine Safety and Health Administration." Point out that the WIPP Land Withdrawal Act requires this.

97 **Page 3-9**
Shipping Routes. It would be helpful to specify the DOT regulations to change routes including public hearing procedures.

98 **Page 3-12. 3.1.3.4 Emplacement of RH-TRU Waste.**
This section states that RH-TRU waste will need to be placed in the access tunnels(Panels 9 and 10). In order to reach design capacity Panels 9 and 10 will each have to be modified to accommodate 944m$^3$ of RH-TRU (compared to 649m$^3$ in a panel) and 17,500m$^3$ of CH-TRU (compared to 16,700 in a panel). Is it physically possible to do this? Please specify the necessary design changes to the repository.

99 **Page 3-12**
Please provide information for a seal that would prevent water from entering the repository and impede gas and brine from migrating out.

100 **Page 3-12**
Closure and decommissioning. Use the definitions of disposal phase and disposal used in the WIPP Land Withdrawal Act. The definitions in the text do not match those in the Act.

101 **Page 3-12**
The projected area above the 10 panel equivalents is said to be 100 acres. It is about 125 acres.

102 **Page 3-12**
Is the proposed fence outside of the 150 acre berm?





103 **Page 3-13**
The commitment to place markers at the site make no mention that they are required by (PL102-579) and need to be approved by EPA (40 CFR 191).

104 **Page 3-14**
The text states that it is reasonable to examine alternatives that include disposing of all DOE-owned and controlled TRU waste at WIPP. It should also be reasonable to discuss plans to amend the law and explain why DOE did not ask Congress to amend the WIPP LWA at the same time this section was written.

105 **Page 3-14**
Action Alternative 1. This alternative would nearly double the repository inventory but does not address the necessary redesign nor operational problems associated with keeping the repository open for 160 years.

106 **Page 3-14**
Problems associated with storage at Consolidation Sites for 160 years are not discussed. DOE has taken the position that such storage would be impracticable and offering this as a viable alternative appears to reverse the Department's position totally.

107 **Page 3-15 and A-14. Tables 3-2 and A-6.**
The total volume for column 2, **Additional Inventory,** should be 139,000 not 136,000.

108 **Page 3-18**
While the text states that the number of panels would be increased from 8 to 68, no specifics are provided on the design to accommodate this. We question whether the current design would be optimum if CH-TRU was not going to be emplaced in the rooms.

109 **Page 3-19**
The surface projection for 68 panels would be about 850 acres rather than the 680 acres estimated if the design is unchanged.

**Page 3-19. Textbox, Long Disposal Periods and SEIS Results.**

110 Statement: "The long disposal periods could be shortened by constructing additional shafts, employing additional shafts, or changing the design criteria for thermal loading." The assumptions mentioned in the statement are more reasonable than the assumptions of 160-190 year disposal periods. The analysis of AA1, 2, 3 should contain more detailed and quantitative information about how the periods could be shortened.

**Page 3-43**

111 The SEIS states that alternatives such as transmutation, co-processing with high level waste, and disposal in space were not considered in detail. The desire to use current technology for projects to be completed in 30 or 40 years is understandable. However, it seems unwise for 160-190 year projects. The alternatives that are discussed in the text are also not considered in detail. Problems associated with keeping the mine open for 180 years are not discussed nor are plans to increase the number of panels from 8 to 68.

111 An alternative not considered at all, which is similar to Action Alternatives 2 and 3, would consist of acid digestion of certain TRU waste followed by volume reduction and solidification. During the 1970s and 1980s the DOE had a research program at Hanford on the acid digestion of TRU waste. The alternative might be preferable to Action alternative 2, which involves a costly thermal treatment process.

**Page 3-44. Lines 2 through 8.**

Statement: *"While the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (DOE 1996b)* considered this process to be a reasonable alternative
112 for analysis the relative large volume of TRU waste (compared to the volume of fissile material) would produce much more waste than the currently planned high-level waste repository could dispose of. This alternative would further delay TRU waste disposal until such a time as sufficient high-level waste repository space was available. In addition, transportation and safety concerns associated with high level waste would need to be addressed."





112 The statement is not correct. Because of thermal loading constraints, a high-level repository is mostly empty space that may have to be back-filled. The currently planned high-level waste repository at Yucca Mountain will have over 100 miles of tunnel. However, a high-level waste repository is not expected to be operational for more than 10 years. The transportation and safety concerns associated with high-level waste will be addressed in the licensing of a high-level waste repository. The major difficulty with this alternative is that a high-level waste repository will be licensed by the NRC and Congress does not want the disposal of defense TRU waste to be under the jurisdiction of the NRC.

**Page 3-44. Lines 18 and 19.**

Statement: "*Underground detonation*. Such detonations would produce a large amount of hazardous
113 fission products."

The statement implies that the underground detonation can only be carried out with nuclear devices. This should be clarified.

**Page 3-45. Lines 17 through 22.**

The following statement is made in the discussion entitled *Alternative Engineered Barriers:* "The
114 Department examined these as alternatives and determined based on the evaluation conducted in the *Engineered Alternatives Cost/Benefit Study Final Report* (DOE 1995c) that they were less effective than the engineered barriers examined in SEIS-II."

There is no discussion of engineered barriers in SEIS-II. However, of the 4 disposal options analyzed, Action Alternatives 2 and 3 include an engineered barrier, (waste treatment).

**Page 3-45. Lines 11 through 16.**

115 In the discussion entitled *Geologic Repositories at Sites Other than WIPP*, it is implied that salt is a more favorable disposal media than granite, basalt, and tuff. The reference for this conclusion is the 1980 FEIS for WIPP.

115 Much has been written on the disposal of nuclear waste since 1980. With regards to spent fuels and high level waste, the DOE maintains that the unsaturated zone in tuff is the most favorable medium. Also, Sweden has successfully constructed and is successfully operating a repository in granite for intermediate level waste.

**Page 3-46**

116 "The SEIS-II Proposed Action is similar to the Draft WM PEIS Decentralized Alternative". The Decentralized Alternative described in the PEIS is more expensive than the No Action Alternative ($1.7B vs. $7.4B). It also has more worker deaths (4 vs. less than 0.5) and a larger collective dose to workers (1,500 person-rem compared to 20 person-rem). These PEIS findings are similar to those in SEIS-II. The text should clearly explain why these results are totally opposite the DOE conclusion to consolidate the material for disposal at a particular site.





CHAPTER 4

**Page 4-1**

117 The 1996 Amendments to the 1992 WIPP Land Withdrawal Act are not recognized.

**Page 4-6**

118 The text states that salt backfill is not required for subsidence control or repository performance, but may be placed into the repository for final disposition.

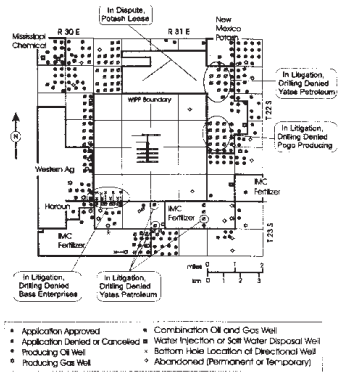
DOE Committed to backfill with salt in the 1980 FEIS.

**Page 4-9**

119 "Geophysical surveys indicate that pressurized brine reservoirs in the Castile formation occur as three or four discrete pockets." EEG is not aware of any data to substantiate this conclusion.

**Page 4-15**

120 Hydrocarbon resource recovery is a very important issue and merits much more than a cursory overview by three short paragraphs. The SEIS should have at least a series of maps showing proven and probable reserves at the various reservoir depths, an illustration of the geologic cross section of the area resources and current production (eg. Figure 1), and a current map indicating drilling interest in the area and the extent of drilling delayed due to the presence of potash. See EEG-62 (Silva, 1996)




Producing oil and gas wells, drilling applications denied due to potash resources, and the potash leases surrounding the WIPP Site.

**Figure 1**. Interest in resources near WIPP (see EEG-62 for more detailed discussions).

for a discussion of these figures. Due to the extensive changes from the FEIS, there should also be a detailed discussion of the anticipated resource recovery activities. Topics should include:

120

- The massive hydrofracturing required by the oil reservoirs surrounding the WIPP.
- Extensive brine injection surrounding the WIPP due to the need for salt water disposal.
- Brine injection for pressure maintenance to enhance oil recovery.
- Documented concerns by the potash industry of the potential impact of fluid injection on the Salado Formation.
- The estimated value of hydrocarbon resources in the area.
- Areas for which there are no estimates due to the lack of drilling and testing as a result of the presence of potash.

*Potash*

121

This section should have maps showing the extent of lease grade potash reserves including the extent of potash reserves under the WIPP Site. Further, the SEIS should rely on the official position of the Department of Interior. The text should then discuss the maps and the impact of WIPP on the potash industry and the potential impact of potash mining on the WIPP based on potash reserve estimates by the Department of Interior.

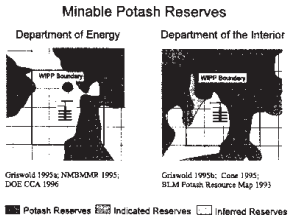



**Figure 2**. Estimated areal extent of potash reserves.

*Halite*

122

The increase in oil and gas activities, shown in Figure 3, continues to put demands on the need for brine supplies in the areas of new drilling. There needs to be a section discussing the decades long activity of solution mining of halite, shown in Figure 4, from the Salado Formation to produce brine for drilling oil and gas wells throughout southeast New Mexico.





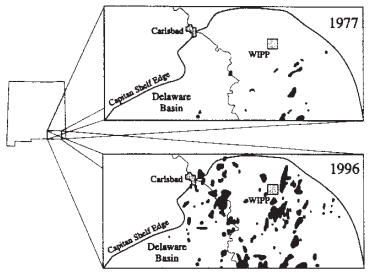



**Figure 3**. Actual growth of oil production.

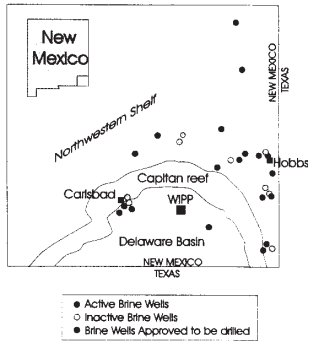



**Figure 4**. Solution mining of the Salado Formation.

**Page 4-21**

123

The discussion of the water level rises in the Culebra Aquifer and the potential impact of salt water disposal wells would be clearer by preparing and presenting a figure such as the one shown below and published in EEG-62.

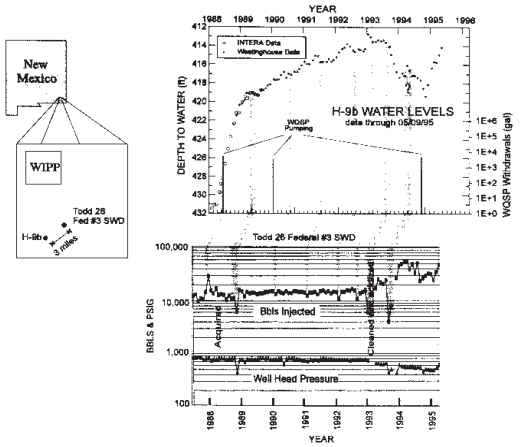



**Figure 5**. Postulate correlation between oilfield salt water injection and water level rises.

124 The discussion of potash mining and subsidence would benefit from a more detailed discussion of 40 CFR 194 and the CCA and a map of the extent of potash reserves as determined by the Department of Interior.





CHAPTER 5

**Page 5-4**

125 The statement is made (3 lines above Section 5.1.2) that "No activity is occurring under these leases, and the Department may acquire these leases in the Future." The current status of these leases, including the producing gas wells and the recent court judgement, deserve a more detailed description in the final SEIS.

**Page 5-9. Table 5-2.**

126 The total in the second column (Basic Inventory RH-TRU Wastes) should be $4800 million (not $4500 million). Estimates should be rounded off using a consistent system.

**Page 5-11. Transportation.**

Detailed transportation comments are included in the Appendix E comments and are not repeated in these comments. Calculations were checked and compared to the results reported in previous EEG reports. The transportation risks reported in SEIS-II are reasonable and adequately conservative.

**Page 5-13**

127 Highway route-controlled quantities (HRCQ) are discussed in the last paragraph. HRCQs are defined in 49 CFR 173.403(1) and routing is described in 49 CFR Part 177.825. The reference cited is not specific or useful. The statement that a majority of WIPP shipments are not HRCQs is misleading. Any waste shipment containing over 6 Ci of $^{239}Pu$ or $^{240}Pu$, 9 Ci of $^{238}Pu$, and 24 Ci of $^{241}Am$ is a HRCQ. Virtually all WIPP CH-TRU shipments will be HRCQs. Interestingly, the average RH-TRU inventory falls below the HRCQ limits and so the majority of RH-TRU shipments probably are not HRCQ.

**Page 5-16**

128 The Footnote to Table 5-7 states that "shipments would stop at sites chosen, in part, for their lack of population,...." Have such sites been chosen and is their usage required? Unless the answer to both questions is 'yes', this claim should not be made.

**Page 5-18. Lines 11 and 12.**

129 The statement is made that state inspectors "dose would be limited by administrative rules and the inspector would be rotated to a new position." Unless DOE knows the requirements of the various states they should not take credit for actions of the States.

Table 5-8 is said to indicate that site and state inspectors would receive the highest probability of health effects. Table 5-8 and Appendix E indicates that the rest stop employee has the highest probability.

**Page 5-21. Lines 18 and 19.**

130 The population density should be stated as "3861 persons per square kilometer"

**Page 5-26. Table 5-11.**

131 Footnote d states that the MEI for RH-TRU is located at SRS. There is no RH-TRU at SRS.

**Page 5-33. Lines 3 and 4 from bottom.**

132 The assumption that there would be no dose to the maximally exposed involved worker in the T1 and T2 accidents is apparently based on the assumption stated on page G-11 ("The involved workers, positioned outside of the glovebox, were assumed to exit the facility immediately and thus would escape impact"). The assumed geometry and operational procedures need to be described in more detail so that the reasonableness of this assumption could be evaluated.

**Page 5-34**

133 The text box on criticality contains information on the amount of Fissile Gram Equivalents present in WIPP Waste streams that is inconsistent with Table 1, Appendix B2 of the Baseline Inventory Report Revision 3. This Table shows there are 2,800$m^3$ of RFETS residue waste with an average concentration per 0.208$m^3$ drum of 13.7 Ci $^{239}$Pu and 53.6 Ci of $^{241}$Pu. This is an average of 218 FGE per 0.208$m^3$ (55-gallon) drum. The permissible limit is 200 FGE/55-gallon drum. Furthermore, Table 1 indicates there are about 151$m^3$ of waste at SRS INEL and Hanford that have average concentrations that exceed 200 FGE/ 55-gallon drum. This discrepancy needs to be





133 reconciled and the Final SEIS-II should use the values published in the latest BIR. Also, the final disposition of wastes that exceed 200 FGE/drum should be stated.

**Page 5-35**

134 We were able to approximately reproduce the LCFs for the RH-TRU Waste Storage Accident in Table 5-17 by using the overall release factor for stored CH-TRU waste from Page G-40 ($3.125x10^{-6}$) rather than the values described on this page for RH-TRU ($6.25x10^{-8}$). This overall RH-TRU release factor seems unreasonably low. Once again, the SEIS-II calculations are difficult to check because the specific input values are not given. It was necessary to retrieve numbers from two locations in Appendix 6 and one in Appendix A. We trust these were the values used in the calculation. Please provide more detail to enable the reader to reconstruct the calculation.

**Page 5-35 to 37**

135 WIPP disposal accidents and their consequences are summarized in this section. More detail is provided in Appendix G.4. The WIPP Safety Analysis Report also contains a suite of WIPP disposal accident consequences. The SEIS-II scenarios and SAR Scenarios are not identical. They differ in numbering, description, assumptions, and consequences. A comparison of the consequences of common scenarios is shown in the following table.

Table 2
EEG Comparison of SEIS-II and SAR
WIPP Accident Consequences

Ratio of SEIS-II/SAR Latent Cancer Fatalities

| Scenario | MEI Public | Non-involved Worker | Involved Worker |
|---|---|---|---|
| CH 7 Spont. Ignition, UG | 0.72 | 1.75 | — |
| CH 3 Puncture, Drop in WHB | 1.7 | 0.25 | 2.7 |
| CH 4 Drop in WHB | 2.0 | 0.29 | 3.6 |
| CH 5 Waste Hoist | 30. | 4.0 | — |
| CH 9 Drop in UG | 1.0 | 0.15 | 15.6 |
| CH 11 Roof Fall | 10. | 1.9 | — |

135 There is no clear pattern to the above ratios. MEI and Involved Worker consequences are mostly greater in SEIS-II, while non-involved worker consequences are mixed. It is unnecessary and confusing to use different scenarios and assumptions in the SEIS-II than were used in the SAR. The scenarios in the SAR evolved over a number of years and influenced by discussions between DOE/Westinghouse and EEG. These SAR scenarios are more specific to WIPP conditions and should be used in the final SEIS-II.

136 **Page 5-36**

As shown in the following Table, the frequency of various accident scenarios are different in SEIS-II than in the 1996 Draft Safety Analysis Report (SAR). An explanation should be provided.





Table 3
EEG Comparison of Accident Scenario Frequencies
in SEIS-II and 1996 SAR

| Table 5-18, Disposal Accident Scenarios | Annual Occurrence Frequency Draft SEIS-II | Draft 1996 SAR |
|---|---|---|
| W1, WHB Drum Drop | 0.1 | 0.011 (CH4) |
| W2, WHB Drum Puncture | 0.01 | 0.006 (CH3) |
| W3, Underground Drum Drop | 0.01 | 0.015 (CH9) |
| W4, Underground Drum Puncture | 0.01 | no scenario |
| W5, Underground Container Fire | 1E-4 | 4.8E-8 (CH7) |
| W6, Hoist Failure | 4.5E-7 | 1.4E-9 (CH5) |
| W7, Roof Fall | 0.01 Panel 1<br>9E-7, other | 4.3E-7 (CH11) |
| W8, RH-TRU Canister Breach | 1E-4 to 1E-6 | no scenario |

137 **Page 5-39. Long-Term Post-Closure Performance.**

The text says that the analysis in Draft SEIS-II are based on results computed for the Draft No-Migration Variance Petition and the Draft Compliance Certification Application (Draft CCA). Also, that "The final SEIS-II will re-examine its long-term performance assessment in light of any changes in methodology adopted for the compliance certification application." This re-examination should be made. It is unfortunate that Draft SEIS-II, even though it was released after the Final CCA was sent to EPA, could not incorporate the same methodology and results for the Proposed Action. We have comments on the current analysis.

**Page 5-40 & 41. 75th Percentile Values.**

The rationale for using median and 75th percentile parameter values is described: "The 75th percentile parameter values are used to yield model results that should fall in the upper tail of a full probabilistic analysis." But it is then said (lines 1-3 on page 5-41) that there is remarkably little difference between mean and 75 percentile values. In fact Table H-24 indicates that direct radionuclide releases to the ground surface are identical for the median and 75th percentile values.

138

This is inconsistent with the CCA (see Figure 6-40) where the median values on the CCDF plot are 67% of the mean value at 0.1 Probability and 40% of the mean value at 0.001 Probability. The reason for this discrepancy is probably because more parameters were sampled over a distribution of values in the CCA than in SEIS-II. For example, the CCA sampled some parameters in the following areas that SEIS-II did not: (1) shaft materials; (2) gas generation, 93) the Culebra aquifer; (4) borehole plugs; and (5) borehole shear resistance. The SEIS-II calculation is, in most cases, using the same parameters values for the 75th percentile as for the median.

The methodology does not yield results that "fall in the upper tail of a full probabilistic analysis."

**Page 5-40 & 41. Family Farm Scenario.**

The decision was made to not include the family farm scenario (500 meters from drill cuttings) that was used in SEIS-I because the land was poor, little water was available, and water quality is poor.

139

All of these facts are correct but there are ranch houses nearby and the majority of the dose (>99% in SEIS-I, Tables 5.63 and 5.64) is from inhalation. EEG-11[1] calculated CEDE inhalation doses of about 175 mrem at 360m from 13 Ci of TRU radionuclides brought to the surface and deposited in a brine pit. Doses to nearby residents should be included in SEIS-II.

**Page 5-41. Third Paragraph.**

140

It is stated that "No population impacts were calculated because only small amounts of radioactive material would be brought to the surface, remain in a wet, relatively nondispersable form, and

[1]Channell, James K., "Calculated Radiation Doses from Radionuclides Brought to the Surface if Future Drilling Intercepts the WIPP Repository and Pressurized Brine," NM Environmental Evaluation Group, EEG-11, January 1982.





would remain localized." The material brought to the surface will not remain wet. The mud pit will dry, enabling wind erosion to transport the radioactive material over long distances. It is quite possible that the mud pit will be dry prior to dismantling the drill rig and be disturbed by that process, exposing those workers to the risk of inhaling radioactive dust.

140

The assumption of wet, non-dispersable material in the brine pond is inconsistent with assumptions used in SEIS-I, EEG-11 and TME-3151.[2] Both EEG-11 and TME-3151 calculated inhalation doses to the population within 50 miles from wind erosion. EEG-11 estimated a population dose of 39 person-rem per year (50-year committed Effective Dose Equivalent) and assumed the exposure would last for many years. TME-3151 projected a population-dose of 76 person-rem CEDE for the one year period before the pond is covered.

Intrusion into the repository would definitely expose the neighboring population to risk. This risk should be calculated.

**Page 5-42. 4th line from bottom.**

141

Reference is made to the 5-kilometer subsurface lateral boundary. The appropriate boundary of concern is the WIPP site boundary which is less than 3 km from the waste panels to the south (down gradient in the Culebra aquifer).

**Page 5-43. Figure 5-1.**

142

There is a $10^6$ conversion error on this Figure (and on lines 18-19 on page 5-42) that is repeated on numerous other Figures in this Chapter and Appendix H. A concentration of 1pCi/l is equal to $10^{-9} Ci/m^3 \left[(1\frac{pCi}{l})(10^{-12}\ \frac{Ci}{pCi})(10^3 \frac{l}{m^3}) = 10^{-9}\frac{Ci}{m^3}\right]$ not $10^{-15}$ Ci/m³. This mistake raises an uncertainty about which value was used in plotting the extent of migration areas in the various figures. This is important; it must be clarified, corrected, and the areas re-plotted if necessary.

[2] Radiological Consequence of Brine Release by Human Intrusion into WIPP," US DOE, TME-3151, July 1982.

143 **Page 5-44. Last paragraph.**
This paragraph (which concludes on the top of page 5-45) concludes that intrusion at 100 years will have the maximum consequences. This determination cannot be made until calculations are made with an acceptable spallings model. Large spallings releases are possible at higher repository pressures which are expected to increase after 100 years. These increased spallings releases could more than offset the reduction in curies from radioactive decay.

144 **Page 5-46. Fourth Paragraph.**
The statement is made here (and elsewhere) that "no radionuclides or hazardous materials would be released into the Culebra within 10,000 years of repository closure for the deep drilling scenario under the proposed action." This is inconsistent with calculations in the CCA which show radionuclide release to the Culebra is a significant fraction of the E1, E2, and E1E2 scenario realizations. Calculations in the Final SEIS-II for the Proposed action need to be consistent with the CCA.

145 **Page 5-48. Section 5.1.12.5**
The statement is made that if all the stored excess RH-TRU waste were released it would cause less than 2 deaths over a 10,000 year period but that if stored it would result in less than 2 worker deaths per 100 years. This suggests that it would be better to release the waste than to store it! This section should go beyond the statement that population may increase around the sites and present a rationale for storing the waste.

146 **Page 5-49. Textbox.**
We have several comments about the Long Disposal Periods on SEIS-II results discussed in the text box:

(1) The problems of keeping a facility open for 160 to 190 years are undoubtedly much more complex than SEIS-II suggests. The current shafts and drifts almost certainly can't be maintained for that long and surface facilities would probably also need to be replaced. Institutional problems would also be expected. The discussion also suggests that large work forces would be employed on these long periods and would thus be uneconomical. The concept of committing to any plan for this long a time is unprecedented and probably unwise;





147 (2) Thermal loading in the repository should not be a major problem. The excavated waste disposal area in the Proposed Plan is about 27 acres (for CH-TRU wastes). This would permit 270 Kw with the present criteria of 10 Kw/acre. The inventory in Appendix A (Tables A-31 and A-33) for Action Alternative 2 total less than 170 kilowatts;

148 (3) We agree that differences in long-term alternatives should be compared in long-term aggregate impacts rather than annual impacts. These comparisons should include the same universe of wastes, regardless of how they are managed.

149 **Page 5-51. Textbox.**
The discussion in this textbox on Factors to consider in Combining Alternatives provides useful information. The brief statements on Waste Treatment and Waste Management should be expanded because they contain much of the rationale for choosing the Proposed Action.

150 **Page 5-59. Rail Accident Methodology.**
The conclusion that the number of rail accidents using dedicated trains will be 23 times that expected for regular rail service is unrealistic. The methodology used could be used to calculate a wide range of numbers, including zero additional accidents (with the assumption that no new locomotives would ever be used). Some of the potential benefits from dedicated trains (e.g., lower potential accident rate per mile, more control over waste package, and shorter shipment times) should be discussed. It is noted that both regular train and dedicated train shipments have less impacts than truck shipments (Table 5-29 versus Tables 5-25, 5-26, 5-28).

151 **Page 5-60**
Detailed evaluations of rail mileage in the SEIS-I and other earlier documents indicates that rail mileage from the major generating sites to WIPP is 16%-26% greater than truck mileage, not similar as claimed here.

152 **Page 5-67**
The Radiological Impacts storage accidents for Action Alternative 1 in Table 5-34 are from Table G-28. We reproduced the calculation for population and MEI LCFs from the Earthquake Scenario.

152 However, the maximally exposed non-involved worker should have only 0.4 LCFs and not 0.7 LCFs for a dose of 1,050 person-rem. We calculated only 760 person-rem for this calculation.

**Page 5-85. 2nd Line Beneath Table.**

153 What is the justification for assuming that thermal treatment of waste reduces the release fraction by a factor of 1,000?

**Page 5-104. Section 5.3.**

154 The impacts of disturbed and undisturbed cases of potash mining and brine reservoirs have not been adequately evaluated for the various Action Alternatives.

**Page 5-142. Lines 7-9.**

155 The assumption (for No Action Alternative 1) that DOE would indefinitely maintain institutional control at all of the storage sites is inconsistent with regulatory requirements at WIPP. Active institutional control may be allowed by EPA for 100 years at WIPP and credit (or partial credit) for up to 600 additional years of passive institutional control may be allowed. An assumption of perpetual institutional control for a No Action Alternative unfairly biases its comparison with the Proposed Action.

**Page 5-145. Table 5-88.**

156 The lifetime waste treatment impacts to Involved workers in the No Action 2 Alternative are only 0.08 LCFs. Yet for the Proposed Action they are 1.7 LCFs (Table 5-13). NAA 2 would treat 43% of the CH-TRU volume and 64% of the RH-TRU volume as the Proposed Action. Both actions treat waste to the WAC criteria at the generating sites. Why are the human health impacts for the Proposed Action 20 times as great?

157 **Page 5-148. Section 5.6.12.**

Detailed comments of intruder scenario modeling for long-term postclosure will be included in the comments on Appendix I.





157 The discussion of why the Record of Decision (ROD) for the FEIS-I came to the conclusion that a No Action Alternative was "unacceptable" is very good.

**Page 5-153. First paragraph.**

158 The estimated 2,325 radiological LCFs in 10,000 years from environmental releases at all storage sites is noted. The EPA allowed limit for WIPP amounts to a maximum of 42 LCF's over 10,000 years. If the limit is met, the analysis indicates that disposal at WIPP is clearly more protective than storage at the generating sites.

**Page 5-154. Lines 34 through 38.**

Statement: "In contaminated areas, currently remote-controlled mining equipment or equipment modified with off-the-shelf systems may be used. Where practical, removal operations would be performed remotely. All support, radiation and air quality monitoring and geotechnical surveying would be performed remotely in the contaminated areas."

159 The discussion of waste recovery in section 5.7.2 relies almost entirely on remote controlled activities as expressed in the above statement. At present, remote controlled handling of CH-TRU and RH-TRU does not exist. The discussion of radiological impacts in section 5.7.2.1 **Operational Impacts of Waste Recovery,** has no basis or justification.

**Page 5-155. Second complete paragraph.**

160 This discussion mentions the greater external radiation hazard from waste recovery (compared to waste emplacement). However, inhalation exposures from dealing with breached containers and contaminated salt could also be significant and this needs to be recognized in the Final SEIS-II.

**Page 5-156. Second complete paragraph.**

161 Was any analysis involved in arriving at the conclusion that health impacts to the public and non-involved workers from recovery operations was 1,000 times that in Action Alternative 3?

**Page 5-159. Lines 6 to 9 bottom.**

The statement is made that DOE is considering transportation of fissile materials for storage and
162 disposition. Is this being considered for WIPP?

**Page 5-161. Lines 5 and 6.**

More information is needed on the statement: "Emissions of radionuclides would be 134% of the
163 standards for the alternatives that would involve treatment to the LDRs at LANL;" Page 5-88 mentions a $9x10^{-5}$ chance of an LCF but doesn't mention standards. Is this the 10 millirem/year NESHAPs Standard?

**Page 5-162. Last paragraph.**

164 The elimination of former " Control Zone IV" made this land available for oil and gas recovery as well as for potash mining. There are a number of producing wells in this area now. Water flooding is also permitted and is occurring.

165 **Page 5-163. Section 5.11.**

The LWA prohibits the extraction of mineral and hydrocarbon resources from the Land Withdrawal Area in perpetuity, not just during the period of disposal operations.





CHAPTER 6

Chapter 6 lists all the regulatory agencies and the status of permits for WIPP. One regulatory agency is notably absent. It is DOE. The Department has the legal authority to self regulate operational activities at WIPP. The status of WIPP's compliance with DOE Orders or even a list of
166 DOE Orders is conspicuously absent. Indeed, DOE has the authority to self-approve the Draft Supplement to the EIS but fails to describe the internal system to be used. For example, the DOE long-term disposal calculations in the SEIS are approved by DOE and in the CCA by EPA.

APPENDIX A
WASTE INVENTORY

Comments on Appendix A are made in the page order they occur. The importance attached to these comments by EEG can be inferred from the text of the comment. Comments related to Waste Inventory that occur in the Summary or the Chapters will be addressed in those locations.

167 **Page A-2. Lines 19 through 22.**
Statement: "The volume of TRU waste for the SEIS-II Basic Inventory is estimated at 135,000 cubic meters (4.7 million cubic feet) for CH-TRU waste and 35,000 cubic meters (1.2 million cubic feet) for RH-TRU waste. These estimates are based on current volumes of stored waste and waste expected to be generated through the year 2033."

167 The estimates of 135,000 cubic meters for CH-TRU and 35,000 cubic meters for RH-TRU involve significant uncertainties that should be estimated and discussed. A generic weakness of SEIS-II is a lack of discussion of uncertainty in the TRU inventory over the past 18 years.

**Page A-6. Lines 22 through 25.**
Statement: "Some heat is generated by TRU waste due to the interaction of alpha radiation, emitted in the radioactive decay of plutonium isotopes, with the walls of the waste
168 container."

The heat is not generated in the wall of the waste containers. It is generated in the waste. The alpha particle range is too short to reach the walls of the waste containers.

169 **Page A-7. Lines 2 and 3.**
Statement: "The amount of gas generated is a function of the amount of heat produced from radioactive decay and the amount of plastic material present in the TRU waste."





169 The amount of gas generated is not a function of the amount of heat produced from radioactive decay. The amount of hydrogen gas generated is a function of the amount of energy deposited by ionizing radiation in the hydrogenous material present in the TRU waste and from anoxic corrosion of the drums.

**Page A-8. Lines 9 through 14.**
The estimated values for $V_{site}$ could also be expressed as: $V_{site} = V_{stored} + (38/28[V_{projected} - V_{stored}])$.
170

In this form the writing of equation A-1 is consistent with the writing of equation A-7 and A-8. Also, to be consistent $V_{stored}$ should be defined as TRU waste volume stored at the generator storage site through 1995. The use of "in 1995" is ambiguous.

171 **Page A-8. Lines 27 through 33 and Page A-10. Table A-4.**
Estimated total volumes of previously disposed TRU waste by site are discussed and presented.

171 The volumes of previously disposed TRU wastes are based on manifests that were written before 1970. If the waste is excavated and repackaged, the volumes will be significantly different due to compaction and the inclusion of contaminated soils. A discussion of the uncertainty in these volumes should be included.

**Page A-12. Lines 5-7.**
The statement is made that "only a few waste forms need packaging to meet thermal power limits, provided that plastic wrap is not used when the drums are filled (bagless posting)."
172 Table A-16 indicates that average concentrations in about 19,400$m^3$ (about 14%) of stored plus projected wastes do exceed the thermal power limits for bagless posting. Furthermore, our understanding is that the majority of presently stored wastes containers use bags. Please comment. Does DOE plan to repackage wastes to remove bags? The plans to repackage and treat stored waste in order to meet the WIPP WAC limits should be explicitly addressed in

172 detail in the SEIS-II.

**Page A-12. Lines 8 through 17.**
The calculation of $V_{Expansion}$ is discussed.

173 The calculation of $V_{Expansion}$ cannot readily be followed since the input data are contained in other documents such as TRUCON. Tables of adjustment factors similar to those provided in Tables B-2 and B-3 of Appendix B should be provided. See page A-22 to A-28 comment below.

**Page A-12. Lines 19 through 24.**
174 The statement is made that some of SRS waste would be processed to become RH-TRU. There is no evidence in the SEIS-II or other documents reviewed that there will be any RH-TRU at SRS.

**Page A-13. Lines 21 through 23.**
The Statement is made. "A 65-percent reduction in the TRU waste volume to be disposed of was assumed due to LDR thermal treatment of both CH-TRU and RH-TRU."

175 No justification is presented for the assumption of a 65-percent reduction factor in the TRU waste volume due to LDR thermal treatment. Also, it is questionable whether a 65-percent reduction should be applied to the additional inventory, since it has been compacted and will contain considerable amounts of soil.

**Page A-13. Lines 35 through 38.**
176 The statement: "A density change assumption, therefore, is made such that a 55 gallon drum containing the slag would weight 454 kilograms (1,000 pounds). Waste density values are used in the determination of the number of shipments (Section A.3.9). See Table A-2 for the CH-TRU average drum weights used to determine the number of shipments."





176 Table A-2 does not provide data for a drum weighing 454 kilograms. It's not clear from Table A-2 whether it is permissible to use any number of waste drums between 11 and 42 as long as the weight of drums plus dunnage does not exceed the Payload per shipment.

**Page A-16. Table A-8**
177 The values for INEL and total in the columns labeled **Post-Treatment Disposal Volume** are in error. The values for INEL should be 10,000, 20,000, 30,000, instead of 10,000, 31,000, 41,000. The values for total at the bottom of the page should be 47,000, 49,000, 96,000 in Tables A-8, A-9, and A-10.

**Page A-20. Table A-12.**
178 The values for RFETS Total in the columns labeled **Post-Treatment disposal Volume** are in error. The values for RFETS should be 13,000, ---, and 13,000 instead of and 19,000, ---, 19,000, and the values for Total at the bottom of the page should be 162,000, 166,000 and 329,000.

**Page A-22 to A-28.**
179 This section calculates the number of waste shipments for the various alternatives. The methodology is explained about shipping weights (Table A-2) and Volume expansion to meet thermal limits (Equation A-2) earlier in the Appendix However, all assumptions were not given (e.g. how volumes were scaled to full repository size and whether the number of drums per shipment is interpolated between values given in Table A-2). For LANL CH-TRU Proposed Action shipments our values were 6% lower than the 5,009 shipments indicated in Table A-15.

**Page A-23. Table A-14.**
180 The use of the term "Newly Generated Waste" for waste that doesn't exist is misleading. Use "To be-Generated Waste."

181 **Page A-23. Table A-14.**

181 The values in Table A-14 have not been rounded off, which is unlike Tables A-3 thru 13. Also, the columns labeled **Existing Stored Volume** should be relabeled **Stored (1995)** to be consistent with Table A-3.

**Page A-33 to A-40**

182 The method described here for scaling up radionuclide inventories is said to rely heavily on the Baseline Inventory Report, Revision 2 and the 1995 Integrated Data Base. Yet the results are different from those presented in the CCA and BIR Revision 3 as shown in Table 4. Values are also different for Pu-241, Am-241, Pu-240, Co-137 and Sr-90.

Table 4

EEG Comparison of Inventories Used in

Different DOE Documents

| | CH - TRU | | RH - TRU | |
|---|---|---|---|---|
| Source | $^{238}$ Pu Ci | $^{239}$ Pu Ci | $^{238}$ Pu | $^{239}$Pu |
| CCA at 2033 | $1.94x10^{6}$ | $7.85x10^{5}$ | $1.07x10^{3}$ | $1.0x10^{4}$ |
| BIR Rev 3,2033 | $1.93x10^{6}$ | $7.85x10^{5}$ | $1.07x10^{3}$ | $1.0x10^{4}$ |
| Table A-27&28 | $1.70x10^{6}$ | $6.82x10^{5}$ | $6.48x10^{2}$ | $3.93x10^{3}$ |

182 We were not able to reproduce the volume factors reported in Table A-25 for the Proposed Action. Our values were about 3.5% higher for CH-TRU at LANL and SRS when using $V_{IDB}$ values from the 1994 IDB in equation A-8. This Appendix did not specify what volumes were used or how the inventory was scaled to a full repository.

More importantly, we do not see any reason for SEIS-II to derive a different disposal inventory for the Proposed Action. The Final SEIS-II should use the same values as the CCA.





APPENDIX B

**Page B-9. Line 5 or equation B-1.**

183 The equation for site adjustment factors is presented. Equation B-1 is confusing and needs additional brackets and explanations. The subscript $_{site}$ appears inside the square bracket and the subscript $_{keysite}$ appears outside the square bracket. The definition of $SF_{site}$ contains the word site and the phrase key contributing sites. The definition of $V_{sites}$ and $V_{WM\ PEIS}$ contain the word site only. The definition of $C_{SEIS}$ and $C_{WM\ PEIS}$ contain the phrase "site Key" only. It appears that there is a multiplication of data from $_{site}$ tables with data from $_{keysite}$ tables. Finally, the large curved brackets have the subscript $_{alternative,\ subalternative}$ where alternative pertains to the SEIS-II and subalternative pertains to the Draft WM PEIS, which suggests that $SF_{site}$ is a matrix.

**Page B-9. Lines 14 through 16.**

184 Statement: "Key contributing sites were determined by ranking the sites by cancer incidence risk for each alternative. The sites with the largest risk were then selected until a contribution of at least 90 percent of the total cancer incidence risk as reported in the Draft WM PEIS was reached."

It is not clear what this paragraph has to do with the calculation of site adjustment factors. Presumable it deals with the evaluation of the ratio of site key radionuclide concentration in SEIS-II/site key radionuclide concentration in the Draft WM PEIS.

**Page B-9. Lines 31 through 33.**

185 Statement: "Key radionuclides are those defined in Appendix D of the Draft WM PEIS as the single radionuclide contributing the highest risk cancer fatality at each site under each alternative. Key radionuclides are identified in Appendix D of the Draft WM PEIS. Equation B-1 deals with "site key radionuclides" and Not "key radionuclides."

**Page B-11. Line 17 equation B-2.**

The equation for adjusting the site-specific cancer incidence values of the WM PEIS is presented.

186 Equation B-2 is confusing and may contain misplaced subscripts. Again the subscript $_{site}$ appears inside rounded brackets and the subscript $_{keysite}$ appears outside the same rounded brackets. Presumably the subscript $_{keysite}$ should be beneath the summation symbol. Also the large square brackets that enclose R(adj) $_{WM\ PEIS}$ have the subscript $_{alternative,\ subalternative}$ which suggest that R(adj) $_{WM\ PEIS}$ is a matrix. $SF_{site}$, which is inside the large square brackets also involved the subscript $_{alternative,\ subalternative}$.

187 **Page B-12. Table B-4.**

The site adjustment factor for LANL should be 0.13 since this is the value used in the results of the calculations that are presented in Table B-5. The rounded off value of 0.1 is not used in the calculations.





APPENDIX D

LIFE-CYCLE COSTS AND ECONOMIC IMPACTS

188 **Page D-1. Section D.1. Life-Cycle Cost.**

The section does not indicate that life-cycle costs were determined for exhuming the CH-TRU waste disposed before 1970. It does not appear that these costs were analyzed in the draft WM PEIS.

**Page D-2. Table D-1.**

The bottom part of the table calculated the **Volume Adjustment Factor**. The volumes in column 5, **SEIS-II CH-TRU Waste,** column 6, **SEIS-II RH-TRU Waste,** and column 7, **SEIS-II Total,** should be rounded off to be consistent with Table A-5. Also, the RH-TRU volumes are quite different in the two tables. The lack of consistency is confusing. It should indicate that the volumes are in $m^3$.

**Page D-3. Table D-2.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-6 and A-7.

189

**Page D-4. Table D-3.**

Volumes in columns 5, 6, and 7 should be rounded off to be consistent with Tables A-8 and A-11.

**Page D-5. Table D-4.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-9 and A-11.

**Page D-5. Table D-5.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-10 and A-11.

**Page D-6. Table D-6.**
Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-12 and A-13.

189 **Page D-7. Table D-7.**
Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-8 and A-11.

**Page D-8. Table D-8.**
Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-9 and A-11.

190 **Page D-10. Line 4.**
The discount factor is presented as (1/1+r). There appears to be an error. It is not possible to reproduce the numbers in Table D-10 using the above formula for the discount factor.

**Page D-10. Table D-10.**
The rounding off of numbers is very crude. The values for **Inflation-Adjusted Discount Rate** of r=3 percent and r=5 percent in column 3 are the same. It is not possible to come close to the numbers in row 3 using a discount factor of $1/1.05^{35}$.
191 Rounding off to the nearest $0.5 B in column 3 on a value of $3.5B does not build confidence. This amounts to 15%.





APPENDIX E
TRANSPORTATION

The Appendix E, review concentrates on the discussions and calculations relevant to the radiological aspects of the Proposed Action for truck transportation. Since this is the most likely final choice for waste shipments to WIPP. Implications of the alternative actions, rail transport, and hazardous chemical impacts were evaluated in less detail.

EEG reviewed various DOE WIPP transportation documents over the years and produced several related reports. None are referenced. One report ("Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) wastes to WIPP along Selected Highway routes in New Mexico using RADTRAN IV," Anthony F. Gallegos and James K. Channell, EEG-46, August 1990) is particularly relevant to Appendix E. EEG-46 is a reasonable and adequately conservative evaluation of transportation risks. Our review of Appendix E is a comparison with EEG-46. Consideration was given to the fact that Appendix E is a nationwide assessment and changes in assumptions have occurred since 1990.

192 **Page E-2.**
The statement "The SARP application for the RH-72B shipping cask is to be submitted to the NRC in September of 1996." It was submitted in December of 1996.

**TRUCK TRANSPORTATION**
Routes and Mileage
193 The proposed waste shipment routes to WIPP agrees with our understanding. The distance reported in Table E-5 for LANL to the WIPP site (549km, with 512km being rural, 34 suburban and 3 urban) agrees favorably with that used in EEG-46 (548km, with 509km rural and 39 km suburban). Distances from the other sites were not checked, but appear reasonable.

Non-radiological Accidents

DOE reported accident, injury, and fatality impacts per roundtrip shipment from each site to WIPP in Table E-8. However, since accident rates per kilometer were not given, the values in Table E-B could not be checked. The back-calculated accident rates for the LANL to WIPP route ($1.62 \times 10^{-6}$/km in suburban areas and $3.13 \times 10^{-7}$/km for rural areas) are reasonably close to the values used in EEG-46 ($3.21 \times 10^{-6}$/km rural and $1.78 \times 10^{-6}$/km rural and $1.78 \times 10^{-6}$/km suburban).

194

Accident per shipment data from Table E-8 and the number of shipments values from Tables E-1 and E-2 were used to check the total values for the proposed values in Table E-9. Agreement was within 3% and differences were probably due to rounding error. The EEG-46 value of 5.0 accidents (while carrying wastes) in New Mexico extrapolated to 52 CH-TRU roundtrip accidents. This was adequate agreement (-10%) with the SEIS-II value of 58 accidents.

We agree with the value of 0.165 (rounded to 0.2) LCF's from vehicle pollution in urban areas.

Accident Free radiation doses

195 In Table E-10 (RADTRAN INPUT, Etc.) it is not clear why the number of people exposed per stop and the exposure distance is different for CH-TRU and RH-TRU.

196 The aggregate accident-free dose to occupational and nonoccupational persons is presented in Table E-14. The non-occupational value for CH-TRU (4.200 person-rem) is similar to the value obtained (4050 person-rem) by scaling up the EEG-46 value of 330 person-rem) by a mileage factor of $40.7 \times 10^{+6}$ mi/$7.8 \times 10^{6}$ = 5.22 and a Transportation index (TI) adjustment of 4.0/1.7 mrem. This is good agreement.

The aggregate occupational dose of 710 person-rem was reproduced within 1% from methodology in SAND 84-0036 (RADTRAN III) and when using the actual average TI value





(1.5 mrem/hr.) from Table E-11. This dose was not calculated directly in EEG-46.

Scenarios for calculating doses to the maximum exposed individual (MEI) are described on page E-32 and the doses are shown in Table E-15. The scenario description does not provide all the assumptions necessary to make the calculations. We were able to reproduce the CH-TRU doses for the Departure Inspector, the State Inspector, and the rest stop employee within ± 12% by using either the TI values reported in Table E-11 or the 4 rem/h value (that the text said was being used). The scenarios are sufficiently conservative so that the MEI doses in Table E-15 adequately represent the doses to members of the public and to occupational workers that do not wear dosimeters.

197

The calculated risk to these MEIs are not large. However, the doses average several hundred millirem/year for 10 years. This is somewhat greater than the 100 mrem/y value that most national and international agencies believe should not be exceeded from all radiation exposure combined (radiation doses from natural background and medical usage are not included in the
100 mrem/y value). These considerations suggest that the following operational control procedures should be implemented:

(1) persons who routinely inspect vehicles should be classified as radiation workers and required to wear dosimeters.

(2) normal procedures should not allow trucks carrying CH-TRU or RH-TRU wastes to routinely stop for long periods of time at locations where public exposure is likely to occur.

**Maximum Transportation Accident Doses**

198 EEG-46 calculated a maximum of 10 LCFs from a category VIII accident in North Carlsbad with an average SRS shipment (1670 PE-Ci in 3 TRUPACTS). The probability of this event was calculated as $4.7 \times 10^{-8}$. SEIS-II calculated a bounding accident value of 16 LCF with a

maximum allowable PE-Ci content in a TRUPACT-II (928 PE-Ci) and 3 LCF with an average inventory (191 PE-Ci). There were numerous differences in assumptions and there is an uncertainty about the actual population density used in EEG-46.

198 Attempts to extrapolate EEG-46 LCFs resulted in only about 60% of the doses reported in SEIS. The SEIS-II bounding values are appropriately conservative and indicate that very low probability accidents could have serious consequences.

It was noted in the PEIS (page E-77) that "waste shipments from LANL were found to result in the highest potential transportation accident doses." SEIS-II did not give highest potential transportation accident doses by site. The PEIS (footnote to Table E-26) assumed that all 3 TRUPACTs would fail in an accident. SEIS-II (page E-42) assumed only one would fail.

**Aggregate Radiological Impact from Accidents**

199 The aggregate radiological impacts from accidents in Table E-22 present the expected population dose (person-rem) from multiplying the person-rems for each accident by the probability of occurrence. The total dose for the Proposed Action is 850 person-rem (829 from CH-TRU shipments and 15 from RH-TRU. These doses are over two orders of magnitude greater than would be predicted from EEG-46 even after scaling for total system mileage. Most of this difference can be attributed to the higher impact release fractions (IRF) for accident categories V, VI, and VII used in SEIS-II. These IRF values are 100, 40, and 4 times (for categories V, VI, VII) those used in EEG-46. These categories have a much higher probability of occurrence and actually contribute more to the expected doses than category VIII accidents. It is concluded that these aggregate population doses from accidents are appropriately conservative.

**Rail Shipments**

200 On page 3-7 the SEIS gives four reasons why truck only transport was chosen: (1) limited interest by rail carriers; (2) higher cost of dedicated trains relative to truck shipments; (3) cost of acquiring additional TRUPACT-IIs; and (4) rail carriers would not assure DOE that





transport could occur in less than 60 days. SEIS-II discusses 7 issues (bottom of page E-58 and top of page E-60) that need to be addressed before a decision can be made to use rail

200 transport. The present uncertainties mentioned for these issues are largely true. However, it is unclear whether DOE has seriously reevaluated this issue since the decision about 12 years ago to have truck only transport to WIPP. There is no indication in DOE/WIPP 93-050 (Comparative Study of WIPP Transportation Alternatives, February 1994) that the decision was really re-evaluated.

The values reported in Tables E-29 through E-32 were "determined by adjusting the transportation impacts from truck shipments" (page E-58). Examples of questionable assumptions used in this analysis are:

(1) The average speed in all population zones was said to be 55 miles per hour for truck transport. This is inconsistent with Table E-10;

(2) The total miles assumed to be the same for truck and rail. SEIS-I actually developed rail route distances (see Table D.4.2). Distances by rail were 16%-26% greater for all of the major generating sites;

201

(3) The origin of the 89% rural, 10% suburban, and 1% urban breakdown is not given. The mileage - average for the distances in SEIS-I (weighted for the number of SEIS-II shipments) is 87%, 12%, and 1%.

(4) The basis for the assumption that the number of individuals sharing the transportation corridor is at least two orders of magnitude less is not given:

(5) We cannot reproduce the value in equation E-5 from Equation E-4. The value of TI in E-4 should be 0.033 (from the previous page). Also, a value is needed for N (number of rail shipment transfers per shipment). If N were about 3.2 and TI was .033 the dose would be $1.7x60^{-4}$(TI)M.

201 (6) The logic for assuming that the aggregate radiological consequences of rail accidents was identical to truck accidents (first paragraph under E.7.3, page E-62) is unclear (same miles traveled times less frequency for rail accidents = same as truck). Is this because the release would be double in rail accidents?

202 A comparison of the Rail Transportation impacts in Tables E-29 (alternative 1) and E-30 (alternative 2) indicates there are less effects from rail transport than from truck transport (Tables E-9 and E-14. This suggests that SEIS-II should provide a better rationale for using truck only transportation or else seriously re-evaluate whether a truck and rail mix might be preferable.

**Alternatives**

203 The results of Alternative Impacts from accidents, vehicle pollution, and routine radiological that are presented in various tables were studied to see if the values were reasonable compared to the Proposed Action. In all cases, the values appear to deviate in the expected direction from the Proposed Action and the magnitude of the deviation seemed reasonable. More description in the text explaining these differences would be helpful however. For example, is the lower (relative to the Proposed Action) non-occupational radiation dose total in Table E-14 for CH-TRU waste in Alternatives 2A and 2B due solely to the fact that there are fewer miles travelled (which can be implied from Table E-9)? Does this calculation use the TI values from Table E-11, or does it use a TI of 4 in both cases?

204 The statement on page E-53 that for thermally treated waste "The release fraction would be reduced by a factor of 1,000, ....." is not referenced or justified. Some reduction would be expected, but a three order-of-magnitude reduction requires justification.

205 A large number of comparisons are made about the transportation effects between alternatives in Appendix E. These comparisons include expected radiological and non-radiological risks from both incidents free and accident conditions. The consequences of severe low probability accidents are also evaluated. Yet there is no discussion in this Appendix of using





205 this information to aid in the selection of the appropriate action. The impression given at this time is that the Proposed Action is the only one being considered.

**Page E-43. Equation E-1**

206 There appears to be a typo error. Equation E-1 has a parameter named FMPI while the explanatory text has a parameter named FMRPI.

**Page E-45. Equation E-2.**

207 There appears to be a typo error. Equation E-2 has a parameter named FMRT while the explanatory text has a parameter named FMRPT.

**Page E-64. Section E.8.2.**

208 There is a conversion error in the first paragraph of this section: $3.4 \times 10^6$ cubic meters is equal to $1.2 \times 10^8$ cubic feet (not $10^6$).

APPENDIX F
HUMAN HEALTH
(from Routine Operations)

209 **Page F-14. Section F.2.3.3 External dose of Involved Workers.**
No units are given in Tables F-11 through F-15. This should be corrected in the Final SEIS-II.

210 **Page F-17, last paragraph.**
The statement that only a small volume of waste would require packaging is perhaps misleading. "Repackaging" is intended, not "packaging". As mentioned under page A-12 comments, about 14% of wastes exceed thermal limits even with bagless posting and a significant percentage of existing wastes are believed to contain bags. Also note that the Draft SAR Appendix A states that DOE plans to repackage or process 88% of the existing CH-TRU waste.

211 **Page F-18, first paragraph.**
Dose rates are said to be reducible by administrative controls but no credit is taken for this. Credit should not be taken because there is no commitment to exercising administrative controls.

212 **Page F-18. Equation F-1.**
No reference is provided as to where the input data of $D_{ad}$ and $C_{k}$ can be found. Without these input data, it is not possible to verify independently the average surface dose rate in Table F-17.

213 **Page F-20.**
The reason for calculating the worker lifetime dose on a per waste panel basis is not apparent since the exposure assumptions are unrelated to the filling of a panel. All that is needed is the assumption of the hours per year that the worker is present at 1 meter from the drum and





213 the average 1-meter dose rate from Table F-17. The workers should have exposure time limited to 345 hours per year in order to have the annual dose $\leq$ 1 rem for an average 1-meter dose rate of 2.9 mrem/hr. Furthermore the assumption in Table F-18 that the 10 panels will be completed in 20 years is inconsistent with the rationale described in the last paragraph of page F-20 that would require 23.2 years in order to hold doses to 1 rem/year. These calculations do not appear to address exposures from the installation of MgO around the drums.

214 **Page F-21.**
Attempts to reproduce two of the individual dose values for storage site workers for alternative 1 resulted in values that were +12% and -17% of the Table F-22 values. In this effort we started with the average 1-meter dose rate in Table F-17 and decayed screening values from Table F-12 over the 20 to 55 year period to obtain average annual dose rates for the 35 years. Ingrowth of $^{241}Am$ from decay of $^{241}Pu$ was also included. It would be helpful to reviewers if SEIS-II gave more details of the calculations so they could be checked without making numerous assumptions.

215 The SEIS-II chose to evaluate the radiological effects of routine operations involving lag storage and no action alternatives on the 35-year working lifetime of individual workers. These results are presented in Table F-22 and this is an appropriate way to evaluate the risk to an individual worker or a (35-year) generation of workers. However, it does not indicate the cumulative effect over several generations (for the various action alternatives) and perpetually for the No Action Alternatives. The method used makes the human health effects (LCFs) of the alternatives appear better in comparison with the proposed action than it would be if multi-generational effects were included.

216 **Page F-21. Equation F-3.**
No reference is provided for the input data of $V_{CH,S}$ and T. The definition of T as a worker throughput rate of one worker per 1,000 cubic meters is confusing. It is not possibly to verify independently the values in Table F-19.

**Page F-25.**

217 The involved worker lifetime radiological impacts from routine CH-TRU waste disposal operations in Table F-21 total 720 person-rem for the entire disposal phase. This total is derived from 36 workers x 20 rem/worker =720. The WIPP Safety Analysis Report (DOE/WIPP-Draft - 2065 Revision 1, Table 7.1-2) used 36.9 rem/year for 38 persons and a 35 year disposal period. This totals 1,292 person-rem and a dose of 34 rem/per person. This is 1.8 times the worker population dose used in SEIS-II. The main difference is in assuming a 35 year disposal phase rather than a 20 year phase. DOE should present consistent methodology and results in its related WIPP documents.

218 The individual lifetime worker doses in Table F-22 for RFETS are excessively high. For Action Alternative 1 and No Action Alternative 2 they exceed occupational limits (5 rem/y) every year for 35 years. Surely such doses would not be allowed. These doses need to be explained or the text needs to be corrected.





APPENDIX G

FACILITY ACCIDENTS

219 There is no statement that SEIS-II is in compliance with the report, U.S. Department of Energy, 1993, *Recommendation for the Preparation of Environmental Assessment and Impacts Statement*, Washington, DC: Office of National Environmental Policy Act Oversight nor that it is in compliance with the DOE/New Mexico C & C Agreement. The second statement in the WM PEIS, **APPENDIX F, Treatment and Storage Facility Accidents**, F.1.1. **SUMMARY**, indicates compliance with the above cited document.

**Page G-1. Lines 31 and 32.**

220 Statement: "The health impacts from acute exposures to radionuclides from accidental releases were calculated as described in Appendix F."

The statement is incorrect. Appendix F deals with human health impacts that may result from exposures to radioactive materials and hazardous chemicals during routine storage operations at waste storage sites and during routine disposal operations at the WIPP.

**Page G-2. Lines 3 through 5.**

221 Dose-to-risk conversion factors for a population are given with a unit of /rem.

The unit is incorrect. The unit for dose to risk conversion factor for a population is /(person-rem). The dose-to-risk conversion factors are correctly presented on page F-2.

**Page G-8. Table G-4.**

222 If Pu-238 and Pu-240 are considered to be major contributors to DOSE at ORNL, Pu-239 should also be listed in that category.

**Page G-13. Line 40.**

223 Statement: "Because of the serious nature of the accident, the involved workers were assumed to be fatally injured."

There should be an indication of the number of workers involved.

**Page G-14. Table G-9.**

224 The text on page G-13 states that thermally treated waste is placed in 5 drums simultaneously. Cell (**T4, Number of Drums**), shows 4.9 drums. The difference is small, but the lack of consistency is confusing.

**Page G-17. Line 4.**

225 Q is defined as the radionuclide or hazardous metal inventory of a waste container (from Appendix A). Appendix A provides radionuclide inventories only on a per treatment site basis. Additional math is required to convert the data to a per drum basis. It is not possible to verify independently the health impacts data presented in Tables G-13, G-16, and G-19.

**Page G-18. Equation G-2 and line 6.**

226 The quantity E/Q is known as the relative concentration (NUREG 1.145 or WIPP/SAR). The quantity is not defined in the Glossary and E/Q cannot be found in Acronyms and Abbreviations. In Table G-12, E/Q is referred to as the atmospheric dispersion factor. There should be consistency and the omission from the Glossary and from the Acronyms and Abbreviation should be corrected. This term has historically been labeled as $\chi$/Q (Chi/Q). The use of the E/Q terminology is unnecessary and confusing.

**Page G-18. Table G-11.**

227 Column 3 of Table G-11 presents "population-Weighted E/Q (sec/cubic meter)".

The quantity "Population-Weighted E/Q" is not defined in the Glossary. Presumably, the units of "Population-Weighted E/Q" should be (person-sec)/(cubic meter). The parameter





227 and its correct units should be included in the glossary.

**Page G-21. Lines 11 through 15.**

228 Statement: "Acute releases were assumed to be dispersed in one direction, so population impacts were estimated for a single, maximally exposed, 22.5 degree sector (out to 80 kilometers [50 miles} and not for the entire 80-kilometer (50 mile) region population. Population weighted atmospheric dispersion values were calculated and used to determine the maximally-impacted sector, considering both the change in air concentration over distance and the population impacts in a single 22.5-degree sector.

The description does not make it possible to independently verify the calculations. The discussion should include equations for the calculations of the population-weighted atomospheric dispersion values and for the calculations of the population impacts in a single 22.5 degree sector.

**Page G-30. Lines 3 through 5.**

229 Statement: "Intakes of radionuclides could result in a dose of up to 14,800 rem, with a corresponding probability of an LCF of greater than 1."

Numerically, a probability is a dimensionless number with values between 0.0 and 1.0. 0.0 indicates that the event cannot occur and 1.0 indicates that the event will occur with absolute certainty. A probability cannot be greater than 1.0 Also, a TEDE of 14,800 rem may be a lethal dose (rather than an LCF) even for transuranic wastes where internal doses are delivered over many years.

**Page G-36. Lines 28 and 29.**

230 Statement: "The fission products contributing the most to external dose rates were Cs-137/Ba-137m and Co-60,...."

Co-60 is an activation product and not a fission product.

**G-42. Table G-28.**

231 Insufficient data are provided in the text to verify the dose calculations. The text does not provide a reference for the dose conversion factor, DCF, for PE-Ci, and it is not possible to calculate the source term for accident scenario 3 (earthquake) because there is no reference to the number of waste drums involved.

**Page G-46. Table G-31.**

See comment page G-42. Table G-28.

**Page G-49. Table G-33.**

See comment page G-42. Table G-28.





APPENDIX H

LONG-TERM CONSEQUENCE ANALYSIS FOR PROPOSED ACTION AND ACTION ALTERNATIVES

232 A general comment is that EEG believes that the Final SEIS-II should use methodology, codes, and selected data from the CCA. Any modifications to the October 1996 CCA that are available prior to writing the Final SEIS-II should also be incorporated.

**Pages H-7&8. 75th percentile values.**

There is no justification for the claim that the 75th Percentile Values as used lead to a realization that is "within 1% of the maximum release statistically possible." See comments under Page 5-40 & 41.

**Page H-8. Last full paragraph.**

233 The analysis is said to have shown no releases into the Culebra dolomite. This is inconsistent with the CCA, which showed releases in a number of realizations.

**Page H-24. Next to last paragraph.**

234 Contrary to the statement in this paragraph, the impacts of chemical retardation are being calculated in the PA for the CCA.

**Page H-30. Table H-7.**

235 These solubility values are from the DCCA. They are somewhat higher than those being used in the CCA because of the effect of MgO backfill. Final SEIS-II should use the CCA values.

**Page H-34. Lines 1 through 6.**

236 Reference is made to Figure H-7 and to Table H-8.

It is difficult to follow what the relationship is between Figure H-7 and the data in Table H-8. There is no explanation on how the last row of Table H-8, entitled **Total Repository**
236 **Volume,** is obtained. It is not clear what the relationship is between **Rest of Repository, Separately Modeled Panel Volume**, and **Total Repository Volume.** Some additional clarification should be presented.

**Page H-36. Table H-8.**
The z distance in a two-dimensional grid was increased by factors of approximately 8 in
237 order to accommodate the larger waste volumes in Action Alternatives 1, 2, and 3. This violates the two- dimensional assumption of the BRAGFLO grid. A three-dimensional analysis may be needed to give reliable results.

**Page H-49. Table H-22.**
The CCA used much smaller brine reservoir values than the volume estimated for WIPP-12.
238 EEG has reservations about this CCA assumption. Also, the compressibility value shown should be for rock compressibility, not pore compressibility (pore compressibility = rock compressibility ÷ effective porosity.)

**Page H-52. Lines 1 and 2.**
Statement: "The pressure release of the waste panel, as a result of the exploratory drilling event at 100 years post-closure, is clearly evident for Case 2 and 4 in Figure H-8."
239
In Figure H-8, the pressure release for cases 2 and 4 appears to occur at 400 years post-closure. No explanation is provided in the text for the delay in pressure release from 100 years post-closure (time of drilling event) to 400 years post-closure (time of pressure release). Also, Figure H-8 indicates a significant pressure increase between 700 years and 1,300 year post-closure for cases 2 and 4. Finally, the asymptotic behavior for cases 2 and 4 at 10,000 years post-closure is significantly different. Are the differences in the brine pressure for cases 2 and 4 the result of error propagation numerical solutions of the differential equations? Some discussion should be provided in the text.





**Page H-52, Figure H-9.**
240 The appropriate conversion factor between pCi/l and Ci/$m^3$ is 1pCi/1 = $10^{-9}$ Ci/$m^3$ (not $10^{-15}$ pCi/1). See page 5-43 comment.

**Page H-55 and Later. Table H-24.**
241 No attempt was made to check the reasonableness of the assumtions and calculations of releases and doses to the driller. It is noted in Table H-24 that the value for Pu-240 is incorrect. It will be a few percent of the Pu-239 value, not less than 0.01%.

**Page H-57. Last paragraph.**
242 Because of the pCi/1 to Ci/$m^3$ conversion error mentioned, we are unsure whether the 1 pCi/1 value quoted here is correct or whether the value is $10^{-6}$ pCi/1.

**Page H-60. Lines 1 and 2.**
Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for case 7 and 9 in this figure."
243
Figure H-11 indicates a pressure release at almost 500 years post-closure, which is significantly different from 100 years post-closure, which is the time of the drilling event. No explanation is provided in the text for this delay. Are the differences in the asymptotic behavior at 10,000 years post-closure between cases 6 and 8 and cases 7 and 9 the result of error propagation in the numerical solutions of the differential equations? An explanation should be provided in the accompanying text.

**Page H-62. Table H-29.**
For the radionuclides of Am-241, Cm-244, Pu-238, Pu-239, Pu-240, Pu-241, U-233, and U-
244 234, column 3, **CH-TRU and RH-TRU Waste Panel**, is the sum of column 1, **CH-TRU Waste Panel,** and column 2, **RH-TRU Waste Panel.** For other radionuclides such as Ac-227, Cm-243, Cs-137, Pa-231, Sr-90, and Y-90, column 3 is not the sum of columns 1 and 2. A more detailed explanation for columns 1, 2, and 3 should be provided in the

244 accompanying text.

**Page H-66. Lines 25 and 26.**

Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for cases 12 and 14 in the figure."

245 Unlike the spiked brine pressure curves for cases 2 and 4 in Figure H-8 and for cases 7 and 9 in Figures H-11, the brine pressure curves for cases 12 and 14 are smooth and peak close to 1,500 years post closure. No explanation is provided for the difference in behavior of the brine pressure curve for cases 12 and 14 from cases 2, 4, 7, and 9.

**Page H-72. Lines 15 and 16.**

Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for cases 17 and 19 in this figure."

See comment page H-52, lines 1 and 2. See also comment page H-60, lines 1 and 2

**Page H-74. Table H-39.**

See comment Page H-62. Table H-29.





APPENDIX I
LONG-TERM CONSEQUENCES OF NO
ACTION ALTERNATIVE 2

This Appendix was reviewed for general approach, assumptions used, and conclusions reached. Little was done to check calculations. The calculations were done in a preliminary manner compared to those for the Proposed Action and (especially) in the CCA. Therefore it is not possible to compare results in more than general terms.

**Page I-1. Last paragraph.**

The statement is made that both the FEIS and SEIS-I records of decision (ROD) determined that the No Action Alternative was "unacceptable because" of the potential impacts of
246 natural, low-probability events and human intrusion at storage facilities after government control of the site is lost." Presumably, this will also be the decision in the SEIS-II ROD. However, this Draft SEIS-II has not addressed the issue of whether it is appropriate to trade-off predictable early fatalities from accidents and routine radiation exposure against the threat of low-probability events far in the future. Nor is there an estimate of the probabilities that these future events will occur.

**Page I-3. Section 1.2.1.**

247 The set of assumptions used for inadvertent human intrusion impacts are appropriately conservative.

**Page I-6. Equation 1-2**

248 The convolution integral appears first in equation I-2. All the explanations pertaining to the convolution integral given much later with equation I-7, should be given first with equation I-2.

**Page I-9. Equation 1-7.**

249 The symbol for the convolution operation is used twice, the second time inside an integral.

249 The use of the convolution symbol inside the integral is incorrect. A symbol representing multiplication should be used inside the integral.

250 **Page I-11. Next to last paragraph.**
The dimensions given here (66 cm diameter and 91 cm height) for a 55-gallon drum differ from those used in WIPP Performance Assessment (60.2 cm diameter and 89.2 cm height). Use of the PA dimensions gives a surface-area-to-volume ratio of 0.11 $cm^{-1}$.

251 **Page I-12. Line 3.**
The effective lifetime of 500 years for cemented TRU waste forms in this analysis may not be conservative.

252 **Page I-12. Line 9.**
Statement: "BIR-2 specifies a waste volume and waste density for each of 10 waste material types (Table I-1). These waste material types were categorized into one of the generated TRU waste-form categories modeled in this analysis."

The reference in parenthesis to Table I-1 belongs at the end of the second sentence.

253 **Page I-12. Lines 23 through 25.**
Statement: "These relative quantities were multiplied by the total TRU Waste volumes for the site (see appendix A) to determine final site volumes for each TRU waste form category. Volumes are also reported in Table I-2."

It is not possible to obtain the waste volumes reported in Table I-2 (columns 3 and 4) by multiplying the waste volumes of Table A-14 by the relative quantities given in Table I-2 (columns 1 and 2).

254 **Page I-17. Fourth Paragraph.**
Buried wastes are assumed to not release any wastes by surface erosion/dispersion





254 mechanisms. Yet Table I-6 predicts that 6 of the 7 major sites will have enough surface erosion to expose wastes in less than 10,000 years. The assumption used may maximize groundwater contamination. Does it necessarily maximize total population dose?

255 **Page I-27. Table I-7.**
Our calculations (for inhalation and soil ingestion only) of driller impacts at LANL and SRS gave values that were 1.6 and 3.1 times as high as the values in this table. We had to make several assumptions that should have been provided.

256 **Page I-31. Twelveth line from bottom.**
The maximum dose of 14.5 rem should be per lifetime (not per year).

257 **Page I-31. Figure I-4.**
Why are the lifetime doses for MEIs at all sites totalled? These are all different individuals and there is no significance to a total dose.

**Pages I-33, 34. Figure I-5 and Table I-11.**
The curves in Figure I-5 can be used to approximate the total of 2,325 LCFs over 10,000 years mentioned on page I-31. Our estimate was about 10% higher than this.

258 It is interesting to compare these estimated LCFs with values that are permitted for geological disposal of TRU wastes in 40 CFR 191. However, in doing so, we realize that these estimates do not have the level of detail and justification required in 40 CFR 191.

The standards in 40 CFR 191 (which apply to WIPP) were based on the assumption that a permissible limit of LCFs was 10 per million curies of alpha-emitting transuranic radionuclides with half-lives longer than 20 years. This scales to about 42 LCFs in 10,000 years for the various inventories listed in Appendix A. The estimate in this Appendix of 2325 LCFs for NA Alternative 2 is over 50 times higher than would be allowed at WIPP.

258 A conclusion that long-term storage is much worse is site specific. If one uses the curves in Figure I-5 and the inventories in Tables A-36 and A-38 to determine the amount of activity stored at each site it can be shown that wastes left at SRS, Hanford, and ORNL would be under the 40 CFR 191 limit. Again, there is the caveat that these calculations are less detailed and justified than would be required to show compliance with 40 CFR 191.





1996-1997
Member Clubs

nisan Wildlands, *Englewood*, Co.
ora Hiking Club, *Astoria*, Or.
Mountains Audubon Society,
*Walla Walla*, Wa.
nerville Country Sportsmen Assn.,
*Idaho Falls*, ID
fornia Alpine Club, San Francisco, Ca.
adiana, *Yakima*, Wa.
nekmans, *Salem*, Or.
ook Trails Assn., *Vancouver*, Wa.
mbia Gorge Audubon Society,
*Hood River*, Or.
ra Costa Hills Club, *Oakland*, Ca.
ada of Nevada Wilderness, *Reno*, Nv
ada of the Three Sisters Wilderness,
*Eugene*, Or.
mmont Club, *Los Angeles*, Ca.
's Harbor Audubon Society, *Aberdeen*, Wa.
o Alpine Club, *Idaho Falls*, Id.
laine Club, *Port Angeles*, Wa.
nmas, *Portland*, Or.
tana Wilderness Assn., *Helena*, Mt.
Baker Hiking Club, *Bellingham*, Wa.
la Helena Club, *Longview*, Wa.
ra Peninsula, *San Francisco*, Ca.
dians, *Eugene*, Or.
spians, *Hoquiam*, Wa.
Se Costa Trail Assn., *Sacramento*, CA
ame Area Ridgerunners Committee,
*Livermore*, Ca.
nigans, *Vancouver*, Wa.
onal Conservation Society,
*Victoria*, B.C.
onal Parks Association, *Berkeley*, Ca.
ram Alpine Club, *Salem*, Or.
le Audubon Society, *Seattle*, Wa.
a Club, *San Francisco*, Ca.
a Club Angeles Chapter,
*Los Angeles*, Ca.
a Club Mother Lode Chapter,
*Sonora*, Ca.
a Club of British Columbia, *Victoria*, B.C.
a Club Toiyabe Chapter, *Reno*, Nv.
ma Audubon Society, *Tacoma*, Wa.
alpais Conservation Club,
*San Francisco*, Ca.
a Club of Oregon, *Portland*, Or.
mpian Alpine Club, *Seattle*, Wa.
qua Hills Audubon Society, *Longview*, Wa.
ton Chambers Northwest, *Seattle*, Wa.

**Officers**

*dent*: Brock Evans
33rd Ave, NW, *Washington*, D.C. 20015

*President*: Winchell Hayward
Willard N., *San Francisco*, Ca. 94118

*President*: Martin Haebner
McKenzie Drive, *Idaho Falls*, Id. 83404

*tary*: Nancy Kroening,
40th Ave. W. *Seattle*, Wa. 98119

*surer*: Robert Haage
Tudor Ave. *Montclair*, Ca. 91763

*Vice Presidents:*
sh Columbia: Sharon Chow
fornia: Robert Haage, Winchell Hayward,
ence Mimkes
rado: Sally Ramsey
i: Martin Haebner
iana: Clinton Merritt, Janet Rose
ska: Margery Sill
on: Shirley Cameron
ington: Betty Hughes, Anne Krannenburg,
ine Gold, Robert Grass

r. OUTDOORS WEST: Hazel Wolf
Boylston Ave. E. #106, *Seattle*, Wa. 98102

ington, D.C. Representative:
k Evans
33rd Ave. NW, *Washington*, D.C. 20015

# FEDERATION OF WESTERN OUTDOOR CLUBS

Established in 1932 for Mutual Service and for the Promotion of the Proper Use, Enjoyment and Protection of America's Scenic Wilderness and Outdoor Recreation Resources.

WIPP SEIS II
Administrative
Record

February 26. 1997

Mr. Harold Johnson
NEPA Compliance Officer

Subject: Comments on Supplemental Environmental Impact Statement (SEIS-II) regarding opening of the Waste Isolation Pilot Plant (WIPP)

Dear Sir:

Please include the following in the hearing records on the subject. These remarks supplement a verbal statement I made on behalf of the Federation of Western Outdoor Clubs (FWOC) in the WIPP hearing held in Boise, Idaho on January 15, in which I promised to provide some additional information related to the subject issue. Except as specifically noted in an addendum sheet, the comments herein can be considered to reflect the views of the FWOC.

The FWOC is a venerable (founded 1932) federation of some 40 outdoor-oriented organizations as denoted in the letterhead. At its Annual Meetings, in its official publications, the concerns for protecting/preserving the wildlands, wildlife, woods, and waters of the American West IS the major focus of this umbrella organization. Our traditional methods of achieving what we feel must be accomplished is via contacting/advising legislators, and officials in state and federal natural resource agencies on issues of interest to the FWOC membership. The wishes of the organization are formalized into Resolutions that have been approved by the Federation's Board of Directors. ( An approved Resolution on "Global Warming" is enclosed.) In addition, representatives of the Federation have also appeared at previous DOE-sponsored hearings. (Specifics on request)

Regarding our evaluation of WIPP SEIS-II, or any other such issue concerning long-term storage of hazardous materials (whether they have chemical, biological or radiological characteristics), the Federation of Western Outdoor Clubs employs a simple environmentally-based principle: There is only one planetary environment. The final disposition of man-made hazardous materials should be in a repository that has been designed, built and operated for the long-term, environmentally-benign, and safe storage of such materials. Period.

1 Based on the prior technical evaluations of the WIPP for its adequacy to meet the above-stated FWOC requirement by such authoritative bodies as the National Academy of Science, and the U.S. Geological Survey, and other high-level objective organizations, the FWOC supports opening the WIPP to receive waste.

2 However, the SEIS-II document does have some serious deficiencies! These MUST be corrected or resolved. The most serious of these is that there is NO mention made of the 1995 Settlement Agreement between the State of Idaho, the Department of Energy (DOE) and the U.S. Navy. This Agreement is a formal, time-lined, and legally-enforceable contract regarding receipt/interim storage and eventual FINAL disposition by the year 2035 of nuclear-related materials. These material include the trans-uranic (TRU) wastes now stored at the Idaho National Engineering and Environmental Laboratory (INEEL) and slated for disposition at the WIPP. In fact, some statements elsewhere made by the DOE regarding the WIPP have appeared to contradict this Settlement Agreement. SEIS-II should be carefully revised to ensure its total and complete coordination and compliance with the 1995 Settlement Agreement. The final SEIS-II should also include a description of this Agreement and the legal federal court-enforceable penalties for non-compliance by the U.S. government entities.

3 The SEIS-II should be revised so that projections of the amount of TRU-waste storage space in the WIPP are consistent not only with current TRU-waste inventories, but of those anticipated to meet the nation's defense needs (and perhaps energy needs, also)

4 The evaluations of hypothesized over-the-road and railway transportation accidents should be revised to concur more with realistic scenarios. DOE films of actual in-field testing of nuclear transport casks that are available to the public would lead to the unescapable conclusion that NOBODY would be exposed to radiation in the event of a transportation accident! Add to this that when the few such such accidents have occurred, there were no (as the media often describes it) "radiation leaks."

5 One last comment. I have attended public hearings on technical issues which were conducted via satellite up-links and down-links. Not only was this informational, but could permit interactive participation from persons in a wide-variety of locations. This sort of wide-area hearing format should be considered for future such DOE hearings.

This concludes the FWOC comments. I have provided additional personal comments on the following "Addendum" page. Also note the authorized FWOC Resolution on "Global Warming" derived from an environmental perspective. It not only supports use of nuclear power as an energy source, but also favors the reprocessing of so-called "spent" nuclear fuels.

Very truly yours,

Martin F. Huelmer

Immediate Past President/State Vice President



ADDENDUM

I made a prepared formal statement on behalf of the Federation of Western Outdoor Clubs at the afternoon session of the WIPP hearing on January 15. Out of curiosity, I also attended the evening session. The personal "testimonies" I heard there not only amazed me in their complete renunciation of actual facts, logic and intelligence, but also in the passionate zeal with which the presenters* conveyed the most disgusting (to me) bunch of irrational piffle and out-and-out-lies I've ever heard in one evening! None of this was supportive of opening the WIPP.

The Hearing Officer asked (at the conclusion of their remarks) if anybody else wished to speak. I responded that although I had already presented a statement for an organization, I asked to make a statement as a private individual (granted).

My extemporaneous remarks (directed to the Hearing Officer) were along the following lines: " I've heard (and learned) a lot today and tonight. There was much said that I can personally agree with as a life-long citizen environmental-activist. I totally agree with those who said use of nuclear weapons (and related weapons testing) must be forever banned. I totally agree with those speakers tonight (and I quote) that said that the WIPP issue '...must be decided on a scientific basis...' and '....on a rational basis...,' and with those persons that said it '...must be decided responsibly...' and also '...ethically...'

But that's NOT what I've witnessed tonight! I've heard a large amount of untruths, half-truths, and misstatements of fact. And I've heard a lot of highly-charged emotional words, i.e. non-factual verbal arm-waving, about mysterious nuclear cataclysms that, by no stretch of the imagination, can plausibly occur. People alluded to diabolical plots by unknown persons to inflict Idaho with horrible events, concepts perhaps derived from old science-fiction movies. And it seems to me that all this scary arm-waving was just to frighten the general public! It was not to inform people about the nuclear facts about the WIPP, but to scare the men, women, and children of this state to be fearful of science and technology, particularly nuclear technology! That scare-tactic approach is NOT scientific, NOT rational, NOT responsible, and is certainly NOT ethical!

Many who spoke tonight call themselves 'environmentalist'. But, as I said (this afternoon) from my own perspective of a career scientist/engineer, as well as a life-long citizen environmentalist, the only rational, science-based, responsible, environmentally-based, and ethical rationale for disposal of INEEL TRU-waste is to start using the WIPP. Instead of obstructing nuclear power technology at every turn, those in the audience ought to be supporting it as the most environmentally-benign, proven-safe, large-scale source of electrical energy now known to humankind." (An observer told me afterwards that while I was addressing these remarks to the Hearing Officer, many in the audience had put their fingers in their ears!)

M. Huelmer 2/26/96

* Most of these were professed members of the Snake River Alliance, a well-funded anti-science/anti-technology/anti-nuclear group.

**GLOBAL WARMING**
FWOC Resolution No. 26

Environmentally-perceptive people from all over this planet are aware of and deeply concerned about the environmental effects of global warming.

The Federation of Western Outdoor Clubs has previously expressed its opinion about this grave matter previously because:

o We are convinced it is a real phenomenon, and is not a short-term weather fluctuation.

o We know that human-kinds' contribution to it must be curtailed.

o We know that if prompt and effect action to curtail it isn't soon taken, irreversible and catastrophic changes to the world's climate and its environments and all its creatures will inevitably result.

One of human-kinds' major contribution to it is carbon dioxide (C02) which is derived mainly from combustion of carbonaceous fossil fuels and bio-mass for transportation, heating, and generation of electrical power.

Based on its assessment, the FWOC recommends its members and member clubs consider the following:

1. So that they, too, can become safe, reliable, large-scale sources of electrical energy, basic and applied research on alternative energy sources by public and private research should be accelerated and well-funded.

As of now, the only such safe, reliable, large-scale sources are carbon based-fuels, with their now completely unacceptable effects on global warming, hydro-electric power, with its often unacceptable effects on riverine and agricultural environments, or free-flowing recreation, and nuclear power. The latter is the most environmentally benign of the three large-scale power sources, but is often the focus of public fear and concern.

2. Basic and applied research to make the combustion processes more fuel-efficient, and also to improve the overall efficiency of *(Continued)*



electrical devices must be accelerated and well-funded. Putting into practice any such improvements discovered will cause an immediate reduction in carbon dioxide emissions.

3. Environmental regulations must be strengthened so as to phase-out fuel inefficient operations and replace them with more fuel-efficient ones that will minimize CO2 emissions.

4. When new large-scale power plants are proposed, environmentally-concerned individuals and groups should first demand implementation of a vigorous energy conservation campaign by the respective public utilities. When new power plants **must** be built, and alternative technologies cannot provide the electrical services required,on a site-specific basis, the preference of environmentalists should first be hydro-electric plants, then nuclear power plants, and only as a last resort fossil-fuel plants.

5. In light of the above logic, the FWOC suggests that all member club/affiliates objectively re-evaluate their policies regarding nuclear power, nuclear fuel reprocessing in the U.S., and consider changes to these policies that reflect that this nation's 110 nuclear power plants are already safely and reliably providing one-fourth of this country's electricity.

---

*FWOC members and member clubs urged to send copies of the above Resolution to their Congressional representatives, their State Governor, to public utilities in their state, and to :*
*Hazel O'Leary,*
*Secretary, Department of Energy*
*Forrestal Building, 1000 Independence Avenue SW*
*Washington, DC 20585*

Copies to:

Governor Phillip E. Batt
Senator Larry Craig
Senator Dirk Kempthorne
Congressman Michael Crapo
Congresswoman Helen Chenoweth
INEEL Oversight Office
Idaho Academy of Science
Idaho Operations Office DOE
Lockheed-Martin Technology
Coalition 21- Idaho Falls Office
Brock Evans-FWOC



2/27/97

WIPP SEIS-II
P.O. Box 9800
Albuquerque, NM 87119

We write as organizations concerned about the about the nuclear waste dilemma facing this nation. We know this issue well as the citizens of Colorado are directly impacted by tons of waste stored at the Rocky Flats Site. For years we have been told that the answer to the problem of nuclear waste is the Waste Isolation Pilot Plant (WIPP), a proposed radioactive dump near Carlsbad, New Mexico. WIPP is not a solution to this nation's nuclear waste problem, and DOE's continued attempts to sell this flawed facility as a solution divert attention and resources from real solutions. 1

We find all of the six of the alternatives (the no action alternatives, the proposed action , and the three action alternatives) outlined in the Draft WIPP Supplemental Environmental Impact Statement II (SEIS - II) insufficient and request that all be rejected.

Following are our reasons for rejecting the opening of the WIPP facility under any of the proposed scenarios.

2 * WIPP was not chosen as a transuranic waste disposal site through a sound scientific process, but rather, through a flawed political process

3 * WIPP has not been demonstrated to be safe. There is pressurized brine below the repository and a layer
4 of groundwater above the facility. It is possible that this could lead to plutonium escaping the facility.
3 Unless WIPP can be shown to safely contain the waste for its dangerous life, it should not be opened.

5 * Related to this is the problem of future intrusion. The plutonium contaminated waste that is to be put in
6 WIPP will be dangerous for 240,000 years. How are we to tell future generations that this area is dangerous? The area is rich in oil, gas, and potash. In the future other substances may be considered valuable. Mining or drilling into the repository could cause contaminants to escape.

7 * Burial of waste that needs to be isolated for such a long period of time is not wise as long as questions remain about the facility. If something goes wrong, retrieval of the waste and correction of the problem will be very difficult and dangerous.

8 * Transportation is a major concern. More than 38,000 shipments will go to WIPP under the proposed action. More than 28,000 will travel through Colorado, most originating in the states of Washington and
9 Idaho. An accident with a breach of the container could be catastrophic. The container has not undergone a crush test and has been tested for fire only at temperatures at which Jet fuel burns - substances that burn
10 at higher temperatures, such as propane, regularly travel the highways. The container should be re-tested. DOE admits that train transportation is safer, yet it continues to pursue trucking options. First responders to accidents will often be volunteers, particularly in rural communities. These responders may not have
11 the necessary training or equipment to deal with an accident involving radioactive contamination. Many first responders in Colorado have not been through even the basic training. Further, some of the waste coming from the Hanford facility, known as RH-TRU (remote handled), emits penetrating gamma radiation. First responders will need special training for these shipments. Hospitals need special decontamination and isolation facilities. No transportation should be allowed to proceed until all of these
12 concerns can be addressed, and until there has been an independent assessment of transportation alternatives.

13 * DOE reliance on WIPP has siphoned resources and attention from storage at Rocky Flats. It is imperative that this waste be stored in the safest possible manner.

## Comment C-154, Page 2 of 2

14 * The Colorado economy is heavily dependent on tourism. Should an accident and a release occur in Colorado it would have negative economic ramifications.

15 * If WIPP opens it will not solve the radioactive waste problem. Under the proposed action DOE plans to dispose of only 32% of existing transuranic wastes(65,600 cubic meters). It plans to dispose of a total of 175,000 cubic meters at WIPP with the difference being transuranic wastes yet to be generated. This is a small portion of all radioactive waste in the U.S. Clearly WIPP is not a solution to the problem of radioactive waste, in fact, if WIPP opens we are likely creating a much bigger problem for future generations.

1 The Department of Energy should reject all alternatives analyzed in the SEIS-II. DOE should plan, first and foremost, for safe monitored, retrievable storage of transuranic wastes at the point of generation, including Rocky Flats in state. The federal government should pursue further research into methods of
16 making this waste benign. There should be an independent review of nuclear waste policy, and there
17 should be process that involves all affected publics in developing real solutions to our nuclear waste problem. In this manner we can begin to responsibly address the problem of radioactive waste. If you would like to discuss this matter further, please contact Tom Marshall of the Rocky Mountain Peace and Justice Center at (303) 444-6981, or Jack Mento of Greenpeace, Colorado at (303) 440-3381.

Sincerely,

American Friends Service Committee, Colorado Chapter- Byron Plumley
Colorado Peace Action- Andy Hanscom
Colorado People's Environmental and Economic Network- Beth Blissman
Cross Community Coalition- Lorraine Granado
Environmental Defense Fund- Dan Luecke
Greenpeace, Colorado- Jack Mento
Physicians for Social Responsibility- Sam Cole
Pikes Peak Justice and Peace Commission- Mary Bauer, S.C.
Rocky Mountain Peace and Justice Center- Tom Marshall
Thorne Ecological Institute- Steve O'Neill
University of Colorado Environmental Center- Brian Holdt
Mary Ann Coyle, President, Sisters of Loretto

## Comment C-155

1 We are not for out of sight out of mind. Let's have on site above ground storage of nuclear waste where it is generated. Not dump it off on someone else.
Registered Voters
Peggy Finch
Jerry J. Finch, Jr.
Jane Finch

Comments

of the

Oak Ridge Environmental Peace Alliance

on the

Waste Isolation Pilot Plant Disposal Phase

Draft Supplemental Environmental Impact Statement

November 1996

submitted by

Ralph Hutchison, coordinator

Oak Ridge Environmental Peace Alliance

February 26, 1997



OREPA comments 1

The Draft Supplemental Environmental Impact Statement (DSEIS) published by the Department of Energy in November, 1996, concerning disposal of transuranic waste at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, fails to consider reasonable alternatives as required by the National Environmental Policy Act (NEPA), contains substantive errors and omissions, and for this reason can not be considered adequate as it now stands. The Oak Ridge Environmental Peace Alliance identifies the following shortcomings which must be addressed prior to the issuance of a final SEIS.

1 **Some significant transportation information is just plain wrong.** The simplest example is the transportation route map which indicates waste traveling down Interstate 59 from Oak Ridge National Laboratory. No such Interstate (or any other highway by that number) is located within 100 miles of Oak Ridge National Laboratory. DOE must indicate the precise transportation route over which it intends to transport this deadly cargo, including winding, narrow, state route 95 if that is part of the plan.

2 **Some significant transportation information is missing.** DOE claims to have analyzed the consequences of transportation of 580 cubic meters of Remote-Handled TRU waste from Battelle, Columbus to Oak Ridge National Laboratory. Yet no map of transportation routes in the D-SEIS indicates the routes on which this material would travel. It is clear that DOE has not completed a careful analysis of this scenario, undermining DOE's consideration of all alternatives in which it appears.

3 **DOE fails to provide maximum protection of public health and the environment.** During the question and answer period at the Oak Ridge hearing, DOE's officer acknowledged that shipments to WIPP by rail would be, according to DOE's own risk estimates, safer than shipment by truck. Shipment by rail is considered in other alternatives, but not the preferred alternative. DOE has failed to justify this decision and must act to provide maximum protection of the public and the environment *before* an accident occurs.

4 **DOE has not adequately assessed its alternatives.** The No Action alternative, required by NEPA to be considered as a serious alternative to any proposed action, is not adequately analyzed in the DSEIS. At the Oak Ridge hearing, the DOE official responsible for the DSEIS was unable to answer questions from the public about the nature and situation of TRU waste in Oak Ridge. When asked if Oak Ridge waste was currently stored safely, he admitted he had no knowledge of the status of Oak Ridge waste. When asked if it needed to be moved to protect the public or the environment, he again pleaded ignorance. While the honesty of this public official is to be commended, the fact is that the document has not answered the first fundamental question of any proposed action: Do we need to do this? Furthermore, ignorance of the current condition of TRU waste in Oak Ridge demonstrates beyond any doubt that DOE has not carefully analyzed the "Leave-it-where-it-is-for-now No Action alternative."

The public rightly suspects there is a reason for DOE's failure to do what is lawfully required. There is no imminent or short-term risk to the public or environment in Oak Ridge which requires the transportation of our TRU waste to WIPP.

5 DOE has acknowledged that health and safety are not driving this decision. In previous

OREPA comments 2

5 documents and meetings, DOE has asserted that *all* Oak Ridge Remote Handled TRU waste (RH-TRU) would be shipped to WIPP. This is the hottest of the hot stuff. Now, in this DSEIS, the majority of RH-TRU waste in Oak Ridge is suddenly *not* going to be shipped to WIPP; in fact, DOE has no plan to do anything with this waste other than leave it where it is. Clearly, if health and safety were a driver, this waste would still need to be moved.

6 **DOE's assertions of 10,000 year safety guarantees with no intrusion are not credible or substantiated.** The question of how to manage an extremely lethal waste dump over millennia is not one with which humankind has experience. No human institution is known to have survived for ten thousand years to date; human languages more than five hundred years old are barely recognizable. DOE has not provided a credible scenario which assures the wastes will be undisturbed for 1,000 years, let alone 10,000. This is a subject which deserves serious study; DOE's current proposal for markers and other institutional controls through record-keeping are not sufficient.

7 **The DSEIS plans to ship unknown wastes to Oak Ridge, for unknown treatment in a not-yet-existing facility, and to store this waste for an unknown time period.** The material DOE proposes to ship to Oak Ridge from Battelle, Columbus has leaped from 70 cubic meters to 580 cubic meters in a period of six months. This is an accurate indicator of DOE's level of knowledge about this material. No credible NEPA document can claim to analyze the environmental impact of an action without a complete understanding of the amounts and character of the contaminants being analyzed, the treatments proposed and the locations of proposed treatments, and the interim and final disposition of the materials. We will not permit the DSEIS to attempt to provide NEPA coverage for bringing unknown materials to Oak Ridge. If DOE proposed to bring TRU wastes from other sites to Oak Ridge, it must first complete a Programmatic Environmental Impact Statement on the proposed action, including in the P-EIS a thorough analysis of the site-specific impacts in Oak Ridge.

8 **DOE has profound technical challenges at WIPP which undermine its assertion of safety.** DOE has yet to explain how it can seal the four main shafts leading to the underground repository at WIPP, how it can prevent encroachment/intrusion, and what it will do to address the boreholes which currently penetrate the WIPP site.

9 **The DSEIS suggests that DOE's current understanding of the WIPP site is incomplete.** The DSEIS notes, on page 3, that DOE's current analysis incorporates "new hydrologic and geologic information," which has been developed since previous analyses were conducted. Absent any evidence that DOE's collection of information is now complete, it is reasonable to assume that future hydrologic and geologic information might further DOE's understanding and significantly change the understanding of environmental impacts.

10 **The description of the "relationship" of the DSEIS to DOE's WM-PEIS is incoherent.** The footnote on page S-2 suggesting the public is better served by a severed WIPP analysis defies logic; it is inane and it is an insult to the public. NEPA forbids segmentation of analyses as DOE is doing here. The fact is that the WM-PEIS addresses TRU waste and must be integrated with the WIPP SEIS.

11 **DOE's preferred alternative makes no economic sense.** DOE's proposed action, according to Table S-5, will cost 11.8 billion dollars. Leaving the material where it is now will cost 1.9 billion dollars, a savings of 10 billion dollars.

12 **DOE's consideration of two (2) "No Action" alternatives defies logic and common sense.** There is, at least in this instance, only one true "No Action" alternative (which DOE calls No Action alternative 2). Any other action, including "No Action Alternative 1A and No Action alternative 1B" is by definition an action and must be presented as such in the DSEIS.



OREPA comments 3

**The least expensive, safest, least environmental impact alternative is No Action Alternative 2.** This is the alternative DOE must embrace at this time.

***Conclusion***

It may be that at some time in the future, removing Oak Ridge's TRU waste for safer storage will prove to be a defensible and wise action, one that reduces risk and provides greater security at less environmental impact. DOE's supplemental EIS demonstrates conclusively that we have not yet reached that time.

13 The Oak Ridge Environmental Peace Alliance does not support the transport of Oak Ridge TRU waste to WIPP. Until such time as the Department of Energy has a clear, comprehensive, coherent, integrated and sensible plan for all its radioactive and hazardous wastes, wastes should be maintained in a stable, contained form as close to the place of generation as possible.

We believe that DOE's DSEIS supports our position; it makes it clear that the least risky, least expensive, most sensible alternative currently is to leave the waste where it is.

Wendy Lynne Botwin
901 Rex Street
Louisville, CO 80027
303-666-5957

February 24, 1997

To whom this may concern:

I am writing to you as a citizen of Boulder County and as a graduate student in Environmental Leadership at the Naropa Institute. I strongly oppose the opening of the Waste Isolation Pilot Plant (WIPP) facility for the following reasons:

1

1. WIPP will contain plutonium contaminated waste that will remain dangerous for at least 240,000 years. DOE has not demonstrated that the facility can contain waste for this long. Further, it only plans to certify the facility for 10,000 years and has not demonstrated that it will contain waste for this period of time. I am concerned about the effects this waste will have on future generations and the environment.

2

2. WIPP has pressurized brine beneath much of this site. Above the site is a layer of groundwater, known as the Rustler Aquifer, which feeds the Pecos River and ultimately the Gulf of Mexico. These bodies of water may lead to plutonium escaping the burial site and contaminating vast areas.

3

3. The area surrounding WIPP is rich in oil, gas, and mineral deposits. There is currently drilling below the site. Future exploration may lead to plutonium escaping the facility. Future generations may not know that this is a dangerous facility.

4

This fact is further exaggerated by not knowing what kind of warning signs to post around the site to keep people out forever.

5

4. If WIPP is allowed to open, 28,000 shipments of plutonium contaminated waste will pass through Colorado on I-25 and Rte. 36. Most of these shipments will come from Washington and Idaho. There is no guarantee of the safety or effectiveness of the storage containers that will carry the waste to WIPP or any other site. An accident could be catastrophic on many public levels. Emergency responders and hospital personnel would need special training and equipment. There is no doubt that an accident will happen at some point and emergency response would not be adequate. Transportation by truck or even train is not a wise risk to take with the health and safety of all U.S. citizens and its inhabitants, including Coloradans.

6

5. WIPP does not address the existing problems of radioactive waste storage. If WIPP opens, it would hold only 1/5 of the existing transuranic waste in this country. I am also strongly against the idea of WIPP reserving 70% of its capacity for waste generated in the next twenty years. I do not agree with any more nuclear weapons production.

7

6. I am concerned about the impacts on the cultural resources on the WIPP land and about the impacts on minority and low-income people in the surrounding area.

8

For the reasons outlined above I strongly oppose the opening of the WIPP facility. Reliance on WIPP has created poor storage conditions for transuranic waste at Rocky Flats. I do support construction of a state of the art fully monitored and retrievable storage facility at Rocky Flats. Such a facility would assure safe storage of waste, and the ability to retrieve the waste should a problem arise or if a technology to make



8

the waste benign is developed. Colorado should take responsibility for its own nuclear waste where it is now and not ship it off for someone else to deal with the problem and dangers. The federal government should pursue an aggressive research and development program aimed at making this dangerous waste benign.

9

I hope you take all of these comments into consideration. Please work to achieve real solutions.

Sincerely,

Wendy Lynne Botwin

# Military Production Network

*A national alliance of organizations working to address issues of nuclear weapons production and waste clean-up*

Member Groups

American Friends Service Committee
Denver, CO

Citizen Alert
Las Vegas, NV

Coalition for Health Concern
Benton, KY

Concerned Citizens for Nuclear Safety
Santa Fe, NM

Environmental Defense Institute
Troy, ID

Fernald Residents for Environmental Safety and Health, Inc.
Ross, OH

Government Accountability Project
Seattle, WA
Washington, DC

Hanford Education Action League
Spokane, WA

Heart of America Northwest
Seattle, WA

Knolls Action Project
Albany, NY

1 Los Alamos Study Group
Santa Fe, NM

Miamisburg Environmental Safety & Health
Miamisburg, OH

2 National Environmental Coalition of Native Americans
Prague, OK

Native Americans for a Clean Environment
Tahlequah, OK

Neighbors in Need
Englewood, OH

3 Oak Ridge Environmental Peace Alliance
Oak Ridge, TN

Panhandle Area Neighbors & Landowners (PANAL)
Panhandle, TX

Peace Action Education Fund
Washington, DC
Nashville, TN

Peace Farm
Panhandle, TX

Physicians for Social Responsibility
Washington, DC

Portsmouth/Piketon Residents for Environmental Safety & Security
McDermott, OH

Rocky Mountain Peace and Justice Center
Boulder, CO

Snake River Alliance
Boise, ID

Southwest Research and Information Center
Albuquerque, NM

STAND of Amarillo
Amarillo, TX

Tri-Valley CAREs
Livermore, CA

[illegible] States Legal Foundation
Oakland, CA

Women's Action for New Directions
Arlington, MA

February 27, 1997

WIPP SEIS-II

Harold Johnson
NEPA Compliance Officer
PO Box 9800
Albuquerque, NM 87119
email - WIPPSEIS@battelle.org

Dear Mr. Johnson:

The Military Production Network (MPN) is an alliance of more than 30 local, regional, and national organizations working on Department of Energy (DOE) weapons and waste issues. MPN groups include citizen organizations near all of the 10 major DOE facilities that are storing wastes to be sent to WIPP, as well as organizations around other DOE sites. Citizen organizations that are members of MPN participated in several of the public hearings on the Draft SEIS-II (D-SEIS-II). Those hearings demonstrated that strong public opposition to WIPP, not only in New Mexico, but in other states. DOE and the SEIS-II must fully recognize that significant public sentiment.

MPN opposes WIPP because it was not selected by an objective, scientific process and because it has environmental and safety problems. MPN supports interim stabilization and isolation of high-level and transuranic nuclear waste at the point of origin in a manner that maximizes worker, public and environmental protection.

Therefore, MPN believes that the preferred alternative in the SEIS-II and the alternative that DOE selects in the Record of Decision should be an alternative not included in the D-SEIS-II. That alternative is to close WIPP quickly to stop wasting money on that site and instead store transuranic wastes at existing sites in an environmentally sound manner, with decisions about waste treatment and storage facilities made in full consultation with state and tribal governments and the public. Such an alternative would be the environmentally preferable alternative, would eliminate the deaths and injuries that would result from nuclear waste transportation, and would cost much less than the proposed action or any of the action alternatives included in the D-SEIS-II.

The D-SEIS-II on page 3-1 lists four decisions that are supported by the proposed action. MPN makes the following responses on those four issues.

1. Whether to open WIPP, or how to store transuranic (TRU) waste if WIPP doesn't open.

**MPN Response: Don't open WIPP, store wastes safely at existing sites.**

2. Which portions of existing and to-be-generated TRU wastes would be disposed at WIPP.

**MPN Response: None**

3. What treatment methods should be used for wastes being sent to WIPP.

**MPN Response: Don't ship wastes to WIPP. DOE should consult with state and local governments and affected citizens about the safest treatment methods at each storage site.**

4. What transportation methods (truck or train) to ship wastes to WIPP.

**MPN Response: Don't ship wastes to WIPP. Don't ship wastes anywhere except by the safest method and to measurably improve public safety.**

Seattle Office: 1914 North 34th St., #407, Seattle, WA 98103, 206/547-3175, Fax: 206/547-7158
Washington, DC Office: 2000 "P" St. NW, #408, Washington, DC 20036, 202/833-4668, Fax: 202/833-4670



MPN believes that the final SEIS must forthrightly discuss the following issues of public concern.

1. Is WIPP safe? No. DOE has spent $2 billion during the past 20 years on WIPP, and it has been trying to ship wastes since 1988. But WIPP is not open because of unresolved health and safety problems and DOE's inability to show that radiation releases would result in less than 1,000 deaths in 10,000 years. EPA's approval must be based on a Compliance Certification Application (CCA) and a public rulemaking process. DOE submitted the CCA on October 29, 1996, but EPA has not found the application to be complete, and MPN believes that the CCA is substantially incomplete. If DOE plans to proceed with WIPP, it must first complete an adequate SEIS-II, then greatly revise and resubmit the CCA to initiate a new public comment process.

4

Among the problems with the WIPP site that are not adequately analyzed in the D-SEIS-II is that the site is surrounded by oil and gas wells and potash mines. Mining those resources at the WIPP site would allow the wastes to escape into the ground water or to the surface. The ground water system at the site is not well understood, and millions of barrels of pressurized brine underneath the disposal rooms could bring wastes to the surface. In addition, water flooding from oil wells outside the site could fracture the rock and bring millions of barrels of pressurized brine into the disposal rooms. DOE assumes that the four several-feet-diameter shafts could be completely sealed for 10,000 years but small boreholes would not remain sealed for more than 200 years, thereby providing pathways for wastes to escape.

5

6

7

2. Will WIPP solve the nuclear waste problem? No. DOE plans to dispose at WIPP about 32% of existing TRU wastes -- 65,600 cubic meters (2.32 million cubic feet) of 208,100 cubic meters (7.35 million cubic feet) ("Proposed Action"). DOE does not know what to do with the remaining wastes, but it plans to dispose of 175,000 cubic meters at WIPP, including TRU wastes produced during the next 35 years. The D-SEIS-II includes the alternative of sending virtually all TRU wastes to WIPP during the next 160 years ("Action Alternative 1"), leaving the wastes where they are ("No Action Alternative 2"), and others. Moreover, the 5 million curies planned for disposal at WIPP is less than 0.02 percent of the radioactivity in all existing DOE and commercial nuclear wastes.

8

MPN believes that if DOE is going to use the SEIS-II to consider disposal of all TRU wastes, as the "action alternatives" propose, that DOE must also consider alternative disposal sites and consider the anticipated TRU inventory beyond the 35-year timeframe included in the D-SEIS-II.

3. Is transportation safe? No. The D-SEIS-II estimates that the 38,089 truck shipments to WIPP during 35 years would result in 6 deaths and 48 injuries from 76 transportation accidents and that 3 people would die from radiation exposures during "accident-free" shipments. DOE does not expect that any accident would release radioactivity, but in a severe accident several people could be killed or injured and plutonium contamination could endanger future generations. Given the unprecedented nature of that shipping campaign, more accidents, deaths, and injuries could occur. The D-SEIS-II says that rail transportation would result in 10 times lower exposures to the public and 100 times lower doses to workers than truck shipments, but DOE plans to ship only by truck.

9

10

Other transportation problems include that the shipments would not be escorted nor have emergency response personnel. Thus, local emergency responders (including thousands of volunteers) in more than 25 states need to be trained and equipped to handle accidents for the next 35 years. And hospitals would need trained and equipped medical personnel with special medicines to treat victims with radiation exposures. Further, the containers to transport high radioactivity remote-handled wastes to WIPP have not been approved and built, so their safety is highly uncertain.

11

4. Aren't millions of people endangered by the wastes at the storage sites? Yes, nuclear wastes are very dangerous! However, major DOE nuclear weapons sites—Hanford, Washington; Idaho National Engineering Laboratory; Savannah River Plant, South Carolina; Oak Ridge, Tennessee; and Los

12

Alamos, New Mexico— will be operating for decades and will have to take care of large quantities of waste in addition to TRU wastes. Rocky Flats, the other major site, is to be closed, but it will take years to do so, and some Colorado citizen groups advocate safer storage at Rocky Flats, rather than opening WIPP.

13 5. Isn't WIPP the cheapest alternative? No. The D-SEIS-II says that the total life cost of WIPP is $19.1 billion (1994 dollars). For comparison, the Action Alternative 1 cost is $50.5 billion (1994 dollars). But the No Action 2 alternative of not using WIPP and storing wastes at existing sites is $2.7 billion (1994 dollars). Spending more to provide for safer storage sites is a much lower cost alternative.

Thank you for your full consideration of our comments.

Sincerely,

Maureen Eldredge
Program Director



Record 481

WIPP SEIS-II
Document # C-159

Author: smaret@CASTLE.CUDENVER.edu at -internet
Date: 3/3/97 4:23 PM
Priority: Normal
TO: ^WIPPSEIS at ~Battelle_Abq
Subject: WIPP Comments

---------- Message Contents ----------

(DEAR DOE: i sent our comments on Friday, but they were bounced back to me! I am re-sending! Thanks.)

To: wippseis@battelle.org

Waste Isolation Pilot Project
SEIS-II
Department of Energy
Box 9800
Albuquerque, NM 87119

From: Susan Maret, smaret@CASTLE.CUDENVER.EDU
for the Sierra Club National Nuclear Waste Task Force

February 27, 1997 (revised March 2, 1997)

COMMENTS ON THE WASTE ISOLATION PILOT PLANT DISPOSAL PHASE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (SEIS), NOVEMBER 1996

We thank the Department of Energy for extending the SEIS comment period until February 27, 1997.

1 After great deliberation, we support DOE "No Action Alternative-2" WITH MODIFICATIONS. D-SEIS Alternative-2 states DOE would dismantle and close WIPP, leave waste untreated, and only treat newly generated waste to meet the Waste Acceptance Criteria. We prefer that all waste be treated.

Another modification to Alternative-2 would be a implementation of solid pollution prevention program (P2) at DOE facilities to reduce new waste. After treatment, waste would then be stored onsite. No shipments of waste would occur.

Sierra Club policy "Nuclear Weapons and Related Issues," which is beyond the scope of the draft SEIS but nevertheless goes to the root of the nuclear waste problem, states:

"Sierra Club is opposed to programs that appropriate or expend public funds for any further testing, production or deployment of destabilizing nuclear weapons systems."

Listed below are specific comments on the D-SEIS.

CONTAINERS

2 The GAO found that "about 41 percent of the waste is expected to be too heavy for efficient transport in the existing type of container. DOE plans to procure new containers for this waste. DOE has not decided how it will transport the remaining amount of CH-handled waste." (p. 16, Nuclear Waste Uncertainties about Opening WIPP). The D-SEIS-II does not address this issue nor the recommendations made by many environmental groups and state agencies in regard to DOE's negligence in performing full scale testing of shipping casks.

ENVIRONMENTAL JUSTICE, SOCIOECONOMIC FACTORS and SAFETY

3 The DOE has characterized environmental justice factors for New Mexican communities that surround WIPP. However, DOE has NOT characterized EJ factors for communities that will be impacted by the transport of TRU waste through THEIR communities. Truck routes are designated by the individual states. Yet it is important to note that many of the designated shipping routes are located in socioeconomically disadvantaged communities in the Southeastern portion of the United States, and these may well be impacted by transport of TRU waste through their backyards. Have communities along the designated transportation routes been involved in WIPPTREX planning?

## Comment C-159, Page 2 of 4

Chapter 4 of the D-SEIS did not fully characterize the effects of an accident on the New Mexican population that surrounds WIPP. For example, have local emergency responders (LEPCs) and emergency medical personnel in all counties affected by the transportation routes been alerted to the opening of WIPP, and do they have a disaster plan? Table 4-2, "1990 Population and Community Characteristics by County" lists community hospitals, bed size, and number of physicians in each county. Have hospitals in the affected areas been notified, have a disaster-triage plan in place, and the ability to call in additional emergency health personnel in the event of an accident? Have local physicians been adequately notified and prepared? Have communities, emergency responders, etc. been actively engaged in WIPPTREX? 4

DOE has neglected to include information in the D-SEIS-II on quality assurance training of workers, how DOE will conduct audits, and resolution of nonconformance and corrective actions. 5

GEOLOGIC UNCERTAINTY

The Conceptual Models Peer Review Team, assigned to review WIPP conceptual modeling, has voiced concern over two of DOE's conceptual models: spallings, and chemically engineered backfill. 6

The spallings model is essential to the safe disposal of TRU waste and will provide data on radioactive releases in the event of accidental drilling in to the Repository. WIPP is surrounded by oil and gas wells as well as potash mines. Mining could, as EPA has pointed out, alter the properties of certain rock formations above the underground repository. Changes to the rock formations above surface could cause alterations in the hydrogeology of the rock formations, specifically groundwater travel time. Human intrusion could also occur by oil and gas drilling into the repository through to the briny aquifer. DOE's selected alternative must include a prohibition on drilling, thus minimizing ANY chance of accidental drilling into the repository. 7

In addition, the groundwater system at WIPP is not currently scientifically well understood; the Dewey Lake rock formation (a layer of rock between the surface of the site and the repository) has not been fully characterized by the DOE, and must be examined as a potential pathway for leaching of contaminants. DOE's selected alternative must include plans to fully characterize the Dewey Rock formation and to find ways to eliminate the potential for this pathway to be a source of contaminant migration. 8

New Mexico's Environmental Evaluation Group found that DOE's engineered barriers are inconsistent with definitions used by other agencies, such as the Nuclear Regulatory Commission (NRC) definition at Yucca Mountain. The only barriers that DOE is planning to use are seals for the shafts leading to the underground repository. DOE's efforts for engineered barriers are minimal, going against the common practice of multiple and redundant barriers to isolate nuclear waste. DOE's selected alternative must include plans for multiple and redundant barriers for sealing shafts leading to the underground repository. 9

LAND DISPOSAL RESTRICTIONS

The General Accounting Office has found that over 60 percent of DOE's stored TRU waste also contains hazardous waste, requiring DOE to dispose of these wastes as defined under the RCRA land disposal restrictions (LDRs). The LDRs prohibit the disposal of untreated hazardous wastes unless the Agency makes a "no migration" determination. DOE's selected alternative must clearly lay out that no migration of hazardous waste will occur as long as the waste remains hazardous. 10

PLUTONIUM RESIDUES

The D-SEIS did not, BUT SHOULD, fully address the plutonium residues at Rocky Flats and INEL that DOE will need to stabilize, process, and repackage before sending onto WIPP. How will residues be handled? 11

TRANSPORTATION:

Transportation of TRU waste on the nation's highways is a matter of great concern. Although the Western Governors Association's (WGA) Technical Advisory Group for WIPP Transport has developed a WIPP Transportation Safety Program Implementation Guide, transportation of TRU waste, if shipped to WIPP, could be more safely transported by dedicated rail, not 12

## Comment C-159, Page 3 of 4

by commercial truckers.

The D-SEIS-II estimates that 38,089 truck shipments to WIPP during 35 years could result in 6 deaths and 48 injuries from 76 transportation accidents. In addition, 3 people could die from radiation exposures in DOE's "accident-free" shipment model. The D-SEIS-II also states that rail transport would result in 10 times lower exposure to the public and 100 times lower doses to workers than truck shipments. 12

The following Sierra Club policy "High-Level Radioactive Waste" has been adopted by the Sierra Club Board of Directors:

"Transportation hazards and distances should be considered and kept as low as possible in the selection of sites. Specific routes shall minimize the possibility of human exposure in the event of an accident and should not override local and state ordinances and laws. We further urge specific congressional action which will permit state and local statutes and ordinances to apply to route selection." 13

Sierra Club policy "High-Level Nuclear Waste" also states: "Appropriately trained personnel and adequate emergency equipment shall be provided along specified transport routes. Shipments shall be monitored to assure acceptable external radiation levels." 14

As stated previously in these comments, no waste should be moved to WIPP unless emergency response teams and hospital personnel along the affected routes have attended emergency training and have AGREED TO PARTICIPATE IN RESPONDING TO A WIPP WASTE TRANSPORTATION ACCIDENT. Transportation of TRU waste, if shipped to WIPP, should be undertaken by the safer method of rail transportation. DOE's selected alternative must include the option of rail transport of TRU wastes to WIPP. 12

TREATMENT TECHNOLOGIES

In D-SEIS-II, 5-88, states that "hazardous chemical impacts would not exceed a 9 X 10 (-10) percent chance of a cancer incidence at any site...No carcinogenic health effects would occur." How did DOE arrive at this conclusion? What studies were reviewed to support this claim? DOE risk assessors should review the literature on the synergistic effects of multiple chemicals and the existing exposure literature on the synergism that occurs between radiation and chemicals. This data should then be applied to the WIPP risk assessment. 15

DOE has not defined what it means by "thermal treatment" of mixed waste in 2-17. The process of thermal treatment is described, with mention of "after burners and syn-gas." With this limited information, Sierra Club can only assume that incineration is the DOE's preferred thermal treatment. Incineration does not eliminate waste, it merely allows waste to change form. In addition, incineration does not eliminate inorganics, but releases a significant percentage of these substances into the airshed. 16

DOE, in 5-86 of the D-SEIS-II, states that before shipment to WIPP, waste would be treated. The SEIS-II goes on to state that "thermal treatment increases the concentration of radionuclides by approximately a factor of 2.8." In fact, incineration should NOT be the DOE's treatment of choice, but every effort should be made by the DOE to identify alternative technologies for the disposal of mixed waste. DOE's selected alternative must not utilize incineration as a "treatment" for mixed waste. Also, local community participation in the selection of technologies is critical to the successful and prompt reduction of these wastes.

Sierra Club policy "Environmentally Hazardous Substances," calls for a prohibition on the release of any environmentally hazardous substance, unless environmental benefits clearly outweigh environmental damage caused by no-action. The use of incineration is not environmentally beneficial.

TREATMENT OF MIXED AND HAZARDOUS WASTE

According to the D-SEIS, DOE must decide pursuant to the WM PEIS, "the most cost-effective and environmentally preferable configuration to treat and store TRU waste, regardless of whether the Department decides to dispose of the waste at WIPP." (p. S-2)

DOE's final selection should include an alternative that requires DOE to fully characterize TRU waste volumes currently being stored at sites (p. A-9, "Basic Inventory") and to propose an alternative to TRU waste storage 17

at WIPP. EPA is in agreement on the matter of waste characterization and suggested to DOE in 1996 that DOE revise its baseline report to include waste characteristics. DOE complied by forming a peer review panel, but that data appears not to have been reported. This specific data on waste is essential for safe disposal, whether at WIPP or onsite.

17

If WIPP does open, the first few years of operation will be spent at the six primary DOE facilities determining if TRU waste meets technical criteria for transportation, disposal, and shipment. DOE will not be ready to begin disposing of remote-handled waste until 2002, with a tentative WIPP shipping date of 2022. Is it possible that a waste treatment technology could be developed during this time that will make the need for WIPP obsolete? DOE should aggressively pursue research and development into waste technology treatments, thereby making WIPP the most costly and least efficient way to deal with this type of waste.

18

In the absence of specific data in the SEIS, the following questions remain regarding the viability of WIPP:

(1) Is there a possibility that TRU waste levels would DECREASE if onsite "treatment" occurred?

(2) What types of P2 programs are in effect at DOE facilities that would encourage decreases in future waste destined for WIPP?

19

(3) What amount of TRU waste would remain after "treatment?"

Consequently, if TRU waste would be significantly reduced by an environmentally safe technology, could this reduced amount of waste be stored indefinitely until technologies are developed that would totally treat this type of waste, preferably onsite, and with acceptance by the community?

Under the Settlement Agreement between the DOE and the State of Idaho, signed October 1995, provisions were outlined for a "Mixed Waste Treatment Facility" to be located at Idaho National Laboratory (INEL). According to the Agreement, this facility would "treat" mixed TRU waste and alpha emitting low level waste, with a procurement contract completed by June 1, 1997. Has the DOE coordinated with other DOE facilities in regard to the Mixed Waste Treatment Facility, and has DOE projected what amount(s) of TRU waste would need to be shipped to WIPP when the Facility opens in 2002?

20

DOE should continue to investigate alternative technologies, study the proposals of the Mixed Waste Working Group (MWWG) of the Federal Advisory Committee to Develop On-site Innovative Technologies (DOIT Committee), and more fully communicate with the Site Teams at various DOE facilities in the development of innovative technologies.

21

In addition, as GAO stated in its 1996 report on WIPP, DOE "needs new facilities and equipment to achieve anticipated disposal rates" before waste can be emplaced at WIPP. At the point of being redundant, wouldn't monies be more wisely spent to deal with TRU waste onsite at DOE facilities, and not transfer it to WIPP?

22

Sincerely,

Susan Maret, Nuclear Waste Task Force, Sierra Club

(( for John W. Winchester, Chair
Sierra Club National Nuclear Waste Task Force
winchester@ocean.fsu.edu))

Susan Maret MLS, Instructor

Auraria Library: Serving the University of Colorado, Denver, Metropolitan State College and Community College of Denver
Reference Department and Instruction Services, 1100 Lawrence Street, Denver, CO 80204
Phone(303)556-4919/Fax(303)556-2178
smaret@castle.cudenver.edu*******
http://www.cudenver.edu/public/library/ecol.html



**Waste Isolation Pilot Plant (WIPP)**
**Disposal Phase Supplemental Environmental Impact Statement**

**Written Comment Record**

Julie | R | Sutherland
First Name (please print) | M | Last Name

Box 264 San Cristobal NM 87564 | Feb. 27, 1997 | morning
Location | Date | Time

myself, my husband, my children
Representing?

**Specific Comment(s) (Summarize & be concise on this form)**

1 We are very concerned that WIPP not open... after 20 years of experimentation at the site it has been shown to be unsafe.

2 The boreholes & shafts are filling up with water & potential breach scenarios are evident. The waste brought to WIPP in steel drums would be placed in direct contact with salt beds that could corrode the containers in a matter of years. Why contaminate a beautiful area & make it uninhabitable for

2 generations to come? Even if it was "safe" moving nuclear waste down the highway* is totally

4 insane in our opinion. Every time we attend a hearing we either pass the scene of an accident or almost are involved in one ourselves.

Please, Mr. Johnson, take a leadership role &

4 * from all over the country. (over)

represent the best interests of ~~real~~ the people & the Planet -- indeed all life forms. ~~xxxxx~~ The billions of dollars still planned to be spent on this project would be better used to find a way to transmute nuclear waste into something non-toxic. Until a real solution is found, it should be left at the site where it is generated. ~~xxx~~ Thank you for your support.

5

6



please take the time to read this & pass it on.

**THE TRUTH ABOUT WIPP GEOLOGY AND HYDROLOGY**

**by Richard Hayes Phillips, Ph.D.**

1. **The WIPP site is wet.** It was supposed to be dry. This was the rationale behind disposing of nuclear waste in salt beds. The very fact that salt beds still exist is proof that they have been isolated from circulating groundwater ever since they were deposited. But the salt beds of the Salado Formation were formed when an ancient sea evaporated, leaving the salt behind. Trapped within the salt beds are pockets of brine that never evaporated. These brine pockets migrate toward areas of low pressure. As soon as the WIPP tunnels were excavated, brine began seeping into the roof and walls. This was unexpected.

2. **The waste brought to WIPP would be buried in steel drums placed in direct contact with the salt beds.** Those fancy containers you have heard about are for transportation only. When the waste gets to WIPP, the DOE will unpack the transportation containers and bury the waste in steel drums, just like they always do. Brine will continue to seep into the WIPP repository. In a matter of years the steel drums will corrode, and the brine will begin dissolving the waste, creating a slurry of radioactive waste and salt water.

3. **The WIPP site is already breached.** The Salado salt beds are deep underground, beneath the water table. When the DOE drilled the WIPP access shafts, they had to drill through groundwater aquifers in order to reach the salt beds. Also within the WIPP site are four deep boreholes penetrating deeper than the waste repository. These shafts and boreholes are ready-made pathways for contaminated water. DOE must be able to seal the shafts and plug the boreholes perfectly, forever, and we doubt that they can do it.

4. **There is pressurized brine beneath the WIPP repository.** This is not to be confused with the brine pockets in the Salado Formation. This is a brine reservoir, beneath the Salado, in the Castile Formation. When this brine reservoir was encountered at a borehole called WIPP-12, located one-half mile north of the waste repository, 1500 barrels a day flowed for forty days, all the way to the land surface. This is because the brine is under artesian pressure, and it is the geologic mechanism, the driving force, which could bring the slurry of radioactive waste and salt water to the overlying aquifers or to the land surface.

5. **The WIPP site is vulnerable to human intrusion.** There are extensive deposits of oil, gas and potash at the WIPP site. Oil and gas wells now surround the site, and the oil and gas fields extend directly beneath the waste repository. As long as DOE controls the site, oil and gas exploration can be prevented. But when institutional controls fail, someone searching for oil will drill directly through the waste repository and into the pressurized brine reservoir, creating an instant breach of containment. The brine will flow to the land surface if the oil well is cased, and into the groundwater aquifers if the oil well is not cased.

6. **The WIPP site is in karst.** In most cases, groundwater moves through porous rocks, like sandstone, flowing uniformly and predictably. The problem with karst is that groundwater flows more rapidly through less space, through fractures enlarged by solution, or through underground caverns. The aquifers above the Salado Formation, both the Rustler Formation and the Dewey Lake Redbeds, are karst, with caverns in dolomite and gypsum, even in sandstone and shale. The caverns get larger with time; and the larger the caverns, the less the amount of radiation that sticks to the rocks as contaminated water flows through them.

7. **Drinking water will be contaminated.** There are wells in the Dewey Lake Redbeds and the Rustler Formation, within and near the WIPP site, that contain potable, drinkable water. These aquifers discharge in Nash Draw, where salt lakes will be contaminated, and they will overflow eventually into the Pecos River.

8. **The WIPP site will get worse over time.** As more and more potash is mined in the Salado Formation, the overlying aquifers will slump and fracture. Every major rainstorm will recharge the Rustler Formation with fresh water to dissolve more dolomite and gypsum. The waste will be radioactive for a very long time. Ice ages, which are cyclical, are inevitable. The climate will change when the glacier advances. There will be more rainfall, less evaporation, and more groundwater, and the rocks will dissolve more rapidly.

*Richard Hayes Phillips holds a Ph.D. in karst geomorphology and hydrology from the University of Oregon. His dissertation is entitled: "The Prospects for Regional Groundwater Contamination due to Karst Landforms in Mescalero Caliche at the WIPP site near Carlsbad, New Mexico." During his field work he camped at the WIPP site for eight months and dug one thousand auger holes and ten backhoe trenches, exposing holes of all sizes in the Mescalero caliche and demonstrating that rainwater readily reaches the Dewey Lake Redbeds.*

Comment C-161

83 Barcelona Ave
Los Alamos, NM 87544

Feb 25, 1997

SEIS Comments
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88220

1 I strongly support the opening of WIPP. I think this facility is based on very sound science and has been studied exhaustively.

2 I believe the transportation system is very safe. The risk to the public is thousands of time less than is commonly accepted for the truck and train transport of fuels and hazardous chemicals.

3 DOE and government officials have bent over backwards to address the concerns of the public (many raised by people who want to curtail all industrial, government, and medical use of radionuclides by opposing all methods of waste treatment and secure emplacement). This has cost the taxpayers billions of dollars in delay costs. It is time to move forward to solve the safe emplacement of radioactive waste.

William L. Partain, PhD, P.E.
William L. Partain

Comment C-162, Page 1 of 6

**WIPP SEIS-II testimony**
**Santa Fe, New Mexico**
**8 January 1997**

**Submitted by**
**Kathleen Sullivan**
**239 Owl Creek Road**
**Boulder, CO 80302**

My name is Kathleen Sullivan and I work at the Rocky Mountain Peace and Justice Center in Boulder, Colorado, nine miles down the road from the DOE's Rocky Flats. Although it has been renamed the Rocky Flats Environmental Technology Site, it was, until 1990, the sole producer of plutonium pits for US nuclear bombs. There are 14 tons of weapons-grade plutonium stored on site and various other amounts clogged in venting ducts, and in the soil, on the wind, and in drinking water supplies for surrounding municipalities. But today I have come to talk about WIPP. And I have driven here all the way from Colorado because I have a message from

1 future generations. And that message is: **WIPP must never open.**

The first major report considering what to do with radioactive waste was published by the National Academy of Science (NAS) in 1957. It is not surprising that 1957 was the year that the NAS chose to commence their research. In 1957, within 6 weeks of each other, 3 accidents rocked the early nuclear fraternity. A fire at Rocky Flats occurred in Building 771 which ripped through the gloveboxes and blew out the

releasing an estimated 20-500 pounds of plutonium into the environment. The Calder Hall reactor at Windscale, now called Sellafield, in the North of England experienced a near melt down. And at Kyshtym in the Former Soviet Union, a high level waste dump exploded. All three accidents were kept

1

secret while the NAS began to grapple with the nuclear bomb industry's growing problem of radioactive waste.

The proposal of the NAS report suggested "deep geologic disposal" as the answer. The main focus of the report was to determine the best "host rock" for deep burial and here, the NAS considered salt the most appropriate host. Salt seemed to have an "encasing" effect due to its tendency to "creep" over time, thus, seemingly endowed with an ability to "lock away" radioactive waste. Salt was also said to be dry and therefore, impermeable to water seepage. In 1975, based on research from 1957, the present WIPP site was chosen.

2 But the original premise of the NAS report has been proved erroneous. WIPP is not dry. In fact, WIPP is surrounded by water. The present WIPP site has a brine reservoir extending beneath much of the burial area. Brine has with the ability to corrode the encasements for radioactive waste, and subsequently lend itself to the

3 migration of radioactive materials into the biosphere. Above the WIPP site is a layer of ground water which feeds into the Pecos River, which will eventually make its way into the Gulf of Mexico.

Apart from the migration of radioactive materials into the environment, one must question the transportation of these materials to WIPP. Some 40,000 truck



shipments of radioactive materials would occur if WIPP opens. In the state of Colorado it is estimated that 25,000 truckloads would pass through Denver and

4 Colorado Springs on I-25. Although, according to the DOE's own research, rail transportation would result in 10 times lower exposures to the public and 100 times lower exposures to workers, the DOE is still choosing truck shipments over rail

5 transport. And why has the DOE gone for trucking? Here's an obvious insight: the

WIPP design provides virtually no above ground storage. WIPP is a receiving facility, not a storage facility. So what will happens over the next 35 years? Is the
5 DOE expecting fair traveling weather, clear roads and an impeccably adhered to timetable?

Other transportation concerns include the lack of readiness on the part of emergency responders along the WIPP route. Local emergency responders in at least 25 states
6 need to be trained and equipped to handle accidents for the next three decades. Hospitals would need further personnel training in the likely event that they would need to treat victims of radiation exposure.

There's the added problem of the uncertainty surrounding the decay of radioactive
7 materials. Gas generation from decaying radioactive waste may create flammability problems during transportation and burial. Furthermore, the promise of WIPP opening has encouraged an irresponsible approach to radioactive materials at former DOE weapons facilities. At Rocky Flats, the TRU and TRU mixed waste
8 disposition program is totally reliant on WIPP. There are no contingency plans. This reliance has left Rocky Flats with very poor storage conditions for radioactive waste and plutonium residues, oxides and metals.

If all these problems weren't enough, it is important to recognize that WIPP as an
1 idea is a failure. The concept of disposal, implicit in the WIPP option is dubious at best. There is no such thing as the "disposal" of radioactive materials. The radioactive waste from Rocky Flats that is targeted for WIPP is contaminated with plutonium. Moreover, if WIPP opens the nuclear industry could claim that the
9 radioactive waste problem had been "solved", and thus further promote the abuses of nuclear technology. Sounds like the MOx fuel option.



And what about the future? Future generations are likely to inhabit or explore the area occupied by WIPP. And not only human beings, but all life forms. How will they know to stay away for 240,000 years? Is it possible (as the DOE envisions) to
10 construct a KEEP OUT sign that will last for such a vast period of time? To build a Landscape of Thorns that will withstand a span of time relegated only to geology: to earth's time. No human institution can claim to know the more modest 10,000 years that the DOE predicts WIPP will operate safely.

So what do we do? What needs to happen? My colleague Joanna Macy of the Nuclear Guardianship Project summed up the WIPP effort beautifully when she stated that "WIPP is a poor use of the human imagination". And it's true, we could do so much better than dig a hole in an extinct ocean 21 hundred feet below the surface of the earth and call it disposal.

It is clear that a safer, more responsible option would require the dynamic containment of radioactive materials at the site of generation. Dynamic
11 containment. This practice involves the monitoring of radioactive waste and their containers with a view to applying future technologies that may better serve the function of isolating these materials from the environment. On site storage avoids the inevitable risk of transportation. The transportation of radioactive materials should occur only in the event that the conditions at the site of generation pose a greater risk to the environment than transportation off site. This may be necessary in areas with great seismic activity, high winds and flood plains. Dynamic
11 containment also requires that we really look at the radioactive materials we have created. And really look after them, take care of them. Perhaps then, it will become clear (to even the most ardent proponent of nuclear technology) that the further

production of radioactive materials is unacceptable. And finally, dynamic containment acknowledges the rights of future generations to know about the dangers of radioactive materials, and to learn about how to protect themselves from the mutagenic substances that we bequeath to them. 11

There are many people in Colorado who oppose WIPP. These people are unwilling to ship radioactive waste to WIPP in order to simply "get it out of their backyard". The earth is our backyard. And that is why we must isolate radioactive materials from the environment to the very best of our ability. The salt dome that WIPP is hewn from is our environment. A barrier of 2,000 feet from the earth's surface does not constitute isolation.

In closing I would like to reiterate that WIPP is a symbol of a total disregard for future generations and ecological integrity. To willfully encourage the practice of deep geologic burial is unconscionable and to open the WIPP facility is to commit an enduring act of violence against the future of all life. 1



THE PROSPECTS FOR REGIONAL GROUNDWATER CONTAMINATION
DUE TO KARST LANDFORMS IN MESCALERO CALICHE
AT THE WIPP SITE NEAR CARLSBAD, NEW MEXICO

by

RICHARD HAYES PHILLIPS

A DISSERTATION

Presented to the Department of Geography
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 1987

This document has been included in its entirety as Exhibit E-49.

# THE PROSPECTS FOR REGIONAL GROUNDWATER CONTAMINATION DUE TO KARST LANDFORMS IN MESCALERO CALICHE AT THE WIPP SITE NEAR CARLSBAD, NEW MEXICO

by

RICHARD HAYES PHILLIPS

A DISSERTATION

Presented to the Department of Geography
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 1987





APPROVED: Clyde P. Patton
Clyde P. Patton

COPYRIGHT 1987 Richard Hayes Phillips

---





An Abstract of the Dissertation of

Richard Hayes Phillips

for the degree of Doctor of Philosophy

in the Department of Geography

to be taken June 1987

Title: THE PROSPECTS FOR REGIONAL GROUNDWATER CONTAMINATION DUE TO KARST LANDFORMS IN MESCALERO CALICHE AT THE WIPP SITE NEAR CARLSBAD, NEW MEXICO

Approved: _____
Clyde P. Patton

Plutonium from nuclear weapons production will be permanently buried in Permian salt beds at the Waste Isolation Pilot Plant (WIPP), located in the Nash Draw watershed of the Mescalero Plain near Carlsbad, New Mexico. Overlying the salt beds are cavernous Rustler dolomite aquifers, the most likely flow paths for contaminated water from WIPP to the biosphere. Overlying the Rustler are sandstones, siltstones, Mescalero caliche, and windblown sand. The WIPP site contains thousands of closed topographic depressions. If some are karst features, the ability of WIPP to isolate nuclear waste cannot be demonstrated. Selected depressions were investigated to determine their origins and hydrologic functions and to evaluate

the suitability of the WIPP site.

Three techniques were used to investigate caliche karst: (1) map and air photo interpretation; (2) reconstruction of subsurface caliche topography from 1,000 auger holes; and (3) description of caliche and sandstone profiles in backhoe trenches. The results are presented in form line maps, structure contour maps, geomorphic cross-sections, isopach maps, and photographs of trench exposures. The WIPP site was found to contain disappearing arroyos, collapse sinks, solution-subsidence dolines, solution pipes in caliche, solution pans, slots and tinajitas in sandstone, and carbonate veins in bedrock; all facilitate rainwater recharge of the Rustler.

A water balance and geochemical analysis of the Nash Draw watershed and nearby brine springs were undertaken to determine: (1) which Rustler aquifers discharge where, and in what quantities; (2) the rates of evapotranspiration and natural groundwater recharge; (3) the most likely discharge point for contaminated water from WIPP. Laguna Grande, a natural salt lake in Nash Draw, is the outlet for the Rustler dolomite aquifers and for plutonium contamination from WIPP. The recharge time for the Rustler may be only 6 to 8 years.

WIPP is unsuitable for nuclear waste isolation because: (1) Rustler groundwater flow paths and travel times are inherently unpredictable; (2) caliche and sandstones allow





rainwater recharge of the Rustler; (3) pressurized brine underneath WIPP can carry dissolved waste up the WIPP shafts to the Rustler; (4) geologic barriers between the brine and WIPP are unreliable; and (5) WIPP is vulnerable to human intrusion.

VITA

NAME OF AUTHOR: Richard Hayes Phillips

PLACE OF BIRTH: Schenectady, New York

DATE OF BIRTH: September 17, 1951

UNDERGRADUATE AND GRADUATE SCHOOLS ATTENDED:

University of Oregon
University of Oklahoma
University of New Mexico
State University of New York, College at Potsdam
Boston University

DEGREES AWARDED:

Doctor of Philosophy, 1987, University of Oregon
Master of Arts, 1983, University of Oklahoma
Master of Arts, 1982, University of Oklahoma
Bachelor of Arts, 1979, SUNY College at Potsdam

AREAS OF SPECIAL INTEREST:

geomorphology, groundwater hydrology, environmental science, historical geography, cartography.

PROFESSIONAL EXPERIENCE:

Graduate Teaching Fellow, Department of Geography, University of Oregon, Eugene, 1983-1986.

AWARDS AND HONORS:

Karst Research Fellowship, Cave Research Foundation, 1985.





PUBLICATIONS:

Phillips, Richard, "Lying, Cheating, Stealing from Oklahoma's Indians;" The Oklahoma Observer, April 25, 1983.

Phillips, Richard, "Kerr-McGee's Radioactive Waste," The Oklahoma Observer, September 25, 1985.

Phillips, Richard, "Extent of Karstification East of Livingston Ridge, Eddy County, New Mexico," Cave Research Foundation, Annual Report, 1985.

Phillips, Richard, "Water Balance of the Nash Draw Watershed, Eddy County, New Mexico;" Cave Research Foundation, Annual Report, 1985.

Phillips, Richard, "Oklahoma New Nuke Dump?," The Oklahoma Observer, January 25, 1986.

Phillips, Richard, "Kerr-McGee Proposes Expansion for Gore," The Oklahoma Observer, February 10, 1986.

Phillips, Richard, "NRC Shills for Kerr-McGee," The Oklahoma Observer, March 25, 1986.

## ACKNOWLEDGMENTS

The author thanks the Cave Research Foundation, Frances Tyson, William Homans, Robert Aly, Janet Greenwald, Larry Barrows, Robert and Donna Phillips, Dory Bunting, Gary Kutcher, David Tantum, Citizens for Alternatives to Radioactive Dumping, Citizens Action for Lasting Security, and the University of Oregon Geography Department, who provided financial assistance.

The author thanks William Homans, Ted Geis, Bill Todd, Robert Aly, Jamahl Tantum, John McCloskey, Sue Essen, Tom Snee, Richard Murphy, Betty Richards and Margaret Darr, who provided field assistance.

The author thanks El Centro Rural de Salud and the Loving Community, Janet Greenwald and Robert Aly, Jessamyn Young and David Tantum, Richard Murphy and Jenny Murphy, and Betty Richards, who provided shelter and transportation.

The author thanks C. C. Reeves, Jr., Larry Barrows, John Hawley, Lokesh Chaturvedi and Jenny Chapman, who visited the trenches at the WIPP site.

The author thanks Clyde Patton, Patricia McDowell, Patrick Bartlein, Sam Boggs, C. C. Reeves, Jr., and Larry Barrows, who reviewed the manuscript.





## DEDICATION

### EVERY LAND IS BEAUTIFUL

East of the Pecos River
Lies the Mescalero Plain
With mesquite, scrub oak and yucca
On a dune and swale terrain
With sink holes, disappearing streams
And caverns and salt lakes
Jackrabbits and coyotes
Packrats and rattlesnakes

Some think of this as desert
Others would not call it such
With a foot or more of rain per year
And sometimes twice as much
There's not much surface runoff
On this semi-arid land
And what does not evaporate
Simply soaks into the sand

With water tanks and windmills
For the brahma bulls and cows
They use the land for grazing
Contented as they browse
The air is crisp, the land is spacious
As the sun falls from the sky
You can almost touch the stars and moon
As the wild coyotes cry

Every land is beautiful
If simply left alone
Every species has the right
To the conditions it has known
The earth does not exist
As a possession of our own
Every land is beautiful
If simply left alone

On a cool September sunrise
You can watch the morning star
Rainbow light at the horizon
You can forget just where you are
But there's some have lost their vision
And they'd have the world at war
So I'll stand here in this desert
I know it's worth fighting for

Every ant and Gila monster
Each coyote, every snake
Is much more dear in the sight of God
Than all the bombs we make
Every prickly bush of mesquite
Every scrub oak in the sand
Calls to common sense to stop
The poisoning of this desert land

Every land is beautiful
If simply left alone
Every species has the right
To the conditions it has known
The earth does not exist
As a possession of our own
Every land is beautiful
If simply left alone

Richard Phillips and William Homans, 1985





TABLE OF CONTENTS


| Chapter | | Page |
|---|---|---|
| I. | INTRODUCTION | 1 |
| | Statement of Purpose | 1 |
| | The Physical Setting | 6 |
| | Regional Stratigraphy | 8 |
| | Overview of Karst Controversy | 14 |
| | Possible Origins of Surface Depressions | 17 |
| | Karst Research Methodology | 19 |
| | Geomorphic Findings | 22 |
| | Overview of Hydrology Controversy | 25 |
| | Hydrologic Research Methodology | 27 |
| | Structure of this Dissertation | 31 |
| II. | KARSTIFICATION OF BEDROCK | 34 |
| | Introduction | 34 |
| | Semi-Arid Karst | 34 |
| | Types of Dolines | 37 |
| | Karst Hydrology | 38 |
| | Karst in the Pecos River Valley | 42 |
| | Karst in Nash Draw | 45 |
| | Karst Throughout the Stratigraphic Column | 48 |
| | Conclusion | 53 |
| III. | CALICHE FORMATION AND KARSTIFICATION | 55 |
| | Introduction | 55 |
| | Nature of Caliche | 55 |
| | Origin of Caliche | 57 |
| | Development of Caliche | 60 |
| | Caliche Karst | 62 |
| | Origin of Mescalero Caliche | 66 |
| | Morphology of Mescalero Caliche | 68 |
| | Karstification of Mescalero Caliche | 70 |
| | Summary | 72 |

| Chapter | | Page |
|---|---|---|
| IV. | A CHAIN OF SINK HOLES | 74 |
| | Introduction | 74 |
| | The WIPP-33 Sink Hole | 76 |
| | Morphology of Adjacent Depressions | 82 |
| | Caliche Escarpment at WIPP-33 | 87 |
| | Caliche Structure at WIPP-33 | 89 |
| | Stratigraphic Evidence of Collapse | 92 |
| | Solution Features in Sandstone | 99 |
| | Adjacent Structural Depressions | 108 |
| | Summary | 122 |
| V. | A KARST VALLEY | 124 |
| | Introduction | 124 |
| | Surface Drainage on the Mescalero Plain | 125 |
| | Surface Morphology of Section 36 Depression | 126 |
| | Caliche Structure of Section 36 Depression | 132 |
| | Solution Pipes in Mescalero Caliche | 139 |
| | Hydrologic Implications of Solution Pipes | 155 |
| | Summary | 158 |
| VI. | SMALL TOPOGRAPHIC DEPRESSIONS | 160 |
| | Introduction | 160 |
| | Eolian Topography | 161 |
| | Barrows' Bathtub | 163 |
| | The Caliche Pit Hypothesis | 167 |
| | Evidence of Natural Origin | 171 |
| | Comparison of a Doline and a Blowout | 173 |
| | Conclusion | 181 |
| VII. | PONDING AND DEGRADATION OF CALICHE | 182 |
| | Introduction | 182 |
| | Evidence of Deep Dissolution at WIPP-14 | 183 |
| | Structure of the WIPP-14 Depression | 194 |
| | The Negative Gravity Anomaly | 203 |
| | Summary | 209 |







| Chapter | | Page |
|---|---|---|
| VIII. | THE REGIONAL WATER BALANCE | 210 |
| | Introduction | 210 |
| | Hydrology of Laguna Grande de la Sal | 211 |
| | Water Balance of the Nash Draw Watershed | 219 |
| | Sources of Groundwater Discharge to Laguna Grande | 227 |
| | Water Balance of Malaga Bend Brine Springs | 232 |
| | Sensitivity Analysis | 235 |
| | Effect of Potash Refinery Effluent on Water Balance | 240 |
| | Geochemistry of Rustler Groundwater Discharge | 242 |
| | Summary | 248 |
| IX. | HYDROLOGIC EFFECTS OF CLIMATIC CHANGE | 250 |
| | Introduction | 250 |
| | Late Quaternary Climatic Chronology of the Llano Estacado | 252 |
| | Late-Glacial Climate in the Guadalupe Mountains | 258 |
| | Evidence of Climatic Change in Pecos River Valley | 262 |
| | Paleohydrologic Parameters | 264 |
| | Hydrologic Effects of Future Climatic Change | 268 |
| | Summary | 273 |
| X. | ASSESSMENT OF WIPP SITE SUITABILITY | 275 |
| | Introduction | 275 |
| | Darcy's Law Applied to Karst Aquifers | 275 |
| | Rainwater Recharge of the Rustler Formation | 280 |
| | Pressurized Brine Underneath the WIPP Repository | 283 |
| | Potential Pathways for Brine Migration | 287 |
| | Flow Paths for Contaminated Water | 296 |
| | Conclusion | 303 |
| BIBLIOGRAPHY | | 305 |

Comment C-163A, Page 15 of 338



LIST OF TABLES


| Table | | Page |
|---|---|---|
| 1. | Stratigraphy of WIPP-33 | 79 |
| 2. | Spatial Extent of Solution Pipes, Section 30 | 155 |
| 3. | Stratigraphy of WIPP-14 and WIPP-34 | 187 |
| 4. | Stratigraphy of P-10 and P-18 | 188 |
| 5. | Results of Sensitivity Analysis | 236 |
| 6. | Sources of Data in Sensitivity Analysis | 239 |
| 7. | Seepage from Potash Refinery Disposal Ponds into Nash Draw | 241 |
| 8. | Geochemical Data from Nash Draw and Vicinity | 243 |
| 9. | Mineral Constituents of Evaporite Rocks | 244 |
| 10. | Solution Features East of Livingston Ridge | 280 |


Comment C-163A, Page 16 of 338



LIST OF FIGURES


| Figure | | Page |
|---|---|---|
| 1. | The Mescalero Plain | 2 |
| 2. | The Nash Draw Watershed | 3 |
| 3. | Generalized Stratigraphy at the WIPP Site | 9 |
| 4. | Index Map to Augering Sites | 21 |
| 5. | Auger Holes at WIPP-33 and Adjacent Depressions | 75 |
| 6. | Form Line Map, Land Surface, WIPP-33 | 77 |
| 7. | Gravity Profile, WIPP-33 | 81 |
| 8. | Form Line Map, Land Surface, Second and Third Depressions | 83 |
| 9. | Form Line Map, Land Surface, Fourth Depression | 85 |
| 10. | Structure Contour Map, Caliche and Sandstone Surfaces, WIPP-33 | 88 |
| 11. | Auger Holes Reaching Sandstone, WIPP-33 | 91 |
| 12. | Geomorphic Cross-Section, WIPP-33, 200 Feet West of Pipeline Route | 93 |
| 13. | Geomorphic Cross-Section, WIPP-33, 150 Feet West of Pipeline Route | 94 |
| 14. | Geomorphic Cross-Section, WIPP-33, 100 Feet West of Pipeline Route | 94 |
| 15. | Geomorphic Cross-Section, WIPP-33, 50 Feet West of Pipeline Route | 95 |
| 16. | Geomorphic Cross-Section, WIPP-33, Along Pipeline Route | 95 |
| 17. | Geomorphic Cross-Section, WIPP-33, 50 Feet East of Pipeline Route | 96 |

| Figure | | Page |
|---|---|---|
| 18. | Geomorphic Cross-Section, WIPP-33, 100 Feet East of Pipeline Route | 96 |
| 19. | Solution Features in Sandstone, Lincoln County, Kansas | 100 |
| 20. | Structure Contour Map, Caliche Surface, Second and Third Depressions | 110 |
| 21. | Geomorphic Cross-Section, Second Depression, 150 Feet East of Pipeline Route | 111 |
| 22. | Geomorphic Cross-Section, Second Depression, 200 Feet East of Pipeline Route | 111 |
| 23. | Geomorphic Cross-Section, Second Depression, 200 Feet North of Trunk Line | 112 |
| 24. | Geomorphic Cross-Section, Second Depression, 250 Feet North of Trunk Line | 112 |
| 25. | Geomorphic Cross-Section, Second Depression, 300 Feet North of Trunk Line | 113 |
| 26. | Geomorphic Cross-Section, Second Depression, 300 Feet East of Pipeline Route | 113 |
| 27. | Geomorphic Cross-Section, Third Depression, 300 Feet North of Trunk Line | 115 |
| 28. | Geomorphic Cross-Section, Third Depression, 800 Feet East of Pipeline Route | 115 |
| 29. | Structure Contour Map, Caliche Surface, Fourth Depression | 118 |
| 30. | Geomorphic Cross-Section, WIPP-33 and Fourth Depression, Along Trunk Line | 119 |
| 31. | Geomorphic Cross-Section, WIPP-33, Along Trunk Line | 120 |
| 32. | Geomorphic Cross-Section, Dune Field, Along Trunk Line | 120 |
| 33. | Geomorphic Cross-Section, Fourth Depression, Along Trunk Line | 121 |
| 34. | Auger Holes at Section 36 Depression | 128 |







| Figure | | Page |
|---|---|---|
| 35. | Form Line Map, Land Surface, Sections 30 and 31 | 129 |
| 36. | Form Line Map, Land Surface, Sections 25 and 36 | 130 |
| 37. | Form Line Map, Land Surface, Along Cow Path | 131 |
| 38. | Isopach Map, Calcareous Dissolution Residue, Section 30 | 135 |
| 39. | Isopach Map, Unconsolidated Deposits, Section 30 | 135 |
| 40. | Structure Contour Map, Caliche and Sandstone Surfaces, Sections 30 and 31 | 136 |
| 41. | Structure Contour Map, Caliche and Sandstone Surfaces, Sections 25 and 36 | 137 |
| 42. | Structure Contour Map, Caliche and Sandstone Surfaces, Along Cow Path | 138 |
| 43. | Form Line Map, Land Surface, Barrows' Bathtub | 164 |
| 44. | Structure Contour Map, Caliche and Sandstone Surfaces, Barrows' Bathtub | 166 |
| 45. | Auger Holes Reaching Sandstone, Barrows' Bathtub | 166 |
| 46. | Form Line Map, Land Surface, The Blowout | 166 |
| 47. | Structure Contour Map, Caliche Surface, The Blowout | 166 |
| 48. | Geomorphic Cross-Section, The Blowout, South to North | 175 |
| 49. | Geomorphic Cross-Section, The Blowout, Southwest to Northeast | 175 |
| 50. | Geomorphic Cross-Section, The Blowout, West to East | 176 |
| 51. | Geomorphic Cross-Section, The Blowout, Northwest to Southeast | 176 |

| Figure | | Page |
|---|---|---|
| 52. | Geomorphic Cross-Section, Barrows' Bathtub, South to North | 177 |
| 53. | Geomorphic Cross-Section, Barrows' Bathtub, Southwest to Northeast | 177 |
| 54. | Geomorphic Cross-Section, Barrows' Bathtub, West to East | 178 |
| 55. | Geomorphic Cross-Section, Barrows' Bathtub, Northwest to Southeast | 178 |
| 56. | Gravity Profile, WIPP-14 | 185 |
| 57. | Auger Holes at WIPP-14 and Negative Gravity Anomaly | 186 |
| 58. | Isopach Map, Rustler Formation | 190 |
| 59. | Structure Contour Map, Top of Dewey Lake Redbeds | 190 |
| 60. | Structure Contour Map, Top of Forty-niner Member | 191 |
| 61. | Structure Contour Map, Top of Magenta Dolomite | 191 |
| 62. | Structure Contour Map, Top of Culebra Dolomite | 192 |
| 63. | Structure Contour Map, Top of Salado Formation | 192 |
| 64. | Form Line Map, Land Surface, WIPP-14 | 195 |
| 65. | Structure Contour Map, Caliche Surface, WIPP-14 | 196 |
| 66. | Form Line Map, Land Surface, Negative Gravity Anomaly | 205 |
| 67. | Structure Contour Map, Caliche Surface, Negative Gravity Anomaly | 205 |
| 68. | Geomorphic Cross-Section Along Negative Gravity Anomaly | 206 |







| Figure | | Page |
|---|---|---|
| 69. | Coincidence of Calcareous Dissolution Residue with Structural Depressions in Caliche, Negative Gravity Anomaly | 207 |
| 70. | Isopach Map, Calcareous Dissolution, Negative Gravity Anomaly | 207 |
| 71. | General Land Office Survey Plat Map, Alkali Flat, 1882 | 212 |
| 72. | Department of the Interior Base Map of New Mexico, 1920 | 213 |
| 73. | First Detailed Map of Laguna Grande de la Sal, Robinson and Lang, 1934 | 214 |
| 74. | General Land Office Survey Plat Map, Laguna Grande de la Sal, 1944 | 215 |
| 75. | Potentiometric Surface, WIPP Site and Vicinity | 223 |
| 76. | North-South Geologic Cross-Section Through WIPP Site | 285 |

LIST OF ILLUSTRATIONS


| Plate | | Page |
|---|---|---|
| 1. | Collapse of Caliche at WIPP-33 | 98 |
| 2. | A Joint-controlled Slot, Enlarged by Solution | 103 |
| 3. | Carbonate-cemented Gatuna Sandstone | 104 |
| 4. | A Nested Tinajita in Gatuna Sandstone | 105 |
| 5. | A Joint-controlled Solution Pan in Gatuna Sandstone | 106 |
| 6. | A Large Solution Pipe in Mescalero Caliche | 141 |
| 7. | Close-up of Calcareous Dissolution Residue | 143 |
| 8. | A Solution Pipe in Mescalero Caliche | 146 |
| 9. | Two Depressions Floored by Mescalero Caliche | 147 |
| 10. | A "Flower-pot Structure" Floored by Mescalero Caliche | 148 |
| 11. | A Trench Exposure 60 Feet Long | 150 |
| 12. | Close-up of Mescalero Caliche Surface | 151 |
| 13. | A Large Solution Pipe in Mescalero Caliche | 152 |
| 14. | A Large Solution Pipe in Mescalero Caliche | 154 |
| 15. | The Middle Section of a Trench in Barrows' Bathtub | 169 |
| 16. | The Uppermost of Three Grooves in Mescalero Caliche | 170 |
| 17. | Close-up of Poorly Consolidated Gatuna Sandstone | 180 |
| 18. | Weakly Consolidated Caliche Remnants | 198 |
| 19. | Weakly Consolidated Caliche Remnants | 198 |







| Plate | | Page |
|---|---|---|
| 20. | Solution Features in Caliche Remnants | 200 |
| 21. | Solution Features in Caliche Remnants | 200 |
| 22. | Gypsum Cave in the Hills High Above Surprise Spring | 229 |
| 23. | Discharge into Laguna Grande from a Small Salt Lake | 231 |
| 24. | A View of the WIPP Waste Emplacement Horizon | 289 |
| 25. | Another View of the WIPP Waste Emplacement Horizon | 290 |
| 26. | An Open Fracture in the Lower Anhydrite Member | 297 |
| 27. | An Eight-foot Cavity or "Washout" in Black Shale | 298 |
| 28. | Gypsum Veins in the Dewey Lake Redbeds | 300 |

CHAPTER I

INTRODUCTION

Statement of Purpose

This dissertation is an investigation of the origins and hydrologic functions of some of the closed topographic depressions on the Mescalero Plain in eastern Eddy County, New Mexico. The Mescalero Plain (Figure 1) is a gently rolling, hummocky landscape of Permian evaporites and sandstones, capped by mid-Pleistocene Mescalero caliche, and covered by a mantle of eolian (windblown) sand.

The study area has taken on a renewed scientific interest due to the decision by the United States Department of Energy (DOE) to bury plutonium waste from the nuclear weapons program in Permian salt beds which underlie the Mescalero Plain. The Waste Isolation Pilot Plant (WIPP) site is centered on the Mescalero Plain about 26 miles east-southeast of Carlsbad, New Mexico (Figure 2).

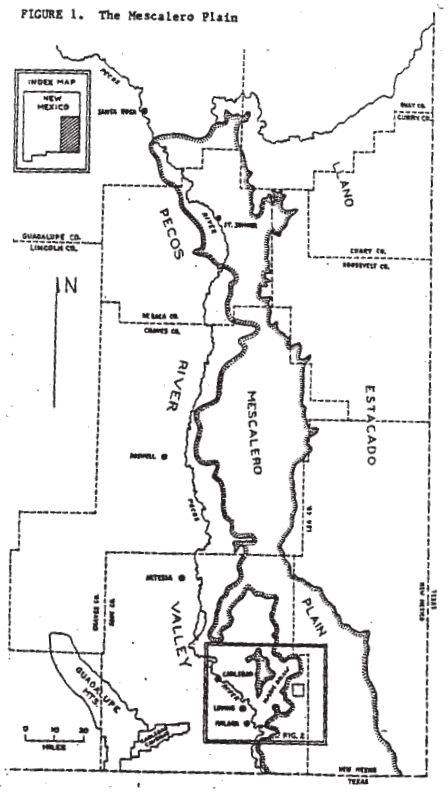
The ability of the WIPP site to isolate plutonium waste from the environment is evaluated in this dissertation. If some of the closed topographic depressions at the WIPP site should prove to be karst features, this would indicate there are modern groundwater flow paths from the soil to deeper karst channels in the Rustler Formation. With

1





FIGURE 1. The Mescalero Plain



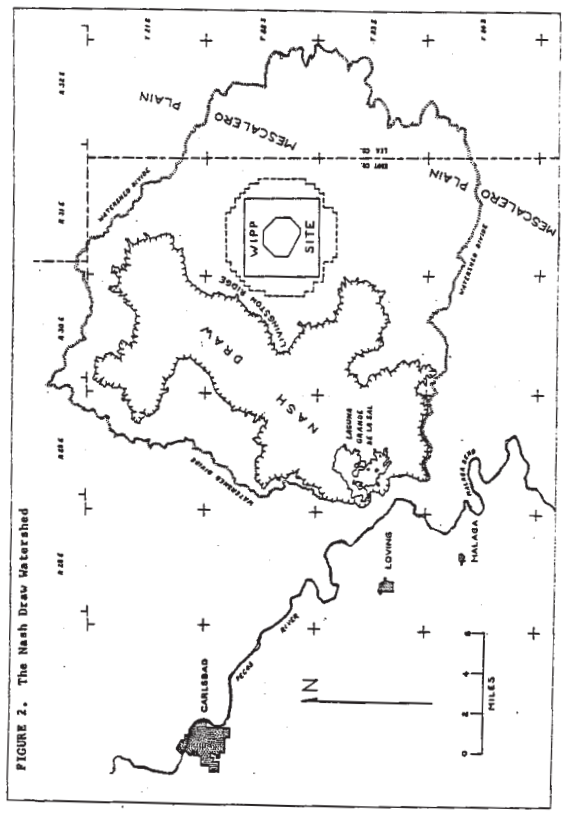



FIGURE 2. The Nash Draw Watershed





1 active karst, the direction and velocity of groundwater flow would be unpredictable and indeterminate, and the ability of the Rustler aquifers to retard radionuclide migration could not be demonstrated.

The term "karst" refers both to a set of landforms and a type of groundwater hydrology. Karst landforms result from the dissolution of rock, which usually takes place in the subsurface, resulting in underground caverns and smaller solution conduits. Although localized karst processes are not always expressed in surface morphology, every active karst hydrologic regime will include some sink holes in the surface terrain, which allow rainwater to percolate downward and, after major rainstorms, to travel almost unimpeded through the underground caverns.

At least four different origins for the closed topographic depressions in the study area were indicated by field work. These are: (1) collapse or subsidence of caliche into voids left by dissolution of underlying soluble rocks; (2) dissolution and breaching of caliche by infiltrating rainwater; (3) deflation by wind; and (4) mining of caliche by humans. Some topographic depressions may originate from a combination of factors, such as windblown dunes formed on the rim of a structural depression. Some depressions were ponded during former climatic regimes that had greater effective precipitation.

Augering and trenching were utilized to reveal the

structure of caliche and/or sandstone beneath the windblown sands of selected topographic depressions on the WIPP site. The results are presented through the use of form line and structural contour maps, topographic and structural cross-sections, photographs of trench exposures, and written descriptions based upon field observations.

The augering and trenching show that caliche underneath some depressions has been breached by solution, subsidence or collapse. The trenches also reveal evidence of solution
2 features and secondary alteration of sandstones underneath some depressions. This represents conclusive proof of the existence of karst landforms in at the WIPP site, and suggests that karstic depressions have an integral role in the hydrologic regime.

Topographic depressions resulting from karstic dissolution, known as sink holes or dolines, are especially of interest because of their role in regional groundwater hydrology. Karst groundwater flow takes place underground through open fractures, cavities and solution conduits. Sink holes are the quintessential surface feature in a karst terrain; they are present in every karstland. Subterranean caverns cannot be active hydrologic features without overlying sink holes through which rainwater can infiltrate and recharge the karstic aquifers. It will be argued in
3 this dissertation that the presence of sink holes in near-surface caliche indicates that subsurface solution





3 features in Permian evaporites participate in the modern hydrologic regime.

In addition to the geomorphic evidence for surface karst, hydrologic evidence supports the conclusion that the study area has an active karst hydrologic regime which involves both surface and deep-seated solution features. Geochemistry of groundwater in the Rustler dolomite aqui-
4 fers, geochemistry of water in a salt lake where the dolomite aquifers discharge, and a water balance analysis all indicate that the Rustler aquifers are actively recharged by rainwater infiltrating through sink holes in caliche and feeder channels in sandstone cover rocks, and that these aquifers presently discharge to the surface in the salt lake.

## The Physical Setting

The Delaware Basin of southeastern New Mexico and west Texas is recognized as one of the largest karstlands of the United States (Barrows, 1982, p. 1; and LeGrand et al., 1976, Figure 1), where sink holes and caverns are more prevalent than surface drainage, and flow of water is primarily underground. Within this karstland lies the Mescalero Plain (Figure 1), between the Pecos River to the west and the Llano Estacado to the east (Bretz and Horberg, 1949a, Figure 1).

The Llano Estacado is capped by the Ogallala Formation; its western margin is defined by the Mescalero Escarpment, an eastward retreating scarp or cuesta up to 200 feet in relief. The scarp is nicked in places by ravines draining westward across the Mescalero Plain toward the Pecos River, but the scarp summit otherwise marks the drainage divide between the southward flowing Pecos River and the slightly entrenched eastward drainage of the Llano Estacado (Bretz and Horberg, 1949a, p. 477).

The Mescalero Plain is capped by Mescalero caliche. Its western margin, Livingston Ridge, is also an eastward retreating escarpment, capped by Dewey Lake Redbeds and Mescalero caliche. Livingston Ridge marks the physiographic divide between the Mescalero Plain to the east and Nash Draw to the west (Figure 2).

Nash Draw is a broad, closed, karstic depression resulting from subsurface dissolution of Permian evaporite rocks. While vanishing arroyos, sink holes and caverns are common occurrences in Nash Draw to the west of Livingston Ridge, there is scientific dispute (Weart, 1983, pp. 20-21 vs. Barrows, 1982, and Barrows et al., 1983) over the reported presence of karst features on the Mescalero Plain to the east of Livingston Ridge.





Regional Stratigraphy

The geologic units pertinent to this study are Quaternary deposits and the Salado, Rustler, Dewey Lake, Santa Rosa and Gatuna Formations. Because the most likely pathways for transport of contaminated water from the WIPP site to the environment are aquifers in the Rustler Formation, located above the waste disposal level, this discussion of regional stratigraphy will not include deeper geologic formations. (Chapter 10 will explain how the buried waste could rise up into the Rustler Formation).

The youngest rocks of Permian age in southeastern New Mexico are the Salado and Rustler Formations; they were deposited in marine environments (Bachman, 1984, p. 6). The WIPP nuclear waste repository is to be located in the Salado Formation (Figure 3). East of Livingston Ridge, the Salado is about 2,000 feet thick; it consists predominantly of halite, with minor beds of anhydrite and commercial deposits of sylvite and langbeinite potash minerals. Numerous impurities or "marker beds" have been recognized in the Salado, consisting of thin layers of siltstone, claystone, polyhalite, and at least 43 beds of anhydrite. The marker beds are persistent across much of the Delaware Basin. They are potential pathways for movement of brine inclusions through the otherwise relatively impermeable Salado Formation (EEG-32, 1985, Figure 3, p. 7; Bachman, 1984, p. 11).

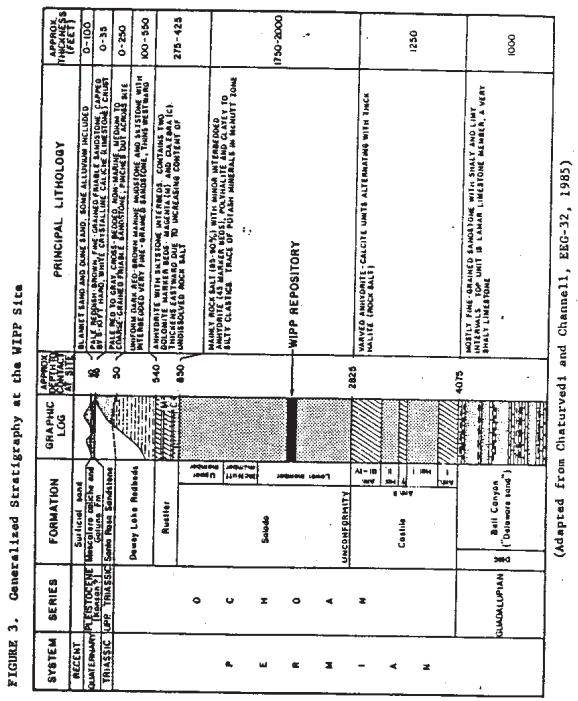



FIGURE 3. Generalized Stratigraphy at the WIPP Site

(Adapted from Chaturvedi and Channell, EEG-32, 1985)





The Rustler Formation overlies the Salado Formation. Much of the Rustler has been removed by dissolution, even in the subsurface, and complete Rustler stratigraphic sections are known only from drill holes (Bachman, 1984, p. 11).

At the base of the Rustler is a leached zone, known as the "brine aquifer." Because it represents the insoluble residue left after dissolution and removal of Salado halite by groundwater (Vine, 1963, p. B-14), the brine aquifer belongs stratigraphically to the Salado Formation, although in hydrologic reports (e.g. Mercer, 1983) it is generally treated as a Rustler aquifer.

The Rustler Formation has been divided into five members, here described in ascending order: (1) The lower unnamed member consists of about 120 feet of siltstone and very fine-grained sandstone, with interbedded gypsum or anhydrite. (2) The Culebra dolomite ranges in thickness from 21 to 31 feet, and is the most transmissive of the Rustler aquifers. (3) The Tamarisk member in the subsurface consists of about 80 to 180 feet of anhydrite with clay seams; Tamarisk exposures are highly deformed and altered to gypsum. (4) The Magenta dolomite ranges in thickness from 17 to 31 feet and is the other major Rustler aquifer. (5) The Forty-niner member consists of about 40 to 75 feet of broken and slumped gypsum with a bed of massive siltstone near the base (Vine, 1963, pp. B-14 to B-18; EEG-32, 1985, pp. 9-15; Mercer, 1983, Table 1, pp. 88-93).

The Rustler Formation ranges from about 275 to 475 feet thick across the study area, becoming progressively thinner toward the northwest (Borns et al., 1983, Figure 2-25, p. 43). Much of the variation in thickness is due to the dissolution and removal of halite from the Rustler Formation. The dissolution proceeds downward and in an eastward direction, and halite is preserved in progressively higher strata toward the east. Insoluble dissolution residues have been identified in drill holes in all members of the Rustler Formation (EEG-32, 1985, pp. 28-32).

Overlying the Rustler Formation are the Dewey Lake Redbeds, consisting of 250 to 500 feet of reddish orange to reddish brown siltstone and fine-grained sandstone deposited in deltaic environments. The Dewey Lake siltstones are characteristically mottled by bluish gray reduction spots; cement is usually gypsum (selenite) or clay; and irregular gypsum-filled fractures are common features (Bachman, 1984, p. 13; EEG-32, 1985, p. 16, and Plate 5, p. 84).

The Santa Rosa Formation consists of pale red, coarse-grained sandstone interbedded with conglomerate lenses containing dolomite, chert and quartz pebbles. The Santa Rosa was not deposited in a marine environment; trough-type cross-bedding probably indicates a fluvial depositional environment. Its most abundant cement is dolomite. Secondary alteration has locally bleached the Santa Rosa to gray or light gray. The Santa Rosa has been eroded from





of the WIPP site except the easternmost part, where it protects the underlying Dewey Lake Redbeds from erosion (Vine, 1963, pp. B-25, B-26; EEG-32, 1985, Figure 3, p. 7; Borns et al., 1983, p. 44, and Figures 2-27, 2-28, pp. 46, 47).

The Gatuna Formation characteristically consists of light reddish brown, poorly consolidated sandstone and siltstone, with local inclusions of conglomerate, gypsum, shale and claystone. The color of Gatuna sandstone is variable, and may be reddish orange or pinkish gray. The Gatuna is of mid-Pleistocene age, and was deposited unconformably in ancient sinks and topographic lows by westward-flowing streams (Vine, 1963, pp. B-27, B-28, B-31; Bachman, 1976, pp. 140-141; Bachman, 1985, p. 14).

A discontinuous mantle of Mescalero caliche developed unconformably on the Gatuna Formation and older rocks (Vine, 1963, p. B-31). Mescalero caliche is composed of white, well cemented limestone (calcium carbonate) and fine-grained quartz sand. Mescalero caliche has much the same composition regardless of whether the underlying formation is Rustler gypsum, or sandstones and siltstones of the Gatuna, Santa Rosa or Dewey Lake Formations (Vine, 1963, p. B-32). Mescalero caliche accumulated by pedogenic processes on a relatively stable land surface following Gatuna deposition during the mid-Pleistocene (Bachman, 1984, p. 14; Bachman, 1976, p. 142).

Where exposed, Mescalero caliche caprock may consist of

1 to 4 feet of dense, massive, slabby carbonate. The caprock may be laminated where the underlying caliche profile is plugged, or it may be brecciated and recemented (Bretz and Horberg, 1949b, p. 494), with more calcareous material than is necessary for cementation, so that clastic grains and pebbles appear to float in the matrix (Vine, 1963, pp. B-31, B-32). Below the caprock is 3 to 4 feet of loose, nodular, chalky, weakly laminated and poorly indurated caliche, which grades downward into the underlying bedrock (Bretz and Horberg, 1949b, p. 497), sometimes engulfing clasts of the bedrock (Bachman, 1985, p. 19).

The Berino soil is a dark red, sandy, non-calcareous, argillic paleosol which overlies the Mescalero caliche in places where the ancient soil profile is preserved (Bachman, 1984, p. 14). The absence of carbonate in the Berino soil indicates leaching of carbonate from the soil profile by rainwater infiltration (Bachman, 1981, p. 4); thus, the Berino soil represents the remnant B horizon of the Mescalero caliche profile (Bachman, 1980, p. 44). The Berino soil is rarely more than 3 feet thick, and is observed mainly in road cuts and construction sites (Bachman, 1985, p. 20), or where exposed by erosion.

The stratigraphic column is usually overlain by well sorted, red to yellowish brown windblown sand (Bachman, 1981, p. 4; Bachman, 1985, p. 20). Mescalero caliche and





sandstone bedrock are covered by shrub-coppice dunes, parabolic dunes, and deflation basins, or blowouts.

## Overview of Karst Controversy

Presence of karst hydrology on the Mescalero Plain would have important implications for the ability of the WIPP site to contain plutonium wastes for the necessary period of isolation. The problem with karst hydrology is that after intense rainstorms, karst groundwater flow can be very fast. Groundwater flow would be highly irregular in both velocity and direction, through open cavities, with little filtration of groundwater into the soluble rocks of the groundwater aquifers, and little retardation of any radioactive contaminants present in the groundwater. Karstic aquifers are recharged by rainwater, and karst groundwater velocity fluctuates with rainfall (Barrows, 1982, p. 1).

It will be shown in this dissertation (Chapters 4-6) that, at the WIPP site, sink holes and solution pipes in the Mescalero caliche are common features, allowing rainwater to reach the underlying sandstone formations. It will be argued (Chapter 10) on the basis of hydrologic data that the sandstone formations do not prevent infiltrating rainwater from reaching and recharging the caverns and solution conduits of the Rustler Formation.

5

The alternative explanation, that karst hydrology is not active at the WIPP site, would demand that the Rustler aquifers not be recharged by rainwater. This in turn would require a continuous layer of impermeable material, acting as a barrier to infiltration of rainwater, somewhere in the stratigraphic column above the Rustler Formation.

5

It has been claimed that Mescalero caliche "forms a barrier to the infiltration of precipitation," (Bachman, 1985, p. 19) and an "obstruction to infiltrating and recharging underlying beds." (Bachman, 1985, p. 27). It has also been claimed (Mercer, 1983, p. 70) that the Dewey Lake Redbeds are a "protective cover" preventing groundwater from reaching the soluble rocks of the underlying Rustler Formation. It will be shown in this dissertation that Mescalero caliche is riddled with solution features which allow rainwater to penetrate the sandstone beds (Chapters 4-7) and that hydrologic and geochemical data indicate freshwater recharge of the Rustler dolomite aquifers (Chapter 10).

6

Mescalero caliche forms a discontinuous mantle east of Livingston Ridge, where its resistance to weathering in the semi-arid climate has allowed it to form extensive surfaces (Vine, 1963, pp. B-2, B-10, B-31). But while caliche caprocks (calcretes) are resistant to erosion and rainwater infiltration where exposed at the land surface (Lattman, 1983), calcium carbonate is a readily soluble material (Frye





et al., 1974, p. 12). Where caliche in southeastern New Mexico is overlain by noncalcareous soils or unconsolidated deposits, irregular solution cavities penetrating downward into the caliche are common features (Bretz and Horberg, 1949b, p. 504), ranging from 9 inches (Reeves, 1976, p. 56) to several feet in diameter (Vine, 1963, p. B-31). Caliche dips toward, thins toward, or is entirely absent beneath the centers of some depressions (Havens, 1966, p. F-8).

A larger karst feature has already been identified in the northwestern part of the WIPP site, one mile east of Livingston Ridge, where a small arroyo drains into a closed topographic depression about 700 feet in diameter (Barrows, 1982, pp. 9-10). Borehole WIPP-33 (Figure 4), drilled into this depression, encountered four cavities totalling 24 feet within a 52-foot section of gypsum and dolomite in the Rustler Formation, and also a 7-foot cavity in Dewey Lake siltstone (Basic Data Report for Drillhole WIPP-33, 1980, Figure 2, p. 11, and Table 3, pp. 16-17).

The importance of the WIPP-33 sink hole and any other karst features, when considering the ability of the present hydrologic regime to isolate plutonium waste from the environment, depends on whether WIPP-33 represents active or relict karst hydrology. Barrows interprets the WIPP-33 depression as an alluvial doline (sink hole), where loose surficial material washes through cracks in the Dewey Lake Redbeds into cavities and solution conduits in the soluble

rocks of the underlying Rustler Formation (Barrows et al., 1983, p. 19; and Borns et al., 1983, p. 81). Bachman (1985, p. 25) concedes that dissolution of Rustler gypsum is a continuing process in Nash Draw, but contends that halite and gypsum dissolution at WIPP-33 is inactive, that it "was part of a paleokarst system resulting from a much different climatic regime."

Possible Origins of Surface Depressions

7 If the karst conduits in the Rustler Formation are active hydrologic features, then rainwater should be able to penetrate the Mescalero caliche through fractures, joints or solution pipes, through dissolved caliche, or through places where caliche is absent altogether. Conversely, if the Rustler karst conduits are relict (paleokarst) features, then the Mescalero caliche and/or Dewey Lake Redbeds should be everywhere present and impermeable.

It could be hypothesized that modern karst features in Mescalero caliche are not hydrologically connected to deep, ancient karst conduits of the Rustler Formation. But this hypothesis would require a pathway for groundwater movement separate from the Rustler aquifers -- that is, a perched water table in the sandstones and siltstones which cover the Rustler Formation and underlie the Mescalero caliche. Sandstone and siltstone formations between the caliche and





7 the Rustler were encountered 98 times in WIPP test holes, yet a perched water table was found only once (Mercer, 1983, p. 71). This point is discussed further in Chapter 10.

If the area east of Livingston Ridge is karstic, then it is what Sweeting (1973, p. 59) describes as a covered karst, where sandstone cover rocks impede but do not prevent solution enlargement of cracks and joints in underlying evaporite or carbonate rocks. The cover rocks subside into the enlarged joints, leaving depressions on the land surface.

The evaporite and carbonate rocks of the Rustler Formation are covered not only by red sandstones and siltstones, but also by a caliche profile and Quaternary sands. Karst topography can be obscured by parabolic dunes, shrub-coppice dunes, and deflation basins, or blowouts.

Closed topographic depressions of karstic rather than eolian (windblown) origin should be expressed in the caliche surface as well as the land surface. Whereas dunes and blowouts are eolian features superposed on a relatively flat or gently undulating caliche surface, karstic depressions are underlain by a dipping caliche surface, sometimes dipping more steeply than the land surface itself.

Karst Research Methodology

Because the Mescalero caliche surface is covered with dune sands, surficial observations were not sufficient to determine the role of Mescalero caliche in karst hydrology. Three techniques were used to investigate karstification in caliche: (1) map and air photo interpretation; (2) reconstruction of subsurface caliche topography from hand augering; and (3) description of caliche profiles in backhoe trenches.

The following research materials were instrumental in selecting appropriate locations for on-site investigation of karst geomorphology east of Livingston Ridge: (1) color, stereoscopic aerial photographs of the WIPP site and vicinity (Mann, 1983); (2) U.S.G.S. blueline advance copy 7.5 minute topographic maps of the WIPP site and Nash Draw, (since replaced by provisional editions), at the same scale (1:24,000) as the air photos, at a ten-foot contour interval; (3) detailed topographic maps (Bechtel, 1978) of the four square miles immediately surrounding the center of the WIPP site, at a two-foot contour interval; (4) a high-precision gravity survey (Barrows et al., 1983) of parts of the WIPP site; and (5) Larry Barrows' (1982) informal report on the implications of karst hydrology at the WIPP site.

Using these materials, five locations within the WIPP





site, all containing closed topographic depressions, were selected for detailed field study (Figure 4), based upon the coincidence of some or all of the following characteristics: (1) disappearing arroyos, and/or unusually dense vegetation in depressions, as seen in air photos; (2) unusually deep topographic depressions, as shown on topographic maps; (3) anomalously low rock density in the subsurface, as inferred from the WIPP site gravity survey; and (4) presence of underground caverns, as reported by Barrows after the drilling of the WIPP-33 depression.

As a major part of field work for this dissertation, more than 1,000 test holes, seldom more than 100 to 110 feet apart, were augered by hand with bucket augers along surveyed compass courses, usually in grid patterns, in the five study areas within the WIPP site (Figure 4). Color, texture, cohesiveness and the range of depth of each distinct soil horizon and subhorizon were carefully noted; calcareous materials and consolidated sandstones were described, and samples were collected.

The surface elevations of all auger holes were surveyed, making possible the construction of: (1) generalized topographic maps (form line maps) of the sand surface; (2) isopach maps of the thickness of surface sands and of calcareous dissolution residue above the caliche surface; (3) structure contour maps of the caliche surface, or of underlying sandstone beds in places where the bucket auger

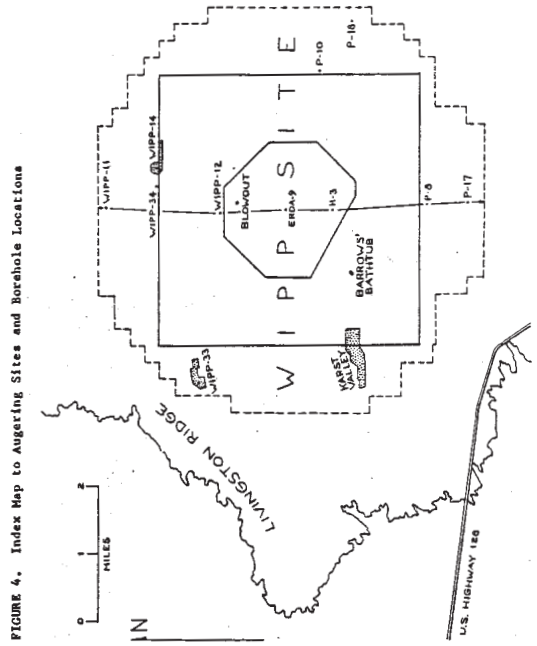



FIGURE 4. Index Map to Augering Sites and Borehole Locations





was not stopped by a caliche profile; and (4) geomorphic cross-sections showing the relationships between closed depressions in the surface sands, closed depressions or holes in the caliche surface, and calcareous dissolution residue.

Based on auger data, four locations within the five study areas were selected for trenching with a backhoe. Factors in choosing locations for trenching sites were: (1) evidence of dissolution or absence of caliche; (2) presence of sandstone or caliche at a shallow enough depth (about six feet or less) to be reached with a backhoe; and (3) proximity to caliche-surfaced roads, for accessibility.

All trenches were two feet wide. The trenching exposed soil profiles and soft caliche in the trench walls, and caliche or sandstone surfaces in the trench floors. All trenches were carefully photographed, and most were video-taped. Solution features in caliche and sandstone were measured and described. Caliche outcrops were also examined and described, for comparison with buried caliche profiles.

## Geomorphic Findings

These geomorphic field methods, coupled with an extensive review of the geologic literature, led to the following conclusions:

Sink holes and disappearing streams are common in the

Pecos River Valley. Solution and collapse are active processes in Nash Draw, where karst features occur in every rock strata above the Rustler dolomite aquifers.

Where Mescalero caliche is exposed, the caprock is fractured, broken into blocks, penetrated by roots, and underlain by caves. It is sometimes rounded, pitted and breached by solution.

Where Mescalero caliche is buried, its surface is often pock-marked with solution pits and leached of much of its carbonate. Small to large solution pipes, solution-enlarged joints, and calcareous dissolution residue are commonly found in place of a complete caliche profile, especially underneath topographic depressions where rainwater collects and dissolves the carbonate. 8

Solution pipes represent the mechanism whereby rainwater is able to easily penetrate the otherwise relatively impervious Mescalero caliche. The same solution processes take place east and west of Livingston Ridge.

The origins of most topographic depressions cannot be conclusively determined without subsurface exploration. Some are dolines, some are blowouts. Dolines are underlain by structural depressions in caliche, with gently to steeply dipping flanks; caliche may be entirely missing underneath them. Ephemeral watercourses may drain into them, leaving weak pans of desiccated clay and organic material in their vegetated bottoms. Blowouts are floored by sand, are





sparsely vegetated, receive little or no surface runoff, and are underlain by relatively flat caliche surfaces.

The WIPP-33 depression was found to be a collapse sink. Evidence of surface collapse can be seen in the caliche escarpment at its southeastern rim. Evidence of subsurface collapse can be seen in the trenches, where caliche breaks off abruptly, with near-vertical drops of four feet to the sandstone bedrock surface.

The WIPP-33 sink hole is the westernmost in a chain of four topographic depressions. All four were found to be underlain by structural depressions in the caliche surface. Three have arroyos disappearing into them. One arroyo formed suddenly during the heavy rains of September 18-19, 1985, only to be swallowed by the easternmost depression; this is direct evidence of active karst processes. 9

Solution features were also found in sandstone cemented with carbonate, underlying the caliche at WIPP-33. The solution features are joint-controlled, in the forms of solution pans or tinajitas, and solution grooves or slots. Solution of the carbonate cement leaves behind loose sand grains to be carried away by wind or water.

The WIPP-14 depression was found to be underlain by a structural depression in the caliche. Multiple episodes of carbonate accumulation were evident in trench exposures. Gleyed sediments were observed, indicating past ponding, when perched water accumulated in the depression and caliche 9

became extremely leached and degraded. Carbonate-filled fractures in Santa Rosa sandstone beneath WIPP-14 are direct 9 evidence of rainwater infiltration. East of WIPP-14, seven smaller structural depressions in caliche, filled with dissolution residue, were found to coincide with a negative gravity anomaly.

Overview of Hydrology Controversy

It will be shown in this dissertation (Chapter 10) that the karstic aquifers of the Rustler Formation are recharged by rainwater, not only in Nash Draw, but east of 10 Livingston Ridge as well. Rustler groundwater flow fluctuates with rainfall, which has important implications for the hydrology of the WIPP site area.

The difficulty with utilizing point-specific borehole data in characterizing karst hydrology is that groundwater flow is highly irregular in both velocity and direction, through discrete underground channels in the form of open 11 solution cavities. An array of test wells is likely to miss the active solution conduits, which comprise a very small portion of the total spatial area of the karst watershed. Groundwater flow paths and velocities in a karstland are inherently unpredictable, and spread of groundwater contamination cannot be reliably monitored.

To properly characterize karst hydrology, a regional





perspective is necessary. Nash Draw lends itself to water budget analysis because, as will be shown in this dissertation (Chapter 8), Nash Draw is a closed drainage basin. The Nash Draw groundwater system discharges to the surface in a natural salt lake (Laguna Grande de la Sal, or Laguna Grande). The salt lake has been enlarged and contaminated 12 by liquid effluent discharge from potash refineries within Nash Draw, reflecting man-made disturbance of the natural water balance. Taking this into account, this dissertation will show, based on historical and hydrologic evidence, that the natural extent of the salt lake is sufficient to account for all the natural groundwater discharge from the Rustler dolomite aquifers.

The brine aquifer at the top of the Salado Formation discharges at brine springs along the Pecos River at Malaga Bend near Nash Draw. A scientific disagreement has arisen over the relative importance of Laguna Grande and Malaga 13 Bend as natural groundwater discharge points in the regional water balance. This dissertation will show, based on hydrologic evidence, that the salt lake accounts for about nine times as much natural groundwater as the brine springs, and that the salt lake would be the probable discharge point for plutonium-contaminated groundwater from the WIPP site.

From the standpoint of long-term geologic isolation of long-lived radioactive isotopes, it is insufficient to characterize the regional groundwater hydrology under the

present climatic regime alone. A decrease in net radiation could trigger a glacial advance, with an associated pluvial climate characterized by decreased evaporation and/or increased precipitation. This, in turn, would increase the
14 volume and velocity of groundwater flow, and would cause the processes of dissolution and karstification to become more active and more effective. Climatic conditions with average annual temperatures as warm as those of the Holocene have typically lasted for only 10% of each glacial/interglacial cycle. An attempt will be made in this dissertation (Chapter 9) to approximate the hydrologic conditions during a full glacial advance.

Hydrologic Research Methodology

A regional water balance analysis will be undertaken in this dissertation (Chapters 8 and 9), for the following purposes: (1) to approximate and compare the average annual groundwater discharge at Laguna Grande and Malaga Bend, so as to determine their relative importance as regional discharge points for Rustler aquifers; (2) to review the groundwater geochemistry, so as to determine which Rustler aquifers discharge at which springs; (3) to approximate the recharge rate for the Rustler dolomite aquifers; (4) to identify the most likely groundwater flow path from the WIPP site to the Pecos River; (5) to account for the disturbance





of the natural water balance due to the importation and discharge of water by potash refineries in Nash Draw, beginning in 1932; and (6) to approximate the water balance during a full glacial advance.

A thorough search of maps and geologic literature uncovered no evidence of a surface or subsurface outlet from Laguna Grande to the Pecos River. Thus, Laguna Grande and the Pecos River were treated as hydrologically separate from each other.

In a closed lake basin such as Laguna Grande, within a closed drainage basin such as Nash Draw, inflow to the lake equals net evaporation from the lake. In a gaining stream interval such as the Pecos River at Malaga Bend, inflow to the stream equals the gain in stream discharge plus net evaporation. The term "net evaporation" refers to the total evaporation from a water body minus the precipitation falling directly on the water body.

Effluent discharge from potash mining and refining in Nash Draw, which began in 1932, has affected the water balance of Laguna Grande. The natural extent of Laguna Grande was determined by examining historical maps dating from before the transgression of its shorelines due to the effluent discharge. The net evaporation rate at Laguna Grande was derived from brine evaporation rates and precipitation rates for this locality. The average annual discharge of naturally occurring groundwater into Laguna Grande

was estimated by multiplying the natural extent of the salt lake by the local annual net evaporation rate for brine.

The Pecos River gaging stations selected for study were the nearest stations upstream and downstream from the Malaga Bend brine springs. The areal extent of the Pecos River water surface between the two gaging stations was measured from topographic maps. The net evaporation rate at Malaga Bend was estimated from freshwater evaporation rates and precipitation rates for this locality. Gain in Pecos River discharge at Malaga Bend was determined from 31 years of daily measurements at the two gaging stations. The average annual discharge of the Malaga Bend brine springs was estimated by adding the annual gain in discharge to the local annual net evaporation of fresh water from the Malaga Bend interval of the Pecos River.

Water samples and well data were analyzed to determine which Rustler aquifers discharge at Laguna Grande. These results indicate that the Rustler dolomite aquifers, which are the principal aquifers capable of carrying radionuclides from the WIPP site to the biosphere, discharge at Laguna Grande and not at Malaga Bend. The most likely groundwater flow path from the WIPP site to the Pecos River is indirect, by way of Laguna Grande, which, during times of greatest flooding, would breach the low topographic divide between Laguna Grande and the Pecos River, washing contaminated lake sediments into the river.

15





Although groundwater travel times for the Rustler dolomite aquifers cannot be reliably calculated from available data, the time span necessary to completely recharge the Rustler aquifers can be approximated. The surface boundary of the Nash Draw watershed must be taken as an approximation of the groundwatershed boundary, so as to make useful calculations possible. Groundwater discharge into Laguna Grande is assumed to represent the total groundwater discharge from the Rustler dolomite aquifers in the Nash Draw watershed. The storage capacity of the Rustler aquifers was divided by the rate of groundwater recharge to reveal the length of time it takes to completely recharge the Rustler dolomite aquifers.

Water samples were analyzed and hydrologic reports were examined to assess the impact of potash refining effluent on the water balance of Nash Draw and the water quality of the Laguna Pequena inlet to Laguna Grande.

The probable increase in groundwater discharge to Laguna Grande during a full glacial advance was estimated, by comparing the minimum possible rainwater infiltration under the present climatic regime, and making adjustments according to the lower evaporation rates believed to have existed during the last full glacial advance. The concomitant shoreline transgression was estimated by considering the increase in groundwater inflow to the salt lake and the decrease in net brine evaporation from the salt lake.

Structure of this Dissertation

Chapters 2 and 3 provide background information on karst and caliche. Chapter 2 discusses karst processes, karst landforms and karst hydrology in Nash Draw, in the Pecos River Valley, and elsewhere. Chapter 3 discusses the origin, development, morphology and karstification of caliche on the Mescalero Plain, on the Llano Estacado, and elsewhere.

Chapters 4 through 7 present results of augering, trenching and field observations. Chapter 4 describes the WIPP-33 collapse sink and three adjacent topographic depressions, with regard to: underground caverns, disappearing arroyos and alluvial fill; structural depressions in caliche; surface and subsurface collapse of caliche; and dissolution of Rustler halite and gypsum, Mescalero caliche, and carbonate-cemented Gatuna sandstone.

Chapter 5 describes a karst valley on the Mescalero Plain with regard to: lack of surface runoff; solution, subsidence and breaching of Mescalero caliche; subsidence and collapse of pervious Dewey Lake Redbeds; and rainwater recharge of the Rustler Formation.

Chapter 6 describes the drainage and vegetation of the dune and swale topography of the Mescalero Plain; then compares a small blowout to a small doline and a caliche pit, with regard to surface morphology and to subsurface





caliche structure, hardness and continuity.

Chapter 7 describes the surface morphology, caliche stratigraphy and environmental history of the WIPP-14 solution doline, with regard to past episodes of carbonate accumulation; evidence of past ponding; leaching of carbonate through the entire soil profile; and rainwater penetration of fractures in the Santa Rosa sandstone.

Chapters 8 through 10 place evidence of near-surface and deep-seated karst features in a regional context. Chapter 8 presents a water balance and geochemical analysis of the Nash Draw watershed, and of the Malaga Bend brine springs, to determine: which Rustler aquifers discharge at what locations, and in what relative quantities; the rates of evapotranspiration and natural groundwater recharge; and the most likely flow path for contaminated groundwater from the WIPP site to the Pecos River.

Chapter 9 assesses the possible hydrologic effects of climatic change on the Mescalero Plain, by reviewing the paleoclimatic evidence and chronology for adjacent physiographic regions, and by adjusting the present Nash Draw water balance in accordance with published estimates of evaporation and precipitation rates during the last full-glacial period.

16-20 | 16 | Chapter 10 judges the WIPP site to be unsuitable for long-term geologic isolation of plutonium waste, because: (1) flow paths and travel times for the karstic Rustler

aquifers are inherently unpredictable; (2) the Mescaler caliche and the underlying sandstones allow rainwater recharge of the Rustler aquifers, so that groundwater movement fluctuates with rainfall; (3) pressurized brin underneath the nuclear waste repository is capable of carrying dissolved waste up the WIPP shafts to the Rustl Formation; (4) existing geologic barriers between the pressurized brine and the waste storage tunnels are not sufficiently reliable; and (5) the WIPP repository is vulnerable to human disturbance and intrusion.





CHAPTER II

KARSTIFICATION OF BEDROCK

Introduction

This chapter provides background on karst in the bedrock of the Mescalero Plain. Karst landforms and karst processes are described, and the types of rocks which are karstifiable in semi-arid climates are characterized. The development of karst groundwater systems is described, with relation to the lack of surface drainage and rapid rainwater infiltration, and to the steadily increasing permeability, groundwater circulation and solution activity in karst aquifers. Sink holes throughout the Pecos River Valley are described, as are sink holes and caverns in Nash Draw. Evidence is cited for the existence of karst throughout the Rustler Formation, and in all overlying sandstone formations which cover the Rustler in the study area.

Semi-Arid Karst

Karst is a distinctive surface morphology and ground-water hydrology resulting from dissolution (corrosion) of highly soluble evaporite and carbonate rocks by chemically undersaturated water. Karstlands are characterized by

collapse sinks, solution dolines, caves, sinking streams, swallow holes, an absence of surface runoff, an integrated system of subsurface groundwater conduits, and a few large irregular springs (Barrows et al., 1983, p. 19).

Karst regions are widespread in the United States where soluble carbonate rocks are exposed to solutional and physical erosion. Prominent exposed regions include the semi-arid Permian Basin of southeastern New Mexico (LeGrand et al., 1976, p. 2-1), which is recognized as one of the two largest karstlands in the United States (Barrows, 1982, p. 1).

The following rocks are karstifiable in semi-arid climates: dolomite, anhydrite, gypsum, rock salt and limestone (Bogli, 1980, p. 1). All these rock types exist at the WIPP site (Barrows et al., 1983, p. 9).

Dolomite resembles limestone in chemical composition, except that magnesium oxide is a large and important constituent (Sweeting, 1973, p. 12). Dolomitic limestone is hard and may form rugged hills; but although it strongly resists erosion, it yields readily to solution (Lee, 1924, p. 109).

Except for limestone, dolomite is the most widespread rock type giving rise to karst. Yet in addition to carbonate rocks, very soluble evaporites, especially gypsum, but also anhydrite and halite, produce karst. This is especially true in dry climates, as in the Delaware Basin of





southeastern New Mexico and west Texas (Jennings, 1971, pp. 2, 30). Even in the desert of central Saudi Arabia, where rainfall presently averages less than 2 inches per year, the supply of undersaturated water has been sufficient over geologic time to create huge areas of complex solution breccias and karst features in evaporites (Bachman, 1983, p. 33).

If anhydrite comes into contact with fresh water, it joins with two molecules of crystal water and converts to gypsum (Bogli, 1980, p. 2). This hydration process, known as gypsification, expands the rock about 35% by volume, which may close some fractures and prevent the passage of water; but it will also buckle the surface rocks and open new joints and fractures across the bedding planes of the gypsum. "These systems of open fractures provide paths for surface water to dissolve evaporites at depth. Collapse sinks develop along these fractures and act as sumps for surface water." (Bachman, 1983, p. 33).

Gypsum is 10 to 30 times more soluble than limestone (Bogli, 1980, p. 14). Gypsum caves are widespread in gypsum karst, but because of the solubility and softness of gypsum, the caves are quickly destroyed; thus, any gypsum caves still existing must have formed in the Quaternary (Bogli, 1980, pp. 2, 234).

The conditions necessary for karstification exist in the study area. Dolomite, anhydrite and gypsum can be karstified in semi-arid climates. Gypsification could

buckle and fracture the sandstone cover rocks, enhancing infiltration of surface water and dissolution of evaporites at depth.

Types of Dolines

Dolines (sink holes) are the most widespread karst landform, and are found in every karst landscape (Bogli, 1980, p. 60). Dolines are closed topographic depressions with underground drainage, and a diameter greater than their depth.

Dolines can appear singly, or as doline fields, or as linear trends on rock boundaries and on joints and faults (Bogli, 1980, p. 61). The more elongated dolines are the most likely to be aligned along structural lineaments (Jennings, 1971, p. 133). Uvalas (karst valleys) are formed by the merging of smaller dolines (Jennings, 1971, p. 135). The density of dolines in a karstland is rarely, if ever, less than 1.5 per square mile (Bogli, 1980, p. 61).

Alluvial dolines, or solution-subsidence dolines, "are abundant in limestone areas where there are superficial deposits of any kind," particularly sandstone. "Solution of the limestone takes place beneath the cover rocks and enlarges cracks and joints," giving rise to crater-like dolines as the overlying beds subside into the limestone fissures. The solution-subsidence dolines then become





filled with alluvial deposits washed in by ephemeral water courses. The karst relief expressed in the surface of the sandstone cover rocks is known as a covered karst (Sweeting, 1973, pp. 59, 62).

Karst Hydrology

Karst hydrology is marked by rapid and substantial infiltration of rainwater into rock outcrops, soil, and underlying bedrock; limited surface runoff, rarely reaching stream channels; and modest lateral movement of groundwater through soil pore space (Jennings, 1971, pp. 61, 63). "Rapid infiltration means that water escapes the heat, wind, and low relative humidities of the surface sooner and so evaporation is reduced" (Jennings, 1971, p. 66), while recharge to the karst groundwater system is increased.

Surface drainage in fully developed karst regions is liable to be intermittent, disrupted, widely spaced, scarce or absent (Jennings, 1971, p. 61; LeGrand, 1973, p. 862). "The absence of surface runoff is characteristic of a karstland." (Barrows, 1982, p. 9) The pitted relief of karst terrains is caused by innumerable dolines, which are usually the fundamental karst landform, because they replace the stream valleys of fluvial terrains (Sweeting, 1973, p. 45). Rivers entering a karstland are liable to lose all or part of their drainage underground (Jennings, 1971, p. 69).

In arid or semi-arid karst, rivers are often completely absent, "and this is rarely true of desert country on impermeable rocks." (Jennings, 1971, p. 64)

The porosity and permeability of karstified rocks differ from those of insoluble rocks. Porosity refers to all the voids in a rock, expressed as a percentage of the bulk volume. Permeability is the capacity of the rock to transmit water (Jennings, 1971, pp. 17-18).

The original permeability, or primary porosity, depends on the size and degree of interconnection of the pore spaces which exist in poorly consolidated deposits. As consolidation takes place, primary porosity is decreased (LeGrand, 1983, p. 350).

Karst porosity is secondary. The interconnected pore spaces are enlarged by the solution action of circulating groundwater (LeGrand, 1983, p. 350). Effective groundwater flow then takes place through large karst channels, caves, and joints of various dimensions and irregular positions, with high transmissivities and poor retardation capacities. Karst channels usually empty quickly (Milanovic, 1976, pp. 7-1, 7-2); some are capable of transmitting water with almost no resistance (LeGrand et al., 1976, p. 2-14).

Karst groundwater circulation differs in every respect from groundwater circulation in homogeneous, porous rocks. Karst hydrologic conditions fluctuate constantly in both space and time. Preferential directions in underground





circulation are principal features of karst, and are difficult to investigate (Milanovic, 1976, p. 7-2). "In karst conditions, rock shape, size, spatial position and number of fissures vary from place to place, with small or large total groundwater storage. This makes the description of basic hydraulic parameters, such as permeability and porosity, difficult and complex." (Torbarov, 1976, p. 5-1).

Permeability of karstic rocks grows steadily as solution enlarges the total volume of voids in the rocks and continuously replaces dissolved solid rocks with loose sediments (Jennings, 1971, p. 2; Yevjevich, 1976, p. 9-8). As groundwater circulation increases, solution activity increases; fractures and solution cavities are enlarged, which further increases groundwater circulation (LeGrand, 1983, p. 353). The greater the groundwater flow, the more intensively the cavities are widened (Bogli, 1980, p. 106).

The preferential and localized nature of groundwater flow results in a great range of permeability in a karst terrain (LeGrand, 1983, p. 353). Wells penetrating the large openings in the rocks have water yields much greater than the average (LeGrand, 1973, p. 861); conversely, boreholes which miss the active solution conduits should show transmissivities and storage capacities which are much less than the average (Barrows, 1982, p. 13). Thus, the common analytical techniques of interpolation and extrapolation, as used in more homogeneous aquifers with more uniform

21

21 groundwater flow, are not applicable in a karstland (LeGrand, 1973, p. 861).

Characteristically, one hole drilled in a karst terrain will strike water, while another drilled only a few meters away will remain dry (Bogli, 1980, p. 104). Karst groundwater tends to collect in large openings, and to discharge in large, widely spaced springs (LeGrand, 1973, p. 861). With increasing hydrological activity, the catchment areas of individual karst springs widen and deepen. The more efficient systems tap the others; thus, the smaller karst springs are gradually eliminated. As underground karstification becomes more advanced, the number of karst springs becomes smaller, and their average discharge becomes larger (Bogli, 1980, p. 120).

In short, karst hydrology is unpredictable. Surface drainage is disrupted or absent; underground drainage is dominant. Karst groundwater flows through open channels, caves and joints with irregular sizes and positions, high 22 transmissivities, and poor retardation capacities. Groundwater flow paths are indeterminate; the water table cannot be reliably mapped; and groundwater velocities fluctuate over space and time.





Karst in the Pecos River Valley

The Pecos River Valley lies within the Delaware Basin in southeastern New Mexico, between the Guadalupe Mountains to the west, and the Llano Estacado to the east (Lee, 1924, p. 107). There are few tributary streams east of the Pecos River, where large areas are drained entirely underground. In much of Eddy County, New Mexico, not even the dry bed of a temporary stream can be found (Lee, 1924, p. 108; Morgan, 1941, p. 780).

The chief geomorphic process causing the broad, shallow depressions which make up the Pecos River Valley in southeastern New Mexico is not surface erosion, but local subsidence due to subsurface dissolution. The surface debris which in most other regions is removed by surface runoff is here carried through sink holes into subterranean caverns (Lee, 1924, p. 121).

The Pecos River Valley has a long history of subsidence resulting from dissolution of Permian evaporites (gypsum, anhydrite, halite and potash). Although dissolution may have begun as early as Jurassic time, dissolution is still active, and karst topography is characteristic of the region. Large parts of the area between Roswell and Carlsbad, New Mexico, have collapsed during Quaternary time (Hawley et al., 1976, pp. 245-246).

Sink holes are common throughout most of the Pecos

River Valley. Some sink holes are open; some are obliterated by erosion; some are partly filled with slumped, distorted, and fragmented surficial material; and some are smoothed and filled or completely choked and silted over by depositional processes. When a sink hole becomes choked, a new one opens nearby (Lee, 1924, pp. 114-116; Morgan, 1941, p. 780).

A chain of sinks or "dry lakes" near Santa Rosa, New Mexico, was formed by modern processes. The gigantic Santa Rosa Sink, 6.1 miles in diameter, is filled with sand and gravel 250 to 400 feet thick. The solution and sinking are still progressing (Kelley, 1980, p. 215). The entire Pecos River disappears into cavernous rocks near Santa Rosa, and returns to the surface a few miles farther downstream (Lee, 1924, pp. 116-117).

Near Roswell, New Mexico, where sandstones overlie thick gypsum deposits in the Pecos River Valley, solution of gypsum by groundwater has been extensive. An older complex of sinks has been integrated with the Pecos River drainage. In the upper sandstone beds, younger collapse hollows have formed; these are at the water level and form deep lakes, known as the Bottomless Lakes (Sweeting, 1973, p. 300; Glass, Frye and Leonard, 1973, p. 8; Lee, 1924, p. 118).

East of the Pecos River, between Roswell and Carlsbad, solution has been associated primarily with the Rustler and Salado Formations (Morgan, 1941, p. 780). Sink holes near





the Pecos River are numerous wherever beds of salt or gypsum lie near the land surface. Near the McMillan Reservoir north of Carlsbad, the entire flow of the Pecos River, even at times of moderate flood, goes underground into sink holes and reappears farther downstream (Lee, 1924, pp. 113, 115).

Some depressions "have been formed since the settlement of the country. It is said that a man living upon the mesa found one morning in front of his house a hole 60 feet in diameter and 150 feet deep." (Lee, 1924, p. 117) Another suddenly-formed depression, filled with water, was claimed by two men. "The controversy was taken to court, but before a decision was rendered the water disappeared, leaving only a dry hole." (Lee, 1924, p. 117).

These sinks are conclusive evidence of subsurface dissolution of gypsum and halite beds. Subterranean water courses are choked by the cave-ins, thus forcing groundwater up into the depressions until it acquires sufficient hydraulic head to reopen its channel, allowing the water in the depressions to sink away (Lee, 1924, p. 117).

It has been shown that an extensive body of geologic literature describes the Pecos River Valley as a regional karstland. In at least two locations, the entire flow of the Pecos River disappears underground. Sink holes due to subsurface dissolution of salt and gypsum are common in the broad, shallow depressions east of the Pecos River. The processes of solution and subsidence are still active.

Karst in Nash Draw

Although networks of fluvial valleys have existed on some limestones, the most common of karst valley forms are the dry valleys. Either because of lowering of the water table, or because of a change in climate, dry valleys are without a permanent surface watercourse. The dry valley floors may be flat or U-shaped, and the walls tend to be steep and well-jointed. Dry valleys are preferential locations for development of dolines. Water collects in small pools and sinks into joints and fissures, and the dry valley profile becomes irregular and broken up (Sweeting, 1973, pp. 115, 117-118, 120).

Nash Draw (Figure 2), located between the WIPP site and the Pecos River, is a dry valley, a broad karstic depression resulting from subsidence due to dissolution of underlying evaporite rocks. Nash Draw is almost entirely bounded by escarpments -- Livingston Ridge to the east, Maroon Cliffs to the north, Quahada Ridge to the west, and an unnamed scarp to the south (Vine, 1963, p. B-3).

Evidence for solution of anhydrite, gypsum and halite beds can be found almost everywhere that the Rustler Formation is exposed in Nash Draw. "Sinkholes of all sizes abound ... ranging from small cavernous joints that trap unwary livestock" to sink holes surrounded by large shallow depressions partly filled with alluvial or playa deposits.





In some places the depressions tend to line up, which may indicate the location of subterranean cavernous water courses (Vine, 1963, pp. B-38, B-39).

In early development, the sink holes are "solution-enlarged fractures in the gypsum where surface drainage disappears underground during periods of heavy runoff." Because the Rustler Formation is relatively incompetent, it collapses in the vicinity of the enlarged fractures and forms circular depressions up to a few hundred feet in diameter (Vine, 1960, p. 1910).

Where the Rustler Formation is overlain by a shallow cover of younger rocks, "there are many closed circular depressions that become filled with silt and soil. Because they collect surface water these depressions are thickly vegetated and resemble animal wallows." (Vine, 1960, p. 1910)

Many circular karst features in Nash Draw are residual domes, 0.1 to 0.5 miles in diameter. These result from formation and collapse of sink holes, which become filled with less soluble material; the residual core is subsequently exposed by differential erosion (Vine, 1963, p. B-2).

Some of the most conspicuous sink holes are found on the Livingston Ranch (now Crawford Ranch) in Nash Draw (sec 10, T 22 S, R 30 E), about 20 miles southeast of Carlsbad, and 5.5 miles west-northwest of the center of the WIPP site. Gypsum and rock salt underlie the surface rocks at this

location. One sink hole on this ranch formed during a single storm in August 1918 when an underground cavern collapsed, leaving a circular opening about 75 feet in diameter and 60 feet deep (Lee, 1924, pp. 114, 117, and Plate XVIII, A). Another sink hole on this ranch was formed by collapse of a cavern in gypsum located only a few feet beneath the land surface. "The sinks are so numerous that the ranchmen fence them to prevent cowboys from riding into them while running stock." (Lee, 1924, p. 114, and Plate XVIII, B).

The cavernous condition of near-surface rocks on the Crawford Ranch is emphasized by the difficulty in finding water there. By 1924, more than fifty holes had been drilled on this ranch, but water was found in only five. Only one well yielded water out of twelve drilled near the ranch house. The groundwater seems to be confined to discrete underground water courses. "One well may yield water, while another within a few feet of it is dry." (Lee, 1924, p. 115).

There is a scientific consensus (Powers et al., 1978; DEIS, 1979; FEIS, 1980; WIPP SAR, 1980, revised 1983; Bachman, 1981; Weart, 1983) that Nash Draw is a broad karst valley with internal drainage through underground caverns. Nash Draw was formed by the coalescence of abundant sink holes. The processes of karstification in Nash Draw are





active today, as shown by the sudden appearance of collapse sinks during this century.

Karst Throughout the Stratigraphic Column

A thorough review of the geologic literature shows the existence of karst features in every rock strata above the Rustler dolomite aquifers. This indicates that there are no reliable aquicludes above the Rustler aquifers. Solution processes in the Rustler Formation can be intensified by rainwater recharge, which can result in subsidence or collapse of overlying strata, leading to further increases in rainwater infiltration and solution activity. 23

Complete stratigraphic sections of the Rustler Formation are known only from drill holes. The Rustler ranges in thickness from a thin dissolution breccia at surface exposures to more than 550 feet in the subsurface in southwestern Lea County. Much of the variation is the result of dissolution of halite, where a collapse breccia occupies the stratigraphic position of the halite, and anhydrite has been hydrated to gypsum (Bachman, 1983, p. 22).

The Culebra and Magenta dolomite members of the Rustler Formation are the principal karst aquifers in the study area. East of Laguna Grande, the Culebra outcrops are locally brecciated and deformed by solution collapse (Vine, 1963, p. B-14). The Magenta dolomite has also been

subjected to intense leaching, brecciation and collapse in some areas of Nash Draw (Vine, 1963, p. B-16). Underneath a collapse sink east of Nash Draw, at the WIPP-33 drill hole, two water-filled cavernous zones were discovered in the Magenta dolomite (Basic Data Report for WIPP-33, 1981, Figure 2, p. 11, and Table 3, pp. 15-17).

Subsurface core samples from well-preserved stratigraphic sections contain as much as 120 feet of Tamarisk anhydrite, separating the Magenta and Culebra dolomite. Yet in the southern part of Nash Draw and near Malaga Bend, three feet of insoluble clay residue may be all that separates brecciated Magenta from brecciated Culebra. At places the Magenta and Culebra are in direct contact (Bachman, 1983, pp. 55-56).

In Nash Draw, surficial deformation has caused the Tamarisk member "to be draped into large irregular folds and tilted blocks with dips as great as 45°. In general, the dips are toward the surface depressions or dry lakes." (Vine, 1963, p. B-15)

The discharge of Surprise Spring into Laguna Grande may come partly from the cavernous gypsum of the Tamarisk member (Mercer, 1983, p. 49). Ephemeral water courses can be readily seen emptying into Surprise Spring from gypsum caves to the northwest of Laguna Grande.

Grikes, tunnels, caves and collapse sinks are common where the Forty-niner gypsum is exposed in Nash Draw





(Bachman, 1980, p. 55; Bachman, 1981, p. 5). Just 5.5 miles southwest of the center of the WIPP site, and 5.5 miles east of Laguna Grande, in Nash Draw (SW/4 sec 3, T 23 S, R 30 E), a surface exposure of the Forty-niner member features a striking display of gypsum caves and collapse sinks. One of the caves is large enough to enter, as are other gypsum caves elsewhere in Nash Draw (Barrows, 1982, pp. 3-4).

Underground caverns are not restricted to the Rustler Formation. Cavernous zones have been encountered at three places in the Dewey Lake Redbeds:

(1) Potash exploration hole #115, located 22 miles north-northwest of the center of the WIPP site (SW/NE/SW sec 13, T 19 S, R 30 E), encountered a 100-foot, open, water-filled cavity followed by 40 feet of mud and silt in the Dewey Lake Redbeds. This was underlain by 40 feet of Dewey Lake Redbeds still intact, which in turn was followed by a normal Rustler stratigraphic section (Barrows to Chaturvedi, 8/6/82).

(2) At borehole WIPP-33, located three miles west-northwest of the center of the WIPP site, the lithologic and geophysical logs indicate a 7-foot cavernous zone in siltstone near the bottom of the Dewey Lake Redbeds (356-363 feet below land surface) where there was a precipitous drop of the drilling equipment (zero minutes per vertical foot), lost circulation of drilling fluid, and no core recovery (Basic Data Report for WIPP-33, 1981, Figure 2, p. 11, and

Table 3, pp. 15-17).

(3) At borehole DOE-2, located two miles north of the center of the WIPP site, circulation of drilling fluid was lost about 100 feet below the top of the Dewey Lake Redbeds, or about 250 feet below the land surface (Chaturvedi, 1/22/86, personal communication).

Where the Dewey Lake Redbeds are cemented with gypsum, solution processes would be possible. The gypsum-filled fractures commonly found in the Dewey Lake Redbeds are direct evidence of former paths of groundwater flow. Open fractures could be groundwater flow paths under the modern hydrologic regime, and could account for the lost circulation of drilling fluid at DOE-2.

But the processes which created the huge cavern at potash hole #115 could not have been restricted to a section of Dewey Lake Redbeds whose modern remnant is only 40 feet thick. The cavern is actually 140 feet from top to bottom, and is filled with water and 40 feet of mud and silt. The cavern was probably created by collapse of Dewey Lake Redbeds into voids left by solution activity in the Rustler Formation. If such collapse were to obliterate the Rustler solution cavities, then the Rustler stratigraphic section would be regarded as normal by potash drillers interested in the Salado Formation.

The 7-foot cavity near the bottom of the Dewey Lake Redbeds at WIPP-33 is probably due to collapse into voids





left in the Rustler Formation by the same karst processes which created the four cavities which exist today in the Magenta and Forty-niner members at the same location.

Solution subsidence hollows also occur in the Santa Rosa sandstone of the Pecos River Valley. Subsurface drainage is active within the underlying limestone; subsidence, cracks and fissures in the sandstone beds are common. The largest collapse hollows associated with groundwater solution are found nearest the river because groundwater is more abundant (Sweeting, 1973, pp. 63, 299).

The Gatuna Formation is the oldest Pleistocene deposit preserved in the lower Pecos River Valley. Its channel gravels indicate vigorous alluviation, and its collapse sink deposits indicate that dissolution of salt and gypsum in underlying Permian rocks has been a major geologic process during the Pleistocene (Hawley et al., 1976, p. 256). The Gatuna Formation is typically only about 3 to 5 feet thick (Vine, 1963, p. B-27); but in some karst depressions in Nash Draw, the Gatuna Formation attains a thickness of 100 feet (Vine, 1963, p. B-2), indicating that processes of solution and fill were intensive during Gatuna deposition in the mid-Pleistocene.

Conclusion

The available geologic data and literature show that all members of the Rustler Formation, and all overlying sandstone formations (Dewey Lake, Santa Rosa and Gatuna) which cover the Rustler on the Mescalero Plain east of Livingston Ridge, have been subject to karstification here or elsewhere in the Pecos River Valley. The processes of solution and subsidence are still active, as illustrated by the sudden appearance of large sink holes during this century.

Powers et al. (1978), DEIS (1979), FEIS (1980), WIPP SAR (1980, revised 1983), and Weart (1983) have assumed that karst is absent east of Livingston Ridge. This assumption seems unfounded, unless it can be shown that a barrier to rainwater infiltration and karstification exists east of Livingston Ridge, and that this barrier is not present or is ineffective in the parts of the Pecos River Valley which are known to be karstified. 24

In most of the study area, the sandstone cover rocks are capped by Mescalero caliche. Bachman (1985, pp. 19, 27) has claimed that the Mescalero caliche "forms a barrier to the infiltration of precipitation," and is an "obstruction to infiltrating and recharging underlying beds." The dune sands which cover the caliche are certainly no barrier to rainwater recharge of the sandstone beds. Either the





caliche is a barrier, as claimed by Bachman, or there is no barrier, and infiltrating rainwater is able to penetrate the sandstone beds.

Chapter 3, based on the geologic literature, will discuss the processes of caliche formation and karstification in semi-arid regions of Texas and New Mexico, including the Mescalero Plain. This discussion will set the stage for descriptions in Chapters 4-7 of karst features discovered during field investigations at the WIPP site.

CHAPTER III

CALICHE FORMATION AND KARSTIFICATION

## Introduction

This chapter provides background on the composition and characteristics of caliche. The conditions under which caliche may become impervious are specified. Explanations are given for the processes of caliche formation, and for the source of its calcium carbonate. A model for the developmental sequence of caliche is discussed. Evidence is presented for the solution and breaching of caliche by percolating water, resulting in sink holes and underground drainage, in Texas and New Mexico. A typical exposure of Mescalero caliche is described from field observations. Evidence from the geologic literature is presented, describing the origin, morphology and karstification of Mescalero caliche.

## Nature of Caliche

The term "caliche" is of Spanish origin, from the Latin "calx," meaning lime (Price, 1933, p. 500). It is applied throughout the Southwest and the Llano Estacado to calcareous caprocks, to soil hardpans occurring at the land





surface or at shallow depths, and to the less-indurated calcareous zones which occur beneath the hardpans. Although the term has also been used to describe subaqueous groundwater deposits and spring deposits (Bretz and Horberg, 1949b, p. 491), such broad usage of the term is excluded here. Caliche is commonly over 80% calcium carbonate ($CaCO_3$), with varying amounts of silica, iron and clay (Lattman, 1983, p. 101).

Caliches are widespread, world-wide features of arid and semi-arid regions (Bretz and Horberg, 1949b, p. 507), especially in semi-arid limestone areas (Sweeting, 1973, p. 293). Caliches are most characteristic of warm areas with limited precipitation, generally less than 20 in/yr, although caliches can form in very hot climates with rainfall up to 30 in/yr (Goudie, 1983, p. 93; Reeves, 1976, p. 85). The ideal environment for the development of caliche is neither arid nor humid. Too little water or too little soil cover allows only surficial accumulations of carbonate; too much water causes regional leaching of calcium carbonate from the subsoil (Reeves, 1970, p. 353; Brown, 1956, p. 14).

Caliches tend to develop preferentially on slopes of less than 1%, but can develop on steep slopes and even on scarps (Goudie, 1983, p. 93). Caliches have the ability to rapidly harden where exposed at the surface, undergoing brecciation, recementation and induration (Lattman, 1983,

p. 103). Hardpans on top of caliche profiles, seldom more than 18 inches thick, form caprocks and ledges. Plugged hardpan horizons can greatly reduce rainwater infiltration rates, thereby accelerating runoff and flooding. Hardpans are always underlain by softer or looser material which is more prone to erosion and may contain cave systems, undercutting the hardpan (Goudie, 1983, pp. 100, 119).

Origin of Caliche

Many theories have been proposed to account for the origin of caliche. Some theories may be dismissed rather easily: for example, periodic flooding, or capillary rise from the groundwater table. The scientific consensus is that the calcium carbonate is supplied by the wind. The carbonate is then leached downward through the soil profile as deeply as soil water penetrates, and is there precipitated as soil water evaporates.

Distribution of caliche in semi-arid regions of Texas and New Mexico is too widespread and continuous to be explained by evaporation of water from localized basins periodically flooded by surface waters bearing carbonate from distant sources. Caliche occurs even on the highest areas of the Llano Estacado (Price, 1933, p. 511; Brown, 1956, p. 10).

Underneath most caliche profiles, the water table is





too deep for its water to reach the caliche by capillary action. Sayre (1937, p. 69) concluded that the depth of caliche is related to the maximum depth of soil water penetration, rather than to the depth of the groundwater table.

Even if carbonate deposition by capillary rise of groundwater could have happened under conditions of a high water table during the pluvial stages of the Pleistocene, capillary rise explains neither: (1) the downward penetration of caliche into impervious shales (Bretz and Horberg, 1949b, pp. 508-509); (2) the occurrence of caliche resting directly on sandstone where the Ogallala Formation is missing; (3) the deposition of caliche principally on the high areas and not necessarily in the low areas of the Llano Estacado (Brown, 1956, pp. 10, 12); nor (4) the nicely graded caliche sequence, and the pattern of greater carbonate accumulation on higher and older surfaces (Gile et al., 1966, p. 348).

Caliche could not have formed as a subsoil concentration of lime carbonate in a degrading soil profile. According to Sidwell (1943, p. 19), the Ogallala caliche ranges in thickness from 42 feet in the southern Llano Estacado to 68 feet near Lubbock, Texas. The original parent material of the soil could not have contained enough calcium carbonate to permit the concentration of even several feet of caliche (Price, 1933, p. 512), for this would demand the assumption

that several hundred feet of overlying material has been successively leached and removed (Judson, 1950, p. 260).

There is strong evidence that the world-wide distribution of caliche may be attributed to an eolian supply of calcium carbonate, and that caliche profiles formed under aggrading soil conditions. This theory would explain: (1) the presence of volcanic ash and rounded, frosted quartz grains in the Ogallala caliche (Sidwell, 1943, p. 261; Brown, 1956, p. 13); (2) the presence of caliche in direct contact with underlying noncalcareous redbeds (Bretz and Horberg, 1949b, p. 501); (3) the occurrence of equally prominent carbonate horizons in calcareous and noncalcareous sediments of the same age (Gile et al., 1966, p. 348); (4) the existence of caliche soil profiles wherever the climate permits, regardless of the calcium carbonate content of the regolith; and (5) the presence of thick caliche profiles on the downwind side of the world's major deserts. Measurements of carbonate content in presently occurring eolian dust in southern New Mexico indicate that 3.2 to 6.2 pounds per acre per year of carbonate may have fallen during the Holocene (Reeves, 1970, p. 355).

Price (1933, pp. 505, 519) proposed the theory, now widely accepted, that solutions of carbonate are leached downward to low soil levels during cool rainy periods, then ascend by capillarity during dry periods, when evaporation in the soil causes precipitation of the carbonate. In





support of his theory, Price (1933, p. 508) recorded the growth of caliche in expanding beds of porous shale, to which soil solutions had access through joint planes in thin surface beds of dolomite. Price (1933, p. 519) also cited Hawker (1927), who showed that progressive leaching of the A horizon results in the concentration of calcium carbonate at gradually increasing depths in the soil.

The scientific consensus is that thick, continuous caliche deposits could not have been caused by calcium carbonate brought in solution by floodwaters from distant sources, or by lacustrine deposition, or by a regionally rising water table, or in a degrading soil profile. An eolian source of calcium carbonate is indicated, because caliche deposits often rest directly on noncalcareous material, and are often found beneath a noncalcareous regolith, generally on the downwind side of deserts. The calcium carbonate is leached downward through the soil profile to the maximum depth of soil water penetration, and is there precipitated as the soil water evaporates. As the soil profile aggrades, the caliche profile thickens.

## Development of Caliche

Gile et al. (1966, pp. 352-354) present the following widely accepted sequence for carbonate accumulation and caliche development in nongravelly materials:

Stage I: A few carbonate filaments or faint carbonate coatings on sand grains.

Stage II: Prominent carbonate nodules, slightly hard to extremely hard or indurated; matrix material at most only slightly whitened by carbonate.

Stage III: Carbonate impregnates practically the entire horizon; carbonate nodules are commonly imbedded; most sand grains are carbonate-coated; most pores are plugged; the horizon is then cemented and may be indurated.

Stage IV: An indurated laminar horizon of nearly pure carbonate, commonly fractured into plates or blocks, rests on the cemented, carbonate-plugged horizon, which in turn is underlain by a transitional horizon.

The plugged horizon would correspond to the most frequent depths of rainwater infiltration. As its pores become filled with carbonate, the plugged horizon becomes only slowly pervious to moisture. As infiltrating rainwater concentrates at the top of the plugged horizon, the zone of maximum carbonate accumulation is forced upward. Thin laminar zones develop, tending to fill irregularities in the upper surface of the plugged horizon. The numerous laminae suggest a periodic, long-term process (Gile et al., 1966, pp. 355-356). Lamination occurs only when caliche is directly exposed, or is near enough to the land surface to receive infiltrating rainwater (Reeves, 1976, p. 53) which might not be the case if the climate has become more arid or





if the soil profile has aggraded significantly since calichification took place.

If the amount of available carbonate or the amount of infiltrating rainwater is insufficient, the caliche remains thin, soft and incompetent. Only if the caliche profile is plugged, or if the soil cover is very thin or the caliche is actually exposed, does regional induration and formation of a laminar zone occur. Thus, in many areas on the Llano Estacado, unexposed Pliocene caliche is still chalky and incompetent, while exposed Pleistocene caliche is already indurated, even though the Pliocene caliche is older (Reeves, 1970, p. 354).

Caliche Karst

Calichification is a reversible process. Solution features in caliche, resulting from solution and removal of carbonate by downward percolating rainwater, have been observed by Price (1933), Sayre (1937), Bretz and Horberg (1949b), Judson (1950), Vine (1963), Havens (1966), Bachman (1973) and Reeves (1976). They are generally thought to result from an increase in available mositure due to a change in climate.

Caliches are essentially limestones and, if available moisture is sufficient, they may develop a whole suite of karstic landforms such as closed depressions and

discontinuous drainage (Goudie, 1983, pp. 119-120). Karst features in caliche have been described in southeast Texas, in south Texas, and in the Ogallala caliche of the Llano Estacado.

Price (1933, pp. 498-499) was one of the first to study caliche karst. He found the Reynosa Plateau of southeast Texas, capped by Pliocene caliche, to be "a typical karst plateau, lacking surface waters because of the sinking of drainage below ground." Some basins have penetrated the entire thickness of the caliche. The basins are partly filled with soil, mostly red sandy loam. The red soils are typically iron-rich, and lacking in calcium carbonate. Windblown sand covers the caliche in some areas. Price attributed the origin of the depressions to solution of the Pliocene caprock caliche.

Sayre (1937, pp. 66, 69-70) studied the coastal plain of south Texas. He reported sink holes in which caliche is absent; in others the caliche is present only as a nodular layer in the soil. The compact, top layer of caliche may be practically impermeable, preventing passage of water downward into underlying formations. As a result, soil water reaching the impermeable layer will migrate along the caliche surface until it reaches a place where the hard caliche is interrupted; there the water will again move downward.

Judson (1950, p. 269) found that the Ogallala caliche





caprock of the Llano Estacado forms "a considerable but not insuperable barrier to the downward passage of rainwater." The dense upper laminar zone is composed of innumerable plates. The contacts between these plates are planes of weakness, and the plates tend to break into blocks. Incipient breaks or fractures in the caprock are quickly widened, allowing downward drainage of water through the caliche, which leaches the lime cement directly below the break in the caprock. The zone of leaching expands as the hole in the caprock continuously widens.

Solution and breaching of caliche caprock would proceed most rapidly during moist periods correlated with glacial advances. Conversely, deflation by wind would be most effective during arid intervals correlated with glacial retreats (Judson, 1950, p. 269).

But Havens (1966, p. F-12) reported that depressions are still forming on the Llano Estacado in Lea County, New Mexico. Caliche dips toward, thins toward, or is absent beneath the centers of some depressions. "Solution and removal of calcium carbonate by percolating water is almost certainly the mechanism for removal of most of the caliche." (Havens, 1966, p. F-8).

The depressions in Lea County are generally in aligned groups, or chains. Havens (1966, pp. F-7, F-8) believed that the chains of depressions occur along poorly formed drainageways, where solution of caliche would entrench the

drainage and lead to enlargement of the depressions, which may coalesce to form broad swales.

Judson (1950, pp. 261, 264-265) found dissected depressions along the northern escarpment of the Llano Estacado to be floored by unconsolidated sand derived directly from the Ogallala Formation through leaching of its calcareous cement. Sink holes have formed in this century where weakly cemented Ogallala sand has collapsed into underlying Triassic redbeds. Judson reasoned that caverns may form in deeper evaporite rocks, as the sandstone and shale are interbedded with salt, gypsum, anhydrite and limestone. By this reasoning, the deep evaporites of the Llano Estacado are part of a covered karst, and the sandstone cover rocks are capped by surface caliche karst.

Some depressions in Judson's study area are so shallow as to be noticeable only be a vegetative change. Judson (1950, p. 265) believed these depressions to be incipient sink holes.

However, most natural topographic depressions associated with the Ogallala caliche have resulted from depositional irregularities or deflation in the windblown sands, where the underyling caliche is not breached or collapsed by solution (Reeves, 1976, p. 159). Many depressions on the Llano Estacado were found by Judson (1950, pp. 265-266) to have low hills of windblown sand on their eastern, leeward sides. This is characteristic of deflation basins, or





"blowouts," where strong winds from the west remove sand from within dry basins with a vegetative cover so weak as to be incapable of holding the sand. Subsurface exploration (augering, drilling or trenching) is obviously necessary to determine conclusively whether the origin of the depression is due to solution of caliche, to the wind, or to a combination of these and other factors (Reeves, 1976, p. 160).

Origin of Mescalero Caliche

The Mescalero Plain extends westward from the Mescalero escarpment at the edge of the Llano Estacado to Livingston Ridge at the edge of Nash Draw (Vine, 1963, p. B-34). Wherever the surface of the Mescalero Plain can be observed beneath the widespread deposits of windblown sand, it is underlain by Mescalero caliche (Bachman, 1976, p. 141).

The Mescalero caliche is thought to have accumulated in the C horizon of an ancient soil profile, during a semi-arid interval of climatic and tectonic stability; this followed the unusually moist conditions of Gatuna time, which is thought to correspond with the Kansan glaciation of the mid-Pleistocene, about 600,000 years ago. Carbonate grains in windblown sand, dust and rainwater were deposited on a relatively stable land surface in an aggrading eolian environment. Calcium carbonate was leached from the sand and dust, translocated downward through the soil profile by

percolating rainwater (Bachman, 1980, p. 42; Bachman, 1976, pp. 141, 142), and precipitated by subsurface evaporation of the carbonate-bearing soil water (Vine, 1963, p. B-32).

The Mescalero caliche may have undergone so many episodes of brecciation and recementation as to make radiocarbon dating totally unreliable, because it may be the age of the clasts which is being measured, rather than an age representative of the most recent episode of recementation. Accordingly, Frye et al. (1974, p. 12) contended that a radiocarbon date on caliche should be regarded as the maximum age of the precipitated calcium carbonate. It has been reported that the Mescalero caliche accumulated between 410,000 and 510,000 years ago (Bachman, 1980, p. 42). But radiocarbon dates as young as 11,250 years before present (B.P.) have been reported for the uppermost platy caliche caprock near Lake Alamogordo in the Pecos River Valley, about 10 miles northwest of Fort Sumner, New Mexico (Frye et al., 1974, p. 13, and Figure 1, p. 4). Although erroneously reported as Ogallala caliche, this is probably Mescalero caliche, as the Ogallala Formation has been entirely removed at this location (Bretz and Horberg, 1949a, Figure 1). Thus, the most recent episode of recementation of Mescalero caliche may well have begun at the close of the Pleistocene (11,000 yr B.P.), a time of falling lake levels, declining stream volume, formation of dunes, and widespread vegetational change throughout the Southwest (Wendorf, 1961a,

25





p. 20; Van Devender and Spaulding, 1979, p. 709; Spaulding et al., 1983, p. 263).

Morphology of Mescalero Caliche

Mescalero caliche is typically 3 to 5 feet thick, and composed of two parts: an upper 1 to 4 feet of light gray to white, dense, massive, slabby, laminated, well-indurated, brecciated and recemented limestone caprock, containing fine-grained quartz sand; and a basal 3 to 4 feet of loose, earthy, nodular, chalky, weakly laminated and poorly indurated caliche. This grades downward into and sometimes engulfs clasts of the underlying bedrock (Bretz and Horberg, 1949b, pp. 494, 497; Vine, 1963, p. B-10; Bachman, 1973, p. 17; Bachman, 1976, p. 141; Bachman, 1985, p. 19).

Where Mescalero caliche crops out at Livingston Ridge, long exposure to weathering has almost invariably resulted in a very hard, dense limestone surface only 1 or 2 feet thick (Vine, 1963, p. B-32). The Mescalero caliche has commonly weathered to a ledge that overhangs less resistant, nodular, basal deposits (Bachman, 1976, p. 141; Powers et al., 1978, p. 3-12).

Field observations show that where Livingston Ridge is most deeply incised by ephemeral fluvial action (SW/4 SE/4 sec 27, T 22 S, R 30 E), the Mescalero caliche caprock is about 18 to 20 inches thick and very strongly indurated.

The caprock is blackened, indicating a mature caliche profile long exposed. Caliche cobbles and boulders which obviously were once individual fragments have been incorporated into the brecciated and recemented caprock. Its surface has been pockmarked and rounded by solution, leaving caliche residuals in relief.

At the exposures observed at Livingston Ridge, the Mescalero caprock may or not be covered with a zone of laminar caliche up to 6 inches thick. In places, the laminar zone is breached by small solution cavities about 0.25 inches in diameter. The laminar zone is typically broken up along bedding planes and fractured into small plates which are also very strongly indurated. Plant roots easily penetrate the fractures. Many of the roots emerge at small caves which are especially common directly underneath the caprock; yet some roots penetrate downward into every horizon of the caliche profile, regardless of whether caves are conspicuous.

The exposures of Mescalero caliche caprock observed at Livingston Ridge are typically underlain by a moderately indurated caliche profile including, successively: as much as 11 to 15 inches of blocky, nearly pure carbonate; 5 inches of weakly laminated, bright white caliche with pink sandstone fragments; 15 to 20 inches of small to large reddish brown sandstone pebbles engulfed and cemented by carbonate; 9 to 14 inches of blocky caliche containing pink





sandstone fragments; and 7 to 11 inches of a crumbly horizon containing sandstone clasts, reddish brown with black marks, few calcareous coatings, and much sand in between the clasts.

Karstification of Mescalero Caliche

The resistance of Mescalero caliche to weathering in the dry climate has allowed it to form extensive surfaces. East of Livingston Ridge the Mescalero caliche forms a discontinuous mantle, locally protecting underlying rocks from solution in many areas (Vine, 1963, pp. B-2, B-31).

But while caliche caprocks (calcretes) are resistant to erosion when exposed at the land surface, calcium carbonate is a readily soluble material (Frye et al., 1974, p. 12). Corrosion is accelerated in buried limestones by the addition of carbon dioxide from the soil and vegetation (Sweeting, 1973, p. 43).

Bretz and Horberg (1949b, p. 506) observed exposures of Mescalero caliche over wide areas. The caprock is often broken into angular blocks which constitute a surface rubble. The upper surfaces of the blocks may be cupped and faceted by solution; and the bottoms may be encrusted with later additions of pustulose, spongy caliche.

Bretz and Horberg (1949b, pp. 504-505) described solution features in Mescalero caliche in two locations in

Eddy County, New Mexico. In places where the Mescalero caliche is overlain by noncalcareous soils or unconsolidated deposits, the caliche is commonly soft and porous as compared to exposed caprock. Irregular solution cavities penetrating downward through the caliche, from a few inches to several feet in length, are common features. Steeply dipping caliche at the cavity margins, and zones of caliche fragments mixed with overlying deposits in the fill material, are evidence of slumping due to solution. Some cavities may have been started by roots or burrowing animals. Many cavities, some of them funnel-shaped, are lined with travertine. Relict solution cavities and fills are evidence that some solution preceded the latest stages of calichification.

At places east of Carlsbad, New Mexico, the Mescalero Plain is pitted with a karst topography of depressions and sinks (Hawley et al., 1976, p. 256). In many areas in and adjacent to Nash Draw, described by Vine (1963, pp. B-31, B-32), erosion and solution are destroying the caliche; it is locally absent in the solution depressions of the Mescalero Plain. Sink holes are common in the Mescalero caliche, ranging from "small cavernous openings enlarged by small animals" to "shallow circular depressions or wallows up to several hundred feet in diameter," where the caliche has collapsed into cavities left by subsurface dissolution of gypsum.





Solution pipes are small to large solution conduits in the caliche, observed by Reeves (1976, p. 56) to range from 9 inches to 2 feet or more in diameter. Bachman (1973, p. 17) observed solution pipes penetrating downward into the Mescalero caliche; the pipes were filled with younger sediments. Some pipes pass entirely through the caliche profile, and may represent the former positions of plant roots. Dissolution of Mescalero caliche is greater at the depressions. At numerous places the caliche thins toward depressions, and in some depressions the caliche is entirely absent.

## Summary

Calcareous caprocks and hardpans, known as caliche, are world-wide features of arid and semi-arid regions. Calcium carbonate dust is deposited by wind, leached downward through the soil profile, and precipitated at the maximum depth of soil water penetration. If soil cover is thin, the caliche horizon may become plugged, impervious and indurated, and a laminar zone may form above the hardpan. Where exposed, the laminar zone may be fractured into blocks, and penetrated by plant roots and burrowing animals. Where overlain by surficial deposits, caliche may be soft, chalky and incompetent. With sufficient moisture, solution and removal of carbonate may create karstic landforms in

caliche, including solution pipes, sink holes, and discontinuous drainage.

None of the studies cited in this chapter refer to caliche karst features located within the WIPP site. Relying on some of these same studies, it has repeatedly been stated (Powers et al., 1978; DEIS, 1979; FEIS, 1980; WIPP SAR, 1980, revised 1983; Weart, 1983) that karst morphology is restricted to Nash Draw and its immediate vicinity, and has not been described at the WIPP site. Chapters 4-7 of this dissertation will demonstrate that sink holes and solution pipes, so common elsewhere on the Mescalero Plain, also occur at the WIPP site.

26





CHAPTER IV

A CHAIN OF SINK HOLES

Introduction

This chapter focuses on a recognized karst feature, the WIPP-33 sink hole, and three nearby surface depressions. The chapter discusses surface morphology, caliche stratigraphy, solution features in sandstone, and underground caverns in dolomite, gypsum and siltstone.

At WIPP-33, an arroyo disappears into a deep depression filled with thick alluvium; the depression is underlain by caverns (Basic Data Report for WIPP-33, 1981; Barrows, 1982; Barrows et al., 1983). A caliche escarpment at the south-southeastern rim of the sink hole provides direct, visible evidence of surface collapse, while caliche is entirely absent underneath the floor of the sink hole. WIPP-33 is an ideal site for the study of solution and collapse in semi-arid karst, and for use as a reference for purposes of comparison with other topographic depressions suspected of being karst features.

The WIPP-33 sink hole (Figure 5) is the westernmost of a chain of four closed topographic depressions leading directly toward Nash Draw. All four depressions were intensively investigated during field work for this

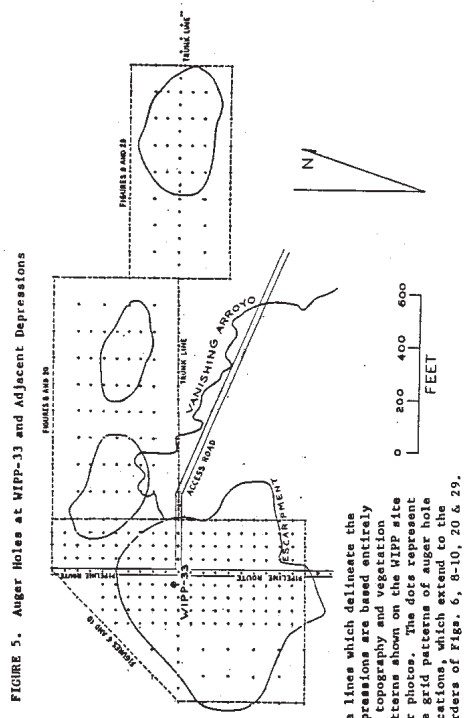



FIGURE 5. Auger Holes at WIPP-33 and Adjacent Depressions

The lines which delineate the depressions are based entirely on topography and vegetation patterns shown on the WIPP site air photos. The dots represent the grid patterns of auger hole locations, which extend to the borders of Figs. 6, 8-10, 20 & 29.





dissertation.

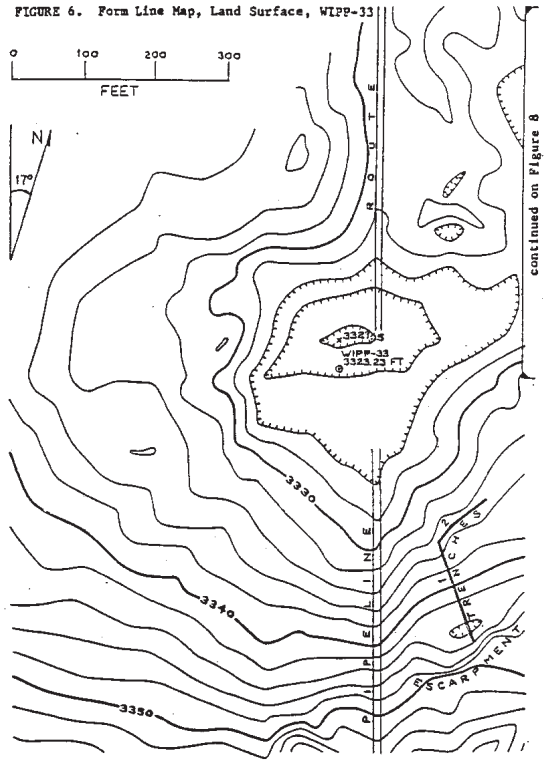
Only at the WIPP-33 depression were the cover sands shallow enough to make trenching worthwhile. The trenches showed collapse and breaching of caliche in the subsurface, and solution features in carbonate-cemented sandstone. This aided in the interpretation of auger data from the three adjacent topographic depressions. All three are underlain by structural depressions in the caliche. Two of them, with disappearing arroyos and deep alluvial fill, bear a striking resemblance to WIPP-33.

## The WIPP-33 Sink Hole

The WIPP-33 sink hole is the only previously documented example of karst in the Rustler Formation east of Nash Draw. Located 2.9 miles west-northwest of the center of the WIPP site, and 1.1 mile southeast of Livingston Ridge (SE/NE/SE sec 13, T 22 S, R 30 E), WIPP-33 is a closed topographic depression about 700 feet in diameter. It is 15 to 30 feet deep, except on its northeast flank (Figure 6). It is prominent on the WIPP site air photos (Mann, 1983), and is shown on the USGS topographic maps (Nash Draw 15 minute quadrangle, photorevised 1965; and Livingston Ridge 7.5 minute quadrangle, provisional edition, 1985).

The WIPP-33 depression is floored by loose alluvial sand and low brush. Clumps of matted leaves and organic

FIGURE 6. Form Line Map, Land Surface, WIPP-33








debris, and desiccated clay pans in the lowest parts, indicate occasional flooding of the depression. One of the few small arroyos in the WIPP site area disappears into this depression from the southeast (Figure 5), yet there is no evaporite crust as would be expected in an undrained playa (Barrows et al., 1983, p. 63). Evaporite deposition is not occurring in the subsurface, within the sandy fill material, as revealed by the intensive augering undertaken in this study.

The fill material was described as alluvial by Sandia Labs, and was considered unusually thick (>20 feet), enough so that borehole WIPP-33 was drilled into the depression (Basic Data Report for WIPP-33, 1981, pp. B-5, B-7). The borehole missed the lowest topographic point by about 40 feet (Figure 6). Still, as stated in Chapters 1 and 2, WIPP-33 penetrated 9 feet of water-filled cavities in Magenta dolomite, 15 feet of water-filled cavities in Forty-niner gypsum, and 7 feet of cavities in Dewey Lake siltstone (Basic Data Report for WIPP-33, 1981, Figure 2, p. 11, and Table 3, pp. 15-17). The stratigraphy of the WIPP-33 drill hole is summarized below:

Table 1. Stratigraphy of WIPP-33

| rock unit | measurements in feet: elevation | depth* | thickness |
|---|---|---|---|
| Holocene deposits | 3323-3279 | 0-44 | 44 |
| Dewey Lake Redbeds | 3279-2922 | 44-401 | 357 |
| Rustler Formation | 2922-2646 | 401-677 | 276 |
| Forty-niner | 2922-2874 | 401-449 | 48 |
| Magenta | 2874-2855 | 449-468 | 19 |
| Tamarisk | 2855-2773 | 468-550 | 82 |
| Culebra | 2773-2745 | 550-578 | 28 |
| lower member | 2745-2646 | 578-677 | 99 |
| Salado Formation | 2646 | | |
| Top of salt | 2645 | 678 | |
| Depth of hole | 2483 | 840 | |

* Caverns at 356-363; 416.5-426; 430-436; 452-456; 462-467.

In the Rustler Formation at WIPP-33, nearly all of the anhydrite has been converted to gypsum; some of the gypsum and all of the halite has been dissolved and removed. Salt dissolution has also affected the top of the Salado Formation. Barrows et al. (1983, p. 63) interpret the depression as an alluvial doline, where loose surficial material washes through cracks in the Dewey Lake Redbeds into solution cavities and conduits in the Rustler Formation (also Borns et al., 1983, p. 81).

The WIPP-33 depression was later included in the WIPP site gravity survey. The gravity method detects and measures small variations in the earth's gravitational field, caused by lateral variations or anomalies in





subsurface rock mass or rock density, due usually to structural displacement. The data can be used to establish the maximum depth to the top of the causative rock structures, and to establish the minimum amount of missing or excess mass in the rock structures (Barrows et al., 1983, p. 25).

A negative gravity anomaly was measured at WIPP-33, originating no deeper than the Magenta dolomite. The gravity anomaly is too pronounced to be attributable to topography (Barrows et al., 1983, p. 57), and too localized to be attributable to depositional variations in the Rustler (Borns et al., 1983, p. 81). Figure 7, reprinted from Barrows et al. (1983, Figure 2.3.1-2, p. 49) graphically displays the gravitational variations along a reconnaissance profile which transects the WIPP-33 depression.

WIPP-33 clarifies the relation between negative gravity anomalies and karst conduits in the study area. Because karst channels are persistent over long time periods, the localized negative gravity anomalies probably result from decreased rock densities near karst channels where anhydrite would be hydrated to gypsum, as well as from the karst channels themselves (Borns et al., 1983, p. 81; Barrows et al., 1983, p. 63).

Thus, at WIPP-33, a deep topographic depression with thick alluvial fill and a disappearing arroyo coincides with underground karst caverns, subsurface dissolution of halite and gypsum, and a negative gravity anomaly of high

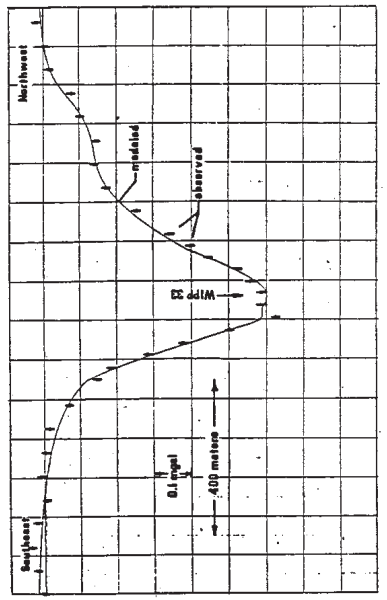



FIGURE 7. Gravity Profile, WIPP-33

Observed and modeled gravity along the pipeline route crossing the WIPP-33 gravity anomaly (from Barrows et al., 1983, Figure 3.2.3-1).





amplitude. On this evidence, WIPP-33 was an obvious choice for an augering site. Where karst morphology is apparent above and below the caliche, one would expect to find karst morphology expressed in the caliche.

Morphology of Adjacent Depressions

In the vicinity of WIPP-33, there are other large topographic depressions whose surface morphology suggests that their origins are not attributable to the wind. Three depressions form a chain in a distinct linear trend leading west-southwestward, directly to WIPP-33 (Figure 5).

The air photos and field observations show that the WIPP-33 arroyo becomes much shallower and less distinct, appearing to lose most of its erosive power, when it discharges into a second depression before it reaches the WIPP-33 depression immediately to the southwest. The second depression (Figures 6 and 8) is broad and only about 2 feet deep, with numerous small pans floored by organic debris and desiccated clay pans which are saturated after rainstorms. Its relief is so low that its extent is difficult to measure. It appears in the air photos to be about 400 feet by 200 feet, trending eastward.

A third depression (Figure 8), centered about 900 feet east-northeast of the WIPP-33 drill hole, is prominent because of its depth (8 to 10 feet). The depression trends

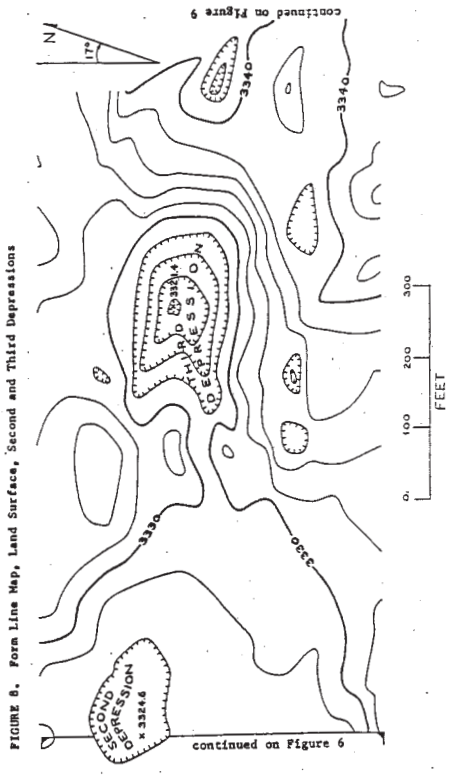



FIGURE 8. Form Line Map, Land Surface, Second and Third Depressions





eastward, with axes of about 300 feet and 200 feet. It is sand-floored with a very small and weak clay pan; big mesquite bushes and other vegetation thrive in its bottom. It is ringed by high dunes (4 to 15 feet), providing a local relief of up to 20 feet, with slopes as steep as 11%.

A fourth depression (Figure 9), centered 1700 feet at 73° from the WIPP-33 drill hole, trends east-northeastward, with axes of about 300 feet and 150 feet, and a depth of about 2 feet. Its broad, slightly hummocky floor is dotted with numerous pans floored by organic debris and desiccated clay, saturated after rainstorms.

These depressions are capable of swallowing large amounts of surface runoff. According to televised weather reports, the town of Loving, New Mexico received a combined 10 inches of rain on two consecutive nights, September 18 and 19, 1985. Field observations indicated that after the first rainstorm, the clay pans in the second and fourth depressions were saturated, and two clay basins adjacent to the drill pad in the WIPP-33 depression held a few inches of standing water. Where the access road crosses the WIPP-33 arroyo (Figure 5), wooden planks 1 to 2 feet long had been emplaced to provide traction for tires. The planks were carried as far as 1,000 feet westward by the flow of storm water in the arroyo.

After the second rainstorm, a brand new arroyo appeared to the southeast of the fourth depression and flowed into

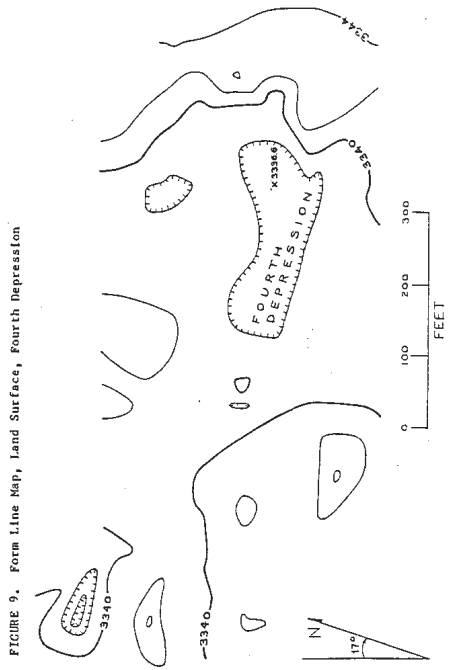



FIGURE 9. Form Line Map, Land Surface, Fourth Depression

continued on Figure 8





the fourth depression. The new arroyo cut across the WIPP-33 access road, and carried large and small caliche cobbles and pebbles more than 600 feet downstream from the access road, with the average size of the deposited caliche rubble steadily decreasing downstream. The arroyo was definitely not there previously, and it does not appear in the air photos.

The channel of the new arroyo split and diverged where it was no longer competent to transport caliche pebbles, and its many distributary watercourses vanish into the numerous shallow clay pans in the fourth depression. This indicates that the fourth depression collects and swallows surface runoff. This water either evaporates or infiltrates deeper. This is a likely spot for solution cavities in the caliche, although augering failed to locate them.

The second rainstorm caused much of the WIPP-33 depression to be a pool of standing water, and left a ring of organic debris on the slopes of the inner dunes on the western flanks of the depression, carried there by the force of the old arroyo from the east. The "bathtub ring" is about 3.3 feet higher than the WIPP-33 drill hole, or about 5.0 feet higher than the topographic low north of the drill hole. Yet standing water up to five feet deep was able to sink into the sand in a matter of days. It is probable that the WIPP-33 sink hole can swallow the surface runoff from any rainstorm under the present climatic regime.

## Caliche Escarpment at WIPP-33

Investigation of caliche structure at the WIPP-33 sink hole began with a detailed examination of the prominent caliche escarpment (Figures 6 and 10) which forms part of the rim of the WIPP-33 depression, about 430 feet south-southeast of the WIPP-33 drill hole. The caliche escarpment is one of the morphogenetically most developed caliche profiles east of Livingston Ridge (Reeves, 1/11/86, personal communication). The escarpment attains a relief of 26 to 32 inches for a length of 70 feet; it plunges on both ends underneath surface sediments and caliche rubble.

The caliche caprock at the escarpment is gray, nodular, and very strongly indurated, indicating a mature caliche profile long exposed. But it is strongly jointed and broken into blocks, and the fractures allow the downward percolation of water and redistribution of calcium carbonate throughout the caliche profile. There is almost a complete absence of weakly developed, powdery caliche.

Toward the bottom of the caliche exposure, there are horizontal, wavy remnants of the sandstone parent material, broken into tabular sandstone clasts. They have been deformed into "teepee structures," apparently caused by volumetric increase due to precipitation and growth of calcium carbonate crystals. At other places the caprock has caved in, exposing the profile to increased water flow;





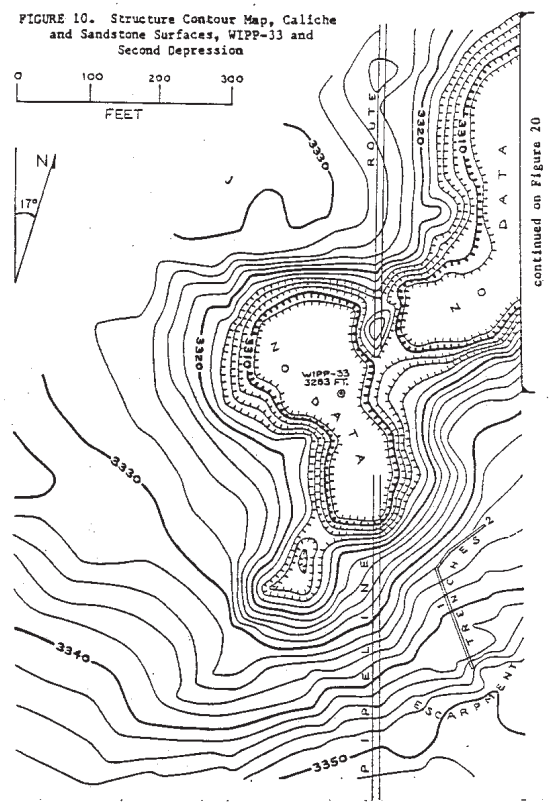



FIGURE 10. Structure Contour Map, Caliche and Sandstone Surfaces, WIPP-33 and Second Depression

consequently the caliche is softer and puggier. Numerous caves are aligned along the foot of the escarpment. There are places where caliche is impervious, but not here.

The caprock of the caliche escarpment rises as much as 30 feet above the floor of the depression. The WIPP-33 drill hole encountered 40 feet of alluvial fill above the Dewey Lake Redbeds (Basic Data Report for WIPP-33, 1981, Table 2, p. 10, and Table 3, p. 12), as seen by comparing Figure 6 with Figure 10. Thus, the structural relief of the WIPP-33 depression is about 70 feet from the caliche escarpment to the drill hole (Figure 10).

The form line maps and structure contour maps presented in this dissertation were constructed entirely from auger data. The depth to hard caliche or sandstone was subtracted from the surveyed elevation of each auger hole, providing data for the actual elevation of the caliche or sandstone surface. The auger holes were then plotted, and the subsurface topography was constructed from these data points.

Caliche Structure at WIPP-33

Investigation of caliche structure in the vicinity of the WIPP-33 sink hole included an intensive augering program. A total of 347 holes were hand augered in a grid pattern encompassing all four depressions (Figure 5).

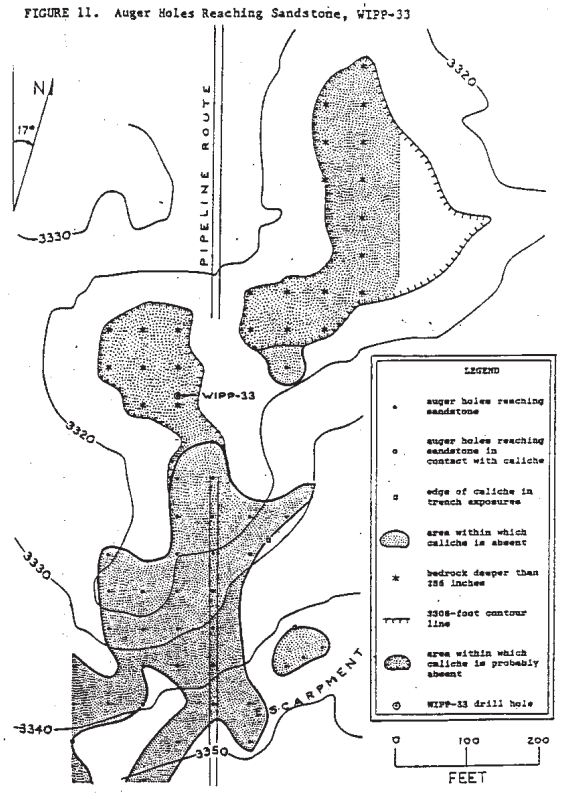




At the foot of the caliche escarpment is a shallow basin no smaller than 70 feet by 40 feet, floored by 9.5 to 14 inches of sand and loose caliche rubble underlain by Gatuna sandstone. To the west and northwest, a cluster of 33 contiguous auger holes reached sandstone (Figure 11). In some of the auger holes, caliche was in contact with sandstone; in others, loose caliche pebbles and/or calcareous powder were encountered above the sandstone. In the five northernmost and topographically lowest auger holes, the sandstone encountered at the depth of augering capability (255 inches) was unconsolidated, and the holes probably could have gone a bit deeper. The areas where the calcrete hardpan is shown to be absent amount to an estimated 76,000 ft².

At elevations below 3307 feet beneath the first and second depressions, the data do not permit the drawing of structure contour lines, because the auger holes failed to bottom out, encountering only loose sand or unconsolidated sandstone. Because 3307 feet is generally well below the caliche elevations in the surrounding area, and because caliche was absent in the WIPP-33 drill hole, it is likely that caliche is absent beneath these deep auger holes, encompassing an estimated 34,000 ft². Thus, the areas where caliche is known or thought to be absent amount to an estimated 110,000 ft², or 15.2% of the total area (725,000 ft²) investigated in the vicinity of the first and second

FIGURE 11. Auger Holes Reaching Sandstone, WIPP-33








depressions.

From the auger data, seven geomorphic cross-sections (Figures 12-18) were constructed along and parallel to the pipeline route. These cross-sections show evidence that the caliche has collapsed: (1) Beneath the pipeline route (Figure 16), caliche was encountered everywhere north of the drill pad, but the caliche surface does not dip smoothly downward toward the depression; twice it rises and falls abruptly. (2) Beneath the caliche escarpment (Figure 18), the caliche surface drops precipitously; the caliche slopes 8% downhill for 100 feet, then ends abruptly, with a drop of 94.5 inches to the sandstone surface. The same thing happens at the edge of the second depression (Figure 18), where the caliche slopes 7.5% downhill for 50 feet, then ends abruptly, with a drop of 120.8 inches to the sandstone surface. (3) Similar precipitous drops in the structural surface can be seen in each of the seven cross-sections.

## Stratigraphic Evidence of Collapse

Given the evidence of surface collapse at the WIPP-33 caliche escarpment, and the evidence of subsurface collapse revealed by the auger data, the prospect of exposing collapsed subsurface caliche made the WIPP-33 sink hole an attractive site for trenching with a backhoe.

Trench I began at the approximate center of the caliche

FIGURE 12. Geomorphic Cross-Section, WIPP-33,
200 Feet West of Pipeline Route

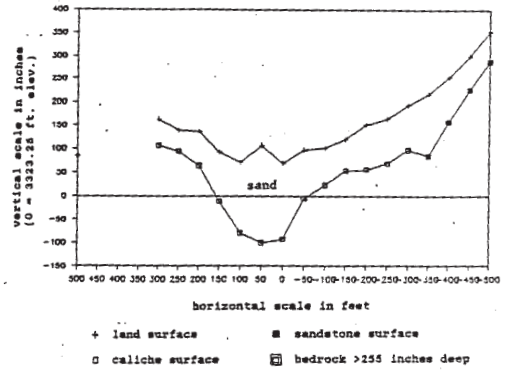







FIGURE 13. Geomorphic Cross-Section, WIPP-33,
150 Feet West of Pipeline Route

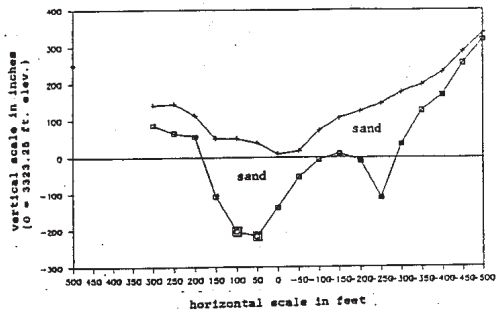



FIGURE 14. Geomorphic Cross-Section, WIPP-33,
100 Feet West of Pipeline Route

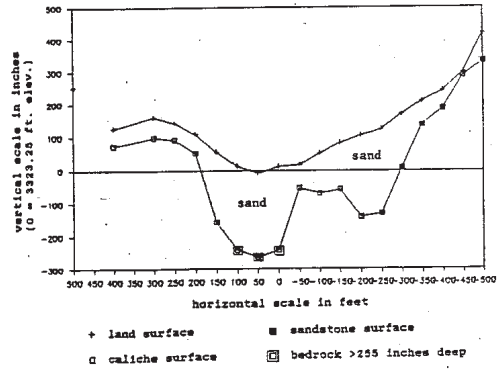


FIGURE 15. Geomorphic Cross-Section, WIPP-33, 50 Feet West of Pipeline Route

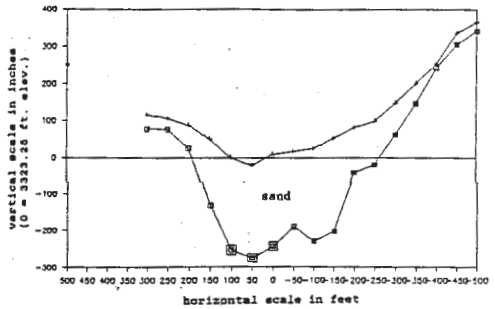



FIGURE 16. Geomorphic Cross-Section, WIPP-33, Along Pipeline Route

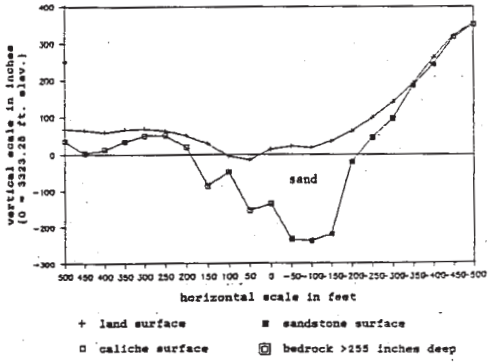







FIGURE 17. Geomorphic Cross-Section, WIPP-33, 50 Feet East of Pipeline Route

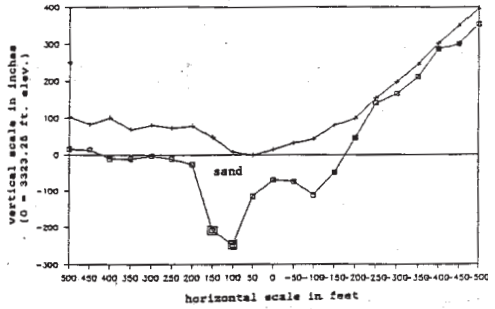
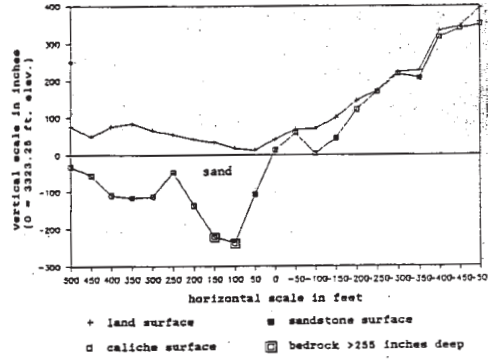



FIGURE 18. Geomorphic Cross-Section, WIPP-33, 100 Feet East of Pipeline Route



escarpment, continuing for 150 feet, past the point where caliche abruptly terminates. Trench 2 began where caliche is 8 to 9 inches deep, continuing for 100 feet until intersecting the lower end of the first trench (Figure 6).

Two factors restricted the trenches to these locations. It was not feasible to trench the floors of the WIPP-33 depression, because the alluvial fill is so thick that the backhoe would have encountered nothing else. Also, the trenches had to be located at least 75 feet from the pipeline route to avoid any possible damage to the pipeline, the location of which is not precisely known.

Trench 1 displays direct evidence of near-surface collapse in Mescalero caliche (Plate 1). At a distance of 91.5 feet downhill from the caliche escarpment, the caliche surface abruptly breaks off. It is displaced 12 inches downward, and is covered by 12 inches of sand and caliche rubble deposited since the collapse; this is the upper edge of the alluvial fill, which thickens downslope toward the bottom of the collapse sink (Figure 18).

At two places further downslope, hard caliche remnants are sometimes preserved, usually beneath 2 to 3 inches of surface sands. In places, hard caliche is exposed at the land surface. At a caliche outcrop 146 feet downslope from the caliche escarpment, the trunk of a mesquite bush, 5 inches in diameter, has penetrated through the caliche hardpan. At 148 feet, the caliche hardpan simply ends.





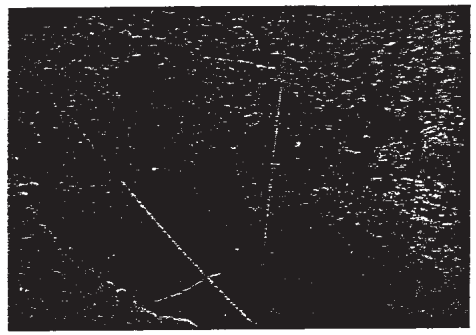


PLATE 1. Collapse of caliche, 91.5 feet downslope from the caliche escarpment at WIPP-33. The caliche is nearly exposed, 22 inches thick, brecciated and recemented, containing caliche cobbles up to 3 inches in diameter. Between the caliche and Gatuna sandstone is 28 inches of reddish yellow sand with caliche cobbles, pebbles and powder scattered throughout.

Immediately downslope, the caliche is only 4 to 6 inches thick, weakly laminated, soft and broken, with a wavy lower boundary. The caliche is easily penetrated by roots, and is overlain by a surface rubble of caliche cobbles up to 5 inches in diameter imbedded in reddish brown sand. The caliche is displaced downward, clear evidence of collapse and slumping. The displaced caliche is covered by 12 inches of sand and rubble which thickens downslope toward the bottom of the depression. (Photo by Robert Aly)

The Berino soil, representing the ancient, non-calcareous, argillic B-horizon overlying the caliche in complete Mescalero profiles (Bachman, 1985, p. 20), is absent at WIPP-33, although it must have once existed where Mescalero caliche is now present. On the upper slopes of the depression, where hard caliche is sometimes preserved, the caliche is exposed or is covered only by a thin layer of sand. The Berino soil has eroded away entirely. It may have been eroded by wind prior to the collapse at WIPP-33; more likely it was eroded by alluvial action, transported downslope, and deposited as reworked fill material in the bottom of the collapse sink.

## Solution Features in Sandstone

An unexpected revelation in the WIPP-33 trench was the presence of solution features in the sandstone floor of the basin directly beneath the caliche escarpment. Frye and Swineford (1947) observed similar solution features on strongly cemented Cretaceous sandstone surfaces in several places in central Kansas. The solution features include solution pans or tinajitas, and solution grooves or slots (Figure 19).

Solution features of one or more of these types were found on virtually every extensive outcrop of Cretaceous sandstone relatively free of soil cover. The solution





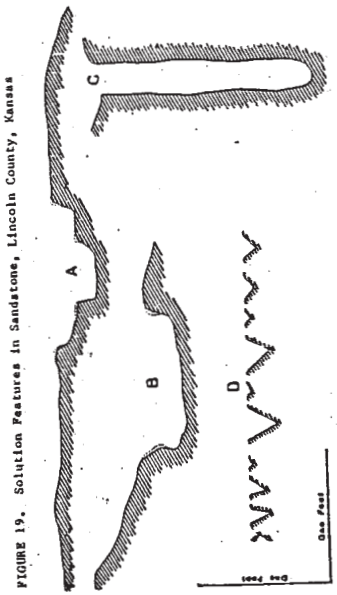



FIGURE 19. Solution Features in Sandstone, Lincoln County, Kansas

Text Figure 1. Cross profiles of tinajitas, slot, and grooves in sec. 7, T. 12 S., R. 10 W., Lincoln County, Kansas. Plotted from steel tape measurements without vertical exaggeration. All features occur in Cretaceous sandstone with dolomitic cement. A, Nested tinajita lacking an overflow outlet or notch. Solid line is profile along flute troughs and dashed line is profile along crest of flutes. B, Tinajita or undrained solution pan on sloping rounded surface. Note overhang. C, Small solution slot cut below sloping surface. D. Grooves in vertical, sloping, and nearly level surfaces. (from Frye and Swineford, 1947).

features in Kansas sandstones were found to closely resemble solution features observed on limestones in Eddy County, New Mexico (Frye and Swineford, 1947, p. 366).

The Kansas sandstones have low permeability, but are cemented with carbonate and dolomite. Solution of the cement leaves behind loose sand grains to be removed by wind or water (Frye and Swineford, 1947, p. 369).

The Kansas tinajitas range in diameter from about 6 inches to more than 2 feet, and their depth ranges from 2 to 10 inches, with no direct relation between diameter and depth. The floors of some tinajitas contain a smaller tinajita, producing a two-tiered effect called a nested tinajita (Frye and Swineford, 1947, p. 369).

The Kansas solution grooves or slots range in size from less than one centimeter in width and depth to slots more than one foot wide and many feet deep. The grooves and slots sometimes form an interconnecting network, but do not display a uniform spatial pattern (Frye and Swineford, 1947, pp. 370, 371).

Solution grooves and tinajitas also occur in carbonate-cemented sandstone on the slopes directly below the caliche escarpment at WIPP-33. The sandstone is commonly fractured, jointed, and broken into blocks, and is buried beneath 9.5 to 14 inches of sand and loose caliche rubble. The sandstone is moderately calcareous. When its carbonate cement is removed by hydrochloric acid, the remaining sandstone is





easily crumbled to sand between fingers.

A joint-controlled slot 2 inches wide and one or more feet deep is visible for 5 feet of its length in the WIPP-33 trench, 14 to 19 feet downhill from the caliche escarpment (Plate 2). At this and other places, solution has widened the fractures in the sandstone to widths up to 2.5 inches. The slots have rounded edges where water has obviously dissolved the carbonate cement (see Figure 19-C).

The slot walls and the sandstone surfaces usually display irregular-shaped pits, about 0.25 inches in width, often coalescing, leaving solution-rounded residuals in relief (Plate 3). These sandstone surfaces are similar in appearance to the travertine-encrusted sides and bottoms of solution-facetted pebbles of Permian limestone photographed in central New Mexico by Bryan (1929, pp. 200, 202). Sand-filled slots at WIPP-33 sometimes contain sandstone pebbles which are rounded and pitted by solution (Plate 3).

A nested tinajita, nearly round and about 4 inches in diameter (Plate 4), is located 35 feet from the WIPP-33 caliche escarpment. Its walls are nearly vertical, its floor holds a smaller tinajita (see Figure 19-A), and it will not hold water. Another joint-controlled solution pan, elongated and of irregular shape (14 inches by 5 inches), with edges rounded by solution (Plate 5), is located 25 feet from the WIPP-33 caliche escarpment (see Figure 19-B). Other more deeply buried tinajitas are up to 3 feet in

PLATE 2. A joint-controlled slot, enlarged by solution, in carbonate-cemented Gatuna sandstone at WIPP-33. The slot is 2 inches wide and one or more feet deep. It is visible for 5 feet of its length, 14 to 19 feet downslope from the caliche escarpment. The slot has rounded edges where water has dissolved the carbonate cement. (Photo by Robert Aly)

PLATE 3. Carbonate-cemented Gatuna sandstone 27 feet downslope from the caliche escarpment at WIPP-33. The slots have rounded edges where water has dissolved the carbonate cement. One slot contains sandstone pebbles which are rounded and pitted by solution. The sandstone surfaces display irregular-shaped pits, often coalescing, leaving solution-rounded residuals in relief. (Photo by Robert Aly)

PLATE 4. A nested tinajita in carbonate-cemented Gatuna sandstone, 35 feet downslope from the caliche escarpment at WIPP-33. It is nearly round and about 4 inches in diameter. Its walls are nearly vertical, its floor contains a smaller tinajita, and it will not hold water. (Photo by Richard Phillips)

PLATE 5. A joint-controlled solution pan in carbonate-cemented Gatuna sandstone, 26 feet downslope from the caliche escarpment at WIPP-33. It is elongated and of irregular shape (14 inches by 5 inches), with edges rounded by solution. It will not hold water. (Photo by Richard Phillips)

diameter, 15 inches deep, resembling solution collapse features with rounded rims; they are penetrated by sizeable roots.

While the slots and tinajitas on the Kansas sandstones are similar to those at WIPP-33, the sandstone surfaces differ. Rather than the irregular-shaped pits and nodules seen at WIPP-33, Frye and Swineford (1947) describe parallel V-shaped grooves up to 3 inches wide, which they interpret as incipient slots. Tinajitas in Kansas typically have fluted margins, with grooves radiating outward. On a larger scale, the Kansas sandstone surfaces are undulating and solution-rounded.

All these features which distinguish the Kansas sandstone surfaces from the WIPP-33 trench exposure were observed by Frye and Swineford on extensive outcrops, and seem to be the product of surface runoff. The solution pits and nodules in the WIPP-33 sandstone appear to be the result of water held in place by saturated overlying sediments. The differing small-scale surface features probably reflect the differences between solution processes acting on exposed and buried sandstone surfaces.

The WIPP-33 sandstone appears to be Gatuna Formation, although the Gatuna is reported to be absent at the WIPP-33 drill hole (Basic Data Report for WIPP-33, 1981, Table 2, p. 10). The sandstone in the WIPP-33 trench is more massive, less silty, and lighter in color than any strata observed in





the exposures of Dewey Lake Redbeds at Livingston Ridge; and it is completely devoid of the bluish gray reduction spots so characteristic of the Dewey Lake Redbeds. The Gatuna Formation, with its soluble carbonate cement and solution-enlarged joints and holes, is not a reliable barrier to the infiltration of rainwater.

The Gatuna Formation represents alluvial fill material deposited in stream channels and sinks during an unusually wet mid-Pleistocene climate (Bachman, 1976, p. 141). The Gatuna Formation is typically present in the general vicinity of WIPP-33 (Borns et al., 1983, Figure 2-30, p. 49). Thus, an anomalously thick occurrence of the Gatuna Formation would be expected in the WIPP-33 drill hole if the depression had existed during Gatuna deposition. The reported absence of the Gatuna at the drill hole, together with its presence beneath the collapsed caliche on the upper slopes of the depression, defines the age of the WIPP-33 collapse sink as younger than the Gatuna Formation and the Mescalero caliche.

27

Adjacent Structural Depressions

As previously stated, investigation of caliche structure in the vicinity of the WIPP-33 sink hole included 347 hand augered holes, in a grid pattern encompassing all four topographic depressions (Figure 5). Not just WIPP-33, but

the other three depressions as well, were found to be underlain by structural depressions in the caliche surface.

The second depression (Figures 10 and 20) was found to contain 285 inches (23.75 feet) or more of alluvial fill, beneath which the caliche is probably absent. Shallow pans of desiccated clay are common at the land surface, indicating occasional flooding of the depression by discharge from the arroyo which drains into it. In contrast to the light pinkish brown windblown sand which blankets most of the WIPP site, much of the fill material is brown. This is indicative of clay content, which would have to be due to alluvial action. Much of the sand may be eolian, but not the clay.

In cross-section, the second depression resembles a dipper, with a long hillslope thinly covered with windblown sand emptying into a deep bowl containing a thick fill of alluvial deposits. This relationship is most striking in Figures 21 and 22. At the crest of the caliche-capped hillslope are dune sands 56 to 91 inches thick. The hillslope is 350 to 400 feet long, with cover sands of only 2.5 to 16 inches, averaging 9.5 inches thick. The caliche then drops abruptly, dipping 18.5°, into a deep depression filled with 285 inches or more of alluvial deposits. Similar relationships can be seen in all the other cross-sections of the second depression (Figures 23-26), although more sand is present on the western slopes (up to 78.5 inches, averaging 49 inches).





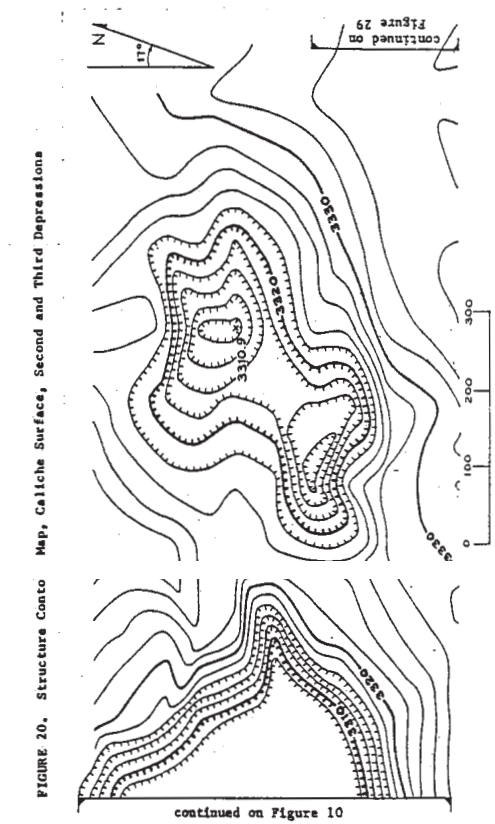



FIGURE 20. Structure Contour Map, Caliche Surface, Second and Third Depressions

FIGURE 21. Geomorphic Cross-Section, Second Depression, 150 Feet East of Pipeline Route

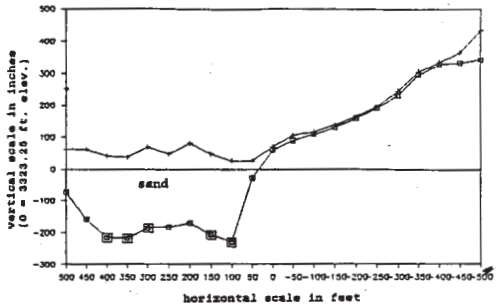



FIGURE 22. Geomorphic Cross-Section, Second Depression, 200 Feet East of Pipeline Route

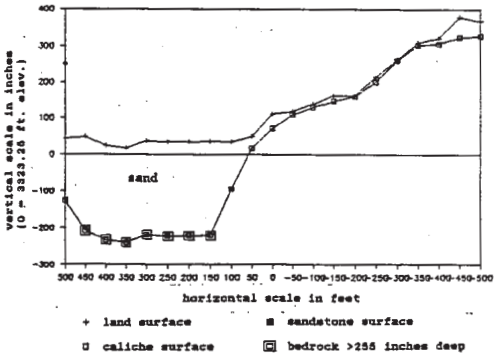







FIGURE 23. Geomorphic Cross-Section, Second Depression, 200 Feet North of Trunk Line

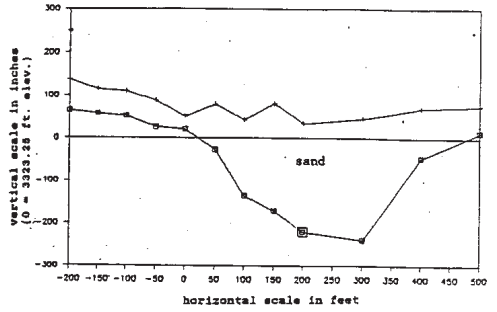



FIGURE 24. Geomorphic Cross-Section, Second Depression, 250 Feet North of Trunk Line

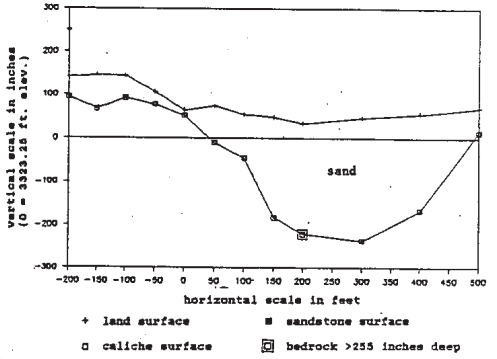


FIGURE 25. Geomorphic Cross-Section, Second Depression, 300 Feet North of Trunk Line

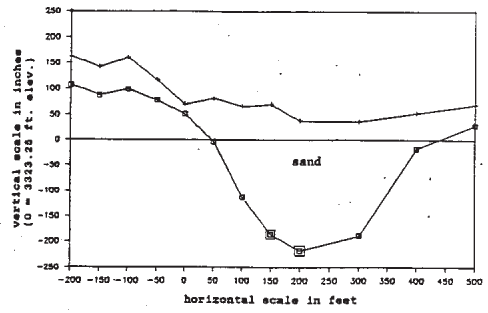
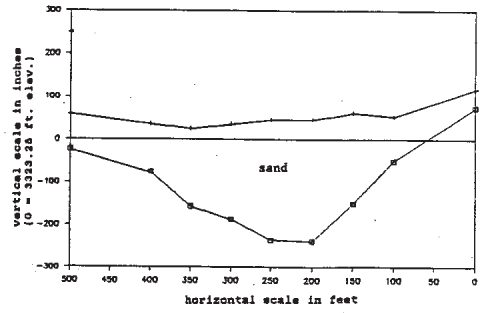



FIGURE 26. Geomorphic Cross-Section, Second Depression, 300 Feet East of Pipeline Route








Clearly the second depression is not attributable to the wind. All flanks of the second depression exhibit steep dips in the caliche surface, as much as 18.5° on the south flank, 13° on the west, 8° on the north, and 9° on the east (Figures 10 and 20). The absence of caliche underneath the floor of the second depression enables it to swallow much of the water carried by the WIPP-33 arroyo. The second depression is probably an alluvial doline, formed by subsidence or collapse of sandstone and caliche into voids in the Rustler Formation left by the same karst processes which created the cavities at the WIPP-33 drill hole less than 150 feet away.

Auger data reveals that the lowest topographic point in the sand-floored third depression coincides with the lowest point in an underlying structural depression in the caliche. The structural depression is at least 150 feet long, 100 feet wide, and 5 feet deep (Figure 20). The caliche surface attains dips greater than 12° on the northern flank, 8° on the south, and 4.5° on the east and west. Its lowest depths were probed by only two auger holes. They both bottomed in caliche, but it is possible that the caliche is discontinuous underneath this depression.

The east-west cross-section through the third depression (Figure 27) shows that the underlying caliche surface almost exactly parallels the land surface. The cover sands are not significantly deeper on the floor of the depression

FIGURE 27. Geomorphic Cross-Section, Third Depression, 300 Feet North of Trunk Line

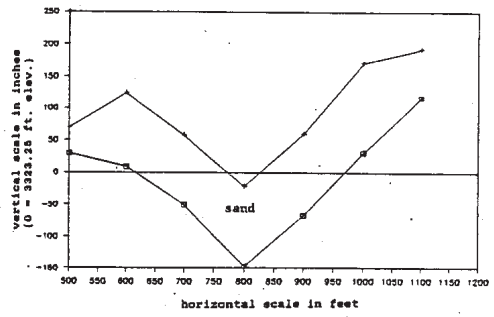
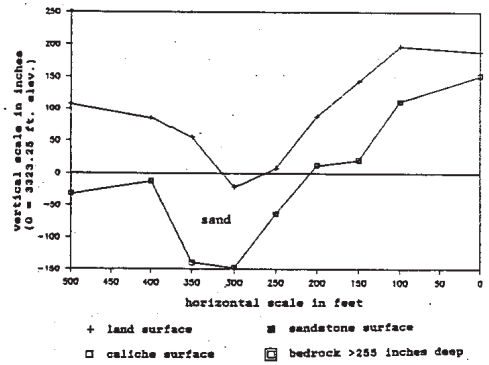



FIGURE 28. Geomorphic Cross-Section, Third Depression, 800 Feet East of Pipeline Route








than on its flanks. In the central five auger holes shown in Figure 27, the thickness of surface sands varies only from 108 to 139.5 inches, averaging 123 inches.

The third depression differs from the others in that its floor is windblown sand with little desiccated clay; its surface relief is deep, closely paralleling the underlying caliche structure, rather than being shallow and simply coinciding spatially with the underlying caliche structure; there is no disappearing arroyo, although non-incised ephemeral watercourses are present on its slopes; and it is only partly filled in with alluvial sediments.

But the depth and steepness of the underlying caliche surface preclude a windblown origin for the third depression. It is more likely an alluvial doline in a less advanced stage of development than the other three depressions. Over time, surface runoff will carry sandy sediments down the steep slopes and deposit them as alluvial fill in the bottom of the depression. The cover sands will become thinner on the slopes, and thicker in the bottom. These processes are incipient today, as shown by poorly defined watercourses on the slopes and a weak pan of desiccated clay on the floor of the third depression.

If the caliche is not already discontinuous beneath the floor of the third depression, the caliche is likely to become breached over time. The third depression is 7 feet deep at the land surface, and 11 feet deep in the caliche

surface. The depression collects surface runoff, which percolates through 10.5 feet of cover sands, and either (1) passes through holes in the caliche to the Dewey Lake Redbeds; or (2) becomes trapped in the low point of the structural depression, where it may initiate dissolution of caliche.

The second possibility explains why, even if a depression in caliche is attributable to undulations in the ancient land surface in which the caliche developed, the depression may eventually act as a sink hole. Solution by groundwater can create voids in deep evaporites and cause subsidence or collapse of overlying strata; or solution by rainwater can proceed downward through buried caliche profiles. It can happen either way; both are karst processes.

The fourth depression was found to contain up to 248 inches of alluvial fill. The many distributary watercourses of the recently formed arroyo drain into shallow pans of desiccated clay in the floor of this depression. The underlying caliche surface consists of two merged structural depressions, 8 and 12 feet deep, with flanks dipping as steeply as 9° (Figure 29).

The structure of the fourth depression is best shown in cross-section along the trunk line, for it can be directly compared with the WIPP-33 depression (Figure 30). The two depressions bear a startling resemblance to each other, with almost identical shape, width and depth. Both have





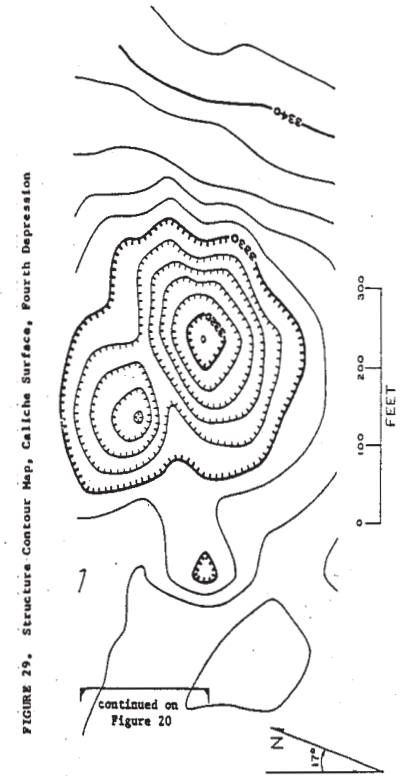
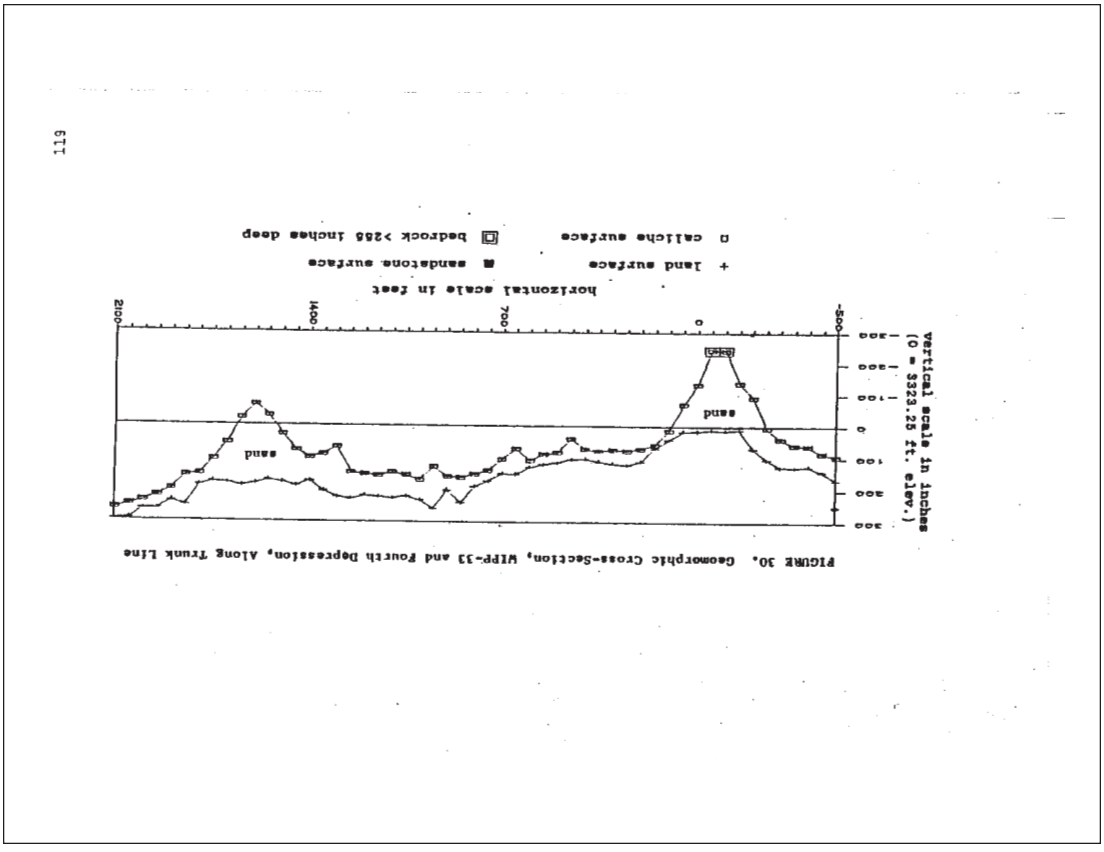



FIGURE 29. Structure Contour Map, Caliche Surface, Fourth Depression

Comment C-163A, Page 141 of 338




Comment C-163A, Page 142 of 338

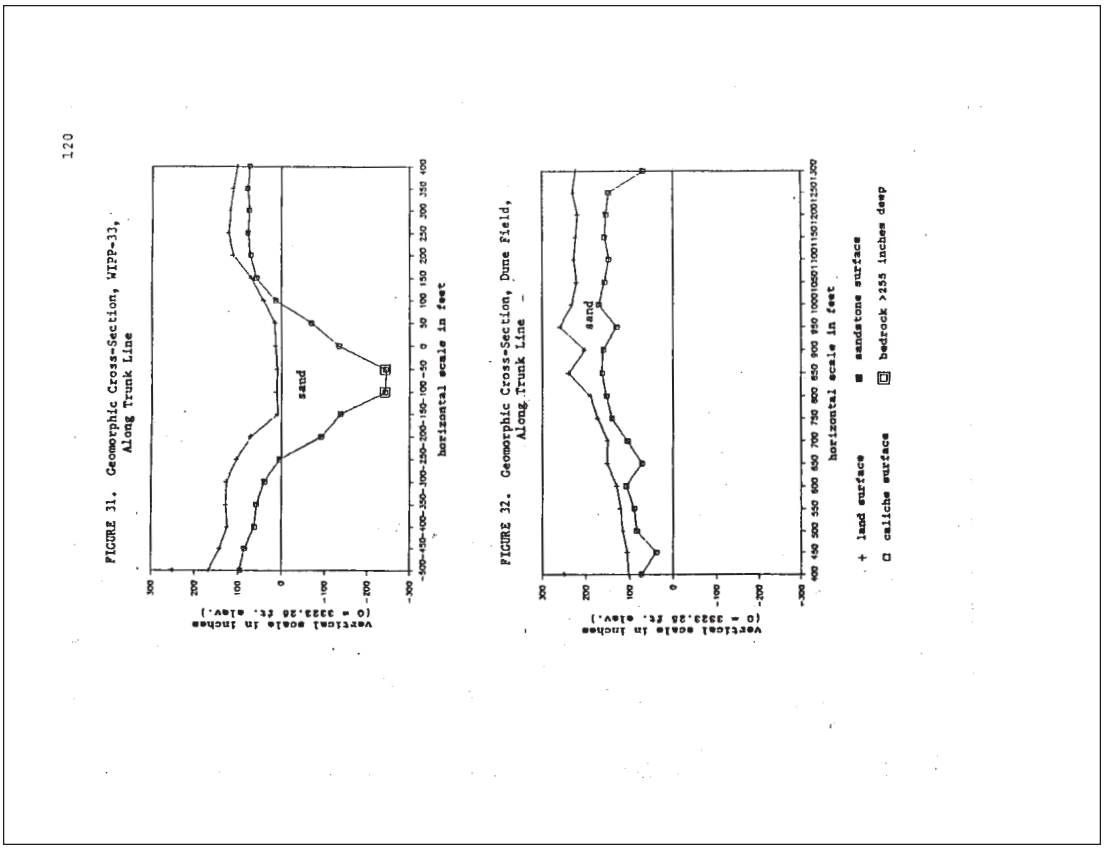
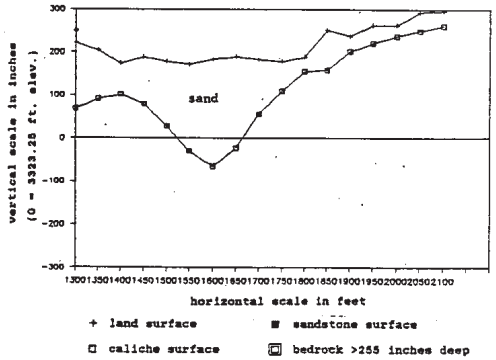


FIGURE 33. Geomorphic Cross-Section, Fourth Depression, Along Trunk Line








relatively flat floors, with shallow basins covered with alluvial deposits, organic debris and desiccated clay. Both now have well-defined arroyos disappearing into them; and the development of an arroyo emptying into the fourth depression is a recent occurrence, indicating active karstification.

The lowest depths of the fourth depression were probed by five auger holes; they all bottomed in caliche, but again, it is possible that the caliche surface is discontinuous underneath the fourth depression. There is no reason to doubt that the fourth depression is an alluvial doline. Although there is no evidence of collapse at the land surface, it is similar in almost every other way to the WIPP-33 depression.

## Summary

28

Active karst features in the Mescalero caliche exist at WIPP-33, and at three other closed topographic depressions farther east from Livingston Ridge and Nash Draw. Surface and subsurface collapse of caliche are evident at WIPP-33; thick alluvial fill is present at three depressions; and steeply dipping caliche is evident at all four depressions. The sink holes tend to line up, which may indicate locations of subterranean cavernous watercourses, leading directly westward toward known karst caverns previously identified in

Rustler dolomite and gypsum at the WIPP-33 drill hole. Solution pans or tinajitas, and solution grooves or slots, 28 are found in carbonate-cemented Gatuna sandstone at WIPP-33. Vanishing arroyos are still forming at present, which suggests that karst processes are active, and that the area is becoming progressively more karstic.

In Chapter 5, surface drainage on the Mescalero Plain 29 is found to be similar to Nash Draw, with lack of surface runoff, highly transmissive cover sands, and prevalence of sink holes with unusually thick vegetation. A broad karst valley at the WIPP site was trenched, and numerous solution 29 pipes in Mescalero caliche were exposed. Stratigraphic evidence demonstrates that the soft powdery caliche in the solution pipes is dissolution residue. Chapter 5 emphasizes the role of solution pipes in allowing infiltrating rainwater to reach the Dewey Lake Redbeds.





CHAPTER V

A KARST VALLEY

Introduction

Within the dune and swale topography of the Mescalero Plain are a number of closed topographic depressions, thousands of feet long and hundreds of feet wide. They seem too large to be of windblown origin, yet they display no evidence of surface collapse. The depressions are somewhat linear in shape and generally east-west in orientation, which suggests that they may result from dolines aligned along structural lineaments leading westward into Nash Draw. One of the largest and most linear of these depressions, informally called the section 36 depression (Figure 4), is located within the WIPP site. The subsurface morphology of this depression was investigated by augering and trenching, to address the suspicion of this depression being a karst valley, formed by the merging of smaller dolines.

In this chapter, the surface drainage and vegetation patterns of the Mescalero Plain are discussed, with particular emphasis on the section 36 depression. The subsurface stratigraphy of Dewey Lake Redbeds and Mescalero caliche beneath the depression is described, based on auger data and trench exposures. Numerous solution pipes are described;

their probable origins are discussed; and their role in assessing rainwater recharge is assessed.

Surface Drainage on the Mescalero Plain

Surface drainage is almost undeveloped east of the Pecos River, including the Mescalero Plain and the WIPP site. The land surface is very hummocky; what little surface runoff takes place generally collects in pools in the numerous small topographic depressions between sand dunes, where it evaporates, is transpired, or sinks into the sand (Mercer, 1983, p. 75; Powers et al., 1978, p. 6-5).

The almost total lack of surface runoff at the WIPP site is characteristic of a semi-arid karstland (Barrows, 1982, p. 9). Rarely are surface water courses completely absent in desert country on impermeable rocks (Jennings, 1971, p. 64). The lack of surface runoff is not due to inadequate precipitation (Barrows, 1982, p. 9); rainfall in Nash Draw averaged 14.21 in/yr between 1955 and 1982. But the development of surface water courses is limited by the high infiltration rates in the pervious sands which cover the region. They are probably similar to the 1.6 in/hr intake rate of Harkey Sand Loam (75% sand) near Carlsbad (Powers et al., 1978, pp. 1-24, 6-7, citing Blaney and Hanson, 1965).

30 | Stereoscopic viewing of WIPP site air photos (Mann,





1983) reveals a long westward-trending swale which begins directly south of the WIPP site, 4 miles east of Livingston Ridge. Here the swale is 2,000 feet wide; it reaches its maximum width of 7,500 feet at Livingston Ridge, where ephemeral drainage courses have deeply incised the caliche outcrops.

30 The swale contains more than 30 shallow topographic depressions hundreds of feet in diameter. The depressions are sometimes partly filled with water. Their vegetation is thick, green and lush; similar vegetation can be found only along the few ephemeral water courses which have eroded into Livingston Ridge, and in dendritic vegetation patterns leading into these depressions and water courses. The thickly vegetated depressions appear to be sink holes, and the dendritic vegetation patterns probably reflect shallow subsurface drainage courses. Similar disrupted drainage patterns and thickly vegetated depressions are found in Nash Draw.

Surface Morphology of Section 36 Depression

Similar but smaller swales interrupt the shrub-coppice and parabolic dune fields on the Mescalero Plain. Some of the swales lead westward toward the deep fluvial incisions in Livingston Ridge. East of Nash Draw and Livingston Ridge, the deepest surface depression (known informally as the section 36 depression) is located in the N/2 N/2 sec 36,

T 22 S, R 30 E, and in three adjacent sections (SE/2 SE/4 SW/4 sec 25, T 22 S, R 30 E, and S/2 SW/4 sec 30 and N/2 N/2 NW/4 sec 31, T 22 S, R 31 E), all in the southwestern part of the WIPP site (Figures 4 and 34).

The depression is depicted as at least 10 feet deep on the USGS topographic map (Nash Draw 15 minute quadrangle, photorevised 1965). The air photos show that the depression extends as far as 2.6 miles east of Livingston Ridge. The depression is nearly one mile long, as shown by the geomorphic map based on air photos (Figure 34). At its eastern end, the depression is a broad swale about 900 feet wide, trending east-west, and bounded by dune ridges which are especially conspicuous on its southern flank (Figure 35). The depression begins to trend southwestward at the township line (Figure 36), gradually narrowing to a distinct eastwest linear trend only 200 feet wide, with a beaten cow path along the middle. It is bounded on both flanks and on its western end by high sand dunes (Figure 37).

Within the depression, vegetation is much denser and lusher than in the surrounding landscape, which indicates that the depression acts as a catchment for available moisture. There is an abundance of mesquite, especially where the depression narrows to 200 feet wide in the western 0.25 miles of its length. Here the groves of mesquite bushes are often so thick as to be nearly impenetrable.

Other smaller topographic depressions, which lead





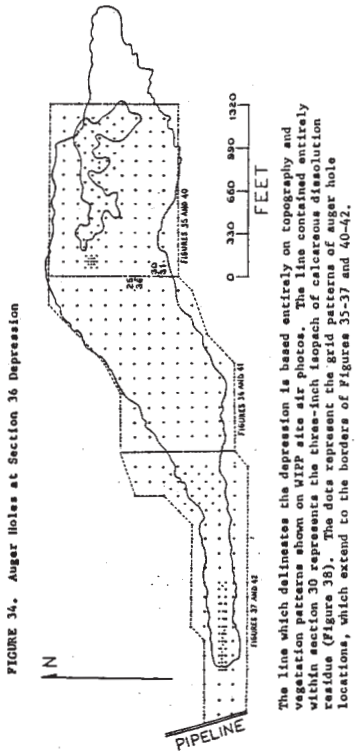



FIGURE 34. Auger Holes at Section 36 Depression

The line which delineates the depression is based entirely on topography and vegetation patterns shown on WIPP site air photos. The line contained entirely within section 30 represents the three-inch isopach of calcareous dissolution residue (Figure 38). The data represent the grid patterns of auger hole locations, which extend to the borders of Figures 35-37 and 40-42.

Comment C-163A, Page 152 of 338

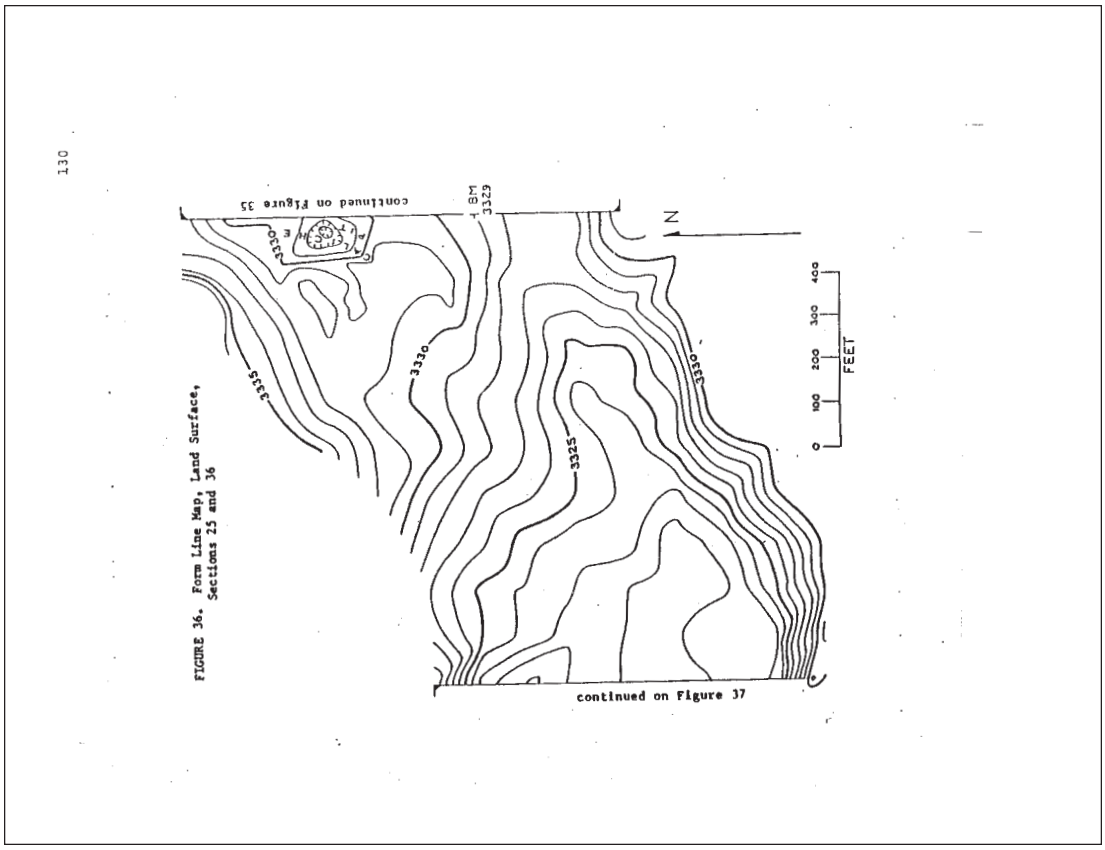



FIGURE 36. Form Line Map, Land Surface, Sections 25 and 36

Comment C-163A, Page 151 of 338

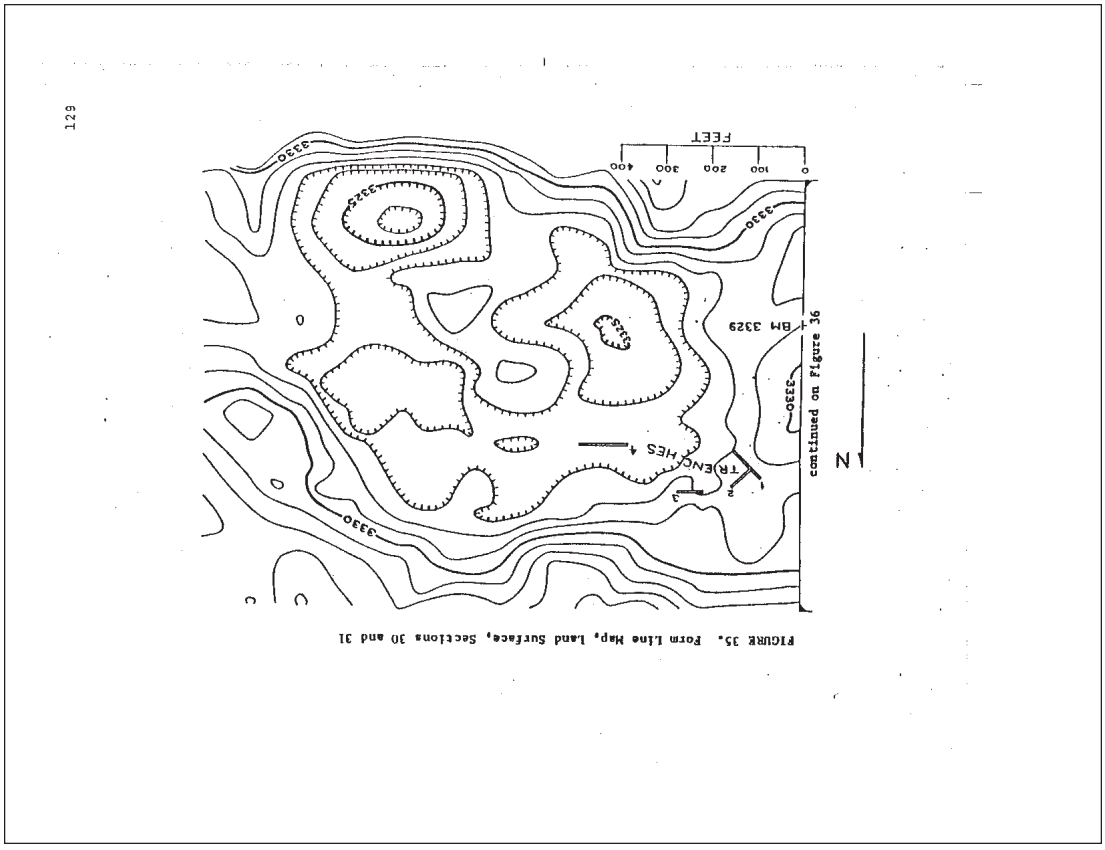
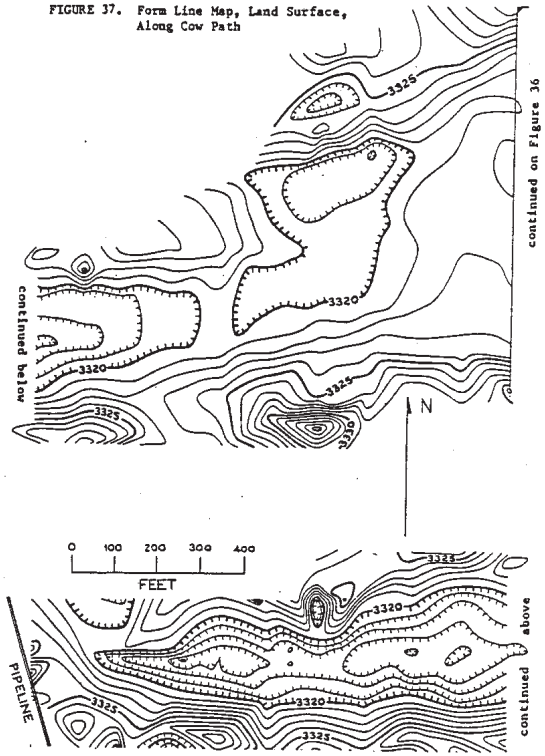



FIGURE 35. Form Line Map, Land Surface, Sections 30 and 31

FIGURE 37. Form Line Map, Land Surface, Along Cow Path








westward from and may be related to the section 36 depression, are depicted on the USGS topographic map (Nash Draw, 15 minute quadrangle, photorevised 1965). The air photos reveal ephemeral or near-surface drainage courses expressed at the land surface as vegetation in dendritic patterns. The courses lead directly from the depressions to the deepest fluvial incisions in Livingston Ridge.

Caliche Structure of Section 36 Depression

Subsurface investigation of the caliche structure underneath the section 36 depression began with an intensive augering program. Virtually the entire depression and its flanking dunes were covered by a grid of 453 hand augered holes, generally 110 feet apart, but with denser data coverage around the cow path and in other areas within which the caliche was sometimes found to be absent (Figure 34).

Within the depression, just inside the southeastern corner of sec 25, T 22 S, R 30 E, is a rectangular caliche pit, about 200 feet long, 100 feet wide, and 3 feet deep (Figure 36). The caliche pit was still active in November 1983, as revealed by the air photos. Although its cut banks are still apparent, and although it was never backfilled and recontoured, field observations showed that it was already colonized by vegetation as of September 1984.

Auger data reveal that the depths to caliche average

about 8 inches (ranging from 4 to 10 inches) at the edges of the caliche pit. The elevations of the land surface at the edges of the caliche pit average about 3330.3 feet, so the elevation of the caliche is about 3329.7 feet. In the bottom of the caliche pit, the depth to caliche is about 12 inches, and the elevation of the caliche is about 3326.2 feet. It may therefore be estimated that about 3.5 feet of caliche was removed from the pit.

Although caliche is nearly exposed at the rim of the caliche pit, auger data revealed that the caliche profile is absent altogether at a point just 110 feet to the east of the caliche pit, in section 30, (330 ft N and 110 ft E of NE corner, sec 36, T 22 S, R 30 E), in the broad eastern part of the section 36 depression. Here the sandstone and siltstone of the Dewey Lake Redbeds are only 75 inches deep, and are so unconsolidated as to be easily broken into small laminar fragments by the hand auger. Every fragment displayed the bluish gray reduction spots which are the most distinctive identifying characteristic of the Dewey Lake Redbeds. No calcareous horizon was encountered.

A tightly spaced grid of 16 auger holes, 22 to 30 feet apart, was centered on this point. In 12 holes, laminar caliche was reached abruptly, beneath absolutely no soft or powdery caliche, at depths ranging from 5 to 18 inches, averaging 11.8 inches. In three holes, cemented caliche was 18 to 43 inches deep, beneath 4 to 9 inches of soft powdery





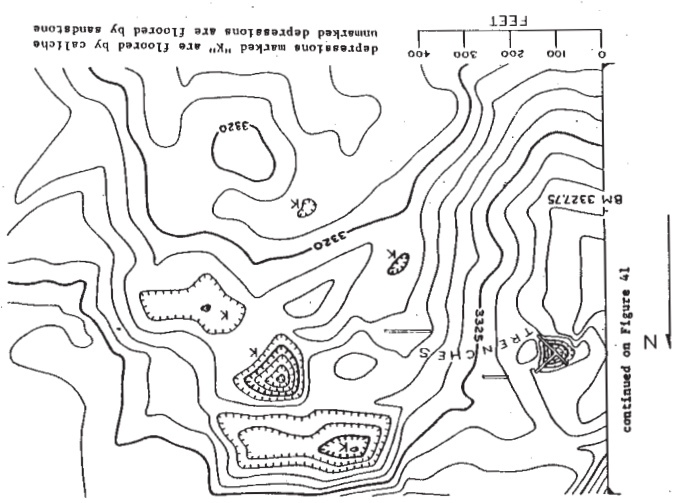
caliche.

Thirty feet southeast of the central hole, beside a mesquite bush, the Dewey Lake Redbeds were reached again, at a depth of 72 inches, beneath 10 inches of soft, powdery caliche. An extra auger hole was placed midway between this point and the central hole; here the caliche was only 12 inches deep, indicating that augering had encountered the Dewey Lake Redbeds within two very localized structures, probably no more than 15 feet in diameter.

Further augering in section 30 revealed that all holes which encountered 3 inches or more of soft, powdery caliche were located to the east of the caliche pit. The data coverage was doubled in this area, with extra auger holes located on diagonals 77 feet from the original holes (Figure 34). Auger data showed that soft, powdery caliche, up to 19.5 inches thick, averaging 7.2 inches thick in 19 auger holes, forms a sinuous course at least 990 feet long, trending westward, leading directly toward the auger holes which reached the Dewey Lake Redbeds. The thickness of the soft, powdery caliche (Figure 38) shows a weak correlation with the depth of burial of the caliche surface (Figure 39).

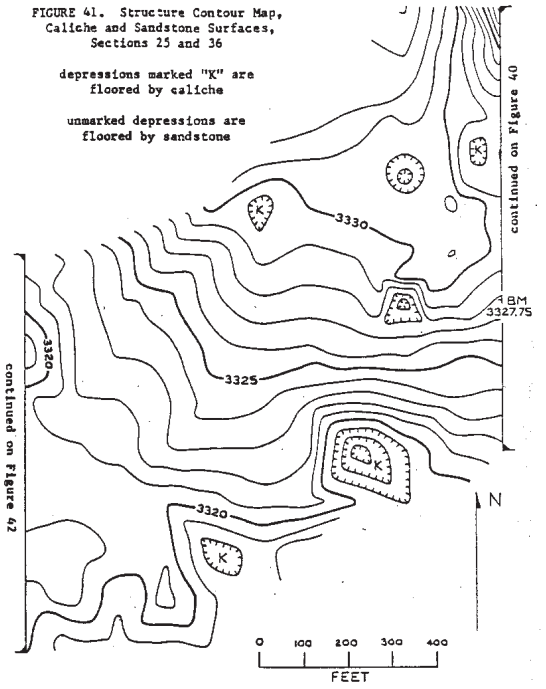
Altogether, 10 of the 453 auger holes reached the Dewey Lake Redbeds, always underneath a topographic low, and never underneath the dune crests (Figures 40-42). The overlying sediments sometimes included caliche pebbles and cobbles, or soft, powdery caliche, which was usually, but not always,

Comment C-163A, Page 158 of 338


136
depressions marked "K" are floored by caliche
unmarked depressions are floored by sandstone
FEET
0 100 200 300 400
3320
3320
BM 3327.75
K
K
K

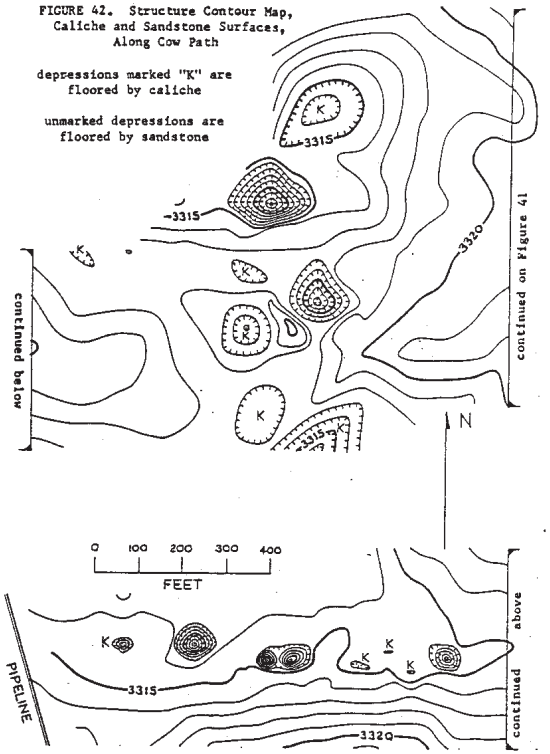
Comment C-163A, Page 159 of 338






Comment C-163A, Page 160 of 338





overlain by Berino soil. In other places, the Dewey Lake Redbeds were overlain by nothing but loose red sand.

None of the ten auger holes which reached the Dewey Lake Redbeds were contiguous to each other, which indicates localized structures. Auger holes in the cow path were spaced closely enough that four deep localized structural depressions were shown to each be less than 55 feet in diameter, with flanks dipping at least as steeply as 8.4°, 17.2°, 20.3° and 13.0°; depths to the Dewey Lake Redbeds were 78, 103, 113 and 137 inches, respectively (Figure 42).

Also, at least ten caliche-floored structural depressions were encountered (Figures 40-42). The largest, in section 30, is about 350 feet by 150 feet, trending east-west, is 3 feet deep and completely obscured by 5 feet of sand dunes; its floor is 170.5 inches below the land surface. Another, also in section 30, is 5 feet deep, with a floor 135 inches below the land surface, and flanks dipping more steeply than 5.7°.

Solution Pipes in Mescalero Caliche

Underneath the section 36 depression, trenches were excavated so as to investigate the morphology, size, and frequency of occurrence of the localized breaches in the the caliche surface; the degree of preservation of the caliche hardpan; the nature and distribution of the soft,





powdery caliche; and the permeability of the top of the Dewey Lake Redbeds. It was decided to locate trenches in the S/2 SW/4 section 30 (Figure 35), east of the caliche pit, where depths to the Dewey Lake Redbeds are relatively shallow, where two holes in the caliche had been identified, and where soft, powdery caliche is a common occurrence.

Trench 1 (Figures 35 and 40) was 90 feet long, connecting the two points where auger holes reached the Dewey Lake Redbeds, and extending 30 feet in either direction. For 20 feet on the northwestern end, the caliche hardpan is relatively intact, but the gray laminar zone above it is broken into plates. Effective permeability is along channels such as fractures and root zones.

Reeves (1/11/86, personal communication) observed no evidence of any secondary quartz precipitation in the caliche hardpan at this location. He concludes that the caliche profile is not sealed, and that any quartz affected by dissolution is moving through the caliche profile.

The caliche hardpan then dips as steeply as 20.8° to where it ends abruptly at a joint 8 inches wide, probably enlarged by solution (Plate 6). At the other side of the joint is a linear caliche outlier, 3 to 6 inches wide. Beyond this the Dewey Lake Redbeds are exposed for a distance of 10 to 14 feet in the walls of the trench, at depths as shallow as 30 inches.

This feature is a solution pipe, floored by Dewey Lake

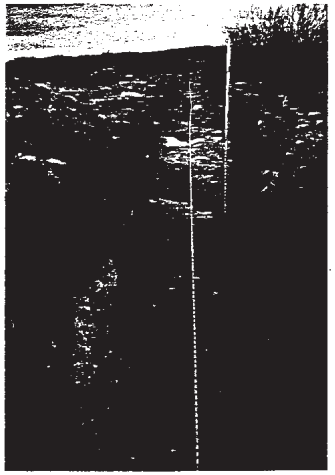


PLATE 6. A large solution pipe in Mescalero caliche, 14 feet across, 75 inches deep, floored by Dewey Lake Redbeds, in section 30. In the background, the gray laminar caliche zone is fractured but otherwise intact. The caliche hardpan then dips 21°, ending abruptly at a solution-enlarged joint 8 inches wide, flanked by a caliche outlier 3 to 6 inches wide. In the foreground, the only visible carbonate is an exposure of dissolution residue in the trench wall. (Photo by Richard Phillips)





Redbeds plunging downward as much as 45 inches. Its fill material is red sand with some clay content. Direct evidence of dissolution is preserved in the wall of the trench, where a remnant of the caliche profile, 2 feet thick and 2 to 3 feet long, rests directly on Dewey Lake Redbeds. Here the caliche has been reduced to soft pinkish sand due to solution and removal of much of its carbonate content (Plate 7). Small fragments of sandstone and siltstone are embedded in the calcareous material.

The soft caliche exposure has been bisected by a taproot, probably mesquite or yucca. The taproot is now gone, and its path has been filled with red sand. There appears to be a genetic relationship between taproot channels (or kangaroo rat burrows) and solution pipes, although which came first is often a matter of conjecture (Hawley, 1/2/86, personal communication).

Although this feature is a solution pipe in caliche, it would seem that deep-seated solution processes in the Rustler Formation must have been causative factors in its origin. The collapse of the Dewey Lake Formation at this location must have been due to solution processes beneath it, not above it. The caliche hardpan probably developed after the collapse of the Dewey Lake Redbeds, as suggested by: (1) the smooth yet steeply dipping laminar zone of caliche pebbles and powder, 3.5 to 12 inches thick, closely paralleling the plunge of the Dewey Lake Redbeds; and

PLATE 7. Close-up of calcareous dissolution residue, 2 feet thick and 2 to 3 feet long, resting directly on Dewey Lake Redbeds, section 30. The caliche has been reduced to soft pinkish sand due to solution and removal of much of its carbonate content. Small siltstone fragments are embedded in the calcareous material. The soft caliche exposure was bisected by a taproot, now gone; its path is filled with red sand with some clay content. (Photo by Richard Phillips)





(2) the engulfing of loose Dewey Lake fragments by Mescalero caliche.

This deep depression in the caliche surface probably reflects the contours of the ancient soil profile in which the caliche developed during semi-arid climatic regimes. In times of greater effective precipitation, percolating rainwater would travel along the laminar caliche and collect at the bottom of the depression, where dissolution of caliche took place. Eventually the caliche was breached; most of its carbonate content was leached downward into the Dewey Lake Redbeds, leaving only soft pinkish sand as a remnant of the caliche profile. This dissolution residue was easily penetrated by the taproot.

Solution pipes are typical of buried caliche profiles in New Mexico and west Texas, especially in depressions where rainwater collects and dissolves the carbonate. Solution pipes sometimes bottom out in caliche, and sometimes pass right through the caliche. It seems likely that on an undulating caliche surface, solution processes may be concentrated at depressions. It is possible that solution activity in depressions and caliche development on higher surfaces may both be active at the same time in adjacent locations.

Elsewhere in the first trench the following features were observed: (1) another solution pipe, previously located by augering, 3 to 9 feet in length, floored by Dewey

Lake Redbeds at a depth of 72 inches, and penetrated by numerous mesquite roots; the caliche flanks slope precipitously, and are overlain by 7 to 9 inches of caliche pebbles and powder (Plate 8); (2) two depressions floored by caliche at depths of 49 and 52 inches, averaging 5 feet and 3.25 feet in length, respectively; here the visual impression is that the more symmetrical shapes belong not to the depressions but to the remnants of the caliche hardpan (Plate 9); and (3) an incipient funnel-shaped depression in the gray, indurated laminar zone, 7 inches deep, ranging from 12 to 18 inches in diameter.

Trench 2 (Figures 35 and 40), 60 feet long, began at the largest of the four solution pipes, and ran perpendicular to Trench 1. Trench 2 passed through the caliche-floored depression, 43 inches deep, previously identified by augering. The depression is almost perfectly round, at least 4.25 feet in diameter, and its flanks are nearly vertical. A mesquite bush thrives at this location, and some of its roots penetrate the caliche (Plate 10). Such features are known as "flower-pot structures," where infiltrating rainwater runs along the petrocalcic (plugged) horizon and collects in the bottom of the solution pipe (Hawley, 1/2/96, personal communication).

Other features observed in the Trench 2 are described as follows: (1) six small holes in the caliche, from 12 to 24 inches long, with slopes ranging from gentle to

PLATE 8. A solution pipe in Mescalero caliche, 3 to 9 feet long, 72 inches deep, penetrated by numerous mesquite roots, floored by Dewey Lake Redbeds, in section 30. The caliche flanks dip precipitously, and are overlain by 7 to 9 inches of caliche pebbles and powder. (Photo by Robert Aly)

PLATE 9. Two depressions floored by Mescalero caliche, 49 and 52 inches deep, averaging 5 feet and 3.25 feet in length, respectively, in section 30. The hardpan is mostly gone, leaving widely separated caliche remnants exposed in the trench. (Photo by Robert Aly)





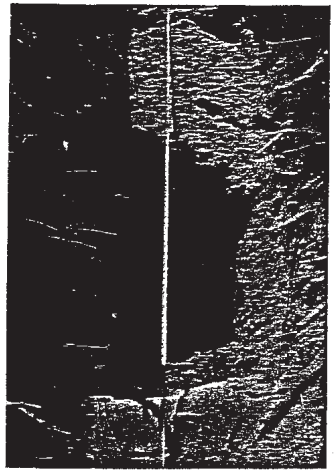


PLATE 10. A "flower-pot structure" floored by Mescalero caliche, 43 inches deep, almost perfectly round, at least 4.25 feet in diameter, in section 30. Its flanks are nearly vertical; infiltrating rainwater runs along the plugged horizon and collects in the bottom of the flower-pot structure. A mesquite bush thrives at this location, and some of its roots penetrate the caliche. (Photo by Robert Aly)

precipitous, often penetrated by roots (Plate 11); and (2) a 32-inch-long incipient depression in the gray laminar horizon.

Trench 3 (Figures 35 and 40), 55 feet long, connected two auger holes which encountered hard caliche beneath 4 to 5 inches of soft, powdery caliche. In the western 33 feet of the Trench 3, the undulating caliche surface is 21 to 34 inches below the land surface, deep enough to have allowed solution activity to leach much of its carbonate. What is left of the caliche is more pink than white, and pock-marked with solution pits 0.25 to 2 inches long, from which the carbonate is essentially gone (Plate 12).

This leached caliche hardpan ends at a solution pipe 9 to 10 feet in diameter; the caliche flanks of the solution pipe are nearly vertical, and are overlain by 8.5 to 9 inches of soft, powdery caliche which terminates as abruptly as the hardpan. There is no evidence of any calcareous material within this solution pipe (Plate 13). It bottoms in Dewey Lake Redbeds, at a depth of 130 inches below the land surface, as determined by hand augering.

Trench 4 (Figures 35 and 40), 110 feet long, connected two auger holes which had encountered hard caliche beneath 6 to 8 inches of soft, powdery caliche. Almost the entire trench was floored by relatively flat caliche, 55 to 65 inches below the land surface. However, the caliche dropped off at the western end of the trench, which was then





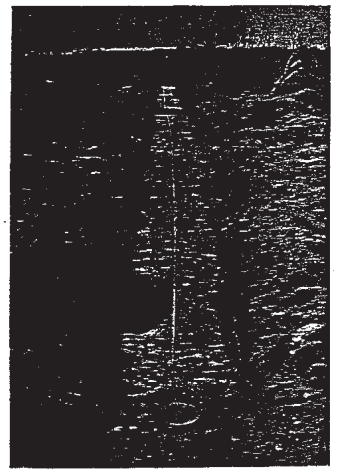


PLATE 11. A trench exposure 60 feet long, in section 30, featuring six small holes in Mescalero caliche, 12 to 14 inches long, with flanks ranging from gentle to precipitous, often penetrated by roots. A smooth, continuous, impervious caliche surface cannot be expected in buried caliche profiles; the effect is more like holes in Swiss cheese. (Photo by Robert Aly)

PLATE 12. Close-up of Mescalero caliche surface, 24 inches deep, in section 30. Solution activity has leached much of the carbonate, leaving pink solution pits 0.25 to 2 inches long, from which the carbonate is essentially gone. (Photo by Robert Aly)

PLATE 13. A large solution pipe in Mescalero caliche, 9 to 10 feet in diameter, 130 inches deep, floored by Dewey Lake Redbeds, in section 30. The caliche flanks dip at angles ranging from 36° to nearly vertical. Powdery caliche terminates as abruptly as the hardpan. There is no calcareous material within this solution pipe; solution processes are complete. (Photo by Robert Aly)

extended so as to fully excavate this feature.

Within this solution pipe, the south wall of the trench displays an exposure of soft, powdery caliche, 36 inches thick and 31 inches long, almost completely devoid of siliceous or calcareous nodules (Plate 14). The solution pipe is at least 12.75 feet in diameter, and its caliche flanks dip as steeply as 52°.

Dewey Lake Redbeds were reached with a hand auger at 110 inches below the land surface, and were easily broken up by the auger for another 10 inches; the auger hole could have gone still deeper. The Dewey Lake Redbeds were exposed along 4 feet of the trench floor on the western flank of the solution pipe; directly beneath the exposure of soft, powdery caliche (Plate 14). Here the Dewey Lake Redbeds consist of sandstone and siltstone fragments engulfed by soft caliche; water soaks in rapidly when poured on this exposure.

Within these four trenches, the spatial extent of the areas without caliche, and of the solution pipes floored by caliche, were carefully measured and compared to the total area exposed in the trenches. It is estimated that 15.3% of the caliche is missing, and that an additional 4.5% of the total area of the trenches contains solution pipes floored by caliche, as shown in the following table:

PLATE 14. A large solution pipe in Mescalero caliche, at least 12.75 feet in diameter, 110 inches deep, floored by Dewey Lake Redbeds, in section 30. Where the caliche hardpan drops off, siltstone fragments of the Dewey Lake Redbeds are exposed in the trench floor; water soaks in rapidly when poured on this exposure. The Dewey Lake Redbeds are overlain by an exposure of soft, powdery calcareous dissolution residue, 36 inches thick and 31 inches long. (Photo by Robert Aly)

Table 2. Spatial Extent of Solution Pipes, Section 30

| trench | feature(s) | floor | area ($in^2$) | depth (in.) |
|---|---|---|---|---|
| one | solution pipe * | sandstone | 3,380 | 75 |
| one | solution pipe | sandstone | 1,960 | 72 |
| one | solution pipe | caliche | 1,700 | 49 |
| one | solution pipe | caliche | 1,450 | 52 |
| two | solution pipe * | sandstone | 2,930 | 75 |
| two | six small holes | sandstone | 610 | 6.5-32 |
| two | flower-pot structure | caliche | 1,060 | 43 |
| three | solution pipe | sandstone | 2,320 | 130 |
| three | two small holes | sandstone | 340 | 13, 30 |
| four | solution pipe | sandstone | 3,670 | 110 |
| | * same feature | | | |

| trench | area ($in^2$) | sandstone ($in^2$) | sandstone (%) | caliche ($in^2$) | caliche (%) |
|---|---|---|---|---|---|
| one | 26,700 | 5,340 | 20.0 | 3,150 | 11.8 |
| two | 18,700 | 3,540 | 18.9 | 1,060 | 5.7 |
| three | 16,300 | 2,660 | 16.2 | 0 | 0.0 |
| four | 31,700 | 3,670 | 11.6 | 0 | 0.0 |
| total | 93,400 | 15,210 | 15.3 | 4,210 | 4.5 |

Hydrologic Implications of Solution Pipes

31 All told, fifteen solution pipes, ranging in diameter from 1 to 14 feet or more, were discovered in section 30, in trenches with a total combined length of 325 feet. This size range of solution pipes was reported by Hawley (1/2/86, personal communication) to be representative of buried caliche profiles. A smooth, continuous caliche surface cannot be expected; the effect is more like holes in Swiss





31 cheese. The frequency of occurrence of these small-scale solution pipes renders the Mescalero caliche an ineffective barrier to the infiltration of rainwater.

32 In the larger solution pipes, where the Dewey Lake Redbeds have collapsed and the caliche hardpan dips steeply, the solution pipes exposed in section 30 may be due to dissolution of underlying evaporites in the Rustler Formation. But the smaller solution pipes are very localized occurrences due to near-surface dissolution processes in Mescalero caliche. That is not to say that the solution pipes are at all unusual; they are typical of buried caliche profiles, to be expected where larger-scale solution-subsidence dolines have not formed. Solution pipes represent the typical mechanism whereby rainwater is able to easily penetrate the otherwise relatively impervious

32 caliche. Some of the water then finds its way through joints and feeder channels in the Dewey Lake Redbeds to solution cavities in the Rustler Formation, as will be substantiated in Chapter 10.

33 There is little doubt that the soft, powdery caliche encountered in the solution pipes is calcareous dissolution residue, rather than a laminar caliche horizon in the incipient stages of development. In the four large solution pipes which are floored by Dewey Lake Redbeds, the caliche flanks are overlain by 3.5 to 12 inches (commonly 6 to 9 inches) of soft, powdery caliche, sometimes containing

caliche pebbles. The layer of soft caliche always slopes as steeply and terminates as abruptly as the laminar caliche beneath it. If any calcareous material remains within the solution pipes, even if it is 2 to 3 feet thick, it has been reduced to soft, pinkish, powdery sand due to solution and removal of much of its carbonate content.

If the soft, powdery caliche were of depositional rather than solutional origin, it would have to be an incipient laminar horizon above a plugged petrocalcic horizon. Where the caliche hardpan does not exist, the depth of an incipient caliche horizon would be commensurate with the deepest level of rainwater infiltration. Instead, where the caliche hardpan is discontinuous, the soft caliche layer is totally disrupted. In some solution pipes the original thickness of the caliche profile is preserved as a partially leached zone; in others the dissolution process is complete, and the carbonate has been removed altogether.

Probably there are so many solution pipes in this area because the caliche surface was undulating to begin with, thus allowing rainwater to accumulate in hollows in the caliche surface and to initiate dissolution of carbonate. The combined effect of so many solution pipes so close together creates large swales in the landscape, dwarfing the shrub-coppice dunes and even the parabolic dunes. The swales and the sand dunes which surround them act as recharge areas for the swales. After heavy rainstorms,





water runs along the caliche surface until it disappears into the solution pipes underneath the swales. The solution pipes are so numerous as to render the Mescalero caliche ineffective as a barrier to rainwater infiltration.

34

The same dissolution processes are at work in Nash Draw. Strikingly similar solution pipes can be seen in the exposed banks of incised arroyos in Nash Draw. One, located along an arroyo bounded by a levee (SW/4 sec 34, T 22 S, R 30 E) near the Duval Potash Mine, is 30 feet in diameter. Its walls are steeply dipping and lined with travertine, and its fill is red sand with a complete absence of visible calcareous material. This solution pipe formed in what was once a buried caliche profile; it has since been exposed by erosion. There is no reason to distinguish between the dissolution processes in Nash Draw and east of Livingston Ridge. One is exposed karst, and the other is covered karst.

34

Summary

There is almost no surface runoff on the Mescalero Plain, due partly to highly pervious cover sands. Within the dune and swale topography are a number of long, wide, linear, thickly vegetated swales leading westward toward Nash Draw. The swales are underlain by numerous solution pipes, 1 to 14 feet in diameter, some bottoming in caliche,

some passing right through the caliche to the pervious Dewey Lake Redbeds. Strikingly similar solution pipes are exposed in Nash Draw. The solution pipes are due to near-surface dissolution processes, are typical of buried caliche profiles, and are to be expected where larger-scale solution-subsidence dolines have not formed. The frequent occurrence of solution pipes renders the Mescalero caliche an ineffective barrier to infiltration of rainwater.

In Chapter 6, a small doline (Barrows' Bathtub) will be described, and a comparison of the surface morphology and subsurface stratigraphy of a doline and a blowout will be made.





CHAPTER VI

SMALL TOPOGRAPHIC DEPRESSIONS

Introduction

35

There are literally thousands of small, closed topographic depressions scattered across the inner zones of the WIPP site. Many, but not all, are interdunal depressions or deflation basins (blowouts). Some are karstic; still others are due to mining of caliche by humans. Although surface morphology may yield valuable clues favoring one hypothesized origin over another, origins of these topographic depressions cannot be conclusively determined without subsurface exploration.

Topographic maps with a two-foot contour interval (Bechtel, 1978) have been constructed for the inner four square miles of the WIPP site, and the two deepest topographic depressions were selected for exploration of underlying caliche and sandstone structure. One is a doline, the other a blowout. A man-made caliche pit was examined for comparison. The results presented in this chapter provide a frame of reference for distinguishing, on the basis of surface and subsurface morphology, between eolian, karstic, and man-made depressions in a semi-arid landscape.

Eolian Topography

The great majority of sand dunes in North America are now anchored, or at least partially stabilized, by a surface cover of grass, brush or trees. By far the most common of the partially anchored dunes are shrub-coppice dunes, parabolic dunes, and blowouts (Melton, 1940, p. 135; McKee, 1979,, p. 11).

Dunes do not originate on grass-covered surfaces because of the stabilizing influence of the grass. But if the grass is killed, at least locally, due perhaps to overgrazing or increasing aridity, a shrub-coppice dune series may be the first topographic manifestation on a smooth surface of shallow sand (Melton, 1940, pp. 125-126).

There are heavy stands of mesquite, scrub oak, creosote bush and Mexican tea in the Pecos River Valley, probably due to disappearance of grass cover (Wendorf, 1961a, p. 17). Shrub-coppice dunes supported and stabilized by mesquite bush are present in vast numbers in southeastern New Mexico (Melton, 1940, p. 125).

The shrub-coppice dunes are advancing slowly toward the northeast, due to dry, persistent and effective southwestern winds. Mesquite bush grows vigorously on loose sand, and is not readily killed even if slowly buried by windblown sand trapped within the bush. As sand accumulates on the leeward side, the shrub-coppice dune is eroded and scoured on the





windward side, which kills the mesquite bush by exposing its roots. The mesquite bush advances onto the sand deposited on the leeward side, leaving a trail of dead mesquite wood. In this manner the shrub-coppice dune migrates with the wind, all the while keeping its protective growth of vegetation (Melton, 1940, p. 125, and Figure 15).

Persistent winds may scour away a deflation basin or hollow in the sand surface, thus exposing and killing the root systems of anchoring vegetation. Windblown sand may accumulate on the leeward margin, thus forming a crescent-shaped sand ridge known as a blowout dune, with the wings of the crescent opening toward the winds (Melton, 1940, pp. 126-127). If the basin and sand-rim migrate downwind, long trailing dunes are left on the stabilized flanks of the windblown hollow and a parabolic dune is formed, also known as an elongate blowout (Melton, 1940, p. 128; Cooke and Warren, 1973, p. 318).

The WIPP site air photos (Mann, 1983) reveal that partially stabilized shrub-coppice dunes are the prevailing dune form on the Mescalero Plain east of Livingston Ridge, especially in the immediate vicinity of the WIPP site. They occur as dune fields, and sometimes as clusters with bare sand exposed in the deflation basins on their upwind sides. The more elevated surfaces are almost always stabilized with mesquite, scrub oak, yucca, and other vegetation. Some of the dunes south of the WIPP site have noses of bare sand;

these tend to develop into parabolic dunes.

All these dune forms migrate with the wind, and are thus unrelated to the structure of the underlying bedrock and caliche. The dunes and deflation basins tend to obscure, rather than clarify, near-surface karst morphology on the Mescalero Plain.

## Barrows' Bathtub

The deepest topographic depression in the inner zones of the WIPP site is located near the southwest corner of sec 29, T 22 S, R 31 E, about 3.5 miles east of Livingston Ridge (Figure 4). The depression, variously thought to be a caliche pit (Hawley, 1/2/86, personal communication), a doline (Barrows, 1983, p. 1; Reeves, 1/11/86, personal communication), or a blowout (Bachman, 1985, p. 21), is known informally as Barrows' Bathtub.

The depression trends northeastward. Its area is 19,600 ft², measuring about 200 feet long, 100 feet wide, and 7 feet deep. A surveyed array of 42 holes was hand augered in this depression in an asterisk pattern, centered near the topographic low point at the bottom of the depression. Two trenches were excavated, converging at the lowest point of elevation reached by the auger holes (Figure 43).

Poorly consolidated Gatuna sandstone was reached in eleven auger holes, including the ten holes at the lowest





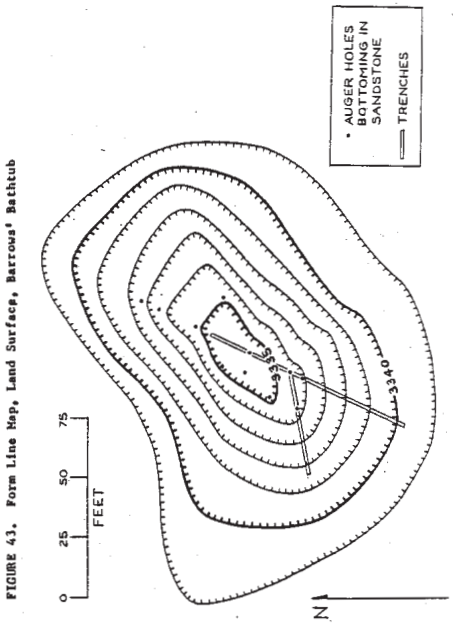



FIGURE 43. Form Line Map, Land Surface, Barrows' Bathtub

topographic locations, and ten of the eleven holes at the lowest structural locations (as determined by the elevations of the bottoms of the auger holes).

All other auger holes encountered a strong calcic horizon, non-indurated but hard, with carbonate distributed throughout the horizon (after Gile, 1961, pp. 53-54). The caliche is thoroughly moist and permeable; if left unexposed to sunlight, it is easily crumbled to powder between fingers. This was typically, but not always overlain by 4 to 17 inches of caliche rubble, caliche powder and sand, with a total absence of incipient lamination as would be found above a plugged caliche horizon.

Structural contours reveal a depression about 100 feet long, 40 feet wide, and 4 to 5 feet deep, also trending northeastward, directly underneath the topographic depression (Figure 44). The structural depression is floored with poorly consolidated sandstone impregnated with carbonate, which is direct evidence of rainwater infiltration. Its caliche walls are moist but hard, about 20 inches thick, with a fairly smooth undulating surface, dipping as steeply as 10°. The caliche abruptly terminates at an elevation of about 3331-3332 feet.

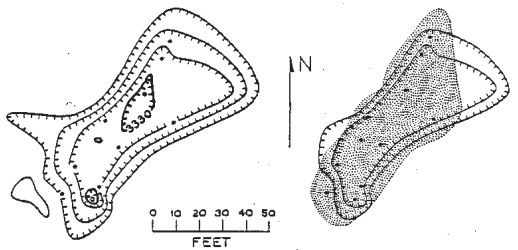
The area where caliche is breached is about 85 feet long, 30 feet wide, and also trends northeastward (Figure 45). Its area is estimated to be 2,650 ft², or 13.5% of the total area of the topographic depression.





FIGURE 44. Structure Contour Map, Caliche and Sandstone Surfaces, Barrows' Bathtub

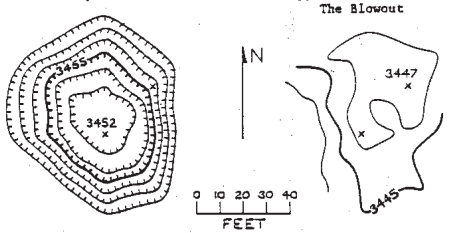
FIGURE 45. Auger Holes Reaching Sandstone, Barrows' Bathtub




contour interval = 1 foot

FIGURE 46. Form Line Map, Land Surface, The Blowout

FIGURE 47. Structure Contour Map, Caliche Surface, The Blowout




contour interval = 1 foot

The Caliche Pit Hypothesis

As previously stated, three hypotheses have been proposed to account for the origin of Barrows' Bathtub: a caliche pit, a doline or a blowout. The depression is located next to a road and about 400 feet west of a drill pad, both constructed of caliche. The evidence for and against the caliche pit hypothesis is presented as follows:

(1) Caliche cobbles are conspicuous on the eastern flank of the depression, and could have been left by heavy machinery. But the caliche cobbles are framed by two watercourses which diverge near the lip of the depression. Floored by Berino soil, a deep red clayey sand, these watercourses would be competent after heavy rains to transport and deposit caliche cobbles from the drill pad or elsewhere. Incised arroyos near the WIPP-33 drill hole have transported bigger caliche cobbles hundreds of feet downstream.

(2) The sandy walls of the trenches were incompetent and liable to collapse. Caliche pebbles and fragments are scattered throughout the sandy fill material. No laminar horizon has developed above the hard caliche. All these could be characteristics of backfill by heavy machinery. But the trench walls at WIPP-33, a known karst feature, were not dissimilar, although they were more competent.

(3) One of the trenches displayed three roughly





parallel grooves in the caliche (Plate 15). The grooves, resembling tool marks from heavy machinery, are 2 to 3 inches wide, 2 to 3 inches deep, and 2 feet apart, oriented at N 47° E, the same as the depression itself. The grooves are penetrated by small roots, and could be traced within the trench for a distance of 14 feet, until the caliche abruptly terminates.

In some ways, however, the grooves do not physically resemble tool marks. One of the grooves does not exhibit the smooth floor and walls characteristic of tool marks; rather, it is filled with soft, loose caliche rubble. The undulating caliche surfaces between the grooves seem too high, relative to the depths of the grooves, to have been left unscathed by heavy machinery. A shovel four feet wide should have more than three teeth; the trenches excavated for this study were dug by a shovel two feet wide with five teeth. And the second trench, also floored by moist, soft caliche steeply dipping and abruptly terminating, has nothing resembling tool marks crossing the trench.

Trench stratigraphy argues against the caliche pit hypothesis. If the grooves were caused by heavy machinery, all overlying material would necessarily have been scooped away before backfilling; yet two of the grooves are directly overlain by a 17-inch layer of loose caliche rubble, caliche powder and sand (Plate 16). If this is backfill material, surely it started out as a random mixture of sand and

Comment C-163A, Page 191 of 338



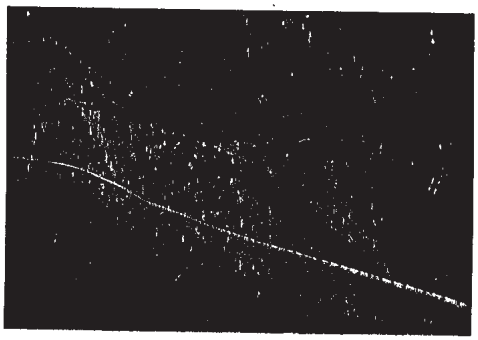


PLATE 15. The middle section of a 75-foot trench in Barrows' Bathtub. Mescalero caliche is hard but non-indurated, and is easily crumbled to powder. The caliche dips gently, then ends abruptly in the foreground, with a drop of 2 feet to Gatuna sandstone. The trench displays three grooves, roughly parallel, 2 to 3 inches wide and deep, and 2 feet apart. (Photo by Robert Aly)

Comment C-163A, Page 192 of 338



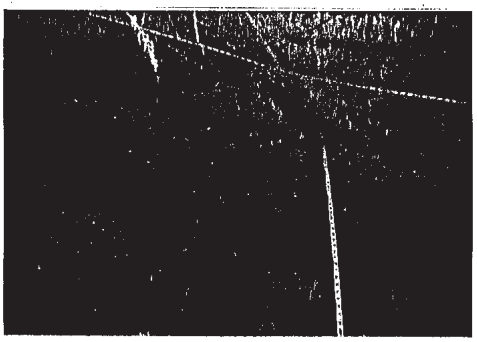


PLATE 16. The uppermost of three grooves in Mescalero caliche in Barrows' Bathtub, overlain by a 16-inch layer of loose caliche rubble and caliche powder, and 4.5 feet of red sand with occasional caliche fragments. (Photo by Robert Aly)

caliche. The caliche pit hypothesis demands that these calcareous components of the backfill must have been translocated downward all the way to the caliche surface after the backfilling was done, leaving behind only the occasional caliche pebbles and fragments which are scattered throughout the 4 to 5 feet of overlying sands. This translocation must have been accomplished in 10 years, because the road and drill pad dates from 1976, when the first potash test hole (P-1) was drilled at the WIPP site. Until this time, vehicular access was inadequate for mining of caliche. Bureau of Land Management (BLM) records for caliche mining on BLM land date back to 1969, and there is no record of a caliche pit in sec 29, T 22 S, R 31 E.

Evidence of Natural Origin

There is direct evidence that Barrows' Bathtub owes its origin to natural processes, and not to mining of caliche by humans:

(1) Black-and-white aerial photographs taken in 1958, at a scale of 1:20,000, show that the depression existed before vehicular access. The photos show a short water-course disappearing into the depression from the northeast. Comparison with color air photos taken in 1983, at a scale of 1:24,000, seem to indicate that the depression is now larger, deeper, steeper and more angular, with the apparent





changes taking place on the southwestern end near the caliche road, near where the "tool marks" are located. But the depression appears to be of natural origin, although there may have been subsequent human disturbance.

(2) On the northeastern and southeastern slopes of the depression, remnants of Berino soil are preserved. This observation was made during field work for this dissertation, and by Bachman (1985, p. 21). Berino soil is stratigraphically higher than Mescalero caliche, and would have been destroyed by caliche mining. It is clear that the original soil structure is intact, because peds (natural soil aggregates) can be removed intact. Berino soil is a deep red clayey sand, the non-calcareous argillic B-horizon from which carbonate was leached in the ancient Mescalero soil sequence (Bachman, 1985, p. 20). It is said that the Berino soil began to form about 350,000 years ago (Bachman, 1984, p. 21). It could not have developed subsequent to caliche mining.

(3) Prior to trenching, the entire depression was examined in my presence by Linda Brett, a BLM archaeologist, who found nothing to indicate that the site had been disturbed. There is no evidence of cut banks, tailings, vehicular disturbance, or oil cans, beer cans, etc.; it simply does not look like a caliche pit (Linda Brett, 9/85, personal communication). The surface depression is floored by sand, some desiccated clay, and organic debris and manure

washed in by alluvial action. Caliche pits are ordinarily located not where caliche is moist, non-indurated, and 4 to 5 feet below the land surface, but where caliche is dry, well-indurated, and crops out or is just beneath the land surface. Such locations abound in the vicinity of the WIPP site; for example, the caliche pit located in the southeast corner of sec 25, T 22 S, R 30 E, described in Chapter 5.

Comparison of a Doline and a Blowout

The solution origin of Barrows' Bathtub can be demonstrated by comparison with a nearby non-solution depression of eolian origin. The difference between the underlying structures of the two depressions is unmistakable, as may be seen by comparing Figures 44 and 47.

Many or most of the small, closed topographic depressions east of Livingston Ridge are "blowouts" ringed by shrub-coppice dunes. These depressions are of eolian origin, and can be quite deep. An example is located 1150 feet from north line (FNL), 2500 feet from east line (FEL), sec 21, T 22 S, R 31 E, or about 5000 feet north-northeast of the center of the WIPP site.

This topographic depression is round to oyster-shaped, measuring 70 to 80 feet in diameter and 6 feet deep (Figure 46). A surveyed array of 20 holes was hand augered in this depression in an asterisk pattern, centered at the





topographic low in the bottom of the depression.

Hard caliche stopped the auger in all 20 holes. Structural contours reveal no discernible relationship between the top of the caliche and the land surface (Figure 47). In fact, the third highest caliche elevation encountered was in the central auger hole, directly underneath the topographic low point. The caliche surface actually drops in all directions from the central auger hole, with dips ranging from 0.6° northward to 9.0° westward, as shown in cross-sections (Figures 48-51). Such a lack of correlation between the sand surface and the caliche surface is to be expected in a blowout, a depression which migrates with the wind, irrespective of underlying caliche structure.

This is in direct contrast to Barrows' Bathtub, where a topographic depression 7 feet deep is underlain by a structural depression with steeply dipping slopes, as shown in cross-sections (Figures 52-55). Such a direct correlation between depressions in the sand surface and the caliche surface is to be expected in a doline, where a topographic depression is causally related to subsurface solution processes.

The two depressions differ somewhat in surface morphology as well: (1) The blowout is surrounded by dunes which rise steeply in all directions, at slopes ranging from 17% northward to 34% eastward, whereas it is not necessary to climb over dunes in order to descend into the doline

FIGURE 48. Geomorphic Cross-Section, The Blowout, South to North

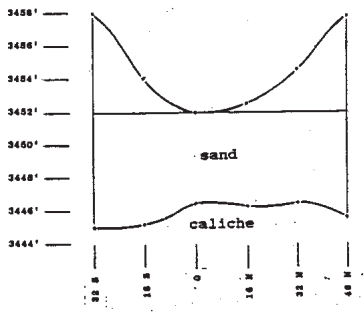



FIGURE 49. Geomorphic Cross-Section, The Blowout, Southwest to Northeast

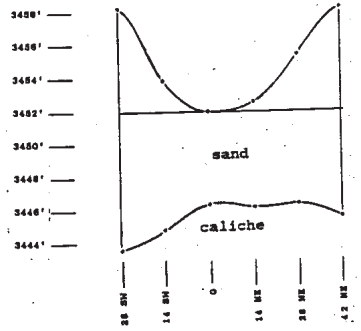







FIGURE 50. Geomorphic Cross-Section, The Blowout, West to East

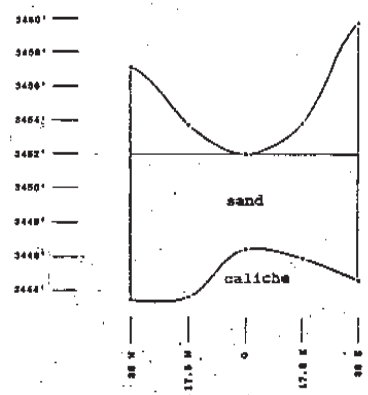



FIGURE 51. Geomorphic Cross-Section, The Blowout, Northwest to Southeast

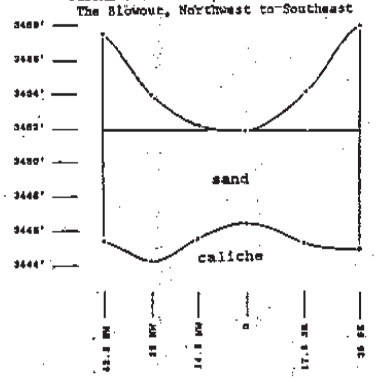


FIGURE 52. Geomorphic Cross-Section, Barrows' Bathtub, South to North

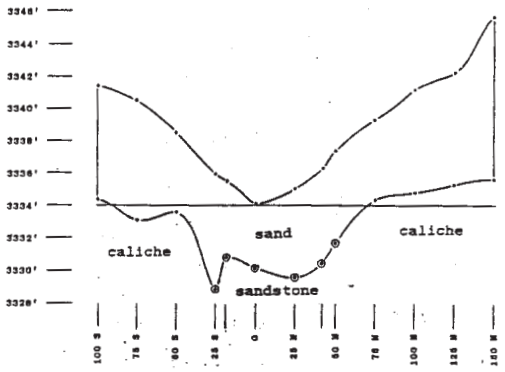



FIGURE 53. Geomorphic Cross-Section, Barrows' Bathtub, Southwest to Northeast

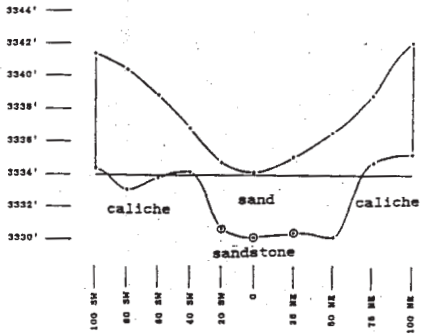







FIGURE 54. Geomorphic Cross-Section, Barrows' Bathtub, West to East

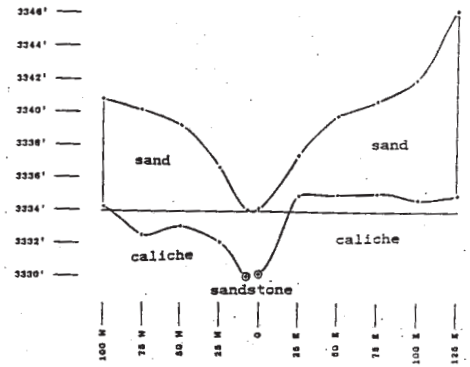
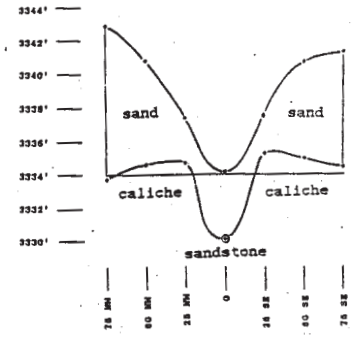



FIGURE 55. Geomorphic Cross-Section, Barrows' Bathtub, Northwest to Southeast



(Barrows' Bathtub), which is partly surrounded by a level plain (to the east and southwest). (2) Watercourses floored by clayey sand drain into the doline, leaving a weak pan of desiccated clay and clumps of organic debris and manure in the bottom; whereas the blowout is floored only by sand, and no surface runoff drains into it. (3) The floor of the doline is vegetated; the floor of the blowout is not.

Barrows' Bathtub is an alluvial doline (or solution-subsidence doline), an ideal example of accelerated solution
36 and downward permeation of near-surface caliche into a steep-walled depression. The trenches confirmed that Barrows' Bathtub is underlain by gently to steeply dipping caliche, certainly not attributable to the wind. Hard caliche and the laminar caliche zone are absent altogether underneath the bottom of the Barrows' Bathtub. There is no evidence of ponding; downward percolating rainwater sinks
36 right through the bottom and impregnates the poorly consolidated sandstone with dissolved carbonate (Plate 17). Even where the hard caliche exists, it is moist and permeable, and crumbles easily to powder. Whether the features in question are tool marks or solution grooves is beside the point. Either way, they are features carved in the steep walls of a sink hole.





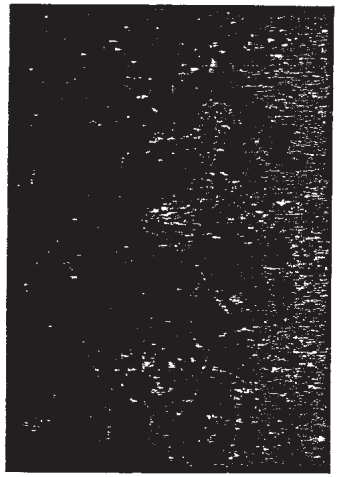


PLATE 17. Close-up of poorly consolidated Gatuna sandstone at the bottom of Barrows' Bathtub. Caliche is absent. Carbonate impregnation of the Gatuna is direct evidence of rainwater infiltration. (Photo by Robert Aly)

Conclusion

The most prevalent topographic features on the Mescalero Plain are shrub-coppice sand dunes, and deflation basins (blowouts). Eolian topography obscures near-surface karst morphology. Although short water courses, weak clay pans, and dense vegetation may be surface indicators of alluvial processes, a doline can only be conclusively distinguished from a blowout by means of subsurface exploration. Dolines are topographic depressions causally related to solution and subsidence of underlying caliche; blowouts are wind-scoured depressions superposed on a relatively flat or gently undulating caliche surface. There are literally thousands of small, closed topographic depressions scattered across the Mescalero Plain. Some are dolines, and some are blowouts. Only an intensive augering and trenching program could tell them apart.

37

Chapter 7 examines a large topographic depression four miles east of Nash Draw, beyond the WIPP repository, where Dewey Lake Redbeds are overlain by Santa Rosa sandstone. A variety of geomorphic and geophysical data is utilized to assess the extent of dissolution in the Rustler, multiple episodes of carbonate accumulation and degradation, the role of Santa Rosa sandstone in facilitating or impeding karst processes, and the relationship between negative gravity anomalies and structural depressions in caliche.





CHAPTER VII

PONDING AND DEGRADATION OF CALICHE

Introduction

A prominent topographic depression was investigated where the Dewey Lake Redbeds are overlain by Santa Rosa sandstone in the northeastern part of the WIPP site. The depression coincides with a high-amplitude negative gravity anomaly, indicating low rock density or missing rock in the subsurface. Borehole WIPP-14 encountered no cavernous zones underneath this depression, and its origins have remained unresolved. The WIPP-14 area presented the best opportunity to see if karst processes have taken place far from Nash Draw, beyond the WIPP repository, and to assess the role of Santa Rosa sandstone in facilitating or impeding karstification.

The WIPP-14 depression is the westernmost of a chain of at least ten closed topographic depressions in a sinuous trend about 1.6 miles long, about two miles northeast of the center of the WIPP site. The depressions, prominent in the WIPP site air photos, are round and densely vegetated. The depressions and the lands between them are covered by grayish brown sediments indicative of clay content, in sharp contrast to the red windblown sands which cover nearly all

the rest of the Mescalero Plain in the study area.

Field observations, gravimetric data, borehole data, auger data and trench exposures were utilized in assessing the environmental history and the present hydrologic functions of the WIPP-14 depression. Auger data was correlated with gravimetric data in characterizing seven nearby structural depressions which coincide with the high-amplitude negative gravity anomaly. The results indicated extensive dissolution of Rustler halite and gypsum, density variations in the Dewey Lake Redbeds, carbonate-filled fractures in Santa Rosa sandstone, and multiple episodes of carbonate accumulation and degradation in the soil profile.

38

Evidence of Deep Dissolution at WIPP-14

The westernmost of the chain of densely vegetated topographic depressions, known as WIPP-14, is believed by Barrows (1982, p. 8) to be due to dissolution in the Rustler Formation. The depression is shown on the 7.5 minute U.S.G.S. topographic map (Livingston Ridge quadrangle, provisional edition, 1985). It is located about 4 miles east of Livingston Ridge (Figure 4).

The WIPP-14 depression displays evidence of alluvial processes at the land surface. Draining into this depression from the east are five ephemeral water courses,





not incised enough to be called arroyos. The depression is floored by light pinkish brown eolian sand, desiccated brown clay, and organic debris washed in by alluvial action.

This closed topographic depression was found by Barrows et al. (1983, Figures 2.1-3, 2.1-4, p. 43) to be underlain by a westward extension of the negative gravity anomaly with the greatest amplitude (-0.805 milligal) of any in the WIPP site gravity survey (Figure 56). The negative gravity anomaly trends southeast to northwest underneath the topographic depression (Figure 57), and indicates anomalously low rock density, or missing rock, in the subsurface. This may be due to dissolution and removal of halite, and hydration of gypsum, in the Rustler Formation. Primarily because this negative gravity anomaly coincides with a closed topographic depression, as at WIPP-33, Barrows (1982, p. 8) interprets the depression as an alluvial doline.

Borehole WIPP-14, (located 100 feet from south line, 2100 feet from east line, sec 9, T 22 S, R 31 E), was drilled into this westernmost depression, as an attempt to establish the geologic origin of the negative gravity anomaly. For stratigraphic comparison, another borehole (WIPP-34) was located 1,000 feet to the west of WIPP-14 (Figure 4), in a fairly level plain rather than in a topographic depression. A stratigraphic comparison of the WIPP-14 and WIPP-34 boreholes is given in Table 3:

Comment C-163A, Page 208 of 338




FIGURE 57. Auger Holes at WIPP-14 and Negative Gravity Anomaly

Comment C-163A, Page 207 of 338




FIGURE 56. Gravity Profile, WIPP-14

Table 3. Stratigraphy of WIPP-14 and WIPP-34

| rock unit | WIPP-14 depth | WIPP-14 thickness | WIPP-34 depth | WIPP-34 thickness |
|---|---|---|---|---|
| Holocene | 0-15.4 | 15.4 | 0-11 | 11 |
| Santa Rosa | 15.4-141.0 | 125.6 | 11-154 | 143 |
| Dewey Lake | 141.0-638.7 | 497.7 | 154-657 | 503 |
| Rustler | 638.7-951.6 | 312.9 | 657-973 | 316 |
| Forty-niner | 638.7-706.5 | 67.8 | 657-718 | 61 |
| Magenta | 706.5-730.0 | 23.5 | 718-741 | 23 |
| Tamarisk | 730.0-817.2 | 87.2 | 741-834 | 93 |
| Culebra | 817.2-836.2 | 19.0 | 834-860 | 26 |
| Lower member | 836.2-951.6 | 115.4 | 860-973 | 113 |
| Salado | 951.6 | | 973 | |

Both boreholes encountered normal stratigraphic sections, and no cavernous zones were found. However, a comparison of the densilogs (measured in grams per cubic centimeter) for WIPP-14 and WIPP-34 clearly displays anomalously low rock density at WIPP-14, particularly at depths of about 340-440 feet in the Dewey Lake Redbeds, 645-670 feet and 685-705 feet in Forty-niner gypsum, and 735-775 feet in Tamarisk gypsum (Barrows et al., 1983, p. 57, and Figure 3.2.1-1, p. 58).

Borehole P-18 is generally taken to represent a complete Rustler stratigraphic section (EEG-32, 1985, pp. 27-28). It is located near the southeastern extremity of the WIPP site, more than 7 miles east of Livingston Ridge (Figure 4). At P-18 the Rustler is predominantly halite, anhydrite and dolomite; gypsum is rarely present in anything





more than trace quantities, and only one five-foot interval (700-705 feet below land surface) is predominantly gypsum (Jones, 1978, Table 18C, pp. 351-352).

In all other WIPP test holes, including WIPP-14, halite of the Forty-niner member has been dissolved and removed completely, and some or all anhydrite has been converted to gypsum. It has been widely reported (e.g. Mercer, 1983, Table 1, p. 91) that halite is also present in the Forty-niner member in the P-10 borehole, one mile northwest of P-18 (Figure 4). But this is contradicted by the lithological log for P-10, which first lists halite at a depth of 885 feet below land surface, or 104 feet below the top of the Tamarisk anhydrite (Jones, 1978, Table 10C, p. 194). A stratigraphic comparison of the P-18 and P-10 boreholes is given in Table 4:

Table 4. Stratigraphy of P-10 and P-18

| rock unit | P-10 depth | P-10 thickness | P-18 depth | P-18 thickness |
|---|---|---|---|---|
| Holocene deposits | 0-8 | 8 | 0-9 | 9 |
| Santa Rosa sandstone | 8-151 | 143 | 9-87 | 78 |
| Dewey Lake Redbeds | 151-686 | 535 | 87-628 | 541 |
| Rustler Formation | 686-1086 | 400 | 628-1088 | 460 |
| Forty-niner | 686-757 | 71 | 628-704 | 76 |
| Magenta | 757-781 | 24 | 704-730 | 26 |
| Tamarisk | 781-931 | 150 | 730-909 | 179 |
| Culebra | 931-957 | 26 | 909-938 | 29 |
| Lower member | 957-1086 | 129 | 938-1088 | 150 |
| Salado | 1086 | | 1088 | |
| Top of salt | 885 | | 665 | |

At WIPP-14, about 150 feet of the Rustler Formation has been removed by solution. The Rustler is 313 feet thick at WIPP-14, as compared to 462 feet thick at P-18, located 3.7 miles to the southeast. Solution and removal of halite in the Rustler is not restricted to the WIPP-14 locality. It is a regional phenomenon, as indicated by the Rustler isopach map (Figure 58).

All ten densely vegetated topographic depressions, including WIPP-14, are probably related to deep-seated dissolution in the Rustler. All are underlain by a large scale structural depression which appears on structure contour maps of the tops of the Dewey Lake, the Forty-niner, and the Magenta (Figures 59, 60 and 61). The structural depression, although diminished in extent, also appears in the structure contour maps of the tops of the deeper Culebra dolomite and Salado Formation (Figures 62 and 63).

This large-scale depression should not be attributed to depositional variations, because it becomes progressively larger and deeper in younger rock strata. It is more likely due to solution in the mid- to upper Salado and throughout the Rustler Formation.

Bachman (1985, p. 26), noting the lack of evidence of collapse at the WIPP-14 land surface, argues that WIPP-14 is a "blowout," not a karst feature. He states that karst should not exist east of the Rustler "dissolution front," but only to the west, where dissolution and removal of







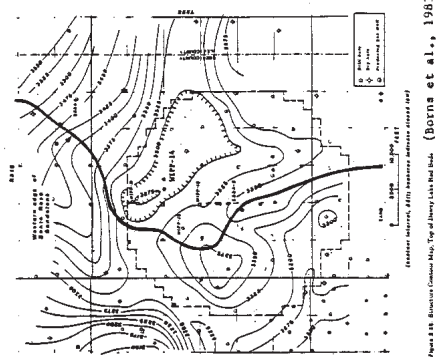


FIGURE 59. Structure Contour Map, Top of Dewey Lake Redbeds (Borns et al., 1983)

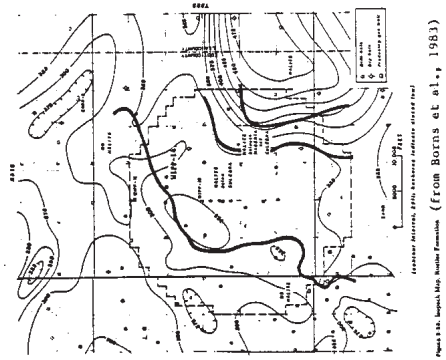


FIGURE 58. Isopach Map, Rustler Formation (from Borns et al., 1983)

Comment C-163A, Page 214 of 338

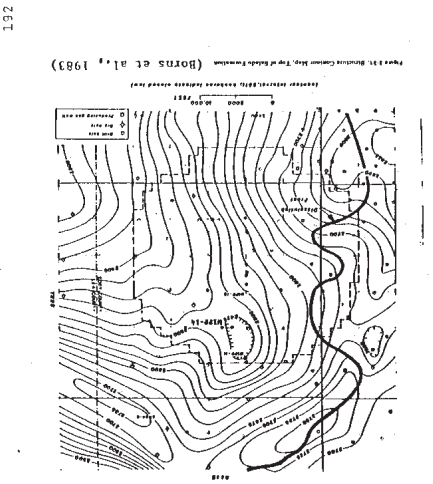


FIGURE 63. Structure Contour Map, Top of Salado Formation

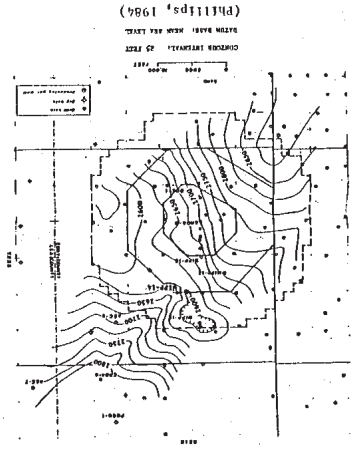


FIGURE 62. Structure Contour Map, Top of Culebra Dolomite

Comment C-163A, Page 213 of 338

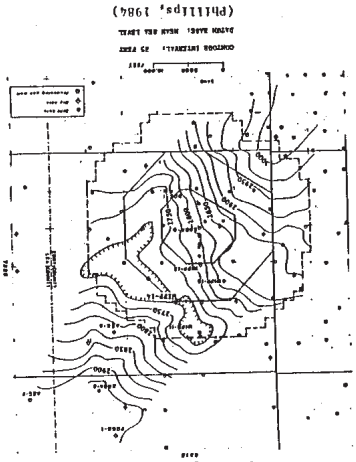


FIGURE 61. Structure Contour Map, Top of Magenta Dolomite

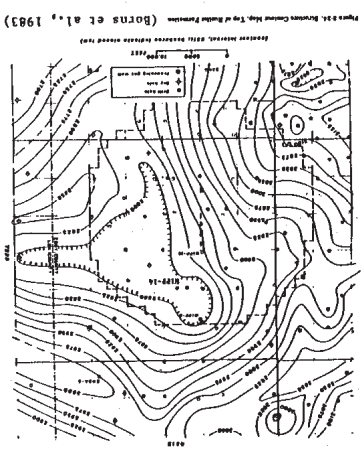


FIGURE 60. Structure Contour Map, Top of Forty-niner Member

Rustler halite is complete in all boreholes (Figure 58). He reasons that karst features cannot develop where any halite remains in the Rustler.

At WIPP-14, the Rustler is only 37 feet thicker than at WIPP-33, where removal of halite is complete, hydration of gypsum is nearly complete (Barrows et al., 1983, p. 63), and a collapse sink has developed. At WIPP-14, dissolution of Rustler halite is at least 95% complete; halite was found only in the lower 7 feet of the Rustler, whereas about 150 feet of halite has been removed by solution. There is no reason to preclude the possibility of karstification underneath the WIPP-14 depression.

40

Bachman (1985, p. 26) also states that: "True karst surface features contain evidence of surface collapse..." This is not necessarily true. Solution dolines involving surface subsidence but not collapse have been described by Lee (1924), Morgan (1941, 1942), Bretz and Horberg (1949b), Judson (1950), Vine (1963), Havens (1966), Gile et al. (1966), Jennings (1971), Sweeting (1973), Bachman (1973), Reeves (1976), Hawley et al. (1976), Barrows (1982), and Barrows et al. (1983).

In summary, there are strong indications of karst conditions at the WIPP-14 depression. Five ephemeral water courses drain into the depression, which is floored with desiccated clay and organic debris washed in by alluvial action. Borehole densilogs and gravity data indicate





anomalously low rock density or missing rock in Dewey Lake siltstone, Forty-niner gypsum and Tamarisk gypsum. About 150 feet of the Rustler Formation has been removed by solution, and the depression is underlain by a large-scale depression in the Rustler and Dewey Lake formations. The evidence against karst conditions consists of 7 feet of halite remaining in the Rustler, lack of evidence of collapse at the surface, and failure of a point-specific borehole to encounter cavities in the Rustler Formation.

Structure of the WIPP-14 Depression

At the land surface, the WIPP-14 depression is 9 feet deep and 600 to 700 feet in diameter. The flanks of the depression have slopes ranging from 3% to 6% (Figure 64).

A surveyed array of 83 holes, 50 or 100 feet apart, was hand augered in a grid pattern centered on the WIPP-14 drill hole (Figure 57) and encompassing the entire surface depression. Caliche was encountered in all auger holes, and the auger data makes it possible to reconstruct the original caliche surface. Structure contours show the WIPP-14 surface depression to be underlain by a structural depression in the caliche, 400 to 650 feet in diameter and 6 feet deep, with flanks dipping from 0.9° to 7.2° (Figure 65).

The wind could not have caused so large and deep a depression in the caliche surface. However, the wind is

Comment C-163A, Page 218 of 338

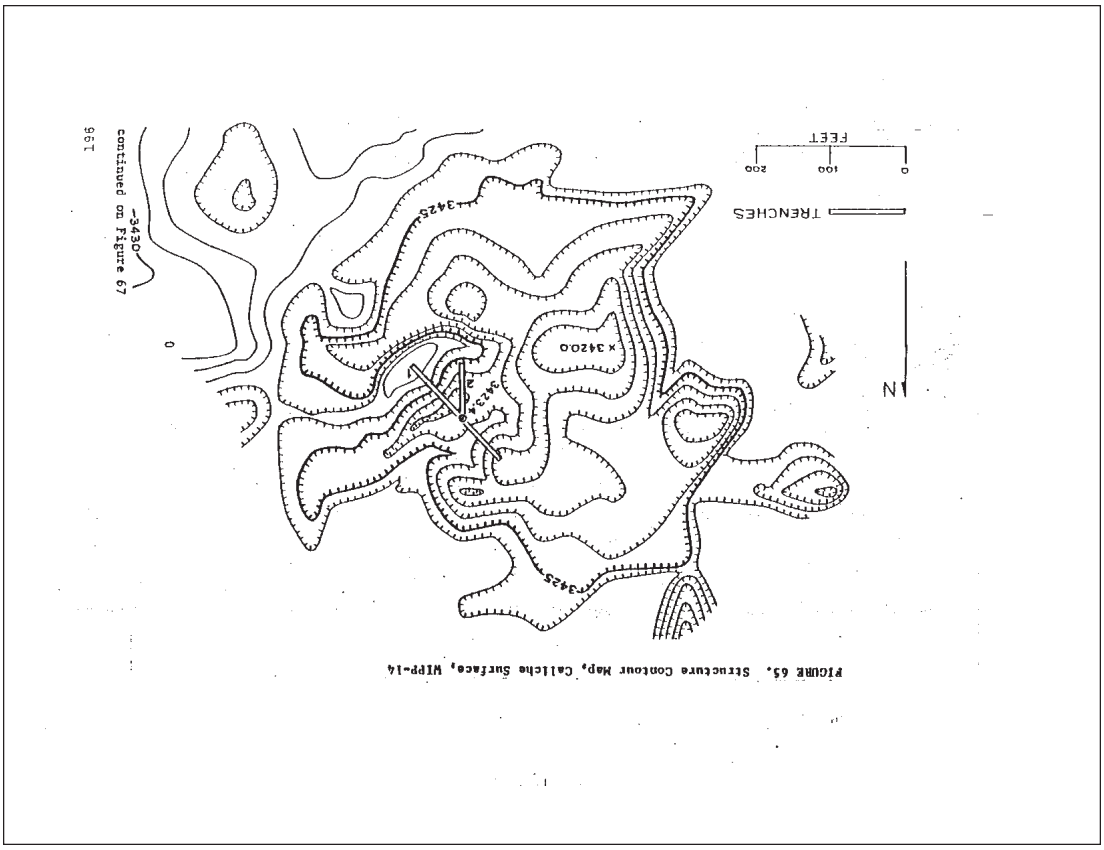



FIGURE 65. Structure Contour Map, Caliche Surface, WIPP-14

Comment C-163A, Page 217 of 338

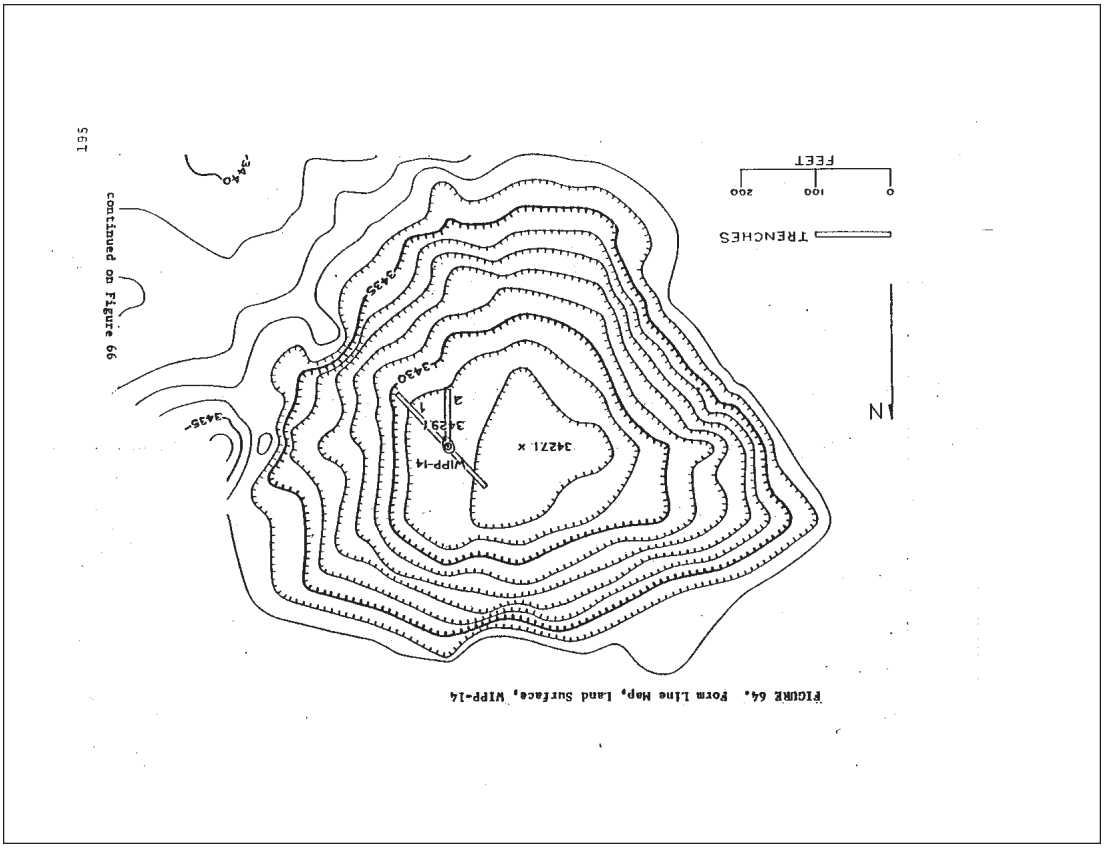



FIGURE 64. Form Line Map, Land Surface, WIPP-14

capable of eroding depressions of this size and depth in the surface sands, and the caliche could have developed afterwards.

Certainly the wind has played an active role in the shaping of the WIPP-14 depression. Its relief at the land surface is 9 feet, while the relief of the structural depression in the underlying caliche is only 6 feet. In 19 of 21 auger holes within 125 feet of the WIPP-14 drill hole, surficial deposits were less than 6 feet thick; by comparison, in 37 of 50 auger holes more than 200 feet upslope from the WIPP-14 drill hole, surficial deposits were 8 to 15 feet thick. This indicates that although the structural depression is not of eolian origin, windblown sand has accumulated on the crests of the structural depression and has thus increased its relief.

Trenching was restricted to the drill pad at the bottom of the WIPP-14 depression, because on the slopes and crests, the caliche is too deep to reach with a backhoe. Trench 1, 150 feet long, was dug diagonally across the drill pad, following the trend of the negative gravity anomaly. Trench 2, 75 feet long, was oriented southward from the drill pipe (Figures 64 and 65).

It is evident that the present topography at WIPP-14 has existed for a long time, because of two distinct caliche layers exposed in the trench walls (Plates 18 and 19), illustrative of multiple episodes of carbonate accumulation.







PLATES 18 AND 19. Weakly consolidated caliche remnants underneath the WIPP-14 depression. Two distinct caliche horizons in the trench walls indicate multiple episodes of carbonate accumulation. Caliche is now soft, sandy and chalky. Bluish-gray gleyed sediments in the trench walls indicate past ponding of the depression, during which time the caliche was leached and degraded under reducing conditions. All previous plates show red to brown sand, indicating oxidizing conditions. (Photos by Robert Ely)

These caliche horizons are generally soft, sandy, chalky and incompetent; thus they have been extremely leached and degraded.

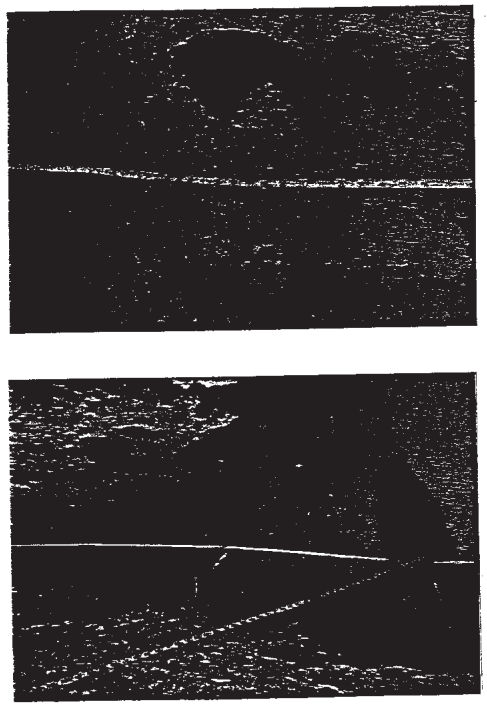
In the trenches, remnants of weakly consolidated caliche are the exception, not the rule (Plates 18 and 19). South of the drill hole, caliche remnants are pockmarked with small solution features (Plates 20 and 21). These caliche remnants had to be cleaned with a whiskbroom, because a pick and even a trowel were too destructive.

The depression has been ponded in the past, probably during pluvial (cooler and/or moister) climatic regimes (Hawley, 1/2/86, personal communication). Silica sand grains are etched and roughened by solution, and the sediments exposed in the trenches appear to be gleyed (Reeves, 1/11/86, personal communication). It may have been past accumulations of perched water which destroyed the caliche (Hawley, 1/2/86, personal communication); this raises important questions about caliche genesis and degradation.

As caliche develops a plugged horizon, it becomes only slowly pervious to moisture. Infiltrating rainwater leaches carbonate from the soil profile and concentrates at the top of the plugged horizon during cool rainy periods; precipitation of carbonate will occur only if soil water evaporates during warm dry periods. The thin laminar zones which develop on top of the plugged horizon are the record of this







PLATES 20 and 21. Solution features in remnants of Mescalero caliche underneath the MDH-14 depression. (Photos by Robert Aly)

periodic, long-term process.

A depression in a plugged caliche horizon will become permanently ponded if its catchment is large enough to allow accumulation of more soil moisture than can be evaporated under the prevailing climatic regime. In this case, leaching of calcium carbonate from the soil profile may take place in the ponded depression, even while laminar caliche zones develop at higher elevations beyond the depression.

Leaching and degradation of the plugged horizon will continue until it is breached; then the depression will no longer hold water. Caliche development could then recur in the depression until the new zone of carbonate accumulation becomes plugged, once again causing ponding and degradation of caliche. The cycle is then complete. It is the ponding, and not necessarily climatic change, which is the actual cause of caliche degradation.

The Mescalero caliche which floors the WIPP-14 depression has been completely breached and removed by solution in an otherwise uniformly sloping caliche surface at 70 feet northwest of the drill hole. Only here did the backhoe reach Santa Rosa sandstone, at 3419.5 feet in elevation, about 2.0 feet lower than the former elevation of the missing caliche.

The interval below the Mescalero caliche consists of: 9 inches of light whitish gray sand (7% carbonate); 3 inches of pinkish yellow powdery sand (2% carbonate); and 10 inches





of yellowish red powdery sand (2.5% carbonate), containing mottles of the overlying pinkish yellow sand.

This is abruptly underlain by fine-grained, reddish-yellow Santa Rosa sandstone, with bright white carbonate veins (<5.0 mm in diameter) and an abundance of small pores (<0.5 mm in diameter). The Santa Rosa sandstone is the same color as the sand fraction of the immediately overlying sandy material; thus, degraded Santa Rosa sandstone was probably the parent material for the overlying sand. The carbonate veins in the sandstone bedrock are direct evidence of downward translocation of carbonate through the entire soil profile.

In summary, augering and trenching revealed that the WIPP-14 topographic depression is underlain by a structural depression in the caliche surface, with accumulations of windblown sand on its crests. The trench exposures display multiple episodes of carbonate accumulation. The caliche horizons are extremely leached and degraded; remnants of weakly consolidated caliche are few, and are pockmarked with small solution features. At times in the past when the caliche horizon has become plugged, the depression has been ponded. Caliche was degraded by perched water, which leached carbonate through the entire soil profile and into carbonate-filled fractures in the Santa Rosa sandstone.

41

The Negative Gravity Anomaly

As previously stated, the WIPP-14 depression was found by Barrows et al. (1983, Figures 2.1-3, 2.1-4, p. 43) to be underlain by a westward extension of the negative gravity anomaly with the greatest amplitude (0.805 milligal) of any in the WIPP site gravity survey. The negative gravity anomaly extends about 1200 feet to the east of the WIPP-14 depression, and trends in a generally east-west direction (Figure 57). The negative gravity anomaly is situated beneath a fairly level but hummocky plain overlooking the WIPP-14 depression. The dune and swale topography trends east-west, parallel to the trend of the negative gravity anomaly. There is no evidence of dissolution, subsidence or collapse at the land surface; however, this is not a reliable indication of a lack of karst development, because the surficial deposits are as much as 14 feet thick, sufficient to obscure completely any subtle structural relief in the caliche surface due to karst development.

A surveyed array of 83 holes, 100 or 150 feet apart, was hand augered in a grid pattern, 1800 feet long and 400 feet wide, connecting with the WIPP-14 grid of auger holes, covering the entirety of the negative gravity anomaly, and extending 600 feet further to the east. For elevation control, the northeast corner of the grid pattern coincides with the brass cap bench mark at the northeast corner of





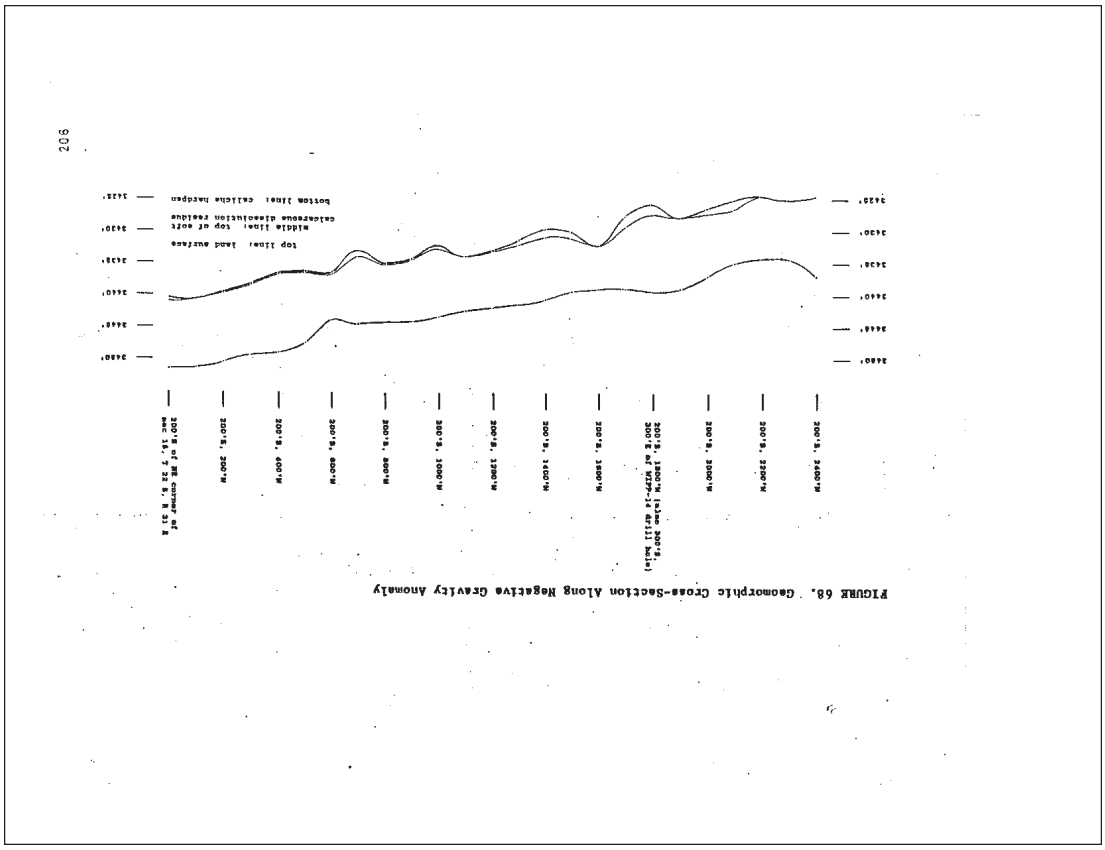
section 14, T 22 S, R 31 E (Figure 57).

Surveying of the land elevations at the auger hole locations revealed a fairly steady drop of 14 feet in elevation from the bench mark to the southeastern crest of the WIPP-14 depression. However, there is a slight topographic trough, about 2 feet deep, trending east-west, directly overlying the negative gravity anomaly (Figure 66).

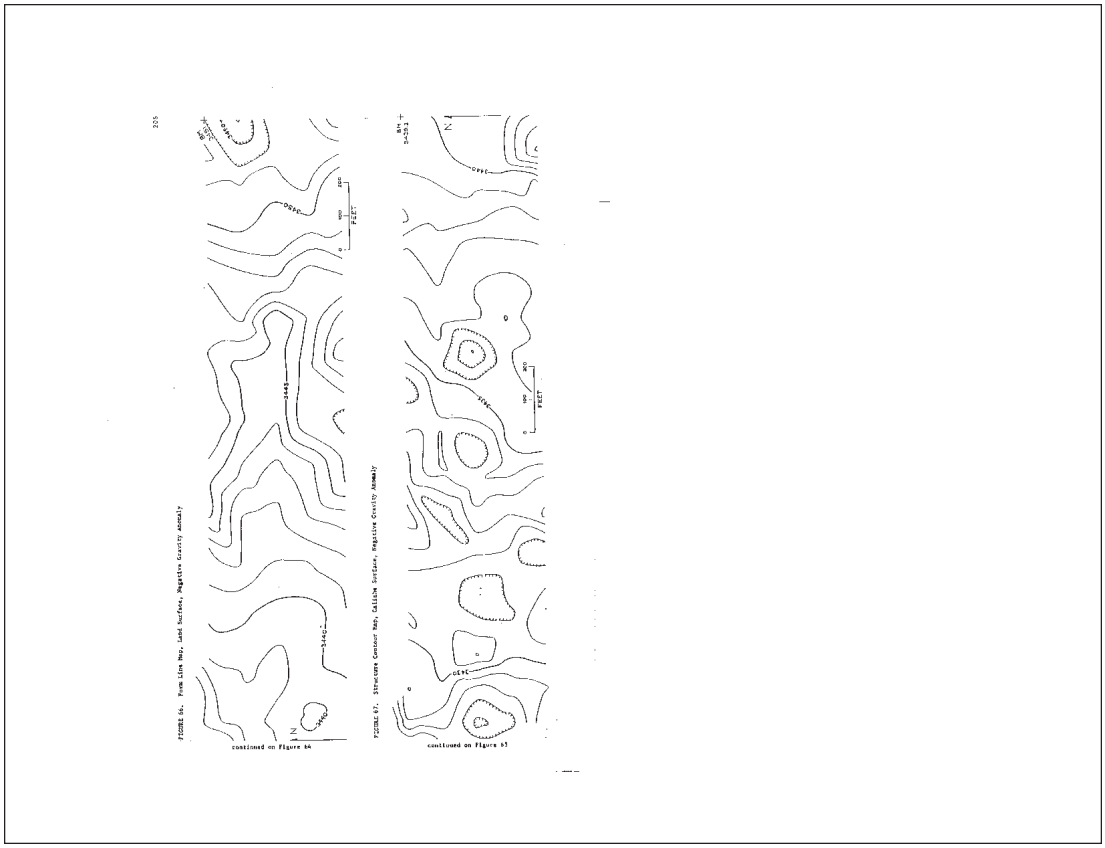
Augering revealed seven closed structural depressions in the caliche surface, 1 to 2 feet deep (Figure 67), each obscured by 9.5 to 13.5 feet of surficial deposits, and each coinciding with the negative gravity anomaly. Each structural depression is partially filled with 6.5 to 24 inches of soft, powdery calcareous dissolution residue. This is best shown in a cross-section (Figure 68) which runs east-west along the middle of the area mapped in Figures 66 and 67, intercepting four of the seven structural depressions, and continues westward across the southern slopes of the WIPP-14 depression.

There are only two instances where 6 inches or more of soft, powdery calcareous dissolution residue were encountered in locations not underlain by structural depressions in the caliche, as shown in Figure 69. An isopach map of the soft caliche is presented in Figure 70. The dissolution residue is unmistakably correlated with structural depressions in the caliche surface (Figures 68 and 69). If this soft calcareous powder were a weakly developed laminar zone

Comment C-163A, Page 228 of 338




Comment C-163A, Page 227 of 338



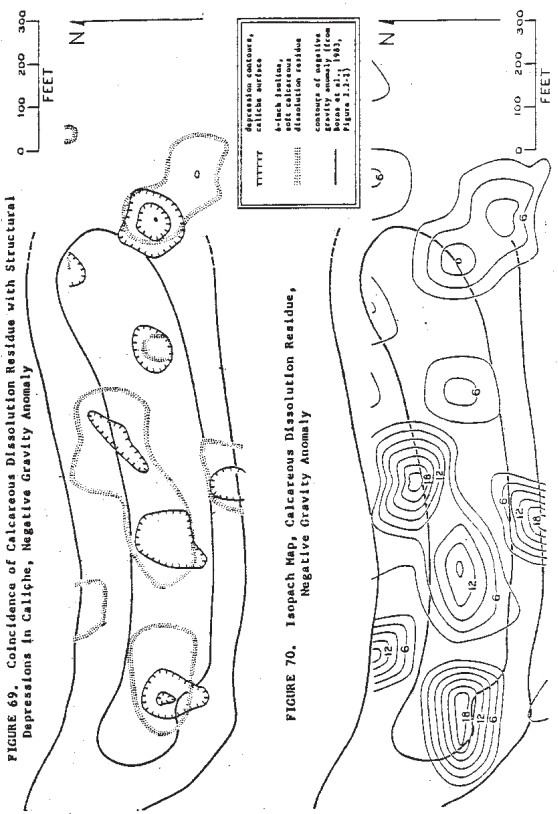



FIGURE 69. Coincidence of Calcareous Dissolution Residue with Structural Depressions in Caliche, Negative Gravity Anomaly

FIGURE 70. Isopach Map, Calcareous Dissolution Residue, Negative Gravity Anomaly





above a plugged caliche horizon, it would be widespread, and of relatively equal thickness.

The actual size of these structural depressions can only be inferred by interpolation between the data points provided by the augering. Trenching above the negative gravity anomaly was not feasible due to the consistently deep cover of surficial sands. However, the density of auger data points is sufficient to be certain that all seven structural depressions in the caliche surface do actually exist.

The geographic location of the seven structural depressions relative to the negative gravity anomaly, and the presence of soft calcareous dissolution residue within all seven depressions (and rarely elsewhere), is powerful evidence that the depressions are related to near-surface dissolution of caliche. Whether or not the structural depressions are related to deep-seated karst conduits in the Rustler Formation, as implied by the high-amplitude negative gravity anomaly, cannot be conclusively determined without drilling into one or more of the structural depressions. Unfortunately, no drilling has been done into this negative gravity anomaly.

42

Summary

A chain of ten thickly vegetated topographic depressions, floored by Mescalero caliche and Santa Rosa sandstone, are probably related to deep-seated dissolution of halite and gypsum in the Rustler Formation. The westernmost depression, WIPP-14, was augered and trenched. It is underlain by a structural depression in the caliche, with accumulations of windblown sand on the crests of the depression.

The depression has been ponded in the past; it probably held perched water when the carbonate horizon was plugged. The caliche was then leached and destroyed, which allowed rainwater to translocate carbonate downward through the entire soil profile and to fill fractures in the Santa Rosa sandstone with carbonate.

Located immediately to the east of WIPP-14 are seven structural depressions in the caliche, each partly filled with calcareous dissolution residue and deeply buried under windblown sand. They closely coincide with gravimetric data indicating anomalously low rock density or missing rock in the subsurface.

43

44

45





CHAPTER VIII

THE REGIONAL WATER BALANCE

Introduction

Karst groundwater flow paths are indeterminate, through discrete underground channels and solution conduits, and are likely to bypass a randomly spaced array of test wells. Borehole data may not be representative of the true conditions of the karstic aquifers; analytical techniques meant for homogeneous rocks should not be applied to a karstland.

In assessing the ability of the Rustler aquifers to transport groundwater, a regional water balance analysis offers a more reliable approach than does analysis of point-specific borehole data. The water balance analysis for the Nash Draw watershed identified: which Rustler aquifers discharge at what locations, and in what relative quantities; the rates of evapotranspiration and natural groundwater recharge across the watershed as a whole; and the most likely flow path for contaminated water from the WIPP site to the Pecos River.

46

Hydrology of Laguna Grande de la Sal

Laguna Grande de la Sal (Laguna Grande) is a natural salt lake (Havens and Wilkins, 1979, p. 4; Geohydrology Associates, 1978, p. 2) that occupies part of Alkali Flat, a large, shallow playa in Nash Draw (Cooper and Glanzman, 1971, p. A-8). The natural origin of Laguna Grande is documented in the historical record:

(1) It was reported by area settlers that Mexicans came to Laguna Grande as early as 1875 and picked off chunks of salt from the lake bottom, and then carried the salt in sacks by trail up the Pecos River Valley (Robinson and Lang, 1938, p. 94). (2) The official plat of the General Land Office Survey, dated July 1882 (Figure 71), shows Alkali Flat to be about 2,000 acres in extent; this would represent the high-water level of the lake. (3) The official base map for the State of New Mexico (Figure 72), compiled in 1920 from the General Land Office Surveys, also identifies this 2,000-acre area as "Alkali Flat." (4) Willis T. Lee (1924, pp. 120-121) collected a water sample from the west end of a salt lake in sec 17, T 23 S, R 29 E, east of the Pecos River and east of Loving, New Mexico. The lake undoubtedly was Laguna Grande.

In 1934, the first detailed map was constructed of Laguna Grande (Figure 73), showing its extent to be about 2,120 acres (Robinson and Lang, 1938, Plates 2, 3 and 4);





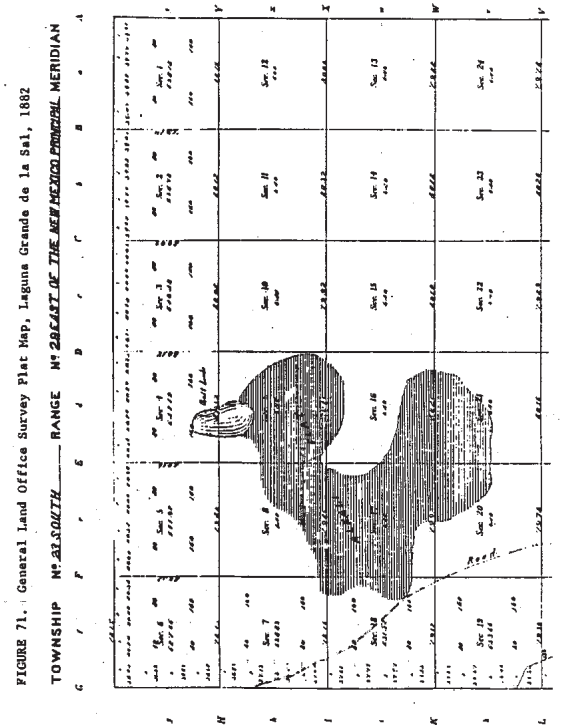


FIGURE 71. General Land Office Survey Plat Map, Laguna Grande de la Sal, 1882

TOWNSHIP Nº 23 SOUTH RANGE Nº 29 EAST OF THE NEW MEXICO PRINCIPAL MERIDIAN

Comment C-163A, Page 236 of 338

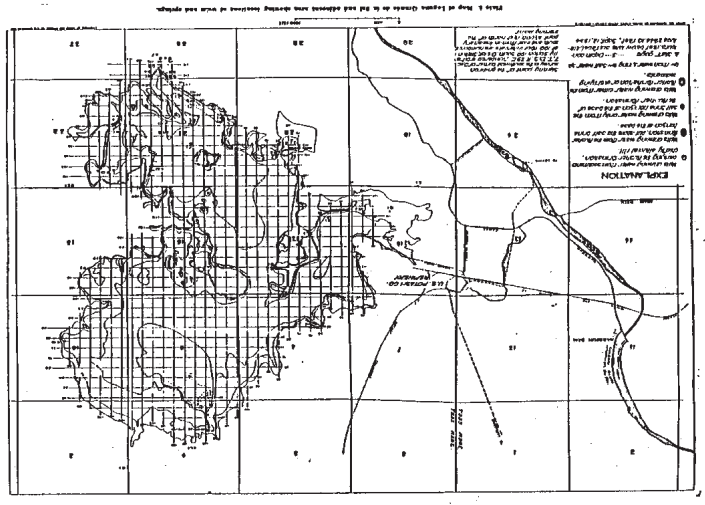


FIGURE 73. First Detailed Map of Laguna Grande de la Sal, Robinson and Lang, 1934

Comment C-163A, Page 235 of 338

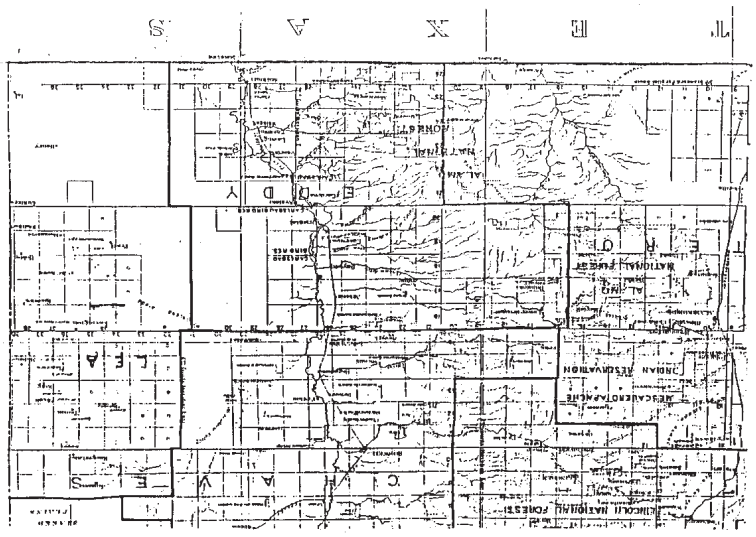


FIGURE 72. Department of the Interior Base Map of New Mexico, 1920

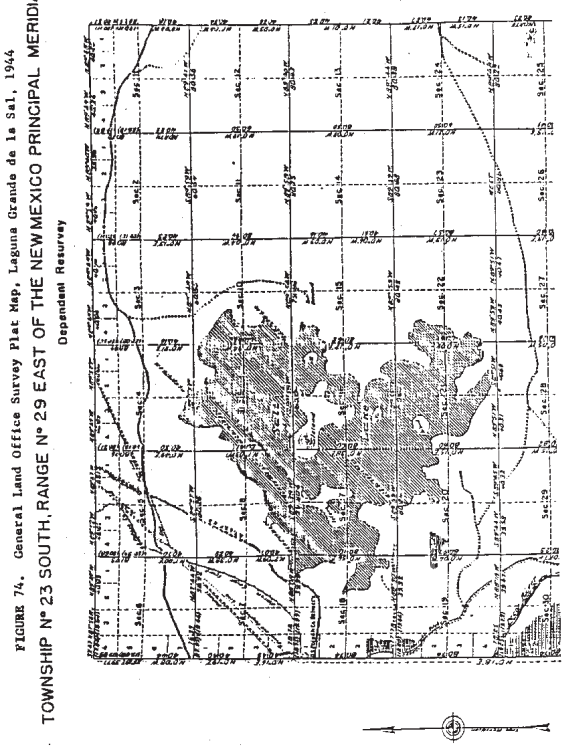



FIGURE 74. General Land Office Survey Plat Map, Laguna Grande de la Sal, 1944





or, according to the accompanying text, about 3.5 square miles (Robinson and Lang, 1938, p. 79). A second General Land Office Survey plat map, dated 1944, is reproduced as Figure 74.

Laguna Grande lies in a sag in the Rustler Formation, which rises in all directions from the lake (Robinson and Lang, 1938, p. 81). Laguna Grande has been filled to a depth of 55 feet or more with fine crystalline gypsum, probably derived from dissolution of Rustler gypsum in Nash Draw, and from the springs that discharge into the playa (Robinson and Lang, 1938, p. 85).

Topographic maps clearly indicate that Laguna Grande is the outlet for the Nash Draw watershed (USGS: Carlsbad, Clayton Basin, Hat Mesa and Nash Draw 15 minute quadrangles; Big Sinks, Paduca Breaks and Pierce Canyon 7.5 minute quadrangles). There is no surface water connection between Laguna Grande and the Pecos River (Robinson and Lang, 1938, pp. 80, 99; Lee, 1924, p. 116; Geohydrology Associates, 1978, p. 58). Hence, if there were a hydrologic connection between Laguna Grande and the Pecos River, it would have to occur underground.

A low, but discernible topographic divide exists between Laguna Grande and Malaga Bend of the Pecos River (USGS: Carlsbad and Nash Draw 15 minute quadrangles; Pierce Canyon 7.5 minute quadrangle). This topographic divide is now partly breached by an irrigation canal which extends

southeastward from a bench mark, located 1100 feet from north line (FNL), 200 feet from west line (FWL), sec 19, T 23 S, R 29 E. The elevation of the bench mark is 2964 feet, only 15 feet higher than the reported lake level of Laguna Grande (USGS: Loving 7.5 minute quadrangle, provisional edition, 1985). Field measurements show that the irrigation canal is actually 4 feet lower than the bench mark, at an elevation of only 2960 feet, only 11 feet higher than the reported lake level.

Field observations at the north end of Laguna Grande on September 4, 1984 showed the artesian water level in an uncased auger hole to be 2955.6 feet, and that the evaporite crust of the salt lake has killed all vegetation up to an elevation of 2959.8 feet, the same elevation as the irrigation canal. Both measurements were determined relative to an immediately adjacent bench mark located 2314 feet from south line (FSL), 2203 feet from east line (FEL), sec 4, T 23 S, R 29 E), with an elevation of 2959 feet according to the USGS topographic map (Nash Draw 15 minute quadrangle, photorevised 1965). The irrigation canal, known informally as the Loving Canal, could be a conduit for overflow discharge from Laguna Grande to the Pecos River in times of major flooding.

The principal water-bearing units of the Rustler Formation in Nash Draw are the Culebra and Magenta dolomite members, and the solution breccia zone known as the "brine





aquifer" at the base of the Rustler (Geohydrology Associates, 1978, p. 14). The brine aquifer is the source of the brine springs which discharge at Malaga Bend of the Pecos River (Hale, Hughes and Cox, 1954, p. 15; Havens and Wilkins, 1979, p. 1).

Robinson and Lang (1938, p. 99) found that the potentiometric (piezometric) surface of the brine aquifer is higher than the land surface in the Pecos River channel and the adjacent flood plain, and slopes downward toward Laguna Grande in all directions. They concluded that salt water from the brine aquifer seeps upward into both the Pecos River and Laguna Grande, and that brine from the lake could not be leaking through the brine aquifer toward the Pecos River.

Laguna Grande is in a closed drainage basin, with no surface water or groundwater outlet to the Pecos River. It is clear from historical documents and hydrologic literature that Laguna Grande is a naturally occurring salt lake. When first mapped accurately in 1934, its natural high-water mark encompassed as much as 2,120 acres. Construction of the natural water balance of the Nash Draw watershed must take Laguna Grande into account.

Water Balance of the Nash Draw Watershed

In order to calculate the amount of naturally occurring groundwater which discharges from the Rustler aquifers into Laguna Grande, it is necessary to determine the extent of Laguna Grande under natural hydrologic conditions. This, when multiplied by the net brine evaporation rate, gives the rate of loss of naturally occurring groundwater from Laguna Grande, which, under equilibrium conditions, would equal the rate of recharge to the lake by naturally occurring groundwater. This can also be expressed as a percentage of the precipitation falling on the Nash Draw watershed, and can be compared to the capacity of the Rustler aquifers to store this water.

In closed basin lakes, which lack surface outlets, the water level, and hence the lake depth and area, fluctuate in response to climatic changes (Street-Perrott and Harrison, 1985, p. 291). Inflow to a closed lake under equilibrium conditions can be represented as follows (Street-Perrott and Harrison, 1985, p. 292):

$$I_L = A_L (E_L - P_L)$$

where

$I_L$ = inflow to the lake (surface runoff plus groundwater inflow)
$A_L$ = area of the lake
$E_L$ = evaporation rate from the lake
$P_L$ = precipitation rate on the lake
$E_L - P_L$ = net evaporation rate





Inflow to a closed basin lake is equivalent to surface runoff plus rainwater recharge of the groundwater aquifers, and thus can also be represented by the following equation (Street-Perrott and Harrison, 1985, pp. 292-293):

$$I_L = A_C (P_C - E_C)$$

where

$I_L$ = inflow to the lake (surface runoff plus groundwater inflow)
$A_C$ = area of the catchment
$P_C$ = precipitation rate over the catchment
$E_C$ = evapotranspiration rate over the catchment

The closest approximation available for the natural extent of Laguna Grande is represented by the first detailed maps of Laguna Grande (Robinson and Lang, 1938, Plates 2, 3 and 4). The data for the map was collected in 1934, and virtually coincided with the first discharge of liquid effluent from the first potash refinery in Nash Draw in 1932 (Cooper and Glanzman, 1971, p. A-8). The maps show Laguna Grande to have been about 2,120 acres ($A_L$ = 9.23 x $10^7$ $ft^2$) in 1934 Figure 73).

In view of the difficulty of gauging evaporation from bodies of water as large as Laguna Grande, direct measurements are taken with a U.S. Weather Bureau Class A pan, made of unpainted, galvanized iron, resting on a low wooden frame. Evaporation from the Class A pan will be larger than from a lake, because the pan receives energy from radiation

and conduction through its base and sides. Therefore, a pan coefficient must be applied to measurements of pan evaporation, in order to estimate water loss from a lake. The difference will vary with the season (Dunne and Leopold, 1978, pp. 100-101), but this should not matter if long-term annual averages are utilized in the evaporation analysis.

Annual Class A pan evaporation in the Malaga Bend area is about 110 inches, according to USGS data (Havens and Wilkins, 1979, p. 27). Measurements range from 108 inches, as illustrated by Dunne and Leopold (1978, Figure 4-3, p. 102), to 112.75 inches measured at Carlsbad by the U.S. Department of Agriculture (USDA, Soil Survey, Eddy Area, New Mexico, 1971, p. 80). Actual freshwater evaporation equals 67% to 77% of pan evaporation in the Carlsbad area, and USGS assumes 70% (Havens and Wilkins, 1979, p. 30), which is in line with Dunne and Leopold (1978, p. 101).

Brine evaporation equals 1.17 times freshwater evaporation, because for each 100 parts of water evaporated, 17 parts of salt will precipitate (Havens and Wilkins, 1979, p. 30). Actual brine evaporation therefore equals 1.17 x .70, or .82, times pan evaporation, which equals 90 inches (7.5 feet) per year in the Malaga Bend area.

The brine evaporation rate ($E_L$ = 90 in/yr, or 7.5 ft/yr), multiplied by the natural extent of the lake ($A_L$ = 2,120 acres, or 9.23 x $10^7$ $ft^2$), equals the annual evaporation of naturally occurring brine from Laguna Grande





(6.93 x $10^8$ $ft^3$/yr). The same amount of water is needed annually to recharge the lake, if its level is to remain constant.

Some of this recharge comes from precipitation falling directly on the lake. Precipitation from 1955 to 1982 averaged 12.67 in/yr (1.06 ft/yr) at Carlsbad, and 14.21 in/yr ($P_L$ = 1.18 ft/yr) in Nash Draw. If 1.18 feet of rain per year falls on Laguna Grande, with a natural extent of 9.23 x $10^7$ $ft^2$, then precipitation falling directly on the natural lake would equal 1.09 x $10^8$ $ft^3$/yr. The net lake evaporation, equal to recharge to the lake by naturally occurring groundwater, would equal total evaporation (6.92 x $10^8$ $ft^3$/yr) minus direct precipitation (1.09 x $10^8$ $ft^3$/yr), or $I_L$ = 5.83 x $10^8$ $ft^3$/yr.

From USGS topographic maps (Carlsbad, Clayton Basin, Hat Mesa and Nash Draw 15 minute quadrangles; Big Sinks, Paduca Breaks and Pierce Canyon 7.5 minute quadrangles), the area of the Nash Draw watershed is measured at 226,000 acres, or $A_G$ = 9.84 x $10^9$ $ft^2$. While recognizing that it cannot be conclusively demonstrated that this topographic divide approximates the groundwater divide, hydrologic data show a close correlation. Potentiometric contours (Figure 75) indicate that: (1) Clayton Basin is hydraulically separate from Nash Draw (Hunter, 1985, Figure 9, p. 35). Groundwater north of Mimosa Ridge (U.S. Highway 180) apparently discharges into Clayton Basin (Hunter, 1985,

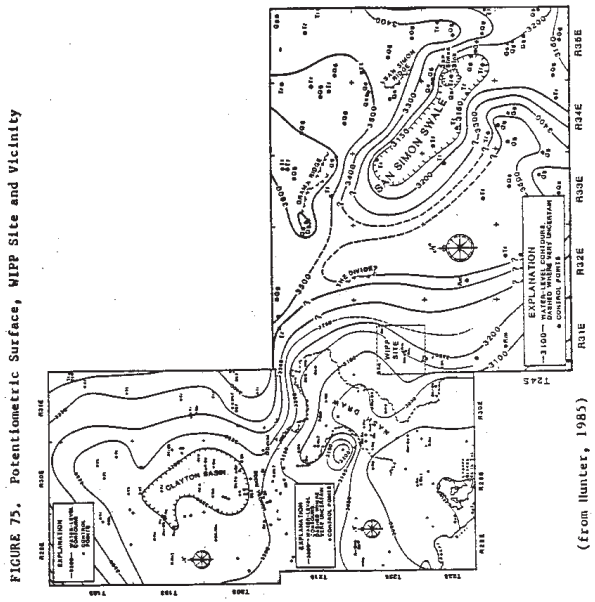



FIGURE 75. Potentiometric Surface, WIPP Site and Vicinity (from Hunter, 1985)





p. 3). (2) San Simon Swale is hydraulically separate from Nash Draw (Hunter, 1985, Figure 11, p. 39). Groundwater east of The Divide recharges a Triassic aquifer which is separated from the WIPP site and Nash Draw by a groundwater divide (Hunter, 1985, p. 38). Water in San Simon Swale apparently percolates downward into the Triassic aquifer and flows to the southeast (Hunter, 1985, p. 3).

If 1.18 ft/yr of precipitation is typical for points in the Nash Draw watershed, and the area of the watershed is $9.84 \times 10^{9}$ ft$^{2}$, then $P_{\Sigma} = 1.16 \times 10^{10}$ ft$^{3}$/yr, the amount of precipitation on the entire Nash Draw watershed. The amount of naturally occurring groundwater needed to recharge Laguna Grande ($5.84 \times 10^{8}$ ft$^{3}$/yr) would be equivalent to 5.03% of the total rainfall in its watershed ($1.16 \times 10^{10}$ ft$^{3}$/yr). Evapotranspiration from the Nash Draw watershed would therefore be about 95% of the precipitation, with the remaining 5% of the rainfall finding its way into the Rustler groundwater aquifers.

The storage capacity of the Rustler aquifers, divided by the rate of rainwater recharge to the Rustler aquifers, reveals the length of time it takes to completely recharge the Rustler aquifers. Storage capacity is here taken as the thickness of the aquifers multiplied by their effective porosity -- that is, the total volume of interconnected pore spaces capable of storing or transmitting water.

According to Barrows (1982, p. 10), the following

equation, when applied to the Rustler dolomite aquifers in the Nash Draw watershed ...

$$\frac{V \times p}{P \times (1-E)}$$

where

V = average thickness of Rustler dolomite aquifers, expressed in feet;
p = average effective porosity of Rustler dolomite aquifers, expressed as a percentage;
P = average annual precipitation on Nash Draw watershed, expressed in feet per year;
E = evapotranspiration, expressed as a percentage; and
1-E = percentage of precipitation not evapotranspired;

... reveals the length of time it takes for rainfall to completely recharge the Rustler dolomite aquifers. By assuming V = 50 ft, p = 0.1, P = 1.0 ft/yr, and 1-E = .04, Barrows arrived at an estimated recharge rate of 125 years. These calculations will now be refined.

Thicknesses of the Magenta and Culebra dolomite aquifers are remarkably uniform throughout the Delaware Basin (Borns et al., 1983, p. 81). The Magenta ranges in thickness from 17 feet (at borehole WIPP-32) to 31 feet (at H-9), and averages 24.37 feet in 52 boreholes. The Culebra ranges in thickness from 21 feet (at WIPP-19) to 31 feet (at H-10), and averages 25.00 feet in 53 boreholes (Mercer, 1983, Table 1, pp. 88-93).

Thus, the total combined thickness of the two Rustler dolomite aquifers is 49.37 feet. It has been shown that the





average annual precipitation on the Nash Draw watershed is measured at 1.18 feet per year. It has been calculated that the percentage of precipitation not evapotranspired is approximately .05 (5%). Assuming .10 (10%) as the average effective porosity ...

$$\frac{49.37 \text{ ft} \times .10}{1.18 \text{ ft/yr} \times .05} = \frac{4.937 \text{ ft}}{0.0590 \text{ ft/yr}} = 83.7 \text{ years}$$

... then enough rainwater is added to completely recharge the Rustler dolomite aquifers every 83.7 years. But this calculation assumes a porosity of .10 (10%), as have Powers et al. (1978), EEG-8 (1980), Barrows (1982) and EEG-32 (1985). This value appears reasonable for homogeneous, porous rocks (EEG-22, 1983, p. 148), but the Magenta and Culebra are fractured rocks which have been altered by solution. At H-6, a three-well test complex 0.9 miles northeast of WIPP-33, corrected porosities are 9.1% for the Culebra and 0.97% for the Magenta. The 0.97% porosity appears reasonable for a fractured rock, suggesting a discrete zone of flow through long, highly permeable, parallel fractures, or else a karst channel (EEG-22, 1983, p. 148). According to Mercer (1983, p. 78), the "effective porosity" derived from the H-6 tracer test was 0.7%.

If karst hydrologic conditions are assumed to prevail, if secondary karst porosity is assumed to be the average effective porosity, then a porosity of .007 (0.7%) or

.0097 (0.97%) should be plugged into Barrows' equation. Under the assumption of karst porosity ...

$$\frac{49.37 \text{ ft} \times .007}{1.18 \text{ ft/yr} \times .05} = \frac{.3456 \text{ ft}}{0.0590 \text{ ft/yr}} = 5.9 \text{ years}$$

or

$$\frac{49.37 \text{ ft} \times .0097}{1.18 \text{ ft/yr} \times .05} = \frac{.4789 \text{ ft}}{0.0590 \text{ ft/yr}} = 8.1 \text{ years}$$

... thus, under karst conditions, enough rainwater would be added to the groundwater system to completely recharge the Rustler aquifers in 6 or 8 years. It follows that groundwater must be removed from the Rustler groundwater system over comparable time periods to those calculated above (6 to 84 years). It is apparent that the Rustler Formation is not a barrier to the migration of groundwater.

Sources of Groundwater Discharge to Laguna Grande

It has been widely assumed that Surprise Spring (SW/NE/SW sec 4, T 23 S, R 29 E) is the largest source of groundwater discharge to Laguna Grande (e.g. Mercer, 1983, p. 49). Surprise Spring was reported by Robinson and Lang (1938, p. 95) to discharge 115 to 125 gallons per minute ($8.09 \times 10^6$ to $8.79 \times 10^6$ ft³/yr) into Laguna Grande.





Reliance on this measurement has led to a gross underestimation of the importance of Laguna Grande as a regional groundwater discharge point. Surprise Spring accounts for no more than 1.5% of the total amount of naturally occurring groundwater ($5.84 \times 10^8$ ft³/yr) needed to recharge Laguna Grande.

Ephemeral watercourses can be readily seen emptying into Surprise Spring from gypsum caves in the hills to the northwest of Laguna Grande (Plate 22). But in modern times these watercourses are fed only by direct precipitation. Field observations showed that the day after a four-inch rainstorm in September 1985, the watercourses were not flowing, although they had flowed during the rainstorm. The gypsum caves may be evidence of a higher water table during the Pleistocene Epoch.

Just north of Laguna Grande is a small salt lake (W/NW sec 3, T 23 S, R 29 E), known informally as Laguna Pequena. A water sample was collected of discharge flowing from Laguna Pequena into the northeastern part of Laguna Grande (at W/NE/NE/SE sec 4, T 23 S, R 29 E).

The water sample was collected on September 5, 1984, shortly after record flooding caused parts of Eddy County to be declared disaster areas. At this time the arroyos leading from the gypsum caves into Surprise Spring were dry (Plate 22), and Surprise Spring itself was 20 inches deep and stagnant, although upward seepage of groundwater into

Comment C-163A, Page 251 of 338

PLATE 22. Gypsum cave in the hills high above the Surprise Spring inlet to Laguna Grande de la Sal. The gypsum cave, 21 inches long and 12 inches high, is one of several in the immediate vicinity. They are evidence of a higher water table during the Pleistocene Epoch. In modern times, dry watercourses leading from these caves are fed only by direct precipitation, even after major rainstorms. (Photo by William Homans)

Comment C-163A, Page 252 of 338



Laguna Grande may have been occurring. No surface inlet to Laguna Pequena was evident. According to field measurements, the discharge from Laguna Pequena (Plate 23) was flowing through a stream channel of 124 ft² in cross-section. The velocity at the water surface was 3.18 ft/sec. Thus, the stream discharge was no greater than 394 ft³/sec (177,000 gal/min), which is more than an order of magnitude higher than the estimated average recharge rate of 18.5 ft³/sec (5.84 x 10⁸ ft³/yr) at Laguna Grande.

Moisture on a stake previously implanted in the outlet channel of Laguna Pequena indicated that the water level had recently been five inches higher. However, the outlet channel was still overflowing its banks on September 5, 1984, and it is doubtful that the discharge is ever significantly higher than 394 ft³/sec; rather, a higher water level results in a greater surface area being flooded. This discharge into Laguna Grande, more than an order of magnitude greater than the estimated average, would be expected in a large, irregular karst spring at a time of record flooding in the region. Certainly Laguna Pequena, not Surprise Spring, is the major groundwater inlet to Laguna Grande.

83

PLATE 23. Discharge into Laguna Grande from a small salt lake known informally as Laguna Pequena. The stream channel is 12 feet wide; stream discharge is nearly 400 $ft^3/sec$. A water sample yielded high levels of calcium, magnesium, sulphate, bromide and fluoride, all due to dissolution and removal of dolomite and gypsum from the Rustler Formation. (Photo by William Homans)





Water Balance of Malaga Bend Brine Springs

The lower reaches of the Pecos River are notoriously saline. "As early as 1582, Spanish explorers noted salt springs and seeps along the banks of the river." (Havens and Wilkins, p. 2).

Upward-leaking brine, from a confined brine aquifer at the base of the Rustler Formation, discharges in brine springs at Malaga Bend on the Pecos River (Hale, Hughes and Cox, 1954, p. 13; Havens, 1972, p. 132; Havens and Wilkins, 1979, p. 1). At Malaga Bend, the total pickup of dissolved sodium chloride in the Pecos River has been calculated at values ranging from 137,000 tons/year (Havens, 1972) to 165,000 tons/year (Morgan, 1942, p. 34), largely derived from the top of the Salado Formation (Morgan, 1942, p. 35). Dissolution and removal of Salado halite by groundwater has left a leached zone of insoluble residue at the base of the Rustler Formation (Vine, 1963, p. B-14), which crops out along the Pecos River (Mercer, 1983, p. 41).

Some have assumed (e.g. Mercer, 1983, p. 3) that the Malaga Bend brine springs represent the major discharge point of the Rustler aquifers. From this unsubstantiated assumption has flowed a long line of reports (Powers et al., 1978; DEIS, 1979; FEIS, 1980; EEG-8, 1980; Gonzalez, 1983a; EEG-23, 1983; EEG-32, 1985) treating Malaga Bend as the nearest natural groundwater discharge point to the WIPP

site. A water balance analysis of the Malaga Bend brine springs, as compared to Laguna Grande, will identify the point which receives the greater discharge.

In a gaining stream interval such as the Pecos River at Malaga Bend, total inflow can be estimated by adding net evaporation to the gain in stream discharge. This requires stream gaging stations on both the upstream and downstream ends of the stream interval.

From the USGS topographic maps, the distance between the Malaga and Pierce Canyon Crossing gaging stations, an interval which includes all of Malaga Bend, is estimated to be 33,500 feet. The average width of the Pecos River throughout this interval is estimated to be 120 feet; thus the total water surface area of this interval is estimated to be four million square feet ($4.02 \times 10^6$ ft$^2$).

As previously stated, Class A pan evaporation in the Malaga Bend area is about 110 in/yr (Havens and Wilkins, 1979, p. 27); and USGS assumes that freshwater evaporation equals 70% of pan evaporation (Havens and Wilkins, 1979, p. 30). This equals a freshwater evaporation rate of 77 in/yr (6.42 ft/yr) in the Malaga Bend area.

This estimate does not account for any differences in freshwater evaporation rates due to differing heat storage capacities of rivers and lakes. River water would be more thoroughly mixed than lake water; thus, its seasonal temperature variations would be reduced. This difference





may not be significant, because long-term annual averages are utilized in this evaporation analysis.

The surface area of Malaga Bend ($4.02 \times 10^6$ ft$^2$), multiplied by the freshwater evaporation rate (6.42 ft/yr), gives the total evaporation between the gaging stations at Malaga and Pierce Canyon Crossing ($2.58 \times 10^7$ ft$^3$/yr, or 0.814 ft$^3$/sec). Annual rainfall (1.18 ft/yr) multiplied by the surface area of the river interval ($4.02 \times 10^6$ ft$^2$) gives the total precipitation falling directly on the river at Malaga Bend ($4.74 \times 10^6$ ft$^3$/yr, or 0.150 ft$^3$/sec. Total evaporation (0.814 ft$^3$/sec) minus direct precipitation (0.150 ft$^3$/sec) equals net evaporation (0.664 ft$^3$/sec).

The difference in river discharge between the Malaga and Pierce Canyon Crossing gaging stations, measured in cubic feet per second, averaged over the 31 water years (1951-1982) for which USGS daily records are available at both stations, is 1.4046 ft$^3$/sec. The gain in river discharge (1.405 ft$^3$/sec), plus net evaporation (0.664 ft$^3$/sec), equals total inflow, or the actual discharge of the Malaga Bend brine springs into the Pecos River (2.069 ft$^3$/sec). The latter figure represents water entering the Pecos River not only through the brine springs, but also through occasional surface runoff, for which no separate estimate is available.

The calculated discharge of 2.069 ft$^3$/sec equals an annual discharge of $6.53 \times 10^7$ ft$^3$/yr from the Malaga Bend

brine springs into the Pecos River. This compares to an estimated 5.84 x $10^8$ $ft^3$/yr of natural groundwater needed to recharge Laguna Grande in Nash Draw. It may then be estimated that the amount of natural groundwater discharged into Laguna Grande is about 8.94 times the amount of groundwater discharged from the Malaga Bend brine springs into the Pecos River.

Therefore, it is concluded that Laguna Grande, not Malaga Bend, is the major outlet of the Rustler aquifers in the Nash Draw watershed, including the WIPP site, and that Laguna Grande is the nearest natural groundwater discharge point to the WIPP site. The previous hydrologic models which assumed a groundwater flow path from the WIPP site directly to the Pecos River are, in a word, wrong.

47

## Sensitivity Analysis

In the foregoing water balance analysis, the values assigned to many of the input variables carry a degree of uncertainty. It is important to bound such calculations with reasonable estimates of the margins of error. To assess the uncertainties in these estimates, the analyses were repeated using alternative values for the different input variables, selected to yield the largest and smallest reasonable estimates.

The sensitivity analysis confirms the basic findings of





the water balance analysis by bounding the margins of error. Laguna Grande receives 7.2 to 10.9 times as much groundwater recharge as Malaga Bend. The recharge time for the Rustler aquifers should be between 4.2 and 110 years. The results of the sensitivity analysis are presented in Table 5. The sources of the selected extreme values are explained in Table 6.

Table 5. Results of Sensitivity Analysis

| input variable | measurements or estimates: least | best | highest | note |
|---|---|---|---|---|
| class A pan evaporation rate (in/yr) | 108 | 110 | 112.75 | A |
| freshwater evaporation coefficient | .67 | .70 | .77 | B |
| freshwater evaporation rate (in/yr) | 72.4 | 77.0 | 86.8 | |
| precipitation rate (in/yr) | 14.51 | 14.21 | 11.25 | C |
| net freshwater evaporation rate (in/yr) | 57.9 | 62.8 | 75.6 | |
| precipitation rate (ft/yr) | .9375 | 1.184 | 1.209 | C |
| total area of Nash Draw watershed ($10^9$ $ft^2$) | 8.54 | 9.84 | 11.15 | D |
| precipitation rate on Nash Draw watershed ($10^9$ $ft^3$/yr) | 8.006 | 11.65 | 13.48 | |

Table 5. Results of Sensitivity Analysis (Continued)

| input variable | measurements or estimates: least | best | highest | note |
|---|---|---|---|---|
| total water surface area, Malaga Bend interval, Pecos River ($10^8$ ft$^2$) | 4.00 | 4.00 | 4.00 | E |
| net freshwater evaporation rate (ft/yr) | 4.83 | 5.23 | 6.30 | |
| total freshwater evaporation rate from Malaga Bend interval ($10^7$ ft/yr) | 1.93 | 2.10 | 2.52 | |
| gain in river discharge at Malaga Bend ($10^7$ ft/yr) | 4.43 | 4.43 | 4.43 | F |
| inflow at Malaga Bend ($10^7$ ft/yr) | 6.36 | 6.53 | 6.95 | |
| freshwater evaporation rate (ft/yr) | 6.03 | 6.42 | 7.23 | |
| brine evaporation coefficient | 1.17 | 1.17 | 1.17 | G |
| brine evaporation rate (ft/yr) | 7.06 | 7.51 | 8.46 | |
| precipitation rate (ft/yr) | 1.209 | 1.184 | .9375 | C |
| net brine evaporation rate (ft/yr) | 5.85 | 6.33 | 7.53 | |
| total water surface area, Laguna Grande ($10^7$ ft$^2$) | 8.58 | 9.23 | 9.23 | H |
| total brine evaporation rate from Laguna Grande ($10^8$ ft$^3$/yr) | 5.02 | 5.84 | 6.95 | |
| total groundwater recharge to Laguna Grande ($10^8$ ft$^3$/yr) | 5.02 | 5.84 | 6.95 | |
| average annual recharge to Rustler dolomite aquifers | 5.02 | 5.84 | 6.95 | |







Table 5. Results of Sensitivity Analysis (Continued)

| input variable | measurements or estimates: least | best | highest | note |
|---|---|---|---|---|
| combined thickness of Rustler dolomite aquifers (ft) | 49.37 | 49.37 | 49.37 | I |
| primary porosity | .1 | .1 | .1 | J |
| thickness x porosity (ft) | 4.937 | 4.937 | 4.937 | |
| total area of Nash Draw watershed ($10^8$ ft$^2$) | 8.54 | 9.84 | 11.15 | D |
| total storage capacity of dolomite aquifers ($10^{10}$ ft$^3$) | 4.22 | 4.85 | 5.50 | |
| average annual recharge to Rustler dolomite aquifers ($10^8$ ft$^3$/yr) | 6.95 | 5.84 | 5.02 | |
| recharge time for Rustler dolomite aquifers (years) | 60.7 | 83.0 | 110 | |
| combined thickness of Rustler dolomite aquifers (ft) | 49.37 | 49.37 | 49.37 | I |
| secondary porosity | .007 | .007 | .007 | K |
| thickness x porosity (ft) | .3456 | .3456 | .3456 | |
| total area of Nash Draw watershed ($10^8$ ft$^2$) | 8.54 | 9.84 | 11.15 | D |
| total storage capacity of dolomite aquifers ($10^9$ ft$^3$) | 2.95 | 3.40 | 3.85 | |
| average annual recharge to Rustler dolomite aquifers ($10^8$ ft$^3$/yr) | 6.95 | 5.84 | 5.02 | |
| recharge time for Rustler dolomite aquifers (years) | 4.24 | 5.82 | 7.67 | |

Table 6. Sources of Data in Sensitivity Analysis

A. 108 in/yr from Dunne and Leopold (1978, Figure 4-3, p. 102); 110 in/yr from Havens and Wilkins (1979, p. 27; 112.75 in/yr from USDA Soil Survey, Eddy Area, New Mexico, 1971, p. 80).

B. All values from Havens and Wilkins (1979, p. 30); 70% value supported by Dunne and Leopold (1978, p. 101).

C. 11.25 in/yr from Carlsbad FAA weather station, 1955-1982, 29 miles from ERDA-9; 14.21 in/yr from Duval Potash weather station in Nash Draw, 1955-1982, 14 miles from ERDA-9; 14.51 in/yr from Maljamar weather station, 1955-1982, 29 miles from ERDA-9.

D. 226,000 acres (9.84 x $10^9$ $ft^2$) measured by planimeter on USGS topographic maps. However, the topographic divide may not be the same as the groundwatershed divide. 400 square miles (11.15 x $10^9$ $ft^2$) is a rough estimate from Hunter (1985, p. 3). 8.54 x $10^9$ $ft^2$ is an arbitrary figure of equal variance from the best estimate.

E. Measured by planimeter on USGS topographic maps.

F. Calculated by subtracting river discharge at the Malaga gaging station from the Pierce Canyon Crossing gaging stations. 31 years (1951-1982) of daily measurements were utilized.

G. From Havens and Wilkins (1979, p. 30). For each 100 parts of water evaporated, 17 parts of salt will precipitate.

H. 2,120 acres (9.23 x $10^7$ $ft^2$) from Robinson and Lang (1938, Figures 2, 3 and 4), which represents the maximum natural extent of the salt lake. Subsequent shoreline transgression has been due to effluent discharge from potash refineries. 1,970 acres (8.58 x $10^7$ $ft^2$) from Hunter (1985, p. 30).

I. Average measurement from 52 boreholes.

J. Assumption of Powers et al. (1978), EEG-8 (1980), Barrows (1982) and EEG-32 (1985).

K. From the H-6 tracer test (Mercer, 1983, p. 78).





Effect of Potash Refinery Effluent on Water Balance

Since the onset of potash refining in the Nash Draw watershed, Laguna Grande has been enlarged and contaminated by liquid effluent discharge from the potash refineries. More recent maps of Laguna Grande reflect this shoreline transgression, and not the natural extent of the salt lake. Large quantities of water are imported from outside the Nash Draw drainage basin, and are released in the form of saturated brine, which has changed the water balance.

Beginning in 1932, the U.S. Potash Company (later called the U.S. Borax and Chemical Company) used Laguna Grande for disposal of liquid waste products from its potash refinery near the west side of the lake (Cooper and Glanzman, 1971, p. A-8; Gilkey and Stotelmeyer, 1965, p. 13). Today there are three other potash refineries within the Nash Draw drainage basin: International Minerals and Chemical Corporation (IMC), Kerr-McGee (recently bought out by New Mexico Potash Company), and Duval Corporation (Geohydrology Associates, 1978, Figure 2).

Some liquid effluent from potash refining operations evaporates from spoils piles and from unlined ponds (Hunter, 1985, p. 20). But none of the brine disposal ponds can evaporate all the brine discharged into them. All the disposal ponds leak into the groundwater system (Geohydrology Associates, 1978, p. 84; Gilkey and Stotelmeyer, 1965,

pp. 13-17), although some of the liquid effluent emerges elsewhere in natural or newly created lakes which allow further evaporation (Hunter, 1985, p. 20).

Based on the most recent estimates in government publications, the potash refineries discharge a combined total of 8,542 gallons per minute (gpm) of liquid effluent into evaporation ponds within the Nash Draw drainage basin. It is estimated that only 5,949 gpm actually evaporates, while 2,593 gpm seeps into the groundwater system.

Table 7: Seepage from Potash Refinery Disposal Ponds into Nash Draw

| | discharge | evap. | seepage |
|---|---|---|---|
| * U.S. Borax & Chem. Corp. | 3,195 | 3,010 | 185 |
| ** Int'l Min'l & Chem. Corp | 3,244 | 1,935 | 1,309 |
| ** Duval Corporation | 1,278 | 560 | 718 |
| ** Kerr-McGee | 825 | 444 | 381 |
| Total industrial | 8,542 | 5,949 | 2,593 |

* Gilkey and Stotelmeyer (1965)
** Geohydrology Associates (1978)
All data expressed in gallons per minute (gpm)

Table 3 does not include 615 gpm discharged by Kerr-McGee into Laguna Toston (Geohydrology Associates, 1978, pp. 73-74), which is outside Nash Draw drainage basin.

If the 2,593 gpm of potash effluent seepage is compared with the 8,152 gpm (5.84 x $10^8$ $ft^3$/yr) of natural groundwater estimated to be necessary to recharge Laguna Grande, then it would appear that about 75.9% of the water in Laguna





Grande is derived from the natural hydrologic system, and that about 24.1% is seepage from potash refinery disposal ponds. At the onset of potash refining in the Nash Draw watershed, the areal extent of Laguna Grande was 2,120 acres (Figure 73), or 80.3% of its current extent of 2,640 acres. The shoreline transgression of Laguna Grande closely correlates with the increased discharge to the lake due to seepage from the evaporation ponds of the potash refineries. This tends to verify the figure of 2,120 acres as a reliable measurement of the natural extent of Laguna Grande.

Geochemistry of Rustler Groundwater Discharge

The geochemistry of groundwater discharge into Laguna Grande and Malaga Bend was compared to the geochemistry of Rustler fluids, affording a basis for determining which Rustler aquifers discharge at which locations. It was confirmed that the Rustler dolomite aquifers and gypsum caves discharge into Laguna Grande, not Malaga Bend.

A search of the geohydrologic literature produced geochemical data for the brine aquifer near Malaga Bend, and for Culebra dolomite, Dewey Lake Redbeds, Surprise Spring, and IMC potash refinery effluent discharge in Nash Draw. Comparable geochemical data was obtained from a water sample collected on September 5, 1984, at the Laguna Pequena inlet to Laguna Grande. The data are compiled in Table 8.

Table 8. Geochemical Data from Nash Draw and Vicinity

| | Location and Date | Origin | HCO$_3$ | Na | Cl | Mg | K | Ca | SO$_4$ | F | Sr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| * | Laguna Plata outlet (9/5/64)<br>NW/4 NE/SE sec 4, T 23 S, R 29 E | surface | | 7.38% | 14.5% | 5,060 | 1,464 | 828 | 1,664 | 15.2 | 5,240 |
| ** | Surprise Spring (1978)<br>SW/4E/4W sec 4, T 23 S, R 29 E | surface | 169 | 9.19% | 17.9% | 5,250 | 1.18% | 425 | 5,500 | | |
| ** | IMC discharge (1978)<br>NE/4 sec 12, T 22 S, R 29 E | surface | 179 | 10.6% | 18.8% | 3,750 | 1.00% | 350 | 8,250 | | |
| *** | Base of Forty-niner Ridge (2/19/59)<br>NW/4/NW sec 32, T 22 S, R 30 E | Culebra | 142 | 110 | 152 | 199 | 5.8 | 584 | 2,080 | 1.6 | |
| *** | Little Mindell well (3/26/59)<br>SE/SE/SE sec 2, T 23 S, R 30 E | Culebra | 113 | 512 | 550 | 131 | 29 | 584 | 2,110 | 1.5 | |
| *** | Indian well (4/1/59)<br>NE/NE/NW sec 21, T 23 S, R 30 E | Culebra | 178 | 432 | 580 | 160 | 10 | 632 | 2,070 | 1.5 | |
| *** | Smith well (2/6/59)<br>SW/4E/4W sec 19, T 23 S, R 30 E | Culebra | 189 | 28 | 22 | 92 | 5.0 | 608 | 1,690 | 1.0 | |
| *** | Cocoa well, James Ranch (4/1/59)<br>SE/NE sec 7, T 23 S, R 31 E | D.L.R. | 252 | 152 | 89 | 56 | 2.0 | 156 | 539 | 1.7 | |
| *** | Hope well (2/4/59)<br>NW/SW sec 17, T 23 S, R 31 E | D.L.R. | 143 | 117 | 270 | 126 | 3.4 | 632 | 1,720 | 1.6 | |
| *** | Fairview well (2/4/59)<br>SE/SW sec 26, T 23 S, R 31 E | D.L.R. | 116 | 198 | 128 | 156 | 3.8 | 552 | 2,080 | 1.6 | |
| *** | Walker well (4/1/59)<br>SW/4NW/4 sec 29, T 23 S, R 31 E | D.L.R. | 134 | 136 | 330 | 156 | 3.8 | 608 | 1,750 | 1.5 | |
| **** | Northeast Depression (5/1/64)<br>SW/4 sec 20, T 24 S, R 29 E | brine aquifer | 146 | 11.9% | 18.7% | 3,540 | 6,300 | 436 | 1.53% | 2.8 | |
| **** | USGS-8 test well (1/17/64)<br>SW/SW/NW sec 16, T 24 S, R 29 E | brine aquifer | 102 | 12.0% | 18.7% | 2,700 | 4,500 | 550 | 1.31% | 4.4 | 58 |
| ** | USGS-8 test well (1978)<br>SW/SW/NW sec 16, T 24 S, R 29 E | brine aquifer | 84 | 9.91% | 15.6% | 2,230 | 4,110 | 455 | 1.08% | | |

* Clyde Hill, 2300 W.N. Walnut Blvd., P.O. Box 428, Carvallis, Oregon, 97339
** Geohydrology Associates, 1978, Table 14, page 92.
*** Cooley and Hughes, 1972, Table 1, page 15, and Table 3, page A-18.
**** Havens and Wilkins, 1979, Table 1, page 14, and Table 4, page 21.

All data expressed in milligrams per liter (mg/l), unless otherwise expressed as a percentage.





The mineral constituents of the evaporite rocks which could turn up as high concentrations of dissolved solids in water samples are given in Table 9:

Table 9: Mineral Constituents of Evaporite Rocks

| | |
|---|---|
| Halite | NaCl |
| Sylvite | KCl |
| Langbeinite | $K_2Mg_2(SO_4)_3$ |
| Dolomite | $CaMg(CO_3)_2$ |
| Gypsum | $CaSO_4 + H_2O$ |

Dissolved halite (NaCl) from the Salado Formation is known to discharge from brine springs at Malaga Bend on the Pecos River (Hale, Hughes and Cox, 1954, p. 15; Havens, 1972, p. 132; Havens and Wilkins, 1979, p. 1). The ratio of chloride (Cl) to sodium (Na) is given in the geochemical data from USGS test wells which tap the brine aquifer at Malaga Bend; the Cl:Na ratio varies only from 1.56 to 1.57 (Havens and Wilkins, 1979, Table 4, p. 28; Geohydrology Associates, 1978, Table 14, p. 92). The ratio of the atomic weights of chloride and sodium is 1.54, which indicates that virtually all of the sodium and chloride content in the brine aquifer is due to dissolved halite, and almost none of the chloride content is due to sylvite potash (KCl). Any significant increase in the Cl:Na ratio at other points of measurement would be attributed to excess chloride not from halite, but from sylvite potash, and would therefore be

accompanied by increased concentrations of potassium (K).

Levels of potassium (K), magnesium (Mg) and sulphate ($SO_4$) are orders of magnitude higher in the brine aquifer than at any of the other test wells. This is clearly due to langbeinite potash [$K_2Mg_2(SO_4)_3$] and not to dolomite [$CaMg(CO_3)_2$] or gypsum ($CaSO_4 + H_2O$), because hydrocarbon ($HCO_3$) and calcium (Ca) levels in the brine aquifer are among the lowest at any of the test wells.

Thus, geochemical data shows that the sources of dissolved solids in the brine aquifer which discharges to the Pecos River at Malaga Bend are halite and langbeinite from the Salado Formation, and not dolomite and gypsum from the Rustler Formation. This implies that the Rustler dolomite aquifers and gypsum caves have no effective hydrologic connection to the brine aquifer at the base of the Rustler.

48

Effluent discharge from the IMC potash refinery to evaporation ponds in Nash Draw contained elevated levels of potassium (K) and chloride (Cl); these are attributable to sylvite potash. The Cl:Na ratio of IMC discharge is 1.77, which indicates a chloride level 22,000 mg/l (13%) higher than that which may be attributed to halite alone. The potassium level in the IMC discharge is 10,000 mg/l, as compared to potassium levels of 5.0 mg/l to 29 mg/l in naturally occurring groundwater from the Culebra dolomite.

Levels of magnesium (Mg) and sulphate ($SO_4$) in the IMC





discharge are also higher than in the Culebra test wells. This should not be attributed to dolomite or gypsum, because the calcium (Ca) level in the IMC discharge is lower than in the Culebra test wells. Therefore, the elevated levels of magnesium and sulphate should be attributed to langbeinite potash.

Geochemical analysis of discharge from the Laguna Pequena outlet indicates a Cl:Na ratio of 1.96, which is almost identical to the Cl:Na ratio of 1.95 at Surprise Spring. Chloride content is 29,000 mg/l (25%) higher at Laguna Pequena, and is 35,000 mg/l (24%) higher at Surprise Spring, than that which may be attributed to halite alone. The excess chloride is due to sylvite potash.

Evidence of high amounts of langbeinite potash in Laguna Pequena is found in its concentrations of potassium (K), magnesium (Mg) and sulphate ($SO_4$), which are 46%, 35% and 101% higher, respectively, than in the IMC discharge believed to be the major source of contamination. At Surprise Spring, high amounts of langbeinite potash are revealed by potassium and magnesium levels 18% and 40% higher, respectively, than in the IMC discharge. This would imply that IMC potash effluent, diluted by mixing with natural groundwater, has been flowing all the way to Laguna Pequena and Surprise Spring for a sufficiently long time to allow the potash minerals to precipitate out of evaporating water and thus to attain concentrations even higher than in

the original source of the contamination.

The sulphate ($SO_4$) level at Surprise Spring is lower than in the IMC discharge, which implies that gypsum may not be a major source of dissolved solids at Surprise Spring. The gypsum caves in the hills high above Surprise Spring may be relict features.

49 At Laguna Pequena, calcium (Ca), sulphate ($SO_4$) and magnesium (Mg) levels are 237%, 201% and 135% higher, respectively, than in the IMC effluent discharge; in fact, levels of both calcium and sulphate are the highest in

49 Table 8. This must be attributed to dissolution of gypsum and dolomite. Robinson and Lang (1938, p. 85) reported that Laguna Grande is filled with 55 feet of fine crystalline gypsum; the waters of Laguna Pequena are a likely source.

The karst interpretation is strongly corroborated by

49 the presence of an unusually high level of fluoride (15.2 mg/l) and an extremely high level of bromide (5,240 mg/l) at Laguna Pequena. Bromide (Br) and fluoride (F) are trace elements associated with dissolution of evaporites such as gypsum.

It is virtually certain that the Rustler dolomite aquifers and gypsum caves discharge into Laguna Grande, not Malaga Bend. There is no evidence to the contrary. Because

50 the Culebra and Magenta dolomite aquifers are the major water-bearing units above the WIPP repository, they are the most likely pathways for transport of radionuclides from the





WIPP repository to the biosphere. Laguna Grande, not Malaga

50 Bend, is therefore the more likely discharge point for contaminated water from the WIPP site.


Summary

Laguna Grande is the outlet for Nash Draw, a closed drainage basin with no surface water or groundwater outlet to the Pecos River. It is a naturally occurring salt lake; its high-water mark encompassed 2,120 acres before the natural groundwater equilibrium in Nash Draw was disturbed by human action.

The recharge to Laguna Grande by naturally occurring groundwater is estimated at $5.84 \times 10^6$ ft³/yr. This is

51 equivalent to 5.03% of the precipitation on the Nash Draw watershed. At this rate of groundwater recharge, the length of time necessary to completely empty and refill the Rustler dolomite aquifers would be about 83.7 years if primary porosity is dominant, and 5.9 to 8.1 years if secondary karst porosity is effective.

A confined brine aquifer at the base of the Rustler Formation discharges in brine springs at Malaga Bend on the

52 Pecos River. The brine springs are saturated with halite, but contain no evidence of dolomite or gypsum; hence the Rustler dolomite aquifers and gypsum caves have no effective hydrologic connection to the brine aquifer.

It is estimated that total inflow to the Pecos River at Malaga Bend equals 6.53 x $10^7$ $ft^3$/yr. Natural groundwater inflow to Laguna Grande accounts for about 8.94 times as much water. Laguna Grande, not Malaga Bend, is the major outlet of the Rustler Formation, and is the nearest natural groundwater discharge point to the WIPP site.

Discharge from Laguna Pequena into Laguna Grande contains a higher concentration of dissolved gypsum than any reported in the geohydrologic literature for the Nash Draw area. This is accompanied by unusually high levels of bromide and fluoride, which are trace elements associated with dissolution of gypsum. Laguna Pequena is a likely source of the 55 feet of fine crystalline gypsum fill in the bottom of Laguna Grande. The Rustler dolomite aquifers and gypsum caves discharge into Laguna Grande, not Malaga Bend. Because the Rustler dolomite aquifers are the most transmissive aquifers at the WIPP site, Laguna Grande would be the more likely discharge point for plutonium-contaminated water from the WIPP site.

53





CHAPTER IX

HYDROLOGIC EFFECTS OF CLIMATIC CHANGE

Introduction

As the search continues for a suitable site for long-term geologic isolation of radioactive waste, scientific reconstruction of past climatic change has taken on a new urgency. The study of paleoclimatology is especially pertinent in regard to the disposal of long-lived radioactive isotopes, such as plutonium-239 from the nuclear weapons program. Plutonium-239 has a half-life of 24,000 years, more than twice the average length of the interglacial periods of the Pleistocene Epoch. 24,000 years ago, the Wisconsin ice sheet was just beginning to advance toward the last full-glacial maximum. Due to variations in the earth's orbital parameters, incoming solar radiation in the northern hemisphere will decrease over the next 9,000 years (Vernekar, 1972; Berger, 1978). Another glacial advance is predictable during the next half-life (24,000 years) of plutonium-239 (Imbrie and Imbrie, 1980, p.943), that is, before even half of it has decayed.

In the Final Environmental Impact Statement (FEIS, 1980) for WIPP, it is erroneously concluded that climatic conditions in southeastern New Mexico did not change during

glaciations, and that the local climate remained semi-arid (FEIS, 1980, p. 7-21) during the last 500,000 years. The FEIS acknowledges that "there were significant climate-caused geologic changes elsewhere in the United States during that time;" but the FEIS insists that "there were no significant geologic effects at the WIPP site." (FEIS, 1980, p. 7-99)

It is the intent of this chapter to review the existing body of paleoclimatic knowledge, so that calculations of the Nash Draw water balance are not limited to the present climatic regime. The scope of this chapter is restricted to late Quaternary environments, for which radiocarbon dating is reliable. The evidence presented relates to climatic change associated with the advance and retreat of the Wisconsin ice sheet.

Paleoclimatic research in the Pecos River Valley has focused on the middle Pleistocene (e.g. Bachman, 1983, pp. 36-43; Bachman, 1984, pp. 17-20). Evidence of late Quaternary climatic change in adjacent physiographic provinces is more substantial. The evidence presented herein is primarily from the Llano Estacado, the Guadalupe Mountains and the Sacramento Mountains, and should be extrapolated to the Pecos River Valley only with caution.





Late Quaternary Climatic Chronology of the Llano Estacado

The Llano Estacado (Staked Plains, or Southern High Plains) of western Texas and eastern New Mexico "is transitional between the desert West and the more humid Great Plains of North America." (Spaulding et al., 1983, p. 283) The Llano Estacado is now an isolated remnant of the massive piedmont alluvial plain (Reeves, 1965, p. 182; Reeves, 1976, p. 214) formed during the late Tertiary (Frye and Leonard, 1965, p. 216) by streams flowing eastward from the Rocky Mountains (Wendorf, 1961a, p. 14).

The Llano Estacado is a clearly defined physiographic province, bounded on all but its southern extremity by nearly vertical, erosional escarpments ranging up to 1,000 feet in relief (Bretz and Horberg, 1949a, p. 477; Reeves, 1976, p. 214; Wendorf, 1961a, p. 14). These cliffs are prominent for hundreds of miles along the western margin of the Llano Estacado (Wendorf, 1961a, p. 14); here the cliffs act as a drainage divide between the southward-flowing Pecos River on the west and the slightly entrenched eastward surface drainage of the Llano Estacado. It is a retreating scarp (Bretz and Horberg, 1949a, p. 477), where tributaries of the Pecos River have cut back the Llano Estacado (Wendorf, 1961a, p. 14).

The present environment allows few permanent lakes on the Llano Estacado; "thus, the presence of thousands of

ancient lake basins and old drainage valleys indicates a drastic climatic change has taken place." (Reeves, 1966, p. 287) Lakes have been forming, filling and disappearing on the Llano Estacado throughout the Pleistocene Epoch (Reeves, 1966, p. 285). Periods of glacial advance closely coincide with periods of high lake levels on the Llano Estacado; conversely, periods of glacial retreat were reflected by low lake levels (Wendorf, 1961a, p. 21; Reeves, 1966, pp. 285, 287-288).

High lake levels in more than 100 closed lake basins throughout the southwestern United States during the last full-glacial maximum have been confirmed. What are now dry playa lakes contained water when the continental glaciers were well-developed (Smith and Street-Perrott, 1983; Van Devender, 1977, p. 192). However, lake level chronologies were different for much larger pluvial lakes such as Lake Lahontan in Nevada; its highest stand was at about 13,000 yr B.P. (Before Present), well after the full-glacial maximum (Thompson et al., 1986, Table 1, pp. 4-5).

Pollen tends to be best preserved in lake sediments. Because pollen is windblown, it represents regional vegetation. If collected in stratigraphic context and properly dated, a lacustrine pollen record can provide a continuous record of climatic change. In the southwestern United States, cores of ancient pollen deposits have been recovered from sediments in existing lakes, dry lakes (playas),





alluvium, spring deposits, and cave fill (Spaulding, et al., 1983, p. 265).

Because the Llano Estacado surface is studded with ancient lake basins (Wendorf, 1961a, Figure 2, p. 15), pollen analysis has provided the most reliable means of paleoclimatic reconstruction for the Llano Estacado (Bryant and Holloway, 1985, p 40). Nowhere else in Texas has a fossil pollen record been recovered which is older than the late Wisconsin full-glacial (Bryant and Holloway, 1985, p. 41).

The earliest studies of late Quaternary pollen sediments from the Llano Estacado were published by Hafsten (1961). These studies are not obsolete. Reeves (1966, pp. 284-285) and Spaulding et al. (1983, pp. 283-284) are in general agreement with Hafsten's conclusions and correlations. Hafsten's sampling locations were as near as 150 miles to northeast of the WIPP site (Bryant and Holloway, 1985, pp. 42-43). The names for the pluvial and interpluvial periods are all taken from Wendorf (1961), and have also been adopted by Reeves (1966).

An early-Wisconsin cold and moist period (the Terry Pluvial), with open boreal woodlands of scattered pine, spruce and juniper, ended about 33,500 years B.P. (Before Present) on the Llano Estacado. Also present were oak, grass and sage; the conifers were probably restricted to protected and better watered areas (Reeves, 1966, p. 284; Hafsten, 1961, p. 90; Wendorf, 1961a, p. 19; Bryant and

Holloway, 1985, p. 44, and Figure 2, p. 45). Older, undated pollen sediments suggest that vegetation on the Llano Estacado may have oscillated between mixed prairie and pine-spruce parkland, in response to changes in the available moisture (Bryant and Holloway, 1985, p. 42).

There followed a relatively dry and warm period (the Rich Lake Interpluvial), slightly moister and cooler than the present climate. Vegetation was mostly desert scrub, grassland, herb and sage. Pine and spruce on the Llano Estacado declined to approximately their present values, then gradually increased. This species assemblage is similar to modern sites at least 125 km (78 mi) from the nearest conifer stands (Reeves, 1966, p. 284; Hafsten, 1961, p. 90; Wendorf, 1961a, p. 19; Bryant and Holloway, 1985, Figure 2, p. 45).

Beginning about 22,000 yr B.P., and for the next six to eight thousand years, cold and wet conditions returned (the Tahoka Pluvial). The grassland steppe was replaced, and open boreal woodlands of pine and spruce again became the principal vegetation on the Llano Estacado. During this period, summer and winter temperatures were 15° to 20°F (8° to 11°C) cooler than today, and ponds reached their maximum extent (Reeves, 1973, p. 693; Hafsten, 1961, p. 90; Wendorf, 1961a, p. 19; Frye and Leonard, 1965, p. 206); Bryant and Holloway, 1985, p. 44, and Figure 2, p. 45). The Tahoka Pluvial encompasses the late Wisconsin full-glacial maximum.





Remains of bison, horse, camel, mammoth, mastadon, sloth, deer, jackrabbit and turtle have been dated at 14,000 to 20,000 yr B.P., during the full-glacial, on the Llano Estacado (Reeves, 1966, p. 285; Wendorf, 1961b, p. 130). Pinyon pine and spruce steadily increased, reaching 65% and up to nearly all of the pollen record. Full-glacial fossils from western and central Texas record open boreal forest "at every site where observations are available." (Reeves, 1966, p. 284)

This sequence is interrupted at about 16,000 yr B.P. (Monahans Interval). The early ponds dried up and were scoured by intensive wind erosion, and dune sand migrated over the lake deposits (Wendorf, 1961a, p. 19, and Figure 4, p. 21; Wendorf, 1961b, p. 130).

With the return of moist conditions at about 14,000 yr B.P. (the Blackwater Subpluvial) occurred the first known human occupation, together with elephant, horse, camel and bison. Grassland species were dominant; pine and spruce, though sharply reduced, were still considerably more frequent than today, probably as remnants of the former boreal forest, concentrated in stream valleys, along escarpments, and in other protected localities (Wendorf, 1961a, p. 20; Wendorf, 1961b, pp. 130-131; Hafsten, 1961, p. 91; Spaulding et al., 1983, p. 284). This was "the last time permanent lakes were sustained" on the Llano Estacado (Reeves, 1973, p. 693).

The late-glacial (14,000 to 10,000 yr B.P.) was a transitional period, converting pluvial conditions into drier steppe conditions with warmer summers. Large areas of grasslands developed at the lower elevations as pine and spruce became restricted to small stands in protected locations and higher elevations (Hafsten, 1961, p. 91; Bryant and Holloway, 1985, pp. 50-51).

The date of 11,000 yr B.P. marks an important fall in levels of pluvial lakes throughout the American Southwest (Spaulding et al., 1983, p. 263; also Street-Perrott and Harrison, 1985, p. 321). It was "a time of consistent, widespread, contemporaneous vegetational change throughout the Southwest." (Van Devender and Spaulding, 1979, p. 709). At this time there was a drying and erosion of ponds, declining stream volume, and a forming of dunes on the Llano Estacado. Elephant, horse and camel disappeared; of the large mammals, only the bison survived (Wendorf, 1961a, p. 20).

Moist conditions returned between 10,500 and 9,500 yr B.P. (the Lubbock Subpluvial) as recorded by pond sediments, stabilization of sand dunes, and formation of a deep soil zone. The frequencies of pine increased slightly, but temperatures were still too high to be tolerated by spruce. This was followed by drier conditions, as recorded by the drying of ponds and the transition from freshwater to saline flora (Wendorf, 1961a, p. 20).





This relatively arid interval was terminated about 7,000 yr B.P., as indicated by the rebirth of ponds, the filling of arroyos, and the presence of freshwater flora. But the extensive boreal woodlands had disappeared. "A few pine and spruce managed to survive in protected areas along the escarpments and in stream valleys" in the grass and sage landscape (Wendorf, 1961b, p. 130).

The pollen record shows that the Llano Estacado has undergone drastic climatic change, coinciding with advances and retreats of the Wisconsin ice sheet. Lakes have formed, filled and disappeared. Open boreal woodlands of pine and spruce have alternated with desert scrub, sage and grassland vegetation. The present climatic regime and vegetation cover are not representative of long-term conditions on the Llano Estacado.

Late-Glacial Climate in the Guadalupe Mountains

In rugged terrain where caves and rock overhangs are more abundant than ponds and playas, packrat "middens" may be more available than pollen deposits as a source of data for reconstruction of ancient climates and vegetation cover.

More than 150 species of packrats range throughout North America, and all gather "prodigious amounts of plant debris for den construction and food." (Spaulding et al., 1983, p. 263) Packrat dens lie protected in heavy brush,

cactus patches, rock shelters and caves. Each den includes a trash midden, which also serves as a urination and defecation point. Packrat middens are cohesive and nearly rock hard; they can adhere to a cave ceiling or wall after a supporting shelf collapses, and may remain intact for tens of thousands of years. Ancient packrat middens contain thousands of perfectly preserved plant macrofossils; most species can be identified. Because a packrat forages mostly within 30 meters (100 feet) of its den, the preserved macrofossils are almost point-specific (Spaulding et al., 1983, pp. 263-264).

If midden samples are collected in good stratigraphic context, a valid radiocarbon date may be associated with the plant species preserved in the midden. This allows the macrofossil assemblages to be located in time as well as in space (Lanner and Van Devender, 1981, p. 278; Spaulding et al., 1983, p. 264). Ancient packrat middens, plentiful in many areas of the Southwest, "provide an elaborate, high-resolution view of local vegetation at particular times in the past." (Spaulding et al., 1983, p. 265)

Ancient packrat middens have been recovered from two limestone caves at the south end of the Guadalupe Mountains, (Lanner and Van Devender, 1981, p.. 283), 70 miles southwest of the WIPP site. One midden from a cave at an elevation of 1,500 meters (5,000 feet) was dated at 12,040 yr B.P.; it contained Colorado pinyon pine associated with Rocky





mountain juniper, wild cherry, oak, and New Mexican locust. Another midden from a cave at an elevation of 2,000 meters (6,700 feet) was dated at 13,000 yr B.P.; it contained Colorado pinyon pine associated with spruce, dwarf juniper, southwestern white pine, and Douglas-fir (Lanner and Van Devender, 1981, p. 283; Spaulding et al., 1983, p. 266).

These are the only two sites in the entire Chihuahuan Desert where the midden record contains a mixed coniferous forest. The two sites contained subalpine species (spruce and dwarf juniper at 2,000 meters); montane species (Douglas-fir and southwestern white pine at 2,000 meters); and woodland species (Rocky Mountain juniper at 1,500 meters, and Colorado pinyon at both elevations). The two sites also included desert grassland elements; "such a mixture cannot be found in the existing vegetation of the area." (Spaulding et al., 1983, p. 266; Van Devender and Spaulding, 1979, p. 707)

Seventeen other packrat midden sites dating from the full-glacial period (21,000 to 15,000 yr B.P.) have been recovered from sites located elsewhere in the Chihuahuan Desert. Sixteen contained abundant juniper; thirteen contained abundant Texas pinyon; oak was found at seven sites; but only the Guadalupe Mountain sites contained spruce or Douglas-fir. Outside of the Guadalupe Mountains, only the two sites at both the highest elevations and the highest latitudes contained Colorado pinyon; these sites

were at 1,495 meters (4,985 feet) in the Sacramento Mountains of central New Mexico (Spaulding et al., 1983, Table 14-1, pp. 269-270).

During the full-glacial period, the range of Colorado pinyon extended no farther south than today, although it occurred at somewhat lower elevations (Lanner and Van Devender, 1981, p. 287). Douglas-fir is present today in the Guadalupe Mountains (Wells, 1966, p. 974; Powell, 1980, p. 301).

But the greatly diminished ranges of other woodland and subalpine species is persuasive evidence of climatic change. A Colorado pinyon-juniper-oak association today occurs only on the upper slopes and valleys of the Guadalupe Mountains (Powell, 1980, p. 301). Spruce and dwarf juniper no longer occur in the Guadalupe Mountains; the lower limit of the modern spruce forest is about 2430 meters (8100 feet) in elevation, 110 km (70 mi) to the northwest in the Sacramento Mountains (Van Devender and Spaulding, 1979, p. 707).

What is most relevant to the Mescalero Plain is that at the same time permanent lakes were last sustained on the Llano Estacado (the Blackwater Subpluvial, about 14,000 to 12,000 yr B.P.) (Reeves, 1973, p. 693), a Colorado pinyon-juniper-oak association grew at an elevation of 5,000 feet in the Guadalupe Mountains, while pine was associated with spruce and dwarf juniper at an elevation of 6,700 feet (Lanning and Van Devender, 1981, p. 283). The present





environment allows few permanent lakes on the Llano Estacado (Reeves, 1973, p. 693); spruce and dwarf juniper no longer occur in the Guadalupe Mountains (Van Devender and Spaulding, 1979, p.707); and the Colorado pinyon-juniper-oak association is now confined to the upper slopes and valleys (Powell, 1980, p.301). Thus it appears that simultaneous climatic change took place on both sides of the Mescalero Plain.

Evidence of Climatic Change in Pecos River Valley

In a closed lake basin with no outlet, under equilibrium conditions, precipitation on the lake plus inflow to the lake must equal lake evaporation (Galloway, 1970, p. 251). The past existence of permanent pluvial lakes is evidence of a Pleistocene climate either cooler or moister, but not necessarily both. A rise in lake level means only that the combined rate of precipitation on the lake plus inflow from the surrounding drainage area must have exceeded the combined rate of lake evaporation plus outflow (Reeves, 1973, p. 693). The term "pluvial" as used by Reeves (1965, p. 181) implies wetter conditions due either to greater precipitation, or to increased runoff, or both.

Numerous small playas (Laguna Gatuna, Laguna Plata, Laguna Tonto, Williams Sink, Sam Simon Sink, Slick Sink, Bell Lake Sink) are located between 12 and 20 miles from the

center of the WIPP site. All contained lakes during the late Pleistocene and early Holocene, as evidenced by core samples, ancient shorelines, and clay dunes on their leeward sides (Widdicombe, 1979, pp. 20, 125; personal observation; Reeves, 1/11/86, personal communication). Clay dunes (lunettes) form when the lake level drops, exposing marginal saline flats to desiccation and deflation. Pellets of salt and clay are formed and carried by the wind and trapped on the former lake shore. When the salt leaches away, clay dunes are left behind, preserving a record of the former lake level. Groundwater is the controlling hydrologic factor in the formation of clay dunes, because it controls the lake size and influences the composition of the lake waters (Widdicombe, 1979, pp. 20, 125).

Gypsum spring deposits are preserved on top of an exposure of Dewey Lake Redbeds at the foot of Livingston Ridge (E/2 sec 15, T 22 S, R 30 E), about 1.5 miles west of WIPP-33. The air photos show that the gypsum deposits cover most of a 3,500-foot-long area; they have been dissected by alluvial action since their deposition. The gypsum deposits formed when tension fractures allowed spring water bearing dissolved gypsum to flow to the land surface; the gypsum mounds developed as the spring water evaporated (Bachman, 1985, p. 20). Bones and teeth of extinct species of horse and camel have been preserved in these gypsum deposits, but the ages of the preserved specimens have not been determined





with any degree of certainty (Bachman, 1981, p. 5).

The gypsum springs are long extinct (Bachman, 1985, p. 20), but this does not mean that dissolution of gypsum is no longer active; the high levels of calcium and sulphate measured in groundwater discharging from Laguna Pequena is evidence of ongoing gypsum dissolution. It does mean that the hydrologic regime has changed; either the water table was lowered, or the effective karst conduits in Rustler gypsum have changed courses, or both.

The groundwater regime, affected primarily by precipitation and evaporation, is the major factor influencing the rate of evaporite dissolution (Bachman, 1980, p. 86). It may be assumed that evaporite dissolution was more intense during pluvial periods associated with glacial advance (Bachman, 1985, p. 96).

Paleohydrologic Parameters

In a closed lake basin, inflow to the lake is a function of precipitation and evaporation rates. As the climate changes, these rates are altered. A reconstruction of the water balance of the Nash Draw watershed during the full-glacial climate therefore requires reasonable approximations of precipitation and evaporation rates during the full-glacial climate.

Over a wide range of precipitation values (Galloway,

1970, p. 256), modern timber lines lie near the 10°C (50°F) isotherm for the warmest month. The relationship between the 10°C summer isotherm and upper timberline in the American west is not coincidental. At this temperature, the photosynthesis rates of timberline species such as Engelmann spruce and Bristlecone pine are "barely sufficient for foliage renewal. Very little yearly growth occurs and krummholz or dwarfed trees result." (Galloway, 1970, p. 247)

Brakenridge (1978, p. 29) considers timberline location to be independent of snowfall amounts. He concludes that the full-glacial timberline is "a quite accurate indicator of the July 10°C isotherm."

In the southwestern United States during the full-glacial period (23,000 to 17,000 yr B.P.), the timberline must have reached its lowest position. Galloway (1970, pp. 245-248; and 1983, pp. 236-248) deduces from periglacial geomorphic evidence that the full-glacial timberline, and hence the full-glacial July 10°C isotherm, "were situated no higher than 2,050 meters" (6,750 feet) in the Sacramento Mountains of south-central New Mexico. Present July mean temperatures at this altitude are 20°-21°C (68°-70°F), and the timberline is at approximately 3,400 meters (11,200 feet). Galloway concludes "that summers were at least 10°C (18°F) colder and the timberline was depressed 1300-1400 meters" (4300-4600 feet).

Brakenridge (1978, p. 29) found Galloway's





site-specific estimate of 10°C for the Sacramento Mountains in south-central New Mexico to be reasonable. Bachhuber (1976) inferred a 10°C cooling of summer temperatures on the basis of fossil evidence from paleolake Estancia, in central New Mexico (Brakenridge, 1978, p. 29). Kutzbach and Wright (1985, p. 176) caution that snowline depression in the American southwest might not have been a manifestation of temperature decrease alone, for evidence from some lake-level studies suggests that precipitation might have been greater.

Although evaporation is not a function of temperature, both are a function of net radiation. Galloway (1970, p. 255) plotted the mean monthly temperature against mean monthly evaporation rates at 51 weather stations in the western United States, and compared these with plots of temperatures 10°-11°C (18°-20°F) lower than at present. Galloway estimated a full-glacial evaporation rate of 40%-50% of the present rate. Galloway concludes that Pleistocene lakes could have formed in the closed basins of the southwestern United States even with reduced precipitation (also Reeves, 1973, p. 694).

Even if Galloway's lake budget is recalculated using temperatures only 8°C (14°F) cooler than today, the estimated precipitation increase is only 2 cm (0.8 in), or about 5%, which Brakenridge (1978, p. 32) regards as negligible in light "of the necessary assumptions implicit in any

paleohydrologic reconstruction." Barry (1983, p. 392) also concluded that a minimum cooling of 7°C to 8°C in both summer and winter could have sustained the maximum pluvial lake levels with precipitation close to present amounts.

Galloway (1970, p. 251) concludes that summer temperatures 10°-11°C (18°-20°F) lower than today would have reduced evaporation by about half. Reeves (1976, pp. 213-214) concludes that the full-glacial summer mean temperature was 10°C cooler than today on the Llano Estacado, and "the combined amount of precipitation and runoff into the local lake basins was about 50% greater than at present." Brakenridge (1978, p. 37) concludes that there is no evidence "for the almost universally held opinion that the full-glacial climate in the Southwest was characterized by increased precipitation."

The prevailing opinion seems to be that, during the full-glacial period (23,000-17,000 yr B.P.) in New Mexico and west Texas, summer temperatures were 8°-11°C (14°-20°F) cooler than at present; evaporation was 40%-50% of the present rate; and precipitation was essentially the same as the present rate. Pleistocene lakes could have formed in the lake basins even with reduced precipitation.

54





Hydrologic Effects of Future Climatic Change

No reasonable calculation of the long-term water balance in the Nash Draw watershed can be restricted to present climatic conditions. Future climatic variations must be considered, based on similar climatic variations in the geologic past.

The amount of circulating groundwater in the WIPP site area has at times in the recent geologic past been greater than at present. This is shown by the gypsum spring deposits in Nash Draw (Bachman, 1985, p. 20), and by the pluvial lakes in the region (Widdicombe, 1979, pp. 20, 125). In fact, it is the present climate which is unusual (Van Devender et al., 1979, cited by Bachman, 1980, p. 91). The Holocene is properly viewed not as an epoch distinct from the Pleistocene, but as the latest interglacial interval. Climatic conditions with annual average temperatures as warm as those of the Holocene have typically lasted for only 10% of each glacial/interglacial cycle. Climatic transitions can be rapid; several cooling events spanning only a few hundred years, with temperature drops of up to 5°C (9°F) per 50 years, have been identified (Barry, 1983, p. 394).

The geographic and seasonal pattern of incoming solar radiation (insolation) depends essentially on the obliquity of the ecliptic and the longitude of perihelion. These nearly periodic variations in the earth's orbit can be

55

55 calculated with great accuracy. Because snow accumulates at high latitudes even during a mild winter, what matters is how much snow is preserved during the summer. Milankovitch concluded that the amount of solar radiation received during summer at 65°N latitude was critical to the growth and decay of ice sheets (Imbrie and Imbrie, 1980, pp. 943-944; Covey, 55 1984, pp. 61,.63).

During the next 9,000 years, incoming solar radiation during summmers will decrease at 65°N latitude and throughout most of the northern hemisphere (Vernekar, 1972; Berger, 1978, Figure 2k, p. 155), principally because of a decrease in obliquity. Although in terms of decades and centuries the warming due to increased atmospheric carbon dioxide may overwhelm any cooling due to orbital variations (Covey, 1984, p. 66), the reverse will be true in 9,000 years, long 56 after the depletion of fossil fuel supplies. Atmospheric cooling will not be as pronounced as during Wisconsin glaciation (Vernekar, 1972; Berger, Figure 2a, p. 145), but a glacial advance is predictable.

Potential evaporation exceeds precipitation in the Carlsbad area not only in terms of annual average, but also as a long-term average for every month of the year (USDA, Soil Survey, Eddy Area, New Mexico, 1971, Tables 9 and 10, p. 80). It is intense storms of short duration which exceed the potential evaporation rate, and allow most of the rainwater infiltration to take place.





Precipitation measurements are reported on a daily basis for Nash Draw and Carlsbad. Potential evaporation rates are reported as ten-year averages, broken down by calendar month. Average daily potential evaporation rates can be assumed from the average monthly rates. If the daily potential evaporation rate for the appropriate month is subtracted from a daily measurement of rainfall, the remainder should be representative of the minimum possible infiltration for that day. The estimated minimum infiltration will be somewhat lower than the reality, because actual evaporation is less than the potential evaporation, and because evaporation rates would be lower on stormy days.

If such a comparison is made between daily potential evaporation rates and daily precipitation measurements over a ten-year period (1955-1964) at the Duval Potash Mine weather station, the minimum total rainwater infiltration during this period is calculated to be 62.62 inches. If evaporation rates were reduced by 50% with no increase in precipitation, as is estimated to have happened during the full-glacial (Galloway, 1970, p. 251), then the minimum total rainwater infiltration during this period would have been 88.94 inches, or 1.42 times greater, provided there were no accompanying changes in vegetation which would have increased evapotranspiration. This closely matches the estimate by Reeves (1976, pp. 213-214) that recharge to lake basins on the Llano Estacado was about 50% greater than at

present.

Laguna Grande is contained in the lowest part of Alkali Flat. This sunken area is "clearly due to the collapse of caverns formed by the removal of soluble rocks" (Lee, 1924, p. 116). The floor of Laguna Grande is mostly covered with a thick crystalline salt crust, as much as 16 inches thick (Hafsten, 1961, p. 61). The low occurrence of pine in pollen samples from Laguna Grande indicates that its salt crust was formed during the Holocene (Hafsten, 1961, p. 81).

Field observations support the interpretation that Laguna Grande is a Holocene lake. In contrast to seven paleolakes observed within 17 miles of the WIPP site, Laguna Grande has no clay dunes (lunettes) above its leeward shore, and no ancient shorelines were observed.

The karstic history of the lake basin is indicated by a 50-acre circular hill on the 65-acre island near the middle of Laguna Grande (Figures 73 and 74). It is a residual dome of interbedded red siltstone and sandstone of the Gatuna Formation. It represents the exposed core of insoluble fill material within a collapse sink of mid-Pleistocene Gatuna age, left exposed by differential erosion of more soluble surrounding rocks (Vine, 1963, p. B-41).

Laguna Grande is a classic example of Holocene solution and collapse. It is not a paleolake, and did not exist during the Pleistocene. But it is presently in a closed drainage basin with no surface or subsurface outlet. If

57





future climatic change were to increase groundwater recharge to the lake and/or decrease evaporation from the lake, then shoreline transgression would take place.

57

A lake with an extent of 6,770 acres ($2.95 \times 10^8$ ft$^2$) would reach the 2970-foot contour line and would overflow into the Pecos River by way of Scoggin Flat. This would happen even if irrigation canals to the west of Laguna Grande were to fill in with sediments, thus restoring the natural topographic divide between Laguna Grande and the Pecos River.

If, during a full-glacial advance, precipitation at Laguna Grande were to remain the same (1.18 ft/yr) and the brine evaporation rate were reduced by 50% (to 3.75 ft/yr), then the net brine evaporation rate would equal 2.57 ft/yr. If groundwater recharge to Laguna Grande were to exceed $7.58 \times 10^8$ ft$^3$/yr ($2.95 \times 10^8$ ft$^2$ x 2.57 ft/yr), then the lake basin would overflow.

58

Natural groundwater recharge from the Nash Draw watershed to Laguna Grande is estimated at $5.84 \times 10^8$ ft$^3$/yr under present climatic conditions (Chapter 8). If a 50% reduction in evaporation would have the effect of increasing groundwater recharge by a factor of 1.42, then recharge to Laguna Grande would swell to $8.29 \times 10^8$ ft$^3$/yr during a full-glacial climate, and the lake basin would overflow.

59

Laguna Grande could remain hydrologically separate from the Pecos River during future climatic changes comparable to

the late Wisconsin full-glacial, but only if the lake basin were to be sufficiently deepened by further underground dissolution and surface collapse of the lake basin. However, this could create an underground hydrologic connection between the lake and the river.


## Summary

The present environment allows few permanent lakes on the Llano Estacado. But drastic climatic change has taken place. Lakes have formed, filled and disappeared on the Llano Estacado throughout the Pleistocene, coinciding with advances and retreats of the Wisconsin ice sheet. The pollen record shows that open boreal woodlands of pine and spruce have alternated with desert scrub, sage and grassland vegetation. The present climatic regime and vegetation cover are not representative of long-term conditions on the Llano Estacado.

At the same time permanent lakes were last sustained on the Llano Estacado (the Blackwater Subpluvial, about 14,000 to 12,000 yr B.P.), a Colorado pinyon-juniper-oak association in the Guadalupe Mountains grew at much lower elevations than today; spruce and dwarf juniper grew at high elevations, but they no longer occur in the Guadalupe Mountains. Thus, simultaneous climatic change took place on both sides of the Mescalero Plain.






In New Mexico and west Texas during the full-glacial period (23,000-17,000 yr B.P.), summer temperatures were 8°-11°C (14°-20°F) cooler than at present; evaporation was 40%-50% of the present rate; and precipitation was essentially the same as the present rate. In the Nash Draw watershed, the minimum possible rainwater infiltration under full-glacial conditions would be about 1.42 times greater than the rate under present conditions, assuming no change in vegetation. Natural groundwater recharge to Laguna Grande would swell to about 8.29 x $10^{8}$ $ft^{3}$/yr, and the lake would overflow into the Pecos River by way of Scoggin Flat.

CHAPTER X

ASSESSMENT OF WIPP SITE SUITABILITY

Introduction

In order for a site in a tectonically stable area with no mineral resources to be unsuitable for long-term geologic isolation of radioactive waste, there must be: (1) an aquifer capable of carrying contaminated water to the biosphere within an unacceptably short period of time; and (2) a mechanism which could allow the radioactive waste to reach that aquifer.

At the WIPP site, the aquifers of concern are the dolomite members of the Rustler Formation. For the WIPP site to be suitable for long-term waste isolation, its known mineral resources must never be mined, and either: (1) there must be no plausible mechanism which could bring the buried waste to the Rustler Formation; or (2) the Rustler groundwater must travel too slowly to bring the waste to the biosphere before the waste decays to safe levels.

60

Darcy's Law Applied to Karst Aquifers

Characterizing groundwater travel times for the Rustler Formation is difficult. Such calculations require reliance





on Darcy's law:

$$T = \frac{d\ p}{K\ (h/l)}$$

or

$$V = \frac{K\ (h/l)}{p}$$

where

T = groundwater travel time
d = distance traveled
V = groundwater velocity (d/T)
K = hydraulic conductivity (permeability)
h/l = hydraulic gradient
p = porosity

In permeable rocks other than those giving rise to karst, the upper surface of the saturated zone is the water table, where hydrostatic and atmospheric pressure are equal. The water table in a permeable medium parallels the land surface in a subdued fashion. Groundwater flow paths are perpendicular to potentiometric contour lines, in accordance with the slope of the water table. Groundwater velocity beneath the water table is proportional to the permeability times the potentiometric gradient (Jennings, 1971, p. 88). This is expressed as Darcy's law, the general hydrogeologic equation (Bloom, 1978, p. 145).

Karst groundwater flows not as a single aquifer through intergranular pores, but as multiple aquifers through solution conduits (Jennings, 1971, p. 90). The permeability and the water-holding capacity of limestone normally

increases with time as bedding planes, joints and faults are differentially enlarged by solution, while the vast mass of the limestone remains relatively impermeable (Sweeting, 1973, p. 250; Bloom, 1978, p. 145).

A water table such as occurs in porous rocks like sandstone does not exist in karst limestone; wells close together in limestone often reach water at very different levels (Sweeting, 1973, p. 250; and Jennings, 1971, p. 90). In karst, the groundwater velocity is not proportional to the potentiometric gradient (Barrows, 1982, p. 15).

61

Karstified rocks are not homogeneous, porous media (Milanovic, 1976, p. 166). Original or primary permeability, which depends on the size and degree of interconnection of the original pore spaces in the unconsolidated rock, is uncommon in karst. Secondary permeability, consisting of flow through joints, solution conduits, caverns and cave sediments, is much more representative in karst terrains (LeGrand, 1983, p. 350; Milanovic, 1981, p. 50).

Because of preferential solution along fracture zones in carbonate rocks, the difference in hydraulic conductivity between fracture zones and adjacent unfractured rock will eventually increase, sometimes reaching three orders of magnitude (Fetter, 1980, p. 224). Over time, carbonate aquifers become highly anisotropic and nonhomogeneous as more and more groundwater flows through fewer and fewer solution conduits (Fetter, 1980, p. 218), comprising only a

62





small part of the total area of the watershed. Therefore, almost all boreholes in a karst terrain will miss the active solution conduits, and will show values for hydraulic conductivity which are much less than the average (Barrows, 1982, p. 13). The common techniques of simple interpolation and extrapolation between data points, so useful in more homogeneous aquifers having more uniform groundwater flow, are not applicable in a karstland (LeGrand, 1973, p. 861). Darcy's law would not apply if the model relies on unrepresentative data from uniformly permeable, granular parts of the aquifer rather than from active solution conduits (Bloom, 1978, p. 145).

62

Previous attempts to model groundwater flow in the Rustler Formation (DEIS, 1979; FEIS, 1980; EEG-8, 1980; Gonzalez, 1983a; EEG-32, 1985) have relied on Darcy's law. Hydrologic parameters were obtained from borehole data and are point-specific. The array of test wells is so sparse between the WIPP nuclear waste repository and potential groundwater discharge points (Laguna Grande and Malaga Bend) that as few as three measured data points have been assumed to be representative of the Rustler aquifers for the entire flow path. All these calculations are unreliable; Darcy's law should not be applied to a karstland.

63

Groundwater movement in karst can most reliably be tested by injecting a tracer substance into the water at its inlet into the limestone, provided the tracer can later be

recognized at the karst spring. Such a substance must be soluble in acidic and alkaline water; not easily adsorbed onto calcium carbonate; absolutely certain to be detectable; cheap and readily available; and not harmful (Sweeting, 1973, p. 228).

Tracer testing actually measures the groundwater travel time, not the groundwater velocity. When the linear distance between source and spring is divided by the elapsed time between injection and detection, the derived velocity will be an underestimate which does not account for irregularities in the flow path (Barrows, 1982, p. 14). Still, there have been measurements of karst groundwater movement as fast as 4.1 miles in 5.25 days (.048 ft/sec) in Indiana (Ash and Ehrenzeller, 1983, p. 143), and 20 km in 16.5 hours (1.11 ft/sec) in Yugoslavia (Milanovic, 1981, p. 236).

Under karst conditions, groundwater levels, channels and velocities vary so greatly in space and time as to be unpredictable. Borehole data is unreliable, because almost all boreholes in a karst terrain will miss the effective groundwater conduits, and will indicate groundwater velocities which are much less than the average. Only through tracer testing can karst groundwater travel times be reliably determined.







Rainwater Recharge of the Rustler Formation

It has been shown (Chapters 4-7) that Mescalero caliche at the WIPP site is not a continuous barrier to infiltration of rainwater. In some areas, up to 15% of the caliche is missing, and presents no barrier at all. Where the caliche is impermeable, soil water migrates along its surface until it again moves downward through holes in the caliche.

Karst conditions east of Livingston Ridge are not restricted to the WIPP-33 sink hole. Field work has revealed numerous solution features farther east of Livingston Ridge, and closer to the WIPP nuclear waste repository:

Table 10: Solution Features East of Livingston Ridge

| name of solution feature | distance in miles from: Livingston Ridge | center of WIPP site | edge of waste repository |
|---|---|---|---|
| WIPP-33 sinkhole | 1.1 | 2.9 | 1.9 |
| 2nd depression | 1.15 | 2.85 | 1.85 |
| 3rd depression | 1.2 | 2.9 | 1.8 |
| 4th depression | 1.3 | 2.7 | 1.7 |
| sec 30, trench 1 | 2.3 | 2.2 | 1.1 |
| sec 30, trench 2 | 2.3 | 2.2 | 1.1 |
| sec 30, trench 3 | 2.35 | 2.15 | 1.05 |
| sec 30, trench 4 | 2.4 | 2.1 | 1.0 |
| Barrows' Bathtub | 3.5 | 1.4 | 0.5 |
| WIPP-14 sinkhole | 3.5 | 2.0 | 1.0 |
| gravity anomaly | 3.8 | 2.1 | 1.1 |

Infiltrating rainwater which penetrates the caliche horizon comes into contact with Gatuna and/or Santa Rosa sandstones, where these formations exist, followed by the sandstones and siltstones of the Dewey Lake Redbeds. Slots and tinajitas are manifest solution features in the carbonate-cemented sandstone of the Gatuna Formation at WIPP-33. Carbonate veins in the Santa Rosa sandstone at WIPP-14 are direct evidence of soil water infiltration. The top of the Dewey Lake Redbeds in section 30 is highly pervious, consisting of sandstone and siltstone broken up into small platy fragments; gypsum-filled veins are frequent; and cavernous zones in the Dewey Lake Redbeds have been found in drill holes. It is evident that the Gatuna, Santa Rosa and Dewey Lake formations are not aquicludes; they retard, but do not prevent, the infiltration of rainwater. Some rainwater must reach the Rustler Formation.

65

The alternative explanation is that no infiltrating rainwater reaches the Rustler Formation. This explanation is embodied in the "paleokarst" interpretation of Bachman (1985, p. 25), who contends that the groundwater regime responsible for dissolution of Rustler gypsum is now extinct. It is shown in Chapters 4-7 that numerous solution features allow rainwater to easily penetrate the Mescalero caliche. Thus, the paleokarst interpretation must rely on two easily disproved assumptions:

66

(1) If the sandstone beds were aquicludes preventing





66

rainwater from reaching the Rustler Formation, then perched water tables would be encountered in the sandstone beds. Although the Santa Rosa Formation was encountered at 23 WIPP test holes, only at H-5 was a perched water table found in the Santa Rosa. No perched water table was found in the Gatuna or Dewey Lake formations, which were encountered 25 times and 50 times, respectively, in WIPP test holes (Mercer, 1983). At least four previously existing wells near Nash Draw have found water in the Dewey Lake Redbeds (Cooper and Glanzman, 1971, Tables 2 and 3, pp. A-16, A-18); all are located south of the WIPP site (Table 8). But these are the exception, not the rule, and only serve to underscore the significance of the lack of a perched water table in the Dewey Lake Redbeds at the WIPP site.

(2) If Rustler groundwater were the remnant of an extinct paleokarst hydrologic regime, if dissolution of Rustler evaporite rocks were no longer happening, then Rustler groundwater would be saturated with dissolved solids. Yet the sum totals for the six dissolved solids (sodium, chloride, calcium, sulphate, magnesium and potassium) measured at WIPP test wells vary widely. The range is from 4,998 mg/l to 261,310 mg/l (a factor of 52.28) in the Magenta dolomite at 11 test wells, and from 2,883.7 mg/l to 238,660 mg/l (a factor of 82.76) in the Culebra dolomite at 20 test wells (Gonzalez, 1983b, Tables 2 and 3, pp. 15, 16).

66

66

Such a great variation in levels of dissolved solids is

66 easily explained by freshwater recharge of the Rustler Formation.

Because the Rustler Formation is recharged by rainwater, then Rustler groundwater flow fluctuates with the rainfall, and groundwater flow times through the Rustler Formation are inherently unpredictable. The groundwater flow paths through the Rustler Formation are indeterminate, due to karst conditions. The regional water balance

67 indicates that a time span of 6 to 84 years is necessary to completely recharge the Rustler aquifers. The Rustler Formation is not a reliable barrier to the migration of contaminated water. For geologic isolation of radioactive waste at WIPP to be successful, the buried waste must be contained in the Salado Formation; it must never reach the Rustler Formation.

Pressurized Brine Underneath the WIPP Repository

A pressurized brine reservoir exists underneath the WIPP nuclear waste repository. This is the geologic mechanism which could dissolve some of the buried waste and carry it upward into the Rustler Formation.

Directly underlying the salt beds of the Salado Formation, in which the WIPP nuclear waste repository is to be located, is the upper Castile anhydrite. In at least 12 of more than 60 deep drill holes within 10 miles of the WIPP



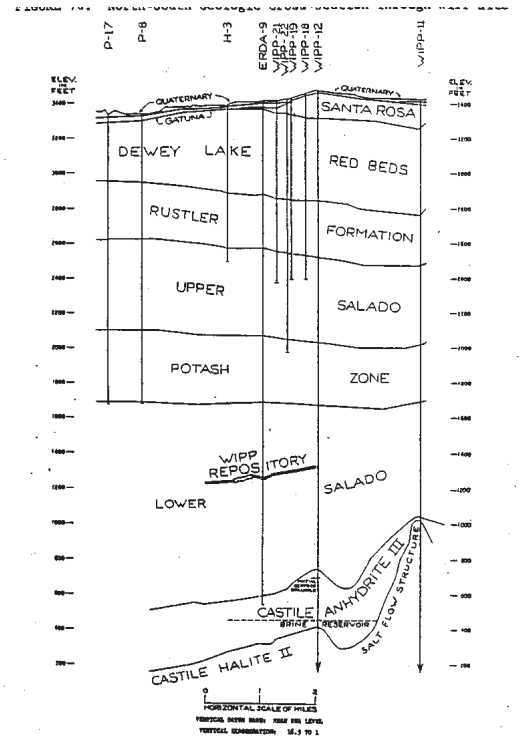


site, pressurized brine reservoirs have been encountered in the upper Castile anhydrite. The brine reservoirs are associated with hydrogen sulfide ($H_2S$) gas, are under anomalously high pressures, and flow to the land surface when encountered in drill holes (EEG-6, 1980, pp. 16, 44-45; Chaturvedi and Rehfeldt, 1984, p. 2).

One of the 13 brine reservoirs was at a depth of 3,016 feet in the WIPP-12 drill hole, located one mile north of the center of the WIPP site (Figures 4 and 76). The WIPP-12 brine was discovered about 800 feet below and 560 feet north of the area where high-level waste would be stored (Neill, 4/15/83, public presentation). The WIPP-12 brine is apparently related to a system of near-vertical fractures of unknown extent in the Castile anhydrite (Basic Data Report for WIPP-12 Deepening, 1982, p. 1-1). The WIPP-12 fracture is described as "open and continuous," and capable of producing over 300 gallons per minute of brine flow (EEG-22, 1983, pp. 83-84).

The volume of the WIPP-12 brine reservoir is estimated at between 17 million barrels (EEG-23, 1983, p. 29) and 30 million barrels (EEG-22, 1983, p. 79). By comparison, about 1.5 million barrels (63 million gallons) of brine would be necessary to fill the WIPP repository (EEG-16, 1982, p. 45).

The area over which the WIPP-12 brine is contained may be estimated as follows (EEG-23, 1983, p. 31):




adapted from Phillips (1984)
borehole data from Mercer (1983)
seismic data from Barrows et al. (1983)





$$A = \frac{V}{H\,p}$$

where

A = areal extent of the brine reservoir;
V = volume of the brine;
H = thickness of the anhydrite that contains the brine;
p = porosity of the anhydrite

The thickness of the anhydrite is reported to be 317 feet, although it is unrealistic to assume that the WIPP-12 brine fills even the entire lower half of the upper Castile anhydrite (EEG-22, 1983, p. 228). An effective porosity of 0.2% was measured at a depth of 3,007 feet in the WIPP-12 drill hole, within 9 feet of the brine reservoir (Popielak et al., 1983). Assuming H = 317 feet, and p = 0.2% (.002), then a brine reservoir with a volume of 170 million ft³ (30 million barrels) would cover an area of 268 million ft², with an average radius of 1.75 miles. A brine reservoir with a volume of 96 million ft³ (17 million barrels) would cover an area of 151 million ft², with an average radius of 1.31 miles. These figures represent the minimum areal extent of the WIPP-12 brine reservoir, because the value for H cannot be more than the assumed 317 feet, and is probably less.

68

Boreholes DOE-2 and WIPP-11, located one and two miles north of WIPP-12, respectively, were both drilled entirely through the upper Castile anhydrite without encountering a brine reservoir. Because all brine encounters in the

Castile Formation appear to be limited to the upper Castile anhydrite, the WIPP-12 brine reservoir must extend less than one mile north of the WIPP-12 drill hole. Thus it is highly probable that the WIPP-12 brine extends at least one mile south of the WIPP-12 drill hole, underneath the center of the WIPP site, where the ERDA-9 drill hole is located, although the center and the geographic shape of the brine reservoir remain unknown. 68

If an artesian brine reservoir does exist beneath the WIPP nuclear waste repository, and a connection were to develop between the brine reservoir, the repository and the land surface, then brine would flood the repository, corrode the waste canisters, and dissolve some of the waste. The contaminated brine would then rise up the WIPP shafts to the Rustler Formation or to the land surface (EEG-6, 1980, pp. 47-48; Chaturvedi and Rehfeldt, 1984, p. 2). Even if the WIPP shafts were sealed, the hydrogen sulfide gas would corrode the concrete (Channell, 6/27/83, personal communication).

Potential Pathways for Brine Migration

The design of the WIPP repository calls for emplacement of nuclear waste in 55-gallon steel drums, directly in the salt beds, [redacted]. The massive Salado salt beds are supposed to be the barrier to the escape of





radioactive materials (DEIS, 1979, pp. 9-98, 9-99).

One of the reasons for the selection of salt as the host rock is that the very existence of undissolved salt demonstrates its isolation from fresh water aquifers (DEIS, 1979, p. 2-1). But the WIPP waste emplacement horizon is no longer isolated from circulating groundwater. Drilling of the WIPP shafts has created man-made conduits connecting the Rustler aquifers with the WIPP underground excavations. When the fans in the ventilation shaft have been turned off (Shukla, 1983, p. 5-2), as much as a foot of water, draining out of the Rustler Formation, has collected in the tunnel connecting the exploratory shaft and the ventilation shaft (Plates 24 and 25) (Chaturvedi, 9/30/82, descriptions of photographs).

Only the perfection of the unproven technology of plugging boreholes and shafts in salt formations could possibly seal these breaches of the WIPP site, and the sea would have to be strong enough to withstand the corrosive forces of pressurized brine and hydrogen sulfide gas. Otherwise, the success of nuclear waste isolation at WIPP demands that the Castile brine must never reach the nuclear waste emplacement horizon. 69

The ERDA-9 drill hole at the center of the WIPP site penetrates 51 feet into the upper Castile anhydrite, or 28 feet below the land surface. In comparison, the WIPP-12 brine encounter was 289 feet below the top of the Castile, 70

Comment C-163A, Page 312 of 338

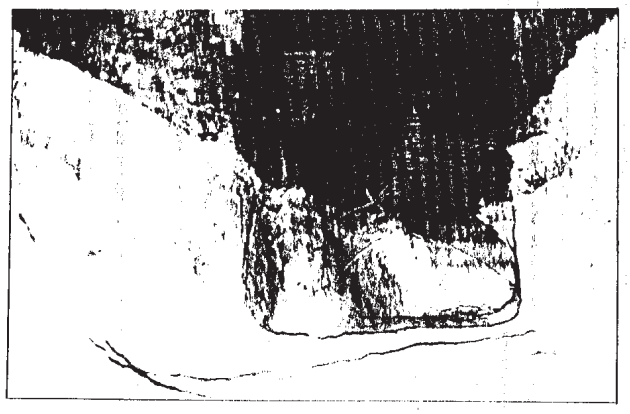


PLATE 25. Another view of the WIPP waste emplacement horizon, in the tunnel connecting the exploratory shaft with the ventilation shaft. When the ventilation fans are turned off, as much as one foot of water collects in the tunnel. The water drains out of the Rustler and Salado Formations in the ventilation shaft. (Photo by Lokesh Chaturvedi)

290

Comment C-163A, Page 311 of 338

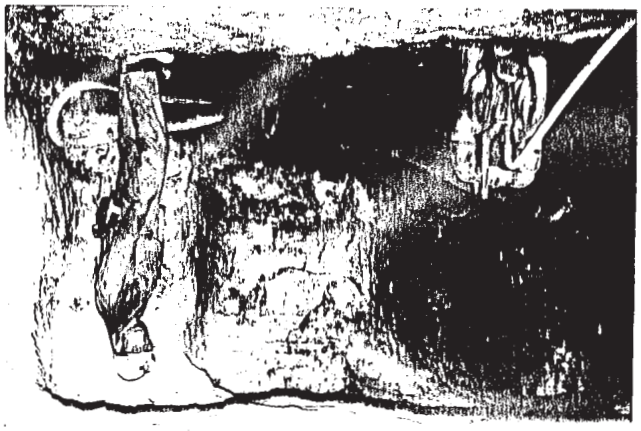


PLATE 24. A view of the WIPP waste emplacement horizon, in the tunnel connecting the exploratory shaft with the ventilation shaft. In the foreground is Art Rose, D'Appolonia engineer, with a large pumping device. (Photo by Lokesh Chaturvedi)

289

or 3016 feet below the land surface (Jarolimek et al., 1983a; Basic Data Report, WIPP-12 Deepening, 1982, p. 3). Moreover, the excavated tunnels of the WIPP repository come within 50 feet of ERDA-9 (Anderson, 5/19/83, personal communication). Thus, the geologic barriers preventing pressurized brine and hydrogen sulfide gas from entering the ERDA-9 drill hole and reaching the WIPP nuclear waste repository consist of: (1) a vertical barrier of about 200 feet of vertically fractured Castile anhydrite; and (2) a horizontal barrier of about 50 feet of Salado salt (Figure 75).

70

However, there are impurities in the Salado salt beds. Four feet below the tunnels excavated for nuclear waste disposal (Chaturvedi, 1/22/86, personal communication) is a seam of anhydrite, a marker bed which underlies the entire WIPP site and much of the Delaware Basin (Jarolimek et al., 1983a). Salt expands at a rate 3 to 4 times greater than anhydrite (Hyder, 5/17/79, personal communication). The stress brought on by mining of the WIPP tunnels causes plastic deformation of the salt (DEIS, 1979, pp. 9-29, 9-29). The anhydrite marker bed is more brittle than the surrounding salt, and it cracks under the stress.

71

The largest crack so far discovered is 2 to 4 inches wide, and was found to run underneath the entire length of one of the WIPP waste storage rooms. The cracks are likely to get larger and more numerous (Chaturvedi, 1/22/86,





personal communication). Fractures have also been observed the WIPP shafts in other anhydrite and siltstone beds of the Salado Formation (Jarolimek et al., 1983b, pp. 4-3, 4-4, 4-5). In any cautious, conservative approach to evaluating the suitability of the WIPP site, it should be assumed that the WIPP nuclear waste storage rooms are or will be connected to the ERDA-9 drill shaft (Chaturvedi, 1/22/86, personal communication), thus eliminating the horizontal geologic barrier.

71

Therefore, the two most likely natural mechanisms which could create a breach of the WIPP site are: (1) an open fracture in the Castile anhydrite, forming a vertical connection between the Castile brine reservoir and the ERDA-9 drill shaft; and (2) fractures in the Salado anhydrite marker bed, creating a preferential pathway for brine flow along the 560-foot horizontal distance between the high-level waste storage area and the WIPP-12 drill hole, which is already connected to the Castile brine reservoir.

72

There is no way to predict when this breach of the WIPP site will occur. Over geologic time, such a breach is almost inevitable. Of more immediate concern are at least five man-made mechanisms which could trigger a breach of the WIPP site:

73

(1) The pressure difference between the WIPP repository and an underlying geopressurized brine reservoir could force

73 a connection along existing fractures between the brine reservoir and the ERDA-9 drill shaft (EEG-6, 1980, p. 47).

(2) In laboratory studies, brine inclusions are observed to migrate up the thermal gradient toward a heat source. The natural equilibrium of the Castile brine reservoir (or of brine inclusions in the Salado anhydrite marker bed) could be upset by the emplacement of heat-

74 emitting radioactive waste, particularly the high-level waste. If brine reaches the waste canisters, it will accelerate the corrosion of the canisters and the leaching of the waste (DEIS, 1979, p. 9-137).

(3) Some of the wastes to be brought to WIPP contain more than 100 Curies of plutonium-238 per drum. This isotope of plutonium has a half-life of 86.4 years; it is

75 295 times more radioactive (17.5 Curies per gram) than plutonium-239; and it generates potentially explosive gas at such a rate that a sealed 55-gallon drum could explode within eleven days. Gas generation would also take place within the WIPP repository where plutonium-238 is emplaced (EEG-24, 1983, pp. iii, v, 6, 9, 13). One of the reasons why salt was selected as the host rock was its self-sealing properties; the stress brought on by mining causes salt "creep," or plastic deformation of the salt, and the mines tend to close up of their own accord (DEIS, 1979, pp. 9-28,

76 9-29). Data collected from the WIPP tunnels indicate that the process of creep closure will completely seal the waste







76 storage rooms in 9 years, which is three times as fast as had been predicted (Chaturvedi, 1/22/86, personal communication). In 9 years, less than 6% of the plutonium-238 will have decayed. If plutonium-238 is buried in salt mines which become air-tight, it stands to reason that the WIPP nuclear waste repository will explode from gas buildup.

(4) Directly underneath the WIPP site, about 400 feet above the waste repository horizon, are 4.4 million tons of langbeinite potash (DEIS, 1979, pp. 9-17, 9-20) -- as much as 40% of all the langbeinite resources in the free world (BLM, in FEIS, 1980, p. P-24). Langbeinite contains soluble potassium, magnesium and sulphur, but no chlorine, and is a desirable fertilizer in soils that cannot tolerate additional chlorine. Langbeinite is found in commercial quantities only in Eastern Europe and in the Carlsbad area (DEIS, 1979, p. 9-16; FEIS, 1980, p. 9-21). While the WIPP nuclear waste repository is in operation, underground mining and through-

77 going boreholes will be prohibited within one mile of the repository. But DOE has no plans to monitor the WIPP site beyond the thirty-year lifetime of the repository (Hearings on WIPP DEIS, 1979, Don Schueler, pp. 1428-1429, and Wendell Weart, pp. 1555-1556). After institutional controls are lost, langbeinite potash mining could destroy most of the Salado Formation as a geologic barrier. If water were to flood the potash mines, the water would travel laterally along lithologic contacts in the Salado Formation, and could

77 reach the WIPP shafts (Channell, 6/27/83, personal communication).

(5) An oil and gas field exists in the Morrow Formation (FEIS, 1980, p. 7-73), more than 10,000 feet below the WIPP nuclear waste repository horizon (Powers et al., 1978, Figure 4.3-2). Two proven but undeveloped oil and gas drill holes are located within two miles of the WIPP nuclear waste repository. Four "possible" drilling sites have been identified within the repository zone itself (FEIS, 1980, Figure 7-27, p. 7-73). After institutional controls are lost, oil and gas drilling could penetrate the nuclear waste repository and even connect it with the geopressurized Castile brine reservoir or with the geopressurized Bell Canyon aquifer beneath the Castile, creating an instant breach of the WIPP site.

78 If such a breach occurs while the WIPP repository is still in operation, the maximum hydrogen sulfide ($H_2S$) gas concentrations (1,940 to 3,870 parts per million) "would occur immediately after the initiation of brine flow into the mine" (Logan, 1983, pp. 24, 25) and would be sufficient to kill all the WIPP miners. Hydrogen sulfide attacks membranes and the nervous system, is lethal on contact at 700 parts per million, and even gas masks offer no protection at concentrations beyond 1,000 parts per million (McCormack, 1982, p. 10).





Flow Paths for Contaminated Water

If and when pressurized brine floods the WIPP repository and dissolves some of the buried nuclear waste, the contaminated brine will rise up the WIPP shafts. Unless the shafts can be successfully plugged and sealed, contaminated brine will enter the Rustler Formation.

In the WIPP shafts, pathways for groundwater were found in every member of the Rustler Formation. In the exploratory shaft, large cavities described as "washouts" were found in the siltstones and mudstones directly above and below the Magenta and Culebra dolomites. The "washouts" extend as deeply as 22 inches beyond the shaft wall. Before the walls of the exploratory shaft could be mapped and logged, the shaft walls in the Dewey Lake and Rustler formations were covered up with a steel liner (Jarolimek et al., 1983b, pp. 4-1, 4-2, and Figure 4, Sheet 1).

In the ventilation shaft, the following features were mapped and logged in the Rustler Formation: (1) a system of 21 open fractures, vertical to near-vertical with apertures up to 2 inches, connected through 90% of a 64-foot interval of anhydrite and mudstone in the lower unnamed member (Plate 26) (Shukla, 1983, Figure 4); (2) an 8-foot-high "washout" in black shale immediately underlying the Culebra dolomite, which required a liner plate to prevent further caving of the unstable shaft wall (Plate 27); (3) one clay-filled

Comment C-163A, Page 319 of 338

297

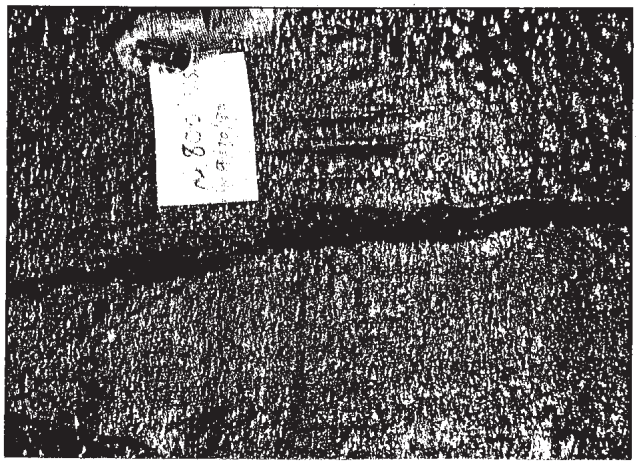


PLATE 26. An open fracture in the lower anhydrite member of the Rustler Formation, at 800 feet below land surface in the WIPP ventilation shaft. The shaft wall is saturated with Rustler groundwater. (Photo by Lokesh Chaturvedi)

Comment C-163A, Page 320 of 338

298

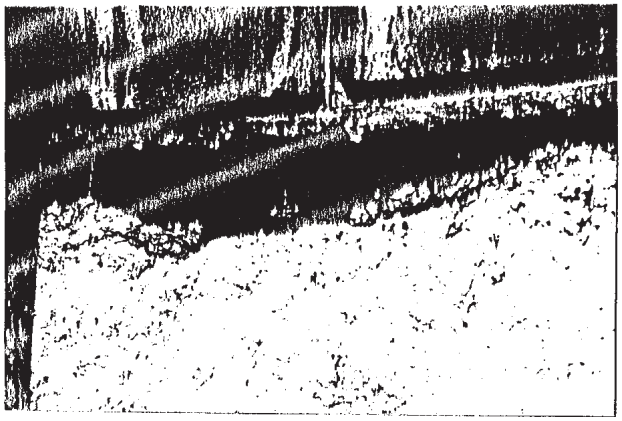


PLATE 27. An eight-foot cavity or "washout" in black shale immediately underlying the Culebra dolomite at 727 feet below land surface in the WIPP ventilation shaft. The photo shows the top of a corroded steel liner plate installed to prevent further caving of the unstable shaft wall. Water can be seen dripping from the dolomite at right. (Photo by Lokesh Chaturvedi)

cavity and one mud-filled cavity in the Culebra dolomite; (4) a 12-foot-high "washout" in silty claystone of the Tamarisk member, which also required a liner plate to keep the shaft wall stable; (5) two normal faults bearing water in the Magenta dolomite; and (6) a "washout" 7 feet high and 30 inches deep in soft brown mudstone of the Forty-niner member, which also had to be covered with a liner plate. (EEG-32, 1985, pp. 11-15; and Chaturvedi, 9/30/82, descriptions of photographs).

Also in the ventilation shaft, irregular fractures in the Dewey Lake Redbeds are filled with gypsum, which helps keep the fractures open. The abundant gypsum-filled fractures represent post-depositional movement of water through the Dewey Lake Redbeds (Plate 28) (EEG-32, 1985, p. 16; Chaturvedi, 9/30/82, descriptions of photographs). Similar gypsum-filled fractures are abundant in outcrops of the Dewey Lake Redbeds on the floor of Nash Draw (e.g. S/2 sec 15, T 22 S, R 30 E).

In the ventilation shaft, the Culebra dolomite produces enough water to wet the underlying shaft walls to the shaft sump, and to begin dissolution of halite exposed in the Salado Formation (Shukla, 1983, pp. 4-3, 4-4). Obviously the Culebra groundwater entering the ventilation shaft is not saturated with respect to halite; this is further evidence that infiltrating rainwater recharges the Rustler Formation.

PLATE 28. Gypsum veins in the Dewey Lake Redbeds, at 175 feet below land surface in the WIPP ventilation shaft. The gypsum filling helps keep the fractures open. Gypsum-filled fractures are abundant in the Dewey Lake Redbeds; they represent post-depositional movement of groundwater. (Photo by Lokesh Chaturvedi)

If plutonium enters the Rustler Formation, karst hydrology will prevail. Flow paths for contaminated groundwater will be highly irregular, through open fractures, cavities and solution conduits. Groundwater flow times will fluctuate with the rainfall.

Some of the plutonium would move through the Rustler aquifers unretarded, at the speed of water (EEG-8, 1980, pp. 17-19). This is because in open karst conduits, flowing groundwater has less contact with the rock formation, so less plutonium is adsorbed onto the rocks (EEG-32, 1985, p. 56).

80

Thus, plutonium-contaminated brine which enters the Rustler Formation would begin showing up at Laguna Grande as soon as the groundwater aquifers can carry it there. As shown by the water balance of the Nash Draw watershed, this time frame should be on the order of 6 to 84 years.

It could be contended that plutonium contamination of Laguna Grande would not result in a radiation dose to the public, because the lake is too saline to use for drinking water, for livestock, or for irrigation purposes. Laguna Grande is in a closed basin which presently has no surface or subsurface outlet to the Pecos River. Oil and gas companies have long been discharging noxious brines into salt playas (e.g. Laguna Gatuna).

81

The problem with Laguna Grande as a regional discharge point for contaminated groundwater is that plutonium





reaching Laguna Grande would concentrate in the lake sediments, whereas if the Pecos River were the primary discharge point, the plutonium contamination would be subject to dilution immediately upon reaching the biosphere. The longer that Laguna Grande were to remain hydrologically separated from the Pecos River, the greater would be the plutonium buildup in the lake sediments. Eventually, in times of catastrophic flooding, plutonium-contaminated lake sediments could wash into the Pecos River. Such a flood has occurred in modern times.

81

The greatest flood on record at the Malaga gaging station occurred on August 23, 1966, when the Pecos River discharge rose to 120,000 $ft^3$/sec, compared to 29 $ft^3$/sec two days earlier. From floodmarks, the high water level at Malaga station was measured at 42.1 feet above the water gage, or 2937.74 feet above sea level. At Carlsbad, the Pecos River discharge rose to 54,400 $ft^3$/sec, compared to 1.1 $ft^3$/sec two days earlier. The high-water level at Carlsbad, as measured by floodmarks left by backwater in Dark Canyon, was 21.90 feet above the water gage, or 3102.18 feet above sea level (USGS, 1974, pp. 753, 760). Because the period of record for the Pecos River is less than 100 years, this should be considered as the 100-year flood.

The record flooding was precipitated by 4.93 to 5.28 inches of rain in three days at the Carlsbad weather stations. Carlsbad residents report that U.S. Highway 285

was flooded where it crosses Dark Canyon Draw (NW/4 SE/4 sec 7, T 22 S, R 27 E), at an elevation no less than 3100 feet above sea level. Also flooded was New Mexico State Highway 31 where it crosses the Pecos River east of Loving (NE/4 NW/4 sec 14, T 23 S, R 28 E), at an elevation no less than 2970 feet above sea level, at least 10 feet higher than the nearby Loving Canal which partially breaches the topographic divide between the Pecos River and Laguna Grande. A flood of this magnitude, in the future, could allow turbulent Pecos River floodwaters to reach Laguna Grande, stir up the plutonium-laden lake sediments, and carry plutonium contamination downstream to populated areas along the Pecos River.

Conclusion

82

The WIPP site should be abandoned. It is not suitable for long-term geologic isolation of nuclear waste, because: (1) the discharge point for the Rustler dolomite aquifers is Laguna Grande, and its waters overflow to the Pecos River during times of catastrophic flooding; (2) flow paths and travel times for the karstic Rustler aquifers are inherently unpredictable; (3) the Mescalero caliche and the underlying sandstones allow rainwater recharge of the Rustler aquifers, so that groundwater movement fluctuates with rainfall; (4) pressurized brine underneath the nuclear waste repository is capable of carrying dissolved waste up the WIPP shafts to





the Rustler Formation; (5) existing geologic barriers between the pressurized brine and the waste storage tunnels are not sufficiently reliable; and (6) the WIPP repository is vulnerable to man-made disturbance and intrusion.

The potential for a catastrophic breach of the WIPP repository is plainly apparent. Due to man-made geologic disturbances, a connection could develop at any time between the pressurized brine reservoir, the nuclear waste repository, and the cavernous Rustler aquifers.

Whenever such a connection develops, brine would flood the nuclear waste repository, corrode the waste canisters, dissolve some of the waste, and carry the nuclear waste up the WIPP shafts to the cavernous Rustler Formation. Even if the WIPP shafts were sealed, hydrogen sulfide gas would corrode the concrete. Some of the plutonium would travel unretarded, at the speed of water, through open conduits in the Rustler aquifers, and could arrive at Laguna Grande within decades. Plutonium could concentrate in the lake sediments and, in times of major flooding of the Pecos River, could ultimately be washed downstream to populated areas.

BIBLIOGRAPHY


Ash, Donald W., and Ehrenzeller, Jeffrey, 1983, "Geochemical and Hydrological Analysis of Harrison Springs, Harrison County, Indiana," in Dougherty, ed., 1983, pp. 137-164.

Bachhuber, Frederick W., "Paleolimnology of Lake Estancia and the Quaternary History of the Estancia Valley, Central New Mexico," unpublished doctoral dissertation, Department of Geology, University of New Mexico, Albuquerque, New Mexico, September 1971.

Bachman, George O., 1973, Surficial Features and Late Cenozoic History in Southeastern New Mexico, U.S. Geol. Survey Open-file report, USGS-4339-8, prepared under Agreement No. AT(40-1)-4339 for the U.S. Atomic Energy Commission, p. 17.

Bachman, George O., 1976, Cenozoic Deposits of Southeastern New Mexico and an Outline of the History of Evaporite Dissolution, Jour. Research U.S. Geol. Survey, Vol. 4, No. 2, Mar.-Apr. 1976, pp. 135-149.

Bachman, George O., 1980, Regional Geology and Cenozoic History of Pecos Region, Southeastern New Mexico, U.S. Geol. Survey Open-File Report 80-1099.

Bachman, George O., 1981, Geology of Nash Draw, Eddy County, New Mexico, U.S. Geol. Survey Open-File Report 81-31.

Bachman, George O., 1983, Regional Geology of Ochoan Evaporites, Northern Part of Delaware Basin, New Mexico Bureau of Mines and Mineral Resources Open File 184.

Bachman, George O., 1984, Regional Geology of Ochoan Evaporites, Northern Part of Delaware Basin, New Mexico Bureau of Mines and Mineral Resources Circular 184.

Bachman, George O., 1985, Assessment of Near-Surface Dissolution At and Near the Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico, Sandia National Laboratories Contractor Report, SAND 84-7178.







Barrows, Larry, 1982, "WIPP Geohydrology -- The Implications of Karst," Memo to Wendell D. Weart of Sandia National Laboratories, reprinted in EEG-32, 1985, Appendix A.

Barrows, Lawrence J., Shaffer, Sue-Ellen, Miller, Warren B., and Fett, John D., 1983, Waste Isolation Pilot Plant (WIPP) Site Gravity Survey and Interpretation, Sandia National Laboratories, SAND 82-2922.

Barry, R. G., 1983, "Late-Pleistocene Climatology," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 20, pp. 390-407.

Basic Data Report, Borehole WIPP-12 Deepening, 1982, U.S. Department of Energy, TME 3148.

Basic Data Report for Drillhole WIPP 14, 1982, Sandia National Laboratories and U.S. Geol. Survey,

Basic Data Report for Drillhole WIPP 33, 1981, Sandia National Laboratories and U.S. Geol. Survey, SAND 80-2011.

Bechtel, 1978, WIPP Topographic Mapping, for U. S. Department of Energy, Waste Isolation Pilot Plant, DOE Contract Number ET-78-04-4-169, Job Number 12484-2, Drawing Numbers 21-C-201 to 21-C-212.

Berger, Andre L., 1978, "Long-Term Variations of Caloric Insolation Resulting from the Earth's Orbital Elements," Quaternary Research, Vol. 9, pp. 139-167.

Bloom, Arthur L., 1978, Geomorphology, A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Bogli, Alfred, 1980, Karst Hydrology and Physical Speleology, Springer-Verlag, New York.

Borns, David J., Barrows, Lawrence J., Powers, Dennis W., and Snyder, Richard P., 1983, Deformation of Evaporites Near the Waste Isolation Pilot Plant (WIPP) Site, Sandia National Laboratories, SAND 82-1069.

Brakenridge, G. Robert, 1978, "Evidence for a Cold, Dry Full Glacial Climate in the American Southwest," Quaternary Research, Vol. 9, pp. 22-40.

Bretz, J. Harlen, and Horberg, Leland, 1949a, "Ogallala Formation West of the Llano Estacado," Journal of Geology, Vol. 57, pp. 477-490.

Bretz, J. Harlen, and Horberg, Leland, 1949b, "Caliche in Southeastern New Mexico," Journal of Geology, Vol. 57, pp. 491-511.

Brown, Charles N., 1956, "The Origin of Caliche on the Northeastern Llano Estacado, Texas," Journal of Geology, Vol. 64, No. 1, pp. 1-15.

Bryan, Kirk, 1929, "Solution-Facetted Limestone Pebbles," American Journal of Science, Fifth Series, Vol. XVIII, No. 105, pp. 193-208.

Bryant, Vaughn M., Jr., and Holloway, Richard G., 1985, "A Late-Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence," in Bryant and Holloway, eds., 1985, Chapter 2, pp. 39-70.

Bryant, Vaughn M., Jr., and Holloway, Richard G., eds., 1985, Pollen Records of Late-Quaternary North American Sediments, American Association of Stratigraphic Palynologists Foundation, Dallas, Texas.

Chaturvedi, Lokesh, and Rehfeldt, Kenneth, 1984, "Groundwater Occurrence and the Dissolution of Salt at the WIPP Radioactive Waste Repository Site," Eos, Transactions, American Geophysical Union, Vol. 65, No. 31, pp. 457-459.

Cooke, Ronald U., and Warren, Andrew, 1973, Geomorphology in Deserts, University of California Press, Berkeley.

Cooper, J. B., and Glanzman, V. M., 1971, Geohydrology of Project Gnome Site, Eddy County, New Mexico, U.S. Geol. Survey Professional Paper 712-A.

Covey, Curt, 1984, "The Earth's Orbit and the Ice Ages," Scientific American, 250, pp. 58-66.

Dickerson, Hoffer, and Callender, eds., 1980, Trans-Pecos Region, Southeastern New Mexico and West Texas, New Mexico Geological Society, Thirty-First Field Conference, November 6-8, 1980.

Dougherty, Percy H., ed., 1983, Environmental Karst, GeoSpeleo Publications, Cincinnati, Ohio.

Draft Environmental Impact Statement (DEIS), Waste Isolation Pilot Plant (WIPP), 1979, U.S. Department of Energy, DOE/EIS-0026-D, two volumes.





Dunne, Thomas, and Leopold, Luna B., 1978, Water in Environmental Planning, W. H. Freeman and Company, San Francisco, California.

EEG-6, 1980, Geotechnical Considerations for Radiological Hazard Assessment of WIPP, A Report of a Meeting Held on January 17-18, 1980, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-8, 1980, Wofsy, Carla, The Significance of Certain Rustler Aquifer Parameters for Predicting Long-Term Radiation Doses from WIPP, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-16, 1982, Radionuclide Release, Transport and Consequence Modeling for WIPP, A Report of a Workshop Held on September 16-17, 1981, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-22, EEG Review Comments on the Geotechnical Reports Provided by DOE to EEG Under the Stipulated Agreement Through March 1, 1983, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-23, 1983, Neill, Robert H., Channell, James K., Chaturvedi, Lokesh, Little, Marshall S., Rehfeldt, Kenneth, and Spiegler, Peter, Evaluation of the Suitability of the WIPP Site, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-24, 1983, Neill, Robert H., and Channell, James K., Potential Problems from Shipment of High-Curie Content Contact-Handled transuranic (CH-TRU) Waste to WIPP, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-32, 1985, Chaturvedi, Lokesh, and Channell, James, The Rustler Formation as a Transport Medium for Contaminated Groundwater, Environmental Evaluation Group, Santa Fe, New Mexico.

Ferrall, Charles C., and Gibbons, John F., 1979, Core Study of Rustler Formation over the WIPP Site, prepared by Civil Systems Inc., for Sandia National Laboratories, CSI 2055-03.

Fetter, C. W., Jr., 1980, Applied Hydrogeology, Charles E. Merrill Publishing Company, Columbus, Ohio.

Final Environmental Impact Statement (FEIS), Waste Isolation Pilot Plant (WIPP), 1980, U.S. Department of Energy, DOE/EIS-0026, two volumes.

Frye, John C., Glass, H. D., Leonard, A. Byron, and Coleman, Dennis D., 1974, Caliche and Clay Mineral Zonation of Ogallala Formation, Central-Eastern New Mexico, New Mexico Bureau of Mines and Mineral Resources Circular 144.

Frye, John C., and Leonard, A. Byron, 1965, "Quaternary of the Southern Great Plains," in Wright and Frey, eds., 1965, pp. 203-216.

Frye, John C., and Swineford, Ada, 1947, "Solution Features on Cretaceous Sandstone in Central Kansas," American Journal of Science, Vol. 245, No. 6, pp. 366-379.

Galloway, Robert W., 1970, "The Full-Glacial Climate in the Southwestern United States," Annals of the Association of the American Geographers, Vol. 60, pp. 245-256.

Galloway, Robert W., 1983, "Full-Glacial Southwestern United States: Mild and Wet or Cold and Dry?," Quaternary Research, Volume 19, Number 2, March 1983, pp. 236-248.

Geohydrology Associates, Inc., 1978, Ground-Water Study Related to Proposed Expansion of Potash Mining Near Carlsbad, New Mexico, U.S. Bureau of Land Management, Contract No. YA-512-CT7-217, Denver, Colorado.

Gile, Leland H., 1961, "A Classification of ca Horizons in Soils of a Desert Region, Dona Ana County, New Mexico," Soil Science Society Proceedings, Vol. 25, pp. 52-61.

Gile, L. H., Peterson, F. F., and Grossman, R. B., 1966, "Morphological and Genetic Sequences of Carbonate Accumulation in Desert Soils," Soil Science, Vol. 101, No. 5, pp. 347-360.

Gilkey, M. M., and Stotelmeyer, Ronald B., 1965, Water Requirements and Uses in New Mexico Mineral Industries, U.S. Department of the Interior, Bureau of Mines Information Circular 8276.

Glass, H. D., Frye, John C., and Leonard, A. Byron, 1973, Clay Minerals in East-Central New Mexico, New Mexico Bureau of Mines and Mineral Resources Circular 139.

Gonzalez, Don Diego, 1983a, Groundwater Flow in the Rustler Formation, Waste Isolation Pilot Plant (WIPP), Southeast New Mexico (SENM): Interim Report, Sandia National Laboratories, SAND 82-1012.





Gonzalez, Don Diego, 1983b, Hydrogeochemical Parameters of Fluid-Bearing Zones in the Rustler and Bell Canyon Formations: Waste Isolation Pilot Plant (WIPP), Southeast New Mexico (SENM), Sandia National Laboratories, SAND 83-0210.

Goudie, A. S., 1983, "Calcrete," in Goudie and Pye, eds., 1983, Chapter 4, pp. 93-131.

Goudie, A. S., and Pye, Kenneth, eds., 1983, Chemical Sediments and Geomorphology: Precipitates and Residua in the Near-Surface Environment, Academic Press, London, England.

Hafsten, Ulf, 1961, "Pleistocene Development of Vegetation and Climate in the Southern High Plains as Evidenced by Pollen Analysis," in Wendorf, ed., 1961, pp. 59-91.

Hale, W. E., Hughes, L. S., and Cox, E. R., 1954, Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, New Mexico, Pecos River Commission and U.S. Geol. Survey.

Havens, John S., 1966, Recharge Studies on the High Plains in Northern Lea County, New Mexico, U.S. Geol. Survey Water-Supply Paper 1819-F.

Havens, John S., 1972, Malaga Bend Experimental Salinity Alleviation Project, A Comprehensive Interim Report, Eddy County, New Mexico, U.S. Geol. Survey and Pecos River Commission.

Havens, John S., and Wilkins, D. W., 1979, Experimental Salinity Alleviation at Malaga Bend of the Pecos River, Eddy County, New Mexico, U.S. Geol. Survey Water Resources Investigations 80-4.

Hawley, John W., Bachman, George O., and Manley, K., 1976, "Quaternary Stratigraphy in the Basin and Range and Great Plains Provinces, New Mexico and Western Texas," in Mahaney, ed., 1976, pp. 235-274.

Hecht, Alan D., ed., 1985, Paleoclimate Analysis and Modeling, John Wiley and Sons, New York.

Hunter, Regina L., 1985, A Regional Water Balance for the Waste Isolation Pilot Plant (WIPP) Site and Surrounding Area, Sandia National Laboratories, SAND 84-2233.

Imbrie, John, and Imbrie, John Z., 1980, "Modeling the Climatic Response to Orbital Variations," Science, Vol. 207, February 29, 1980, pp. 943-953.

Jarolimek, Timmer and Powers, 1983a, Correlation of Drillhole and Shaft Logs, D'Appolonia Consulting Engineers, Inc., TME 3179.

Jarolimek, Timmer and McKinney, 1983b, Geotechnical Activities in the Exploratory Shaft -- Selection of the Facility Interval, Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, U.S. Department of Energy, TME 3178.

Jennings, Joseph Newell, 1971, Karst, M.I.T. Press, Cambridge, Massachusetts.

Jones, C. L., 1978, Test Drilling for Potash Resources: Waste Isolation Pilot Plant Site, Eddy County, New Mexico, U.S. Geol. Survey Open-file Report 78-592, two volumes.

Judson, Sheldon, 1950, "Depressions of the Northern Portion of the Southern High Plains of Eastern New Mexico," Geological Society of America Bulletin, Vol. 61, pp. 253-274.

Kelley, Vincent C., 1980, "Gatuna Formation (Late Cenozoic), Pecos Valley, New Mexico and Trans-Pecos Texas," in Dickerson et al., eds., 1980, pp.

Kutzbach J. E., and Wright, H. E., Jr., 1985, "Simulation of the Climate of 18,000 Years BP: Results for the North American/North Atlantic/European Sector and Comparison with the Geologic Record of North America," Quaternary Science Reviews, Volume 4, Number 3, 1985, pp. 147-187.

Lanner, Ronald M., and Van Devender, Thomas R., 1981, "Late Pleistocene Pinon Pines in the Chihuahuan Desert," Quaternary Research, Vol. 15, pp. 278-290.

Lattman, Laurence H., 1983, "Effect of Caliche on Desert Processes," in Wells and Haragan, eds., 1983, Chapter 4, pp. 101-109.

Lee, Willis T., 1924, "Erosion by Solution and Fill," U.S. Geol. Survey Bulletin 760-D, pp. 107-121.

LeGrand, Harry E., 1973, "Hydrological and Ecological Problems of Karst Regions," Science, March 2, 1973, Vol. 179, pp. 859-864.





LeGrand, Harry E., 1983, "Perspective on Karst Hydrology," Journal of Hydrology, Vol. 61, pp. 343-355.

LeGrand, Harry E., Stringfield, V. T., and LaMoreaux, P. E., 1976, "Hydrologic Features of United States Karst Regions," in Yevjevich, ed., 1976, pp. 31-46.

Logan, S. E., and Associates, Inc., 1983, "Modeling of Flow of Pressurized Brine and Hydrogen Sulfide Gas into the WIPP Repository During Construction," unpublished work performed for Environmental Evaluation Group, Santa Fe, New Mexico.

Mahaney, W. C., ed., 1976, Quaternary Stratigraphy of North America, Dowden, Hutchinson and Ross, Inc., Stroudsburg, Pennsylvania.

Mann, Thomas R., and Associates, Inc., 5115 Copper SE, Albuquerque, New Mexico, 87108, Color Contact Prints of WIPP Site, November 7, 1983,

McCormack, Ken, 1982, "Consulting Firm Says Poisonous Gas Endangers WIPP," New Life News, Santa Fe, New Mexico, July, 1982.

McKee, Edwin D., ed., 1979, A Study of Global Sand Seas, U. S. Geol. Survey Professional Paper 1052.

Melton, Frank A., 1940, "A Tentative Classification of Sand Dunes, Its Application to Dune History in the Southern High Plains," Journal of Geology, Vol. 48, No. 2, pp. 113-145.

Mercer, Jerry W., 1983, Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medanos Area, Southeastern New Mexico, U.S. Geol. Survey, Water-Resources Investigations Report 83-4016.

Milanovic, Petar, 1976, "Water Regime in Deep Karst, Case Study of the Ombla Spring Drainage," in Yevjevich, ed., 1976, pp. 165-188.

Milanovic, Petar, 1981, Karst Hydrogeology, Water Resources Publications, Fort Collins, Colorado.

Morgan, Arthur M., 1941, "Depth of Active Solution by Ground-waters in the Pecos Valley, New Mexico," American Geophysical Union Transactions, 1941, pp. 779-783.

Morgan, Arthur M., 1942, "Solution Phenomena in the Pecos Basin in New Mexico," American Geophysical Union Transactions, 1942, pp. 27-35.

Phillips, Richard Hayes, 1984, "WIPP Cover-Up: Geopolitics in the Land of Enchantment," unpublished graduate research paper and investigative report, Department of Geography, University of Oregon.

Popielak, R. S., Beauheim, R. L., Black, S. R., Coons, W. E., Ellingson, C. T., and Olsen, R. L., 1983, Brine Reservoirs in the Castile Formation, U.S. Department of Energy, TME 3153.

Powell, A. Michael, 1980, "Vegetation of Trans-Pecos Texas," in Dickerson et al., eds., 1980, pp. 299-302.

Powers, Dennis W., Lambert, Steven J., Shaffer, Sue-Ellen, Hill, Leslie R., and Weart, Wendell D., eds., 1978, Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico, Sandia National Laboratories, SAND 78-1596, two vols.

Price, W. Armstrong, 1933, "Reynosa Problem and Origin of Caliche," American Association of Petroleum Geologists Bulletin, No. 9, pp. 488-522.

Reeves, C. C., Jr., 1965, "Pleistocene Climate of the Llano Estacado," Journal of Geology, Vol. 73, pp. 181-198.

Reeves, C. C., Jr., 1966, "Pluvial Lake Basins of West Texas," Journal of Geology, Vol. 74, pp. 269-291.

Reeves, C. C., Jr., 1970, "Origin, Classification, and Geologic History of Caliche on the Southern High Plains, Texas and Eastern New Mexico," Journal of Geology, Vol. 78, pp. 352-362.

Reeves, C. C., Jr., 1973, "The Full-Glacial Climate of the Southern High Plains, West Texas," Journal of Geology, Vol. 81, pp. 693-704.

Reeves, C. C., Jr., 1976, "Quaternary Stratigraphy and Geologic History of Southern High Plains, Texas and New Mexico," in Mahaney, W. C., ed., 1976, pp. 213-234.





Robinson, Thomas W., and Lang, Walter B., 1938, Geology and Ground-Water Conditions of the Pecos River Valley in the Vicinity of Laguna Grande de la Sal, New Mexico, with special reference to the salt content of the river water, State Engineer of New Mexico, 12th and 13th Biennial Reports, pp. 77-100.

Sayre, Albert Nelson, 1937, Geology and Ground-Water Resources of Duval County, Texas, U.S. Geol. Survey Water Supply Paper 776, pp. 65-72.

Shukla, Dev K., 1983, Geotechnical Field Data Report No. 4, Geologic Mapping and Water Inflow Testing in the SPDV Ventilation Shaft, D'Appolonia Consulting Engineers, Inc., TME 3171, reprinted in TME 3177.

Sidwell, Raymond, 1943, "Caliche Deposits in Southern High Plains, Texas," American Journal of Science, Vol. 241, No. 4, pp. 257-261.

Smith, George I., and Street-Perrott, F. Alayne, 1983, "Pluvial Lakes of the Western United States," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 10, pp. 190-212.

Spaulding, W. Geoffrey, Leopold, Estella B., and Van Devender, Thomas R., 1983, "Late Wisconsin Paleoecology of the American Southwest," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 14, pp. 259-293.

Street-Perrott, F. A., and Harrison, S. P., 1985, "Lake Levels and Climate Reconstruction," in Hecht, ed., 1985, Chapter 7, pp. 291-340.

Sweeting, Marjorie M., 1973, Karst Landforms, Columbia University Press, New York.

Thompson, Robert S., Larry Benson, and Eugene M. Hattori, 1986, "A Revised Chronology for the Last Pleistocene Lake Cycle in the Central Lahontan Basin," Quaternary Research, Volume 25, Number 1, January 1986, pp. 1-9).

Torbarov, Konstantin, 1976, "Estimation of Permeability and Effective Porosity in Karst on the Basis of Recession Curve Analysis," in Yevjevich, ed., 1976, pp. 121-136.

United States Department of Agriculture (USDA), 1971, Soil Survey, Eddy Area, New Mexico.

United States Geological Survey (USGS), 1974, Surface Water Supply of the United States 1966-1970, Part 8, Western Gulf of Mexico Basins, Volume 2, Basins from Lavaca River to Rio Grande, U. S. Geol. Survey Water-Supply Paper 2123.

Van Devender, Thomas R., 1977, "Holocene Woodlands in the Southwestern Deserts," Science, Vol. 198, October 14, 1977, pp. 189-192.

Van Devender, Thomas R., and Spaulding, W. Geoffrey, 1979, "Development of Vegetation and Climate in the Southwestern United States," Science, Vol. 204, May 18, 1979, pp. 701-710.

Vernekar, Anandu D., 1972, Long-Period Global Variations of Incoming Solar Radiation, Meteorological Monographs, Vol. 12, No. 34, American Meteorological Society, Boston, Massachusetts.

Vine, James D., 1960, "Recent Domal Structures in Southeastern New Mexico," Bulletin of the Association of American Petroleum Geologists, Vol. 44, No. 12, pp. 1903-1911.

Vine, James D., 1963, Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico, U.S. Geol. Survey Bulletin 1141-B.

Waste Isolation Pilot Plant Safety Analysis Report (WIPP SAR), 1980, revised 1983, U.S. Department of Energy, five volumes.

Weart, Wendell D., 1983, "Summary of Evaluation of the Waste Isolation Pilot Plant (WIPP) Site Suitability, Sandia National Laboratories," SAND 83-0450, reprinted by U.S. Department of Energy, 1983, in Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program, WIPP-DOE-161.

Wells, Philip V., 1966, "Late Pleistocene Vegetation and Degree of Pluvial Climatic Change in the Chihuahuan Desert," Science, Vol. 153, pp. 970-975.

Wells, Stephen G., and Haragan, Donald R., eds., 1983, Origin and Evolution of Deserts, University of New Mexico Press, Albuquerque.

Wendorf, Fred, ed., 1961, Paleoecology of the Llano Estacado, Museum of New Mexico Press, Fort Burgwin Research Center, Santa Fe, New Mexico.





Wendorf, Fred, 1961a, "A General Introduction to the Ecology of the Llano Estacado," in Wendorf, ed., 1961, pp. 12-21.

Wendorf, Fred, 1961b, "An Interpretation of Late Pleistocene Environments of the Llano Estacado," in Wendorf, ed., 1961, pp. 115-133.

Widdicombe, Roberta Eileen, 1979, "Quaternary Surficial Features in the Delaware Basin, Eddy and Lea Counties, New Mexico," unpublished master's thesis, Department of Geology, University of New Mexico, Albuquerque, New Mexico, December, 1979.

Wright, H. E., Jr., ed., 1983, Late-Quaternary Environments of the United States, University of Minnesota Press, Minneapolis, Volume 1, The Late Pleistocene, Stephen C. Porter, ed.

Yevjevich, Vujica, 1976, "Advanced Approaches to Karst Hydrology and Water Resource Systems," in Yevjevich, Vujica, ed., 1976, Karst Hydrology and Water Resources, Water Resources Publications, Fort Collins, Colorado.

DRAFT DRAFT DRAFT DRAFT

# GEOLOGIC PROBLEMS WITH WIPP

by Richard Phillips

edited by Robert Aly

DRAFT DRAFT DRAFT DRAFT



CHAPTER 1

## ALTERATION OF WIPP SITE SELECTION CRITERIA

Current Congressional legislation authorizes the excavation of the Waste Isolation Pilot Plant (WIPP) in Permian bedded salt formations 26 miles east of Carlsbad, New Mexico. WIPP is intended for permanent disposal of transuranic waste from nuclear weapons production.[1] Transuranic (TRU) waste consists of radioactive isotopes with an atomic number heavier than uranium[2], including all isotopes of plutonium.

The sequence of events which resulted in the selection of the WIPP site began in 1957 when the National Academy of Science (NAS) reported that the most promising method of disposal of high-level waste seems to be in salt deposits.[3] The continued existence of Permian salt deposits demonstrates that they have remained isolated from dissolution by circulating groundwater since their deposition 225 million years ago.[4] NAS cited the absence of solution cavities in salt as evidence that water has been unable to penetrate salt beds; the plasticity of salt, which flows under the lithostatic pressure of overlying rocks, tends to close any fissures that might develop.[5]

In June 1970, an existing salt mine at Lyons, Kansas, was tentatively selected by the Atomic Energy Commission (AEC), and was conditionally endorsed by the National Academy of Science (NAS), as the location for a radioactive waste repository. By early 1972, two technical problems arose and the site was abandoned. There were many existing boreholes near the repository, penetrating through the salt beds into underlying aquifers; not all these holes could be adequately plugged, and eventual breaching of the repository was likely. Also, large volumes of water were unaccountably "lost" in fractures caused by mining of salt near the repository.[6]

The renewed search for a suitable repository site quickly settled upon the Permian Basin of southeastern New Mexico. One of the "most restrictive" of the site selection criteria, adopted primarily because of the Lyons experience, was "avoidance of drill holes penetrating through the salt within two miles of the repository border."[7]

Drill hole ERDA-6 was located at the northwest corner of the site eventually selected by Oak Ridge National Laboratories.[8] ERDA-6 was drilled entirely through the Salado Formation salt beds under investigation for nuclear waste disposal. The Geological Characterization Report (GCR), released in August 1978 by Sandia National Laboratories, briefly described the "unexpected subsurface geology" encountered at ERDA-6:

> Formation contacts were higher than anticipated, and salt and anhydrite beds exhibited severe distortion with dips up to 75 degrees. Sections of the upper Castile Formation were missing, and the fractured anhydrite encountered at a depth of 2,710 feet contained a pocket of pressurized brine.[9]

The GCR does not mention the lethal hydrogen sulfide ($H_2S$) gas associated with the "pocket" of highly pressurized brine. It had not been expected that ERDA-6 would reach the Castile anhydrite at such a shallow depth. The drilling equipment penetrated an anticline (upward fold) in the Castile Formation.[10] The brine and hydrogen sulfide gas were trapped in this anticline.[11]

The search began again for a suitable repository site. Oak Ridge National Laboratories (ORNL) identified three other "areas more than two miles from deep drill holes" in the Delaware Basin of southeastern New Mexico.[12]

One of these sites lies directly south of Big Sinks, the northernmost in a chain of topographic depressions resulting from deep-seated dissolution processes in the Lower Salado salt.[13] A second site would have posed extreme difficulties in land acquisition, because only 42.5% is Federal land; 37.5% is State land, and 20% is privately owned.[14] A third site is centered only 3.5 miles from brine springs at Malaga Bend of the Pecos River, a major regional discharge point for groundwater saturated with dissolved salt.[15]

For these reasons, all three sites were unacceptable for radioactive waste disposal. But rather than abandon the Delaware Basin, ORNL "re-evaluated" the site selection criteria. The required distance between the repository and boreholes penetrating through the salt was reduced from two miles to one mile, despite the experience at Lyons, Kansas, and despite the fact that "improved borehole plugging" had not been demonstrated.[16] 1

In fact, borehole plugging in salt formations is still an unperfected technology. Research and development continues toward "sealing concepts" for the WIPP site.[17] Although "plugging technology is the presumed barrier" to preclude a pathway for radionuclide migration from WIPP to the biosphere[18], it will not be possible to obtain experimental data which will assure that plugging of a borehole will last for even 1,000 years.[19] 2

A new map was drawn, indicating seven possible "areas more than one mile from deep drill holes".[20]

Five of these seven areas were eliminated from consideration because they are located within 6 miles of the Capitan Reef aquifer, where "distortion of salt is most severe," and where deep dissolution hazards might be associated with known locations of artesian

brine flow.[21] A sixth area, dubbed "Alternate II," is traversed by State Highway 128; it was considered undesirable because it is restricted in size, and the acceptable salt zones are deep or absent altogether.[22]

Thus the current WIPP site, dubbed the "Los Medanos site," five miles southwest of drill hole ERDA-6, was selected through a process of eliminations guided by the alteration of site selection criteria.[23] It was selected in late 1975 by the United States Geological Survey (USGS) and Sandia National Laboratories, "independently" of each other.[24] Justification by Sandia Labs rested primarily upon the assumption that the Los Medanos site is located in a synclinal area where "geopressurized brine reservoirs would be less likely."[25]

Only later were other site selection criteria considered. It was asserted in the GCR that avoidance of deep drill holes "would also result in avoiding existing oil and gas fields."[26] The Final Environmental Impact Statement (FEIS) states there are ten holders of oil and gas leases within the WIPP site, aggregating 6,600 acres.[27] The FEIS also shows twenty potential drilling sites for development of oil and gas reservoirs underneath the WIPP site, including two proven but undeveloped holes in the southwestern part of Zone IV, and four "possible" sites located in or on the boundary of Zone II).[28] [29]

Evaluation of potash resources at the WIPP site commenced in August 1976, after the WIPP site was chosen for detailed characterization. When chosen, the site was located mostly outside the "Known Potash Area" as then defined by the USGS.[30]

In 1977, the Carlsbad Potash Mining District supplied 93% of all potassic chemical fertilizers mined in the United States.[31] "Potassium salts occur in a variety of mineral types, but only sylvite (KCl) and langbeinite [$K_2Mg2(S04)3$] are mined" in the Carlsbad District.[32]

Langbeinite is a specialized agricultural fertilizer[33] desirable in certain soils that require soluble potassium, magnesium and sulfur but cannot tolerate additional chlorine. Langbeinite is found in commercial quantities only in Eastern Europe and in the Carlsbad area[34] -- which is the only source of langbeinite in the free world.[35]

It is now uncontested that 4.4 million tons of langbeinite reserves, which could be produced at today's market prices and with existing technology, lie directly underneath the WIPP site.[36] This is estimated to be up to 40% of all the langbeinite reserves in the free world.[37]

3 More serious than the potential loss of mineral resources are the consequences when future oil and mineral exploration does take place. Mining out big gaps of potash several hundred feet above the repository would endanger the miners, would destroy most of the Salado Formation as a geologic barrier, and would cause subsidence fracturing in the aquifers of the overlying Rustler Formation. Water flooding the potash mines would travel laterally along lithologic contacts in the Salado, and could reach the WIPP shafts.[38]

While the WIPP repository is in operation, underground mining and through-going boreholes will be prohibited within one mile of the repository. But institutional controls may cease shortly thereafter.

4 DOE has no plans to monitor the site beyond the thirty-year lifetime of the repository.[39]

The WIPP site selection criteria for mineral resources were tailored to accommodate the site already selected. Potash mineralization directly above the WIPP repository would be avoided "to the extent possible".[40] Sandia Labs argued that "it was not possible" to avoid potash deposits, "because other site-selection factors such as avoiding deep oil and gas test wells ... took precedence."[41] In other words, either deep drill holes or potash deposits would have to be acceptable.

## CHAPTER 2

# EEG EDITS LYNN GELHAR'S REPORT

In the summer of 1978, on the initiative of George Goldstein, then New Mexico Health and Environment Secretary, and Don Schueler, then WIPP Project Manager for the U.S. Department of Energy (DOE), the Environmental Evaluation Group (EEG) was organized.[42] Its purposes are to conduct "an independent technical evaluation" of potential human exposure to radiation from WIPP, to protect the public health and safety, and to minimize environmental degradation.[43] EEG often addresses the issue of WIPP site suitability, but it is not EEG's expressed purpose to pass judgment on the site or the project.

Although EEG functions as a State agency under the Environmental Improvement Division, the EEG "is funded entirely by the U.S. Department of Energy..."[44] Thus, the EEG is paid by the DOE to conduct an independent analysis of the DOE's WIPP project. It is a compromising position.

From February 15 to June 1, 1979, Dr. Lynn Gelhar served part-time on the EEG staff. According to James Channell of EEG, Dr. Gelhar "has a very good reputation as a hydrogeologist."[45] On June 22, 1979, Gelhar submitted to EEG his first draft of review

5 comments on the Geological Characterization Report (GCR). His draft was then edited by EEG and turned over to DOE for criticism.





5 In EEG's own words, Lynn Gelhar "was not involved in any way in the preparation of the final version of EEG's comments on the GCR."[46] Gelhar said to me: "I do not know who did the editing of my report. I was not privy to the process. I do not know why my conclusions were deleted. EEG did send me a copy a couple of days before publication, but there was no opportunity for me to review it."[47]

5 Almost every characterization by Gelhar of geologic hazards as presenting threats to the immediate or long-term integrity of the WIPP site was deleted by EEG from its published version. Specific examples include:

* brine reservoirs and developing breccia pipes (Gelhar, 1979, p. 4, all of page deleted);
* hydrogen sulfide ($H_2S$) gas associated with large flows of highly pressurized brine (Gelhar, 1979, p. 12, two sentences deleted);
* the location of the shallow salt dissolution front at the top of the Salado (Gelhar, 1979, p. 13, most of first paragraph deleted);
* the active occurrence of deep dissolution in the Lower Salado salt (Gelhar, 1979, p. 17, two sentences deleted);
* possible future alteration of the course of the Pecos River (Gelhar, 1979, p. 19, three sentences deleted);
* the effect of long-term climatic variation on the hydrologic regime (Gelhar, 1979, pp. 23, 25, three sentences deleted);
* the established presence of potash and natural gas resources at the WIPP site, and the threat posed by potential mining and drilling (Gelhar, 1979, pp. 4, 30, both pages deleted);
* the possibility of flooding of the potash mines, thereby inducing rapid dissolution of the adjacent salt (Gelhar, 1979, p. 31, three sentences deleted).

Much of Gelhar's discussion of the geologic studies of Dr. Roger Y. Anderson, Professor of Geology at the University of New Mexico, was deleted by EEG. Anderson estimated that the shallow salt dissolution front at the top of the Salado could be advancing across the WIPP site at a rate three times as fast as that accepted by EEG.[48] Gelhar identified its location as one mile from the WIPP repository, at the western boundary of Zone III, which, according to Gelhar's deleted analysis, "may not be adequate to ensure that the front will not reach the disposal horizons within the lifetime of the repository."[49]

6 Anderson also suggested that the contact between the Lower Salado and the Upper Castile is a zone of relatively high permeability.[50] Gelhar noted that the Lower Salado is 1,195 feet thick at the center of the WIPP site, but thins to 430 feet toward the northeastern part of the Delaware Basin. Gelhar asked if this thinning could reflect removal of salt by deep dissolution.[51] EEG deleted these passages from Gelhar's draft.

Gelhar called the possibility of brine reservoirs or developing breccia pipes "a threat to the immediate and long-term integrity of the site." Gelhar affirms that their origins are not understood: that they cannot be detected without drilling; and that failure to explore alternate sites left as an open question whether or not similar problems could occur elsewhere (Gelhar, 1979, pp. 4, 22). The GCR challenged Roger Anderson's conception of breccia pipes as deep dissolution features, but offered no alternative explanation (Gelhar, 1979, p. 18). These comments were all deleted by EEG.

Gelhar called for "some reasonable estimate of how climatic variation may affect the hydrologic regime over the desired period of isolation of 250,000 years." Gelhar was concerned about accelerated rates of salt dissolution (Gelhar, 1979, pp. 23, 25). EEG's published version contains no indication of why changes in the hydrologic regime are important, or of the extremely long period of time over which these considerations will be crucial.

Gelhar's entire section on mineral resources was deleted by EEG. Gelhar was concerned that once institutional control of the WIPP site is lost, future generations may be unaware that radioactive materials have been placed there. Subsequent potash mining could remove a portion of the natural geologic barrier, provide a pathway for groundwater movement in the Salado, produce subsidence fracturing in the overlying Rustler aquifers, and adversely affect WIPP site hydrology (Gelhar, 1979, p. 30).

Also deleted from Gelhar's draft was the letter of transmittal which accompanied the GCR, wherein Sandia Labs recommended that DOE select the Los Medanos site for "underground development." (Beckner to Schueler, 12/21/78) In Gelhar's deleted words:

Contrary to its stated purpose, the GCR is being used as the basis for recommending that the site be selected and that underground construction proceed. In view of the numerous unresolved questions concerning geological conditions at the site, there does not seem to be scientific justification.... If underground development is required to determine acceptability of the site, (there should be identification of) the specific geological questions to be resolved and the specific investigations that will resolve them.[52]

Gelhar found it necessary on March 13, 1980, to present his own review of EEG's finished product to other dissenting geologists, to the Governor's Advisory Committee, and to the EEG:

Because of the unresolved geotechnical issues ... it is important that the State of New Mexico have the capability to carry out an in-depth scientific review which addresses the geotechnical suitability of the WIPP site. From my experience with the State review process, I am convinced that this capability does not now exist. ... EEG lacks expertise in the

earth sciences and has restricted the scope of its investigations to '...evaluation of the potential radiation exposure to people from...' WIPP, thereby excluding considerations of questions of geotechnical suitability of the proposed site.[53] Such exclusion is explicitly demonstrated by EEG's GCR review; through its editorial approach EEG deleted comments on the significance of the unresolved geotechnical issues, applicable geological criteria, geotechnical suitability of the site, and the DOE proposal to proceed with exploratory underground construction.[54]

## CHAPTER 3

# CORE STUDY OF THE RUSTLER FORMATION

In November 1979, five months after the public hearings on the Draft Environmental Impact Statement, (DEIS), a contractor's report entitled "Core Study of Rustler Formation over the WIPP Site," by Charles C. Ferrall and John F. Gibbons, was released by Sandia National Laboratories. This was the earliest report to challenge the notion that the Rustler Formation is a barrier to groundwater migration. Ferrall and Gibbons focused on the extent and nature of fractures in the Rustler. Photos of core samples were used extensively, and cores were examined to clarify observations made from photographs. Some holes were not cored within the Rustler; their geophysical logs are secondary evidence and were not extensively used.[55]

Ferrall and Gibbons found that fractures are most frequent in the Magenta and Culebra dolomites, which are the most brittle members of the Rustler. Fractures parallel to bedding planes (horizontal, low-angle) are the most commonly found,[56] occurring at least once per vertical foot in all horizons of the Rustler;[57] but vertical or steeply dipping fractures are less likely to be detected by vertical boreholes. Fractures also occur in beds which have collapsed into voids created by solution along former paths of migrating groundwater.[58]

The complete Rustler core at WIPP-19 is described by Ferrall and Gibbons. At the Rustler--Salado contact is a solution residue which represents the leached top of the Salado. This is overlain by dark gray siltstone with numerous, irregular, near--vertical fractures, 1 to 3 per vertical foot, normally filled with halite, the result of undermining due to solution of the underlying salt.[59]

This dark gray siltstone grades upward into a reddish brown siltstone, overlain by 17 feet of solution residue with about one high-angle fracture per vertical foot. Only 7 feet of halite, not significantly fractured, remains above the solution residue. Only horizontal fractures were encountered between this solution residue and the Culebra dolomite.[60]

In the Culebra dolomite are bedding plane fractures, 1 to 8 per vertical foot; numerous irregular, near-vertical fractures, generally filled with gypsum; and high-angle planar fractures, 1 to 5 per vertical foot. The Culebra dolomite is the primary aquifer of the Rustler, "with fracture permeability providing the dominant flow mechanism."[61]

In the Tamarisk anhydrite, few high-angle fractures were observed. In the Magenta dolomite, high-angle fractures were spaced at 1 to 6 per vertical foot. In all boreholes the bottom few feet of the Magenta contain past or present groundwater conduits. Virtually no high-angle fractures were observed in the Forty-niner member.[62]

In summary, WIPP-19 exhibits horizontal fractures throughout the Rustler Formation, but the Rustler aquifers are not connected by high-angle fractures at WIPP-19. The core shows that dissolution can affect the top of the Salado even if some halite remains in the Rustler.[63]

Ferrall and Gibbons identify a possible collapse feature at borehole WIPP-13, in the northwestern part of Zone III.[64] Frequent, moderate-angle (30-60 degree dip) fractures extensively break up the Magenta, and there is no gypsum filling of the fractures. The shattering here suggests a local origin, due to collapse or to hydration of gypsum.

Ferrall and Gibbons place WIPP-13 at the edge of the shallow dissolution front.[65] In all boreholes north and west of WIPP-13, no significant halite remains in the Rustler, and some gypsum has been removed by solution.

Ferrall and Gibbons identify WIPP-19 as a pocket of active dissolution.[66] There are leached zones in Forty-niner anhydrite at the top of the Rustler. In WIPP-19 these zones are open. In other boreholes, similar zones are filled with gypsum. This suggests that solution is an active process at the WIPP site, while to the north and west, solution may be essentially complete and solution voids are filled by reprecipitated gypsum.

Ferrall and Gibbons also expressed concern about the hydrologic effects of climatic change.[66] The Pleistocene Epoch in New Mexico has been punctuated by humid pluvial climates alternating with dry interglacial periods. These cycles are related to climatic influence of continental glaciers. The last pluvial climate ended about 10,000 years ago. The





extensive solution residues and widely distributed evidence of collapse are relicts of that climate or one of the preceding pluvials. Open solution channels and enlarged fractures may result from modern processes.

Ferrall and Gibbons concluded that the extensive presence of open fractures, open solution channels, and solution residues strongly implies that historic or recent flow through the Rustler is not confined to the Culebra and Magenta dolomites.[67] Permeability in the Rustler is the result of flow along fractures or bedding planes where solution has extensively altered the rock. Flow paths include leached zones in anhydrite as well as extensively fractured zones in dolomite. The resulting groundwater channels are extremely complex and segmented by steeply dipping or vertical fractures.

7 Ferrall and Gibbons' core study should have destroyed the notion that the Rustler is a barrier to groundwater migration. Yet the Final Environmental Impact Statement (FEIS) incorporated none of Ferrall and Gibbons' work, and restricted groundwater flow to low-yielding fractures in the Culebra and Magenta dolomites.[68]

Although the core study was published by Sandia Labs, its distribution was extremely limited. As of 1983, it was available to the public only at the Atomic Museum Library at Kirtland Air Force Base in Albuquerque.

7 Distribution of WIPP documents is ultimately DOE's responsibility, and EEG normally receives "all the documents related to WIPP on a routine basis".[69] Larry Barrows brought this report to the attention of Lokesh Chaturvedi in October 1982, three years after publication.

## CHAPTER 4

# FRACTURE MODEL OF THE RUSTLER FORMATION

8 I telephoned John Gibbons and inquired as to the whereabouts of a subsequent study by Gibbons and Ferrall, entitled: "A Fracture Model of the Rustler Formation at the WIPP Site," submitted to Sandia National Laboratories in August 1980. Gibbons confirmed the existence of a report by that title, but he explained that it had never been released to the public by Sandia Labs. Because Gibbons and Ferrall had prepared the report under government contract for the WIPP site validation program, the unreleased report was still government property. "I would be sued if I showed it to you," said Gibbons. He did say that he would be happy to discuss it with me if I could arrange for a copy to be placed in the public reading room at the Atomic Museum Library.[70]

I specifically requested the report from Everett Beckner of Sandia Labs, during the first week in June 1983. "Considerable confusion" surrounded my request. Sandia had no record of such a report, because Sandia had changed the title to "Characterization of Pre-Existing Geologic Fractures in the Rustler Formation at the WIPP Site."[71] Sandia had detached Gibbons' conclusions, which became two separate documents with lengthy titles: "Mechanical Modeling of Deformation of the Rustler Formation at the WIPP Site," and "Impact of Thermomechanical and Geomechanical Effects on the Geohydrology of the Rustler Formation at the WIPP Site."

Finally a the report was obtained by Sandia from John Gibbons. Wendell Weart, WIPP Director at Sandia Labs, provided a copy to DOE attorney Mary Wilson on July 6, 1983.

As explained by Weart, the report was never published by Sandia "because many of the statements contained therein did not have adequate technical support and in some cases were contrary to existing information. The memo which contains the decision not to publish the report is attached."[72]

In the attached memo from R. V. Matalucci, dated November 5, 1980, it is contended that the "fracture pattern reported by Gibbons and Ferrall was not substantiated." This was the consensus of six Sandia scientists, and I am in agreement on this point.

Matalucci acknowledged that the attempt by Gibbons and Ferrall "to find an existing computer model that would simulate flow through the Rustler" had been "largely unfruitful." Thus, the report was "not expected to be published." Comments recorded on the review copies "reflect major disagreements" with statements which "were inconsistent with the data assembled by other investigators." Therefore, "the report did not warrant the additional effort" required for publication. "It will remain on file as written for future reference."[73]

8 The report remained unpublished because: (1) the described fracture pattern was unsubstantiated; (2) it contended that Rustler groundwater flow could not be computer modeled; and (3) it contained statements contrary to the scientific consensus at Sandia Labs.

The reports describe geomorphic processes related to scarp retreat and fracture frequency in and near the WIPP site.

Livingston Ridge is an escarpment capped by red siltstones of the Dewey Lake Redbeds. It marks the eastern edge of Nash Draw; it is located about one mile west of Zone IV of the WIPP site. Dissolution

has essentially replaced erosion as the prime geomorphic process in Nash Draw. This is responsible for the eastward retreat of Livingston Ridge.[74]

Livingston Ridge "has been stable in its present position long enough" to be deeply mechanically weathered and locally incised "by small ephemeral tributaries to the fluvial drainage of Nash Draw."[75] However, the "recent inactivity" of Livingston Ridge "in an arid climatic regime does not necessarily preclude the possibility of processes which may produce very rapid scarp retreat in humid climatic conditions."[76]

Incision of the Dewey Lake Redbeds, "under humid conditions, would result in very rapid downcutting" of stream channels.[77] Fresh water streams would then come into direct contact with soluble Rustler evaporite rocks above the regional groundwater table. The result would be "extremely rapid removal of rock by a combination of erosion and dissolution. Rivers commonly 'sink' into evaporite rocks under such conditions as in the karst country of Tennessee and Kentucky."[78]

The Magenta and Culebra dolomites "have been fractured since shortly after their deposition."[79] Subsequent fracturing due to the related processes of dissolution and scarp retreat cannot be estimated by any available method, because of the unusual solutional and erosional modes of evaporite rocks.[80]

"Halite beds have been almost entirely removed from the Rustler at the (WIPP) site." An unknown amount of halite, perhaps a few hundred feet, has been removed at the top of the Salado which underlies the Rustler.[81] The presence of halite-filled fractures and solution residues strongly implies that dissolution of halite is an ongoing process.[82]

Alteration and solution along fractures, the result of rainwater percolating toward the groundwater table, increases gradually across the WIPP site toward Nash Draw. Ragged irregular fractures in Mescalero caliche and Dewey Lake Redbeds, parallel with the east wall of Nash Draw, are prominently visible in air photos. The fracture pattern "is related to the boundaries of Nash Draw, but extends beyond it, into the siltstone-capped mesa, ... beyond the usual influence of rotational slumping or gravity shearing along the escarpment."[83]

The most reliable means of evaluating the fracture pattern would be core samples from a slant drilling program. If angled 45 degrees with respect to the horizontal, and oriented perpendicular to the predicted trends of dominant fracture sets, a valuable three-dimensional record of fracture spacing could be generated without damaging rock near the repository. "Such an array of carefully logged holes would offer an optimum means of estimating fracture filling and alteration by solution."[84]

Because fracture spacing is inversely proportional to bedding thickness,[85] thin beds would require much smaller areas of exposure to yield a large enough fracture sample to reliably represent its fracture pattern and spacing.[86] Westward across the WIPP site toward Nash Draw, alteration and solution along fractures gradually increases, and bedding thickness in the Rustler gradually decreases. Thus, the optimum location for slant drilling and coring would be between Nash Draw and Zone IV of the WIPP site.

As previously mentioned, Sandia Labs detached the conclusions of John Gibbons, which became two separate documents. His conclusions were reviewed by Dennis W. Powers and L. S. Costin of Sandia Labs in early February 1981.

In "Mechanical Modeling," Gibbons concluded that there is no basis for evaluating the extent of natural fractures in Rustler rocks at the WIPP site. Until extensive site studies are performed, none of the necessary elements of the data base will be available.[87]

"These statements indicate that modeling of Rustler deformation cannot be done," observed Powers after reviewing Gibbons' conclusions. Powers charged that no information was given by Gibbons to indicate if the parameters necessary for mechanical modeling are obtainable, or even if such modeling is important. Therefore, wrote Powers, "I see nothing substantive in this report to justify publication" as a Sandia document.[88] Costin agreed: "I see nothing of technical merit in this report."[89]

"Impact on Geohydrology" (Gibbons, 1980b) contained the information which Powers charged was lacking from the other half of Gibbons' conclusions. The impact of an extensive fracture pattern on WIPP geohydrology depends in part on the degree and geohydrologic character of fracture filling by groundwater. Neither of these important geohydrologic influences is reflected in existing data. The few existing Rustler cores and all existing geohydrologic data are from vertical borings in massively bedded rocks which have extensive but moderately spaced vertical fractures. Only a precisional slant drilling and coring program based on an extensive study of fracture geometry could provide representative data.[90] Gibbons issued the following early warning:

> At this time the probability that the Rustler Formation is an effective barrier against the migration of radionuclides is unknown. There is no present evidence that the Rustler is a barrier, since all testing has been in a few vertical borings.[91]







CHAPTER 5

# RADIONUCLIDE MIGRATION IN GROUNDWATER

The Geological Characterization Report (GCR) described the geologic barriers to migration of contaminated water from the WIPP repository to the Rustler dolomite aquifers. According to the GCR, groundwater would have to contact and leach the waste; then during its exit, the radioactive liquid would have to overcome polyhalite, anhydrite and clay seams in the Salado, all of which could act as barriers to vertical migration of contaminated water. Only then would radionuclides reach the Rustler dolomite aquifers.[92]

The weakness of this argument is that none of these horizontal seams would be encountered if the leached waste were to follow a man-made pathway from the WIPP repository to the overlying aquifers. Such potential pathways already exist in the form of the exploratory shaft, the ventilation shaft, the waste shaft, and ERDA-9, the central drill hole. Therefore, a primary concern should be the sorptive abilities of the Culebra and Magenta dolomite aquifers.

The GCR explained uncertainties involved in quantifying radionuclide sorption abilities in rocks, which ideally "would be measured in situ in the geologic formation of interest" using long flow paths and available groundwater. Because this is not "feasible,"[93] "the only rational approach to the problem" is to conduct laboratory experiments to quantify "radionuclide sorption properties for site-specific rocks and site-specific aqueous solution..."[94]

The object is to quantify the concentration of the sorbed radionuclide per unit volume of rock, and to divide this by the radionuclide concentration remaining in the liquid per unit volume of liquid. The quotient will represent the proportion of the radionuclide which is retarded during fluid migration. What is being measured is the sorption coefficient, or distribution coefficient (Kd), with units of milliliters per gram (ml/g). The lower the Kd value, the less the retardation of radionuclide migration. The result "applies only to the system described and for the particular set of conditions used in making the measurement."[95]

Various rock samples, including Culebra and Magenta dolomite, "were reduced to a powder prior to use" in Sandia Labs experiments. Three different groundwater solutions were used, simulating brine in contact with: (A) potash deposits at the WIPP site; (B) halite deposits in the WIPP repository; and (C) Rustler groundwater.[96] Therefore, Culebra and Magenta dolomite samples in Solution C are of primary interest.

For WIPP, the radionuclides of concern are plutonium isotopes. A wide range of results for plutonium were obtained by Sandia Labs; "the magnitude of error ... is unknown, as multiple samples were not used."[97] In Solution C, a distribution coefficient of 2,400 was obtained for plutonium in Magenta dolomite,[98] and 7,300 for plutonium in Culebra dolomite.[99] But, as noted above, these rock samples were reduced to a powder prior to use.

A distribution coefficient of 2,100 was obtained for plutonium in powdered Culebra dolomite in Brine B.[100] This is the Kd value presented by DOE in its Final Environmental Impact Statement (FEIS), 1980, Table K-3, p. K-20. In other words, DOE siezed upon a high distribution coefficient for Culebra dolomite ground to a powder and emplaced in a salt water solution meant to simulate conditions 1,400 feet below the surface. DOE then portrayed this Kd value as approximating actual conditions in the Rustler aquifers.

Strikingly different Kd values for plutonium were also obtained by Sandia Labs, including 41 for Magenta (gypsiferous dolomite), and 19 for Culebra (silty dolomite). These Kd values were measured "on tablets of rock with known dimensions," and "in waters that have been equilibrated with the individual rock..." These surface adsorption coefficients are believed by Sandia to be "more applicable to migration along fissures and cracks"[101], and thus would be more representative of fracture flow in the Rustler aquifers.

CHAPTER 6

# PRESSURIZED BRINE DISCOVERED UNDERNEATH WIPP

Prior to 1980, brine had been encountered in anhydrite of the Castile Formation in 10 of 60 deep drill holes within 10 miles of the WIPP site. The frequency of brine encounters was cited as a factor favoring the possibility of such an occurrence at the WIPP site.[102]

In nine drill holes, the brine was associated with hydrogen sulfide ($H_2S$) gas, that was under artesian pressure, and flowed to the land surface at initial rates up to 20,000 barrels per day. All ten drill holes "were plugged before the brine flows were exhausted, so it is difficult to estimate the total volume or the size of the chambers."[103]

George Griswold of the New Mexico Bureau of Mines believes that three holes, located northeast of the WIPP site, (ERDA-6, Pogo and AEC-7) encountered the same brine reservoir.[104] Griswold showed hydraulic head calculations for four brine encounters (Pogo, ERDA-6, Belco-Hudson and Gulf) for which shut-in pressures had been measured. These calculations suggest a brine flow to the south, away from the Capitan Reef, toward the WIPP site, if the brines are interconnected.[105] Draw-down tests to measure the response between ERDA-6 and Pogo were never performed, so it is still unknown if these brines are interconnected.[106]

Dr. Roger Anderson, Professor of Geology at the University of New Mexico, believes that the brine reservoirs are too large to consist of Permian sea water trapped during deposition of the salt. He believes that the brine reservoirs may be evidence of deep dissolution, supporting his view that the WIPP site is potentially vulnerable to deep dissolution.[107]

The Draft Environmental Impact Statement (DEIS) concluded that deep dissolution does not occur near the WIPP site, and that there was no evidence of brine reservoirs at the WIPP site.[108] DOE relied upon seismic reflection data to rule out the possibility of brine reservoirs at WIPP, assuming that brine reservoirs are always associated with anticlinal structures (upward folds) at the top of the Castile Formation, and that anticlinal structures can always be identified using seismic reflection data. There were two main objections to this methodology:

> (1) Griswold and Anderson contend that the Castile brine encounter at Pogo, 1.25 miles north of ERDA-6, is associated with a syncline (downward fold), not an anticline (upward fold).[109] The matter is still unresolved.[110]
> (2) Boreholes WIPP-11 and WIPP-13 were drilled at or near anticlinal structures in the northern part of the WIPP site. Anderson and Chaturvedi contended "that these boreholes were not drilled at the optimum locations ... to detect brine reservoirs which might underlie the anticlinal structures."[111]

Griswold suggested that the "disturbed zone" of anomalous seismic reflection data in the northern part of the WIPP site would be "the best place to look for brine reservoirs and for evidence of deep dissolution. He believes these phenomena may be related."[112] EEG agreed that the disturbed zone "could be interpreted as potential artesian brine pockets or advanced stages of deep dissolution in proximity to the repository horizon."[113] EEG described the potential hazard in this manner:

> If there were an artesian brine reservoir in the Castile Formation below the repository, and a connection formed between the brine reservoir, the repository and the surface, brine would flow to the surface and some of the waste could be brought to the surface with the brine. Griswold has suggested that ... the pressure difference between a repository and an underlying geopressurized brine reservoir could open a pathway along an existing fracture, forcing a connection.[114]

In a letter of transmittal accompanying the Final Environmental Impact Statement (FEIS), Sandia Labs took the position that "all of the investigations to date continue to support the technical acceptability" of the WIPP site. The letter dated October 1, 1980, was from Everett H. Beckner of Sandia Labs to Joseph M. McGough, then Acting WIPP Project Manager for DOE.[115]

Beckner acknowledged that little had been learned about "these large volume brine reservoirs" since the GCR was published in August 1978. Beckner contended that brine reservoirs "deplete in those cases where allowed to do so"[116]; in fact, all ten boreholes were plugged before the brine flows were exhausted.[117]

Beckner vouched for the acceptability of the WIPP site on the basis of borehole WIPP-12, in the southern part of the disturbed zone, one mile north of the center of the WIPP site. Beckner advised McGough that WIPP-12 showed modest and acceptable deformation in the Salado at the repository horizon, which "will not preclude repository operations or jeopardize long-term safety.".[118] This evaded the real issue of deformation in the Castile. Beckner concluded that WIPP-12 "does not give rise to the conditions favorable for evaporite brine reservoirs," which therefore "are not likely to exist at the WIPP site.".[119]

In the Final Environmental Impact Statement (FEIS), the DOE lightly dismissed the possibility of brine underneath the WIPP site. The FEIS referred to the anticlinal structure in the Castile at the northern edge of Zone II as the closest area "that might be suspected of containing a brine reservoir." Three boreholes (ERDA-9, WIPP-12 and WIPP-13) had been drilled at or near this anticline, and had "penetrated into the upper Castile anhydrite ... without revealing any brine reservoir."[120]

The FEIS fails to explicitly mention that ERDA-9 and WIPP-12 penetrated only 51 feet and 47 feet deep, respectively, into the upper Castile.[121] Neither hole had been drilled deep enough into the Castile to reach the brine reservoirs. Yet the FEIS concluded that brine reservoirs "are extremely unlikely near the repository."

Based upon seismic evidence, Roger Anderson described the northern part of Zone II as a "highly disturbed zone" of complex geologic structure in the Castile Formation, with associated displacements in the underlying Bell Canyon aquifer. Anderson warned that large volumes of pressurized brine are





associated with dissolutional effects in similar Cenozoic salt structures near the WIPP site; for example, at ERDA-6 and WIPP-11.[122]

Anderson charged that evaluating WIPP site stability in terms of the rate of advance of a regional dissolution front does not consider locally initiated dissolution in the Lower Salado. An appropriate investigation would include drilling into the disturbed zone, although Anderson acknowledged that this method "may be site-destructive." Anderson repeated that the Delaware Basin as a whole "exhibits an advanced stage of dissolution," and he suggested looking elsewhere for a suitable site, in a less dissolved evaporite basin.[123]

A "Stipulated Agreement" between DOE and the State of New Mexico was signed on July 1, 1981, as a result of a lawsuit filed by Jeff Bingaman, then New Mexico Attorney General.[124] The Stipulated Agreement "does not waive any right by the State to judicial review of any federal agency action with respect to the WIPP project."[125] The Stipulated Agreement required DOE to investigate the disturbed zone by deepening the WIPP-12 borehole, for several reasons:

> (1) to investigate the anticlinal structure and associated thickening of halite;
> (2) to determine the nature and extent of deformation in the Castile; and
> (3) to characterize any fluid-bearing zones encountered in the Castile Formation when drilling.[126]

As late as September 1981, WIPP Director Wendell Weart of Sandia Labs questioned the probability of encountering a brine reservoir at the WIPP site. "He emphasized that the boreholes where brine was encountered are grouped east and northeast of the site"[127], disregarding the Belco-Hudson brine encounter immediately southwest of Zone IV.[128] Dr. Weart, speaking for DOE at a court hearing the same month, testified that DOE considered it extremely unlikely that brine would be encountered in the WIPP-12 area.[129]

The deepening of the WIPP-12 borehole began on November 16, 1981.[130] "Drilling progress was rapid and virtually trouble-free" until the evening of November 22, 1981. "Hydrogen sulfide gas was detected by the safety monitoring system" at a depth of 3006 feet. Drilling continued to a depth of 3016 feet, when brine flow was observed which quickly increased to a rate of 45 gallons per minute (1540 barrels per day). At that point drilling was discontinued because of "safety considerations" -- the levels of hydrogen sulfide ($H_2S$) gas "rendered continued drilling hazardous..."[131]

By January 1, 1982, WIPP-12 had been drilled to its total depth of 3927.5 feet. Total brine outflow during this 40-day period "was 60,000 barrels, or about 2.5 million gallons." "Thirteen days were devoted exclusively to hydrologic testing of the brine reservoir" which, DOE concluded, "is apparently related to a system of near vertical fractures of an unknown extent" in the Castile anhydrite. The Castile halite "is about 200 feet thicker than observed in undisturbed areas in the vicinity of WIPP.[132]

The WIPP-12 brine was discovered 560 feet north of where the nuclear waste was to have been stored, and about 800 feet below.[133] Nine days after the WIPP-12 brine encounter, New Mexico Health and Environment Secretary George Goldstein said that the brine reservoir was "very, very serious" and "could mean an end to the project." Goldstein said that although brine had been encountered before near the WIPP site, it was "never so much and never so close." Goldstein said that the WIPP-12 brine flowed at a rate "between 200 and 250 gallons per minute. In fact, it filled up the catchment area so fast that they shut it down after a few days to dig a new catchment area. It seems the probability of finding brine is going up the closer they're coming to the site."[134]

Said Roger Anderson:

> It's a bad place to bury wastes. Brine has been found throughout the area and salt formations in the basin are in a fairly advanced stage of dissolution. DOE is in a catch-22 situation. Once they discover brine in a test hole, the only way to determine the extent of it is to do extensive boring -- which ruins the integrity of the site for waste storage.[135]

## CHAPTER 7

# WIPP WASTE DISPOSAL AREA IS MOVED

As a direct result of the brine discovery at WIPP-12,

DOE acceded in 1982 to the State of New Mexico's demand that the WIPP repository be moved to the southern quadrant of Zone II, away from the WIPP-12 brine reservoir. The new WIPP disposal area was approved after publication of the Final Environmental Impact Statement (FEIS), and entirely without public input.

On April 15, 1983, EEG Director Bob Neill acknowledged at a public presentation that the WIPP-12 brine reservoir "extended under" the old repository location in the northern quadrant of Zone II. At the "urging and analysis" of EEG, "the Department of Energy relocated the repository, to slide it a mile and a quarter to the south, to get it away from that area with the brines." Neill's presentation was followed by a question-and-answer session which turned into a dialogue between Mr. Neill and myself:

PHILLIPS: This procedure of rotating the dis-

posal area to be in the mile south of the center of the site, rather than north --

NEILL: Right.

PHILLIPS: The whole NEPA (National Environmental Policy Act) process was based upon an evaluation of the site north of the center; and that's where most of the drilling was done; and I don't understand how the site can be moved without requiring that the whole NEPA process be redone, with an evaluation of equal depth of the site south of the center.

10

NEILL: Okay. Good question. The WIPP site is designed with four (concentric) zones in mind. ... The original location of this rectangle for the repository, as you said, was in the northern part of Zone II. That always was the zone in which waste was to be placed. When we found brine that could be as close as 1,000 feet from the repository, (we said) the area to the south appears preferable -- still within Zone II, now -- because, first, the beds on the top of the Castile in the north were tilting; second, you were heading ... towards an unstable area in the north, the so-called disturbed area, in which the seismic reflection data didn't make much sense; and third, you had an observed brine reservoir in that area. So based on that, we looked at the area in the south. The seismic data indicated the beds were pretty damned flat in the south. And for that reason the State made the recommendation to DOE to relocate the repository -- slide it down 6,000 feet, stay within Zone II, and put the repository there. DOE-1, an additional borehole, was drilled at the State's suggestion, in the most unfavorable-looking area down there. But I don't think one could say that the area in the north had been characterized in extraordinarily greater detail than the area in the south...

PHILLIPS: I certainly can say that. The (Environmental) Impact Statement process was based upon the assumption that (waste) was going to be stored north of the center -- I understand why you asked that it be moved out of there, because there were so many geologic hazards.

10

NEILL: Well, I think one way I looked at it -- in fact, DOE made the same point -- they said, you know, if we move this thing, it's going to be almost a tacit admission that brine is a major problem, that we're changing our mind again, and we ought to hang tough, and we ought to stay where we are. And I think we (EEG) argued successfully that -- no, I don't think it would show that. Your building lot of 2,000 acres, ... presumably you should be free to build anywhere you want on that 2,000-acre lot. If you can pick a better location, move it. And I guess I'll take the full responsibility of that, because we convinced the (WIPP) Task Force, and then we convinced DOE, and Sandia (Labs) and everyone else, that you put this thing in the best real estate, you don't put it in the crummiest real estate.

PHILLIPS: So you don't think that the southern half of Zone II needs drilling and geologic analysis to the extent that the northern half --

NEILL: Well, at our insistence they've drifted, put a tunnel all the way to the south, and I've walked up and down that drift ... with the National Academy of Science people, and it looks good. It looks better than the north. ... Now, the cancelled checks down at Carlsbad amount to $180 million, in site characterization. ... It's a very difficult judgment call as to whether additional experimentation, additional studies, will make you feel any more secure in predicting that real estate's behavior or not. And there is genuine disagreement. ... The only two independent groups looking at it are the EEG and the National Academy of Science's WIPP Panel.

ANOTHER QUESTIONER: At this point we've spent $180 million ... Is it conceivable that DOE will say -- "Hey, no, this isn't the right place, this isn't the best thing to do," and then drop it?

NEILL: It's conceivable, but common sense would say that after you've spent that kind of money, unless you really found an active earthquake that's spewing the stuff out, you probably aren't going to walk away from the project. And with every dollar you spend, the threshold to walk away gets higher and higher ... To date, we (EEG) have not seen any evidence of anything that would clearly rule out the site, ... we do not see any evidence that WIPP poses an unacceptable threat or risk to the public health and safety. ... This doesn't mean that something will not turn up tomorrow, or next month...

PHILLIPS: Well, DOE's not going to come up with that evidence. Then who presents the evidence?

NEILL: Well, that's part of our job. We're looking at it, we're monitoring it, and we're bringing in a scientific group next month...

PHILLIPS: To that extent, the burden of proof is thrust upon the State?

NEILL: Yes and no. The burden of proof is on DOE. We don't have to prove it's unsafe. They have to prove it's safe. But I'm not in too much disagreement with you.

In summation, Bob Neill vouched for the suitability of the new WIPP waste disposal area because: (1) the seismic data indicates that its geologic formations are "pretty damned flat;" (2) DOE drilled one more borehole (DOE-1), and found nothing that would clearly rule out the site; and (3) DOE excavated a tunnel through the salt between the old site and the new site, and it "looks good." Not that one could expect to see brine and dissolution in the exploratory tunnel, which is 700 feet above the Castile Formation. Nothing short of an active earthquake fault will convince DOE to walk away from the WIPP project, because too much money has already been invested.

11

Characterizing the entire 2,000-acres of WIPP site Zone II as a "building lot" of "real estate," Bob Neill contends that DOE should be able to select the waste disposal area of its own choosing, without any public comment. The WIPP site is not DOE's real estate. It is public land under the stewardship of the Bureau of Land Management (BLM).





EEG still contends that relocation of the WIPP repository "did not appear to warrant a basis for a new NEPA process," because the geological characterization of the new site fulfilled the requirements recommended by EEG. According to EEG, "the southern portion of the site is equally well characterized as the north and the only borehole in Zone II is at ERDA-9."[136] These statements are incorrect. ERDA-9 is in Zone I, virtually in the center of the WIPP site. There are seven boreholes in Zone II, but the only Rustler core sample from Zone II is from WIPP-19, in the northern half.[137] None of these seven boreholes are deep enough to reach the repository level.

13

EEG goes on to claim that: "To have continued drilling deep holes or conducting other extensive tests after DOE-1 was drilled in the southeastern part of the site would have been wasteful."[138] If DOE-1 was designed to shed light on the geological suitability of the new waste disposal area in the southern part of Zone II, then the drillhole location and the drilling procedures at DOE-1 were wasteful. DOE-1 is located in Zone III, about 1,500 feet southeast of Zone II.

According to the Basic Data Report for DOE-1, there were no core samples taken in DOE-1 above the repository level. Cuttings were taken at selected intervals. But the top 154 feet of the Salado Formation were drilled with fresh water gel used as spud mud, instead of the standard procedure of using saturated brine as drilling fluid. "As a result, the unsaturated drilling fluid dissolved much or all of the halite in the cuttings, yielding samples which consisted mostly or entirely of secondary rock constituents." Throughout the 653 feet immediately above the repository level, "a slight leak from the fresh water supply into the mud circulation system" resulted in numerous samples being essentially devoid of halites.[139]

12

The reason why brine saturated with salt is normally used for lubrication of drilling equipment is to not destroy the evidence by dissolving the salt in the borehole. Yet, despite seven years' experience with the drilling of test holes in the Delaware Basin, the DOE and its subcontractors used fresh water gel as a drilling fluid. In all, over 800 feet of Salado salt was dissolved through incompetent drilling procedures at DOE-1. There is no halite in the Rustler at this location[140]; but any evidence of natural dissolution in the Salado was destroyed.

12

## CHAPTER 8

# BRINE UNDERNEATH THE NEW WASTE DISPOSAL AREA

Jeff Bingaman, then New Mexico Attorney General, said on December 1, 1981 that because of the brine discovery at WIPP-12, the DOE would be required under the Stipulated Agreement to do additional testing between WIPP-12 and the actual repository site.[141] To the contrary, DOE has never deepened any boreholes within Zone I or Zone II of the WIPP site, and the occurrence or absence of brine underneath the repository remains a matter of informed speculation.

At WIPP-12 a fracture occurs in the upper Castile anhydrite, at about 3,010 feet below land surface. This fracture is capable of producing over 300 gallons per minute of brine flow, and it is described by EEG as "open and continuous."[142]

The volume of the WIPP-12 brine is estimated at between 17 million barrels[143] and 30 million barrels,[144] at 42 gallons per barrel. By comparison, about 1.5 million barrels of brine would be necessary to fill the WIPP repository.[145]

A brine reservoir estimated at 30 million barrels would occupy 170 million cubic feet of space (1 cu. ft. = 7.480 U.S. gallons). According to EEG, any attempt to correlate the volume of brine calculated from flow tests presumes the localization of brine within anticlinal structures. "This attempt is meaningless since the structures are not well defined." In the case of WIPP-12, the anticlinal structure is too small to contain the brine.[146]

Given a rough estimate of the WIPP-12 brine volume, "the next logical step is to estimate an area over which the brine is contained." The area is given by EEG (1983, p. 31):

$$A = \frac{V}{H P}$$

where

A = area which contains the brine;

V = volume of the brine reservoir;

H = thickness of anhydrite which contains the brine; and

P = porosity of anhydrite which contains the brine.

The thickness H of anhydrite is given by EEG as 317 feet, although EEG acknowledges as unrealistic the idea that WIPP-12 brine fills even the lower half of the anhydrite layer.[147] EEG estimates the porosity

P at between 0.1% and 1.0%[148]; and assumes "a uniform porosity of 0.5%."[149] More precise figures are presented by DOE. The two cores from the upper Castile anhydrite in WIPP-12 indicate effective porosities of 0.2% at 3,007 feet, and 0.8% at 2,815 feet.[150]

Because the WIPP-12 brine reservoir was encountered at a depth of 3,016 feet below land surface, I shall assume that 0.2% (0.002), measured a mere nine feet above the brine, is the more representative porosity. Assuming H = 317 feet, then a brine reservoir volume of 170 million cu. ft. (30 million barrels) would cover an area of 268 million sq. ft., with an average radius of 1.75 miles. A brine reservoir volume of 96 million cu. ft. (17 million barrels) would cover an area of 151 million sq. ft., with an average radius of 1.31 miles. These figures represent the minimum areal extent of the WIPP-12 brine reservoir, because the value for H cannot be more than 317 feet, and is probably less. 15 16

Figure One of this report, entitled "South to North Geologic Cross Section through the WIPP Site," depicts the WIPP-12 anticline and the salt flow structure at WIPP-11. The level at which the WIPP-12 brine reservoir was encountered (455.5 feet above sea level), is shown by a dotted line extending horizontally in both directions from the WIPP-12 borehole. Because all eleven brine encounters appear to be restricted to the upper Castile anhydrite, it may be assumed that the northern extent of the WIPP-12 brine reservoir is limited by the WIPP-11 salt flow structure, which attains an elevation of 455.5 feet above sea level at about 1.1 miles north of the WIPP-12 borehole, as shown in Figure One.

The average depth from the top of the WIPP-12 brine reservoir to the bottom of the Castile anhydrite, measured from the WIPP-12 borehole to the southern edge of the WIPP-11 salt flow structure, is shown in Figure One to be not 317 feet, but about 85 feet. (The average depth of the brine reservoir between WIPP-12 and ERDA-9 would be about 80 feet). If H = 85 feet, then the estimated average radius of the WIPP-12 brine reservoir (1.31 to 1.75 miles) is too small. Thus, the WIPP-12 brine reservoir probably extends underneath the ERDA-9 drill hole and the new waste emplacement area, which are 1.0 and 1.2 miles, respectively, from the WIPP-12 drill hole.

Likewise, the areas calculated by EEG for WIPP-12 brine all extend beyond the anticlinal structure. While of limited accuracy, "these estimates indicate that the WIPP-12 brine could extend beneath the repository."[151] Because the existence of a brine reservoir beneath the repository cannot be disproved, "other than by drilling boreholes into the Castile Formation," EEG assumes a brine reservoir does exist, and quantifies the consequences.[152] 14 17

Roger Anderson agrees that the WIPP-12 brine reservoir could extend beneath the repository. Anderson stresses that the presence of deep boreholes at the WIPP site eliminates the necessity of fractures and fissures for brine to enter the WIPP excavations. Anderson told me that "the workings of the repository are supposed to come within 50 feet of ERDA-9," which "taps into the (Castile anhydrite) bed which contains the brine." Anderson expects that there "could be brine under ERDA-9." Noting that WIPP-12 was deepened by 242 feet and hit brine, Anderson recommends a similar deepening of ERDA-9. If brine does extend underneath the center of the WIPP site, warns Anderson, then about 200 feet of fractured Castile anhydrite is the only geologic barrier preventing brine from finding its way into the ERDA-9 drill shaft and migrating toward the repository. "The plan is to plug ERDA-9," but Anderson says there is no proven technology for plugging boreholes in salt formations, and he doubts that it can be done successfully.[153]

## CHAPTER 9

# LETHAL LEVELS OF HYDROGEN SULFIDE GAS

In 1979, when editing Lynn Gelhar's draft of review comments on the Geological Characterization Report (GCR), EEG deleted Gelhar's reference to "toxic levels" of hydrogen sulfide ($H_2S$) gas in the ERDA-6 brine reservoir, 4.5 miles northeast of the current WIPP site.[154]

I asked in June 1983 if the level of $H_2S$ gas in ERDA-6 was toxic. EEG's James Channell answered: "True. It was. We would expect hydrogen sulfide levels to be lethal if they didn't have respirators."[155] But, added EEG's Kenneth Rehfeldt: "As far as I know there's not a respirator that would work at that concentration" of hydrogen sulfide gas.[156]

In 1981, the $H_2S$ at ERDA-6 "corroded all exposed metallic surfaces and rendered some of the equipment useless." Profile, Inc., of Carlsbad, New Mexico, which was contracted to do gas sampling at ERDA-6 in 1981, reports that there "is no apparatus presently available capable of accurately measuring such high concentrations of the gas." The on-site supervisor said that $H_2S$ concentrations were so high that his crew, at the land surface, "was on 'red alert' for 48 hours, as dangerous quantities of gas rose up through the ERDA-6 borehole."[157] Despite their inability to accurately measure the levels of $H_2S$ gas at







the ERDA-6 borehole, Profile, Inc. estimated the $H_2S$ level at 260,000 parts per million (ppm), or 26%. DOE was publicly critical of this estimate.[158]

It turns out that analysis of gas samples from ERDA-6 had been performed for Sandia Labs in 1975, six years earlier. This analysis indicated $H_2S$ concentrations of 320,000 parts per million (ppm), or 32%. This potentially lethal measurement was revealed in the Basic Data Report for Drillhole ERDA-6 (1983, p. 59). 17

$H_2S$ is the second most lethal gas known and is dangerous at levels of 100 ppm. "$H_2S$ attacks membranes and the nervous system, and is lethal on contact at 700 ppm. ... Gas masks can protect miners from $H_2S$ in concentrations up to 1,000 ppm, but for concentrations beyond that there is no protection."[160] The National Institute for Occupational Safety and Health regards $H_2S$ levels of 10 ppm to be the permissible exposure for miners without respirators. 17

## CHAPTER 10

# FAULTING AND DEFORMATION UNDERNEATH THE WIPP SITE

The WIPP site was extensively surveyed with the seismic reflection technique, so as to resolve the geologic structures in the Castile and deeper formations. The results were published in March 1983 by Sandia Labs in what is known as the "Deformation Report"[161], co-authored by David J. Borns, Lawrence J. Barrows, Dennis W. Powers and Richard P. Snyder.

From his interpretations of seismic data, Larry Barrows constructed maps of the WIPP seismic time structure.[162] The maps show an elongated syncline, trending east-west, in the southwestern parts of Zones II and III. Its relief is about 210 feet. The syncline is expressed on the maps of the top, middle and bottom of the Castile, extending through the entire Castile Formation.

The sides of the syncline appear to be faulted, with displacement of 35 to 70 feet. The faults are both more than one mile long, are expressed on the maps of the top and middle of the Castile, and extend virtually underneath the new waste emplacement area in the southern part of Zone II. "If the fault indications are valid this feature is a small graben."[163]

Larry Barrows assured me that it "really is a structural graben. Seismic data seem to show a sharp discontinuity instead of a more gradational one."[164] The graben is shown in Figure Two of this report, entitled "West to East Geologic Cross Section through the WIPP Site."

The significance of the faults is that they present weaknesses in the Castile anhydrite, forming two potential pathways for pressurized brine to migrate upward into the Salado salt when brine equilibrium is upset by the emplacement of heat-emitting transuranic waste. This could trigger deep dissolution in the Lower Salado.

Because seismic readings cannot be reflected off any member of the mid-Salado,[165] there are only two ways to determine if the faults extend upward through the Salado all the way to the repository level:

Larry Barrows, in November 1980, recommended drilling of "horizontal boreholes" from the center of the WIPP repository, crossing directly over the graben, to see if the faults could be found at the repository level. Said Barrows:

> "I don't know what happened to that suggestion."[166] However, this approach would not reveal the full extent of the faults, nor would it reveal a brine pocket in the Castile.

Roger Anderson thinks it probable that there is a brine pocket at this location, and he recommends vertical drilling directly into the graben, deep into the Castile, to test for brine. Anderson also recommends vertical drilling on both sides of the graben, to measure the displacement at each rock horizon.[167]

The geologic cross sections presented in this report (Figures One and Two) intersect at test well H-3, located 0.6 miles south of the center of the WIPP site. The two cross sections may be directly compared at this point, as shown in Figure Three, entitled "Key to Geologic Cross Sections." Figure One shows that the WIPP-12 brine reservoir may extend 1.6 miles southward from WIPP-12 to H-3, while Figure Two shows that H-3 is located almost directly over the eastern end of the graben. Thus, it is likely that the graben is associated with the WIPP-12 brine reservoir.

The "disturbed zone" was initially recognized on the basis of "chaotic seismic reflection data."[168] "The seismic data are valid, but the geologic structures within the Castile Formation are too complex to map with the seismic technique."[169]

The existence of deformation structures in the disturbed zone was confirmed by later drilling.[170] The disturbed zone is defined by thickened or thinned halite units of the Castile, and anticlines or synclines in anhydrite units of the Castile.[171]

CHAPTER 11

# KARST IN THE RUSTLER FORMATION

Lateral variations in the subsurface distribution of rock mass or rock density can be detected by measuring small variations in the earth's gravity field. These variations (or anomalies) in the gravity data can be used to detect subsurface density structures, and to establish the minimum amount of missing, or excess, mass in the structures.[172]

The "Deformation Report" finds that lateral variations in the Rustler Formation are "reasonably established" by the gravity survey, seismic reflection data, and borehole data. "A common consensus about their origin has not formed among the WIPP geologic investigators." Barrows believes they result from karst processes.

Barrows believes that the lateral density variations are too localized to be attributed to depositional variations in the Rustler. Barrows cites as evidence the density variations which occur in the Rustler between two boreholes (WIPP-14 and WIPP-34) barely 1,000 feet apart, even though the Culebra and Magenta dolomite members of the Rustler "form remarkably persistent stratigraphic markers" across the entire Delaware Basin. "Considering the indications of halite dissolution within the Rustler Formation," Barrows concludes that "the karst interpretation is much simpler."[173]

Borehole WIPP-14 was drilled into a closed topographic depression, 10 feet deep and 700 feet across. The depression is located in the northeastern part of Zones III and IV, near the western end of the most pronounced negative gravity anomaly in the WIPP site gravity survey. Barrows interprets the depression "as an alluvial doline formed when loose surficial material washes through cracks in the Dewey Lake Formation into solution conduits in the Rustler Formation."[174]

Borehole WIPP-33 was drilled into a closed topographic depression in the northwestern part of Zone IV, one mile east of Nash Draw. The depression coincides with a high-amplitude negative gravity anomaly. WIPP-33 encountered four cavities totalling over 20 feet in Forty-niner gypsum and Magenta dolomite of the Rustler Formation.

According to Barrows, the negative gravity anomalies are correlated with alluvial dolines and cavernous zones. As "karst channels are persistent over long time periods," the negative gravity anomalies would result from "decreased rock densities near karst channels," where "the anhydrite would be hydrated to gypsum," as well as from the karst channels themselves.[175]

In April 1983 the "WIPP Site Gravity Survey," by Lawrence J. Barrows et al., was published by Sandia Labs. David J. Borns and C. A. Searls reviewed the report.

Barrows et al. describe karst as a distinctive surface morphology and groundwater hydrology resulting from dissolution of evaporite and carbonate rocks by chemically unsaturated water.[176] Karst surface morphology includes collapse sinks, alluvial dolines, grikes and caves. Karst hydrology is characterized by sinking streams, swallow holes, absence of surface runoff, an integrated system of subsurface conduits, and a few large irregular springs.

The Delaware Basin of southeastern New Mexico and west Texas is recognized as one of the karstlands of the United States. Barrows et al. relate the present episode of dissolution to development of the Pecos River drainage system. The dissolution progresses downward and eastward, following the easterly structural tilt of the Delaware Basin; progressively older rock formations are exposed westward.[177]

The gypsum outcrops of the Rustler Formation in Nash Draw support "caves and swallow holes, some of which are large enough to enter." Dissolution has formed a subsurface complex of tunnels and caves. "Many of the cavities have filled with alluvium washed in from the surface, and many have collapsed, forming complex breccias. The surface exhibits collapse sinks, grikes and vanishing arroyos."[178]

"The negative gravity anomalies are the most distinctive and unanticipated feature of the gravity field" at WIPP. These anomalies were first detected at the closed topographic depression drilled as WIPP-14. "They were later found to extend in an east-west direction across the northern part" of the WIPP site.[179]

A negative gravity anomaly is also present at the closed topographic depression drilled as WIPP-33.[180] The depression is floored by loose sand and low brush. Clumps of matted leaves and debris indicate occasional flooding of the depression. "One of the few small arroyos in the (WIPP) site area drains into the depression from the southeast," yet "there is no evaporite crust as would be expected in an undrained playa." Barrows interprets this depression as an alluvial doline, which he defines as a karst feature "formed when surficial material washes into cavities and conduits in the underlying corrodable rocks."[181]

At WIPP-33, halite dissolution is complete in the Rustler and is affecting the top of the Salado. Nearly all anhydrite in the Rustler has been converted to gypsum, and some of the gypsum has been removed by dissolution.[182]



18

Barrows et al. believe that WIPP-33 clarifies the "relation between negative gravity anomalies and karst conduits." The cavities in the Rustler Formation at WIPP-33 "resulted in lost circulation of drilling fluid" and are interpreted as karst conduits. "There is no reason to distinguish this negative gravity anomaly" at WIPP-33 from others detected in the WIPP site gravity survey; "all are assumed to have a common origin."[183]

CHAPTER 12

# THE IMPLICATIONS OF KARST HYDROLOGY

19

The "Gravity Survey" has no comment on the implications of karst to WIPP geohydrology. The reader is told only that these implications "are being carefully assessed" by Larry Barrows.[184] This assessment is referenced in the "Gravity Survey" as a memo to WIPP Director Wendell Weart of Sandia Labs.[185]

This "memo," entitled "WIPP Geohydrology -- The Implications of Karst," was submitted by Larry Barrows on May 20, 1982, as part of the WIPP site characterization program. It has not been printed by Sandia Labs. 20

"WIPP is in one of the largest karstlands of the United States," writes Barrows.[186] "The evidence for regional karstification is extensive, and there is no reason to preclude karst conditions from the immediate vicinity of the WIPP site."[187]

Barrows attributes the westward thinning of the Rustler Formation to downward and eastward progression of karst dissolution. Barrows thinks that the process involves "downward infiltration of fresh water through feeders in the overlying Dewey Lake Formation to karst channels in the Rustler Formation."[188]

Barrows identifies the locations of the gypsum caves which are large enough to enter. They are near the Ken Smith Ranch, near borehole WIPP-26, and near the turn-off from State Highway 128 to borehole ERDA-10 and the Gnome Site.[189]

Barrows reveals the existence of color aerial photographs of the WIPP site, and of topographic maps with a two-foot contour interval. Barrows recommends stereoscopic viewing of the air photos, and inspection of these detailed maps, as the best way to interpret the numerous small, closed topographic depressions scattered across the WIPP site.[190]

The smaller depressions may be windblown.

However, the larger depressions are not reasonably attributed to the wind. They are generally round instead of elongate in the prevailing wind direction, symmetric instead of having windward and leeward sides, and have hummocky sandy bottoms instead of a pebble-strewn wind scour.[191]

Barrows interprets the larger depressions as alluvial dolines.[192] He cites the cavities in the Rustler Formation at WIPP-33 as "direct evidence of karst."[193]

"The WIPP site has almost no surface runoff," Barrows emphasizes. This lack of surface erosion "is not due to inadequate precipitation."[194] The soils at the WIPP site "are at least transmissive enough to allow infiltration of the larger storms."[195] "Instead of running off, the precipitation collects in the small topographic depressions and rapidly soaks into the ground. The absence of surface runoff is characteristic of a karstland."[196]

In a karst terrain, groundwater flow is dominated by a few throughgoing conduits. A test hole which misses one of the active corrosion conduits should show values which are too low to be representative of the area. This applies to almost all boreholes in a karst terrain because groundwater conduits comprise only a very small part of the total area of the watershed.[197] This is the case within the WIPP site, where the measured transmissivities vary by more than five orders of magnitude (0.001 sq. ft/day to 140 sq. ft/day).[198]

Therefore, the "very long travel times" calculated from borehole data are "both understandable and wrong."[199] Groundwater flow "models based on a linear Darcy relation should not be applied to a karstland," partly because groundwater velocity "is not proportional to the potentiometric gradient."[200]

More reliable measurements can be made by injecting a "tracer" into a karst water course, usually at a sink hole, and observing the arrival of groundwater at a spring. This "velocity" is an underestimate, being the linear distance divided by travel time, which "does not account for irregularities in the flow path."[201]

In closing, Barrows cites sixteen reports which "have identified karstlands as unreliable waste disposal environments."[202] He draws these conclusions:

(1) "The WIPP site is regionally and locally a karstland."
(2) "Representative hydraulic characteristics cannot be measured at boreholes."
(3) Conventional groundwater models "should not be used to establish minimum flow times" for the Rustler Formation.
(4) Rustler groundwater flow should be highly irregular in both velocity and direction, through open channels with little groundwater filtration and, under the right weather conditions, extremely fast.
(5) "The Rustler Formation is not a reliable barrier to the migration of contaminated water."

EEG scheduled a field trip for May 11, 1983, to give Larry Barrows an opportunity to point out field evidence of karst at the WIPP site.[203] This was followed by a two-day conference.

In his unpublished "Notes for the Karst Hydrology Field Trip," Larry Barrows interprets Surprise Spring, at the northern end of Laguna Grande, "as the probable outlet for both Nash Draw and the (WIPP) site area." The next stop was at gypsum caves in Nash Draw. According to Barrows: "These caves and drainages demonstrate solution conduits in gypsum. The rocky, soil-free terrace and swallow holes are typical karst features." The field trip also included a stop at the WIPP-33 depression, where four underground cavities were encountered in the Rustler Formation.[204]

EEG hired Harry LeGrand as a consultant, and he "has written two brief reports for EEG"[205] on karst hydrology. Barrows' discussion of LeGrand's reports, dated February 11, 1983, concludes with this summary (Barrows to Chaturvedi, 2/11/83, p. 3):

I have reinspected the topographic maps, formation isopachs, core descriptions, gravity data, reported transmissivities, and Culebra potentiometric surface. ... The evidence indicates to me that the site is situated on a karst plane in the immediate midst of a larger regional karstland.

The bottom line is the need to establish groundwater travel times between the site and spring. This parameter is an important part of the site evaluation program. The fracture flow approach implies travel times of tens of thousands of years. Karst implies potentially very rapid velocities. If karst cannot be clearly disproven then the travel time is indeterminate. Until, and if, it is disproven, the Rustler Formation cannot be regarded as a reliable barrier to the migration of contaminated water.

CHAPTER 13

## HYDROLOGIC TESTING IN KARST CAVITIES

The most conclusive way to test the interpretation that the WIPP site is an integral part of the regional karstland of southeastern New Mexico would be to perform tracer tests of actual groundwater flow from the WIPP-33 cavities to the eventual point of groundwater discharge to the biosphere. Tracer tests could be performed by injecting colored dyes into the WIPP-33 cavities, but this approach has inherent limitations. The assumed discharge point must be correct, observable, and continuously monitored for as long as it takes for the dye to travel through the entire groundwater flow path from injection point to discharge point. The existence of karst might still be plausibly denied until discharge to the biosphere could be observed; even then, the flow path itself would remain undetermined.

According to the Basic Data Report, WIPP-33 penetrated four cavities totalling 24 feet within a vertical distance of 52 feet in Magenta dolomite and Forty-niner gypsum.[206] The Magenta "has lost much of its dolomite by dissolution,"[207] The Magenta at WIPP-33 is only 19 feet thick[208]; nearly half of this vertical distance consists of cavities.[209]

A cavity in a borehole is inferred when the drilling rig drops precipitously from top to bottom of the cavity. In the lithologic and geophysical logs for WIPP-33, four "cavities" exactly correlate with drilling times of zero minutes per vertical foot.[210] Video tape filming of borehole WIPP-33 was done from the near-surface to the depth of the uppermost cavity in the Forty-niner gypsum. "At that depth the cable tension slackened, possibly indicating a ledge, and viewing was obscured by drilling mud in the water."[211] The fluid level during geophysical logging of WIPP-33 was 143 feet above the top of the cavities in Forty-niner gypsum.[212]

No one at EEG denied that WIPP-33 encountered cavities in the Rustler Formation; in fact, EEG's James Channell calls them "caverns." Said Channell:

> "There clearly appears to be flow into WIPP-33 and percolation into the Magenta because of the fact that you have caverns down there." What we need to find out is "what sort of flow you would get after a rainstorm."[213]

CHAPTER 14

## WIPP SHAFTS PENETRATE RUSTLER AQUIFERS

The WIPP waste disposal level is no longer isolated from circulating groundwater. Drilling of the exploratory shaft and the ventilation shaft has created man-made conduits connecting the Rustler aquifers with the WIPP underground excavations. Only the perfection of the unproven technology of plugging boreholes and shafts in salt formations could possibly seal these breaches of the WIPP site.

In the exploratory shaft, large washouts resulted from drilling in the Rustler Formation, predominantly in the siltstones and mudstones directly above and below the Magenta and Culebra dolomites. These





washouts reached 19 to 22 inches beyond the shaft wall. A washout near the Rustler-Salado contact was 4 inches deep.[214]

Before the exploratory shaft walls could be mapped, the shaft was lined with steel to a depth about 8 feet above the Rustler-Salado contact. This allowed "only the base of the Rustler Formation to be mapped." Likewise, the lithologic log for the exploratory shaft fails to include the Rustler and overlying formations.[215]

In the exploratory shaft, some of the thicker seams in the Salado tended to wash out during drilling. The maximum washout was one foot into the shaft wall. Water seepage came from the upper 50 feet of the Salado Formation.[216]

Halite-filled fractures, vertical or nearly vertical, were observed at four locations below the steel liner: fractures of undisclosed size in siltstone beds near the bottom of the Rustler; fractures up to one inch wide in two siltstone beds in the upper Salado; and a fracture up to three inches wide in an anhydrite bed in the upper Salado.[217]

No fracturing was observed in the salt beds of the Salado. Thus, although fractures in salt can be expected to seal themselves under lithostatic pressure of overlying rocks, fractures persist in impurities in the Salado. These impurities, such as siltstone beds, anhydrite beds and clay seams, can act as preferential pathways for the horizontal movement of water through the Salado.

Water inflow tests indicated that total inflow from all Rustler aquifers into the exploratory shaft was less than 1.5 gallons per minute before the liner installation, and less than 0.1 gallon per minute afterward; "hence, the shaft construction has not had a deleterious effect on site aquifers."[218] The DOE does not address the deleterious effect of the exploratory shaft creating a connection between the WIPP repository and the Rustler aquifers.

The ventilation shaft wall is smooth and dry above the Magenta dolomite. Seepage from the Magenta wets the 20 feet of shaft wall immediately below it.[219] Soft mudstone and claystone beds in the Rustler and Salado Formations frequently washed out during drilling. The deepest washout, extending up to 2.5 feet into the shaft wall, occurs in a mudstone unit of the Forty-niner member, separated from the Magenta dolomite by 19 feet of anhydrite. Other washouts occur in claystone in the Tamarisk member, and in claystone immediately below the Culebra dolomite.[220] Photographs of the ventilation shaft, including all three washouts, are said to be "available at the office of WIPP site manager;" a log of photographs is included in Table 3 of the Field Data Report.[221]

In the ventilation shaft, the Culebra dolomite "produces sufficient water to wet the underlying shaft walls to the shaft sump, and to begin dissolution of evaporites exposed in the shaft walls below." The shaft wall in the Salado "is deeply fluted by dissolution of halite by the seepage" from the Culebra.[222] In the Salado, only the clay and silt seams are insoluble; the accumulation of salts "has formed a crust up to 4 inches thick on the wet shaft walls."[223]

Five intervals of the ventilation shaft were mapped in detail: Magenta dolomite, Culebra dolomite, lower member Rustler mudstone; Rustler-Salado contact; and the repository level.[224] Fractures in the mapped intervals are generally vertical to near-vertical. In the Rustler mudstone, 21 open fractures were logged, and the fracture system is connected through 90% of the entire 64-foot mapped interval.[225]

There is no halite in the Rustler Formation in the ventilation shaft, and about one foot of dissolution residue was encountered at the top of the Salado.[226] The Salado is fractured in the same seams as in the exploratory shaft. "Due to inflow of water dripping down the shaft, it was difficult to obtain photographs without special precautions to prevent damage to the film and camera."[227]

Eight water samples were collected in the ventilation shaft, from Magenta dolomite, fractured Rustler mudstone, and the Rustler-Salado contact.[228] Inexplicably, no water samples were collected from Culebra dolomite, which is the "primary source of water seeping into the shaft."[229]

Measurements of water inflow could not be made for Magenta dolomite or the Rustler-Salado contact.[230] Based on two or three days of "limited testing," total inflow into the ventilation shaft was "estimated to range from 0.3 to 0.9 gallons per minute (gpm), averaging about 0.6 gpm." The Rustler produces "about 0.3 to 0.4 gpm;" the Culebra dolomite produces most of this inflow.[231] One may infer that 0.2 to 0.3 gpm of water seeps into the ventilation shaft from clay, anhydrite and siltstone beds in the Salado Formation.

I met with Chaturvedi. He allowed me to borrow and reproduce his color slides and prints of the ventilation shaft, and he allowed me to copy his written descriptions of his photographs.

Two of Chaturvedi's photographs are views of the waste emplacement level, in the tunnel connecting the exploratory shaft with the ventilation shaft. "The grey and pink layers seen just above the water are clay and polyhalite," respectively. "The water in the tunnel is the Rustler water draining out of the ventilation shaft."[232]

The grey and pink seams are located approximately one foot above the tunnel floor ("Generalized Geologic Cross-Section of the Facility Interval in the Vicinity of the SPDV Test Rooms"). Thus, Chaturvedi's photographs show a foot of water in the tunnel at the waste emplacement level.

Heading up the ventilation shaft, Chaturvedi's photographs reveal: (1) An open fracture in the lower anhydrite member of the Rustler; (2) An eight-foot "washed out zone" immediately underlying the Culebra dolomite, and the top of a steel liner plate installed to prevent further caving; (3) One clay-filled cavity, and one mud-filled cavity, both in Culebra dolomite; (4) Two water-filled faults in Magenta dolomite; and (5) Dewey Lake sandstone with abundant gypsum-filled fractures "representing post-depositional movement of water"[23]

Chaturvedi's photographs were taken during the brief period of hydrologic testing in the ventilation shaft, when the vent fans were turned off, which allowed Rustler groundwater to accumulate in the tunnel (Shukla, 1983, p. 5-2, and Table 6). Ordinarily, "circulation from the vent fans is sufficient to evaporate nearly all of the seepage before it reaches the sump." (Shukla, 1983, p. 5-2) It is during these times that the public is offered a sanitized tour of the WIPP underground tunnels.

On November 19, 1983, I participated in a tour of the WIPP project, arranged primarily for members of the Sierra Club. Before descending via the exploratory shaft, I interviewed Fred Gurney, manager of site operations for Westinghouse; he was accompanied by Dick Stewart, who concurred with everything Gurney told me. Gurney vigorously denied that any cavities were found in the WIPP shafts; officially they are called "washed out zones."

Gurney offered hydrologic data at odds with the official D'Appolonia geotechnical reports. Gurney said that the hydrologic testing had shown a groundwater inflow of 2.5 gallons per minute into the exploratory shaft, and 1.0 gallon per minute into the ventilation shaft (Gurney, 11/19/83). D'Appolonia's published figures are 1.5 gallons per minute in the exploratory shaft (Jarolimek et al., 1983, pp. 4-3, 4-4) and 0.3 to 0.9 gallons per minute in the ventilation shaft (Shukla, 1983, p. 1-3). Gurney insisted that there is no water inflow any more in the exploratory shaft, because groundwater "flows around the casing." (Gurney, 11/19/83) D'Appolonia's published figure is not zero, but "less than 0.1 gallon per minute." (Jarolimek et al., 1983, pp. 4-3, 4-4)

We asked to descend via the exploratory shaft, which was not cased, so that we could stop during the descent and photograph the Dewey Lake Redbeds and the Rustler Formation. Permission was denied, because the steel cage elevator had been removed from the ventilation shaft, which was being enlarged with explosives so as to serve as the waste shaft, through which the radioactive waste canisters are to be lowered. The use of explosives by D'Appolonia, although quicker, easier and cheaper than overcoring the ventilation shaft, will render impossible any geologic mapping of the enlarged shaft, because there will be no way to determine if the observed fractures were caused by natural forces or by explosives. Furthermore, the use of explosives may be site-destructive.

Even though the Salado Formation was still exposed in the exploratory shaft, we were not allowed to stop at any point during our descent or ascent of the exploratory shaft. I had wanted to photograph anhydrite with vertical halite-filled fractures, and any of eight fractured seams of clay or siltstone in the Salado.

Before the tour, I made it clear that I wished to travel southward from the exploratory shaft, so as to photograph the tunnel leading to the ventilation shaft, even though I fully accepted the argument that, for safety purposes, we could not stand directly underneath the vent- ilation shaft, because it was being enlarged with explosives. Our tour guide gave these instructions: "We are not going to make any deviations from the standard tour."

After we had descended the exploratory shaft, we were not allowed to travel southward, even though tour guides had "been bringing people down there all day." We were guided 1,450 feet northward to view the WIPP underground cafeteria, but were told there "would not have been enough time" to travel 415 feet southward instead.

According to a map of the WIPP underground layout, there were four possible routes to the tunnel which leads to the ventilation shaft. According to our tour guide, one was "sealed off," one was "boarded up," one was "not yet excavated," and one was "not well enough ventilated." These must have been recent developments if tour guides had been bringing people down there all day. When we returned to the surface, another person offered to "describe the geology" for us, instead of bringing us there.

## CONCLUSION

The decision to proceed with underground exploration and development of WIPP was based upon the "Geological Characterization Report (GCR), issued by Sandia National Laboratories in August 1978. The recommendation to select the Los Medanos site for WIPP was contained in a letter of transmittal dated December 21, 1978, from Everett H. Beckner, Director of Nuclear Waste and Environmental Programs at Sandia Labs, to Don T. Schueler, then WIPP Project Manager for the Department of Energy (DOE).

It was acknowledged by Sandia Labs that the GCR "certainly should not be construed as the final word on the WIPP geology." The GCR is only a compilation of previously available geologic information relevant to WIPP (GCR, 1978, p. i) Thus, the





22

interpretation that the WIPP site is suitable rested in part upon the following geologic assumptions, all of which later turned out to be incorrect:

* The Castile Formation at the WIPP site is free of anticlinal structures which might be associated with brine reservoirs (GCR, 1978, p. 8-5).

* The waste repository is located 1.75 miles from shallow Salado salt dissolution (GCR, 1978, Figures 2-6, 2-9).

* The Rustler aquifers have such low transmissivity that flooding of the waste repository through shafts or drill holes is not credible (Beckner to Schueler, 12/21/78, p. 5).

* Upon decommissioning of the WIPP site, plugging of shafts and drill holes will be readily attained (Beckner to Schueler, 12/21/78, p. 5).

* The Rustler Formation represents a secondary barrier if the Salado salt beds are breached; transport of plutonium through the Rustler aquifers would be slow enough that a significant hazard to humans would not exist (GCR, 1978, p. 2-17; Beckner to Schueler, 12/21/78, pp. 5, 6).

* The natural groundwater discharge point nearest to the WIPP site is Malaga Bend on the Pecos River, over 14 miles distant (Beckner to Schueler, 12/21/78, p. 6).

* Karst geomorphology is restricted to Nash Draw; there are no sink holes or solution features at the WIPP site (GCR, 1978, pp 1-16, 1-17, 4-76; Beckner to Schueler, 12/21/78, p. 5).

But geologic evidence has never been a determining factor in the fate of the WIPP project. The WIPP site selection criteria were altered to accommodate the site already selected. The WIPP project proceeds not for geologic reasons, but for economic reasons. The financial resources, careers and reputations which have been invested in the WIPP project have created a bureaucratic momentum which moves the project forward regardless of its environmental implications.

## Footnotes

1. Final Environmental Impact Statement, 1980, p. 2-1.
2. Neill, 4/15/83.
3. GCR, 1978, p. 2-3.
4. GCR, 1978, p. 1-13.
5. Montague, 4/79; also DEIS, 1979, pp. 9-131, 9-135.
6. GCR, 1978, p. 2-4.
7. GCR, 1978, pp. 2-4, 2-5, emphasis added.
8. GCR, 1978, Figures 2-3 and 2-8.
9. GCR, 1978, p. 2-6.
10. Hyder, 5/17/79.
11. Anderson and Powers, 1978, p. 79, and Figure 4.
12. GCR, 1978, Figure 2-3.
13. Anderson, 1981, p. 139; Anderson, 1982, p. 451.
14. U.S. Bureau of Reclamation, 1968.
15. Mercer, 1983, p. 3.
16. GCR, 1978, p. 2-6.
17. Hunter, 1982; Gulick et al., 1982; Christensen et al., 1983, p. 16.
18. Chaturvedi, 6/28/83.
19. Channell, 6/27/83.
20. GCR, 1978, Figure 2-8.
21. GCR, 1978, p. 2-12.
22. GCR, 1978, p. 2-22.
23. GCR, 1978, p. 2-11.
24. GCR, 1978, p. 2-7.
25. GCR, 1978, pp. 2-22, 2-23.
26. GCR, 1978, p. 2-13.
27. FEIS, 1980, Figure 8-6.
28. FEIS, 1980, Figure 7-27, p. 7-73.
29. The WIPP site was initially divided into four concentric zones. The innermost Zone I (60-100 acres) is for surface facilities and access shafts. Zone II (1,860 acres) is the underground radioactive waste disposal zone, all subject to development if the WIPP mission is expanded. Zone III (recently expanded to 8,280 acres) is an administrative buffer zone where underground mining and through going boreholes are prohibited. Zone IV (8,760 acres) has been deleted from the WIPP land withdrawal. For a map of WIPP site zonation, see Figure Four of this report.
30. GCR, 1978, p. 8-6.
31. FEIS, 1980, p. 8-27.
32. GCR, 1978, pp. 1-32, 1-33.
33. GCR, 1978, p. 1-33.
34. DEIS, 1979, p. 9-16; FEIS, 1980, p. 9-21.
35. DEIS, 1979, pp. 9-18, 9-19; FEIS, 1980, p. 9-23.
36. DEIS, 1979, pp. 9-15, 9-17, 9-20.
37. FEIS, 1980, p. P-24.
38. Channell, 6/27/83.
39. Hearings on WIPP DEIS, Don Schueler, pp. 1428-1429, and Wendell Weart, pp. 1555-1556.
40. GCR, 1978, p. 2-14; FEIS, 1980, p. D-8.
41. GCR, 1978, p. 8-5.
42. Neill, 6/28/83.
43. Foreword to each EEG publication.
44. Foreword to each EEG publication.
45. Channell, 6/28/83.
46. EEG-2, 1979, p. 3.
47. Gelhar, 9/83
48. Gelhar, 1979, pp. 12-13
49. Gelhar, 1979, p. 13
50. Gelhar, 1979, p. 27
51. Gelhar, 1979, p. 16
52. Gelhar, 1979, pp. 31-32
53. Gelhar, 1980, pp. 6-7
54. Gelhar, 1980, p. 7
55. Ferrall and Gibbons, 1979, pp. 1-2
56. Ferrall and Gibbons, 1979, p. 3
57. Ferrall and Gibbons, 1979, Table 4, p. 57

58. Ferrall and Gibbons, 1979, p. 4
59. Ferrall and Gibbons, 1979, pp. 10-11, and Table 4, p. 57
60. Ferrall and Gibbons, 1979, pp. 11-13
61. Ferrall and Gibbons, 1979, pp. 13, 25
62. Ferrall and Gibbons, 1979, pp. 15, 16, 30
63. Ferrall and Gibbons 1979, pp. 30-31
64. Ferrall and Gibbons 1979, p. 52.
65. Ferrall and Gibbons 1979, p. 35.
66. Ferrall and Gibbons 1979, p. 42.
67. Ferrall and Gibbons 1979, pp. 55, 58-59.
68. FEIS, 1980, p. 7-95
69. Chaturvedi, 7/11/83
70. Gibbons, 6/83
71. Weart to Wilson, 7/6/83
72. Weart to Wilson, 7/6/83
73. Matalucci to T. O. Hunter, 11/5/80
74. Gibbons and Ferrall, 1980, p. 37
75. Gibbons and Ferrall, 1980, p. 38
76. Gibbons and Ferrall, 1980, p. 39
77. Gibbons and Ferrall, 1980, p. 41
78. Gibbons and Ferrall, 1980, p. 39
79. Gibbons and Ferrall, 1980, p. 80
80. Gibbons and Ferrall, 1980, p. 3
81. Gibbons and Ferrall, 1980, p. 9
82. Gibbons and Ferrall, 1980, p. 50
83. Gibbons and Ferrall, 1980, pp. 41, 43-44
84. Gibbons and Ferrall, 1980, p. 74
85. Gibbons and Ferrall, 1980, p. 52
86. Gibbons and Ferrall, 1980, p. 76
87. Gibbons, 1980a, p. 7
88. Powers to Matalucci, 2/2/81, p. 1
89. Costin to Matalucci, 2/5/81
90. Gibbons, 1980b, p. 3
91. Gibbons, 1980b, p. 5
92. GCR, 1978, pp. 9-23, 9-24
93. GCR, 1978, p. 9-24
94. GCR, 1978, p. 9-23
95. GCR, 1978, pp. 9-24, 9-41
96. GCR, 1978, p. 9-26
97. GCR, 1978, p. 9-30
98. GCR, 1978, Table 9.3-3
99. GCR, 1978, Table 9.3-4
100. GCR, 1978, Table 9.3-4
101. GCR, 1978, p. 9-39
102. EEG-6, 1980, pp. 16, 44
103. EEG-6, 1980, pp. 16, 44-45
104. EEG-6, 1980, p. 45
105. EEG-6, 1980, p. 17
106. Chaturvedi, 6/27/83
107. EEG-6, 1980, p. 45
108. DEIS, 1979, p. 7-75; EEG-3, 1979, pp. 42, 48
109. EEG-6, 1980, pp. 17, 46
110. Chaturvedi, 6/27/83
111. EEG-6, 1980, p. 46
112. EEG-6, 1980, p. 17
113. EEG-3, 1979, p. 31
114. EEG-6, 1980, pp. 47-48
115. Beckner to McGough, 10/1/80, pp. 1, 8
116. Beckner to McGough, 10/1/80, p. 7
117. EEG-6, 1980, p. 45
118. Beckner to McGough, 10/1/80, p. 6
119. Beckner to McGough, 10/1/80, pp. 6, 8
120. FEIS, 1980, p. 7-45
121 Borns et al., 1983, Table 2-1, p. 18
122. Anderson, 1981, p. 144
123. Anderson, 1981, pp. 144-145
124. "State Aide Says Brine May Endanger WIPP," Albuquerque Journal, 12/2/81, p. A-1
125. Civil Action No. 81-0363 JB, p. 1
126. Basic Data Report for WIPP-12 Deepening, 1982, p. 1-1
127. EEG-16, 1982, p. 45
128. EEG-6, 1980, p. 17; EEG-10, 1981, p. 23
129. Nuclear Waste News, No. 6, p. 1
130. Basic Data Report for WIPP-12 Deepening, 1982, pp. 1-1, 3-2
131. Basic Data Report for WIPP-12 Deepening, 1982, p. 3
132. Basic Data Report for WIPP-12 Deepening, 1982, pp. 1-1, 3-2, 3-3
133. Neill, 4/15/83
134. "State Aide Says Brine May Endanger WIPP," Albuquerque Journal, 12/2/81, p. A-1
135. "A-waste site safety questioned," Engineering News Record, McGraw-Hill publication for Cement Industry
136. EEG, 5/10/84, pp. 9-10
137. Ferrall and Gibbons, 1979, p. 5
138. EEG, 5/10/84, p. 10
139. Basic Data Report for DOE-1, 1982, p. 3-3
140. Basic Data Report for DOE-1, 1982, Table 3, p. 6
141. "State Aide Says Brine May Endanger WIPP," Albuquerque Journal, 12/2/81, p. A-1
142. EEG-22, 1983, pp. 81, 83-84
143. EEG-23, 1983, p. 29
144. EEG-22, 1983, p. 79
145. EEG-16, 1982, p. 45
146. EEG-22, 1983, p. 228
147. EEG-22, 1983, p. 228
148. EEG-23, 1983, p. 30
149. EEG-22, 1983, p. 228
150. Popielak et al., 1983
151. EEG-23, 1983, p. 31
152. EEG-23, 1983, p. 38
153. Anderson, 5/19/83
154. Gelhar, 1979, p. 7
155. Channell, 6/27/83
156. Rehfeldt, 6/28/83
157. McCormack, 1982
158. McCormack, 1982
159. McCormack, 1982
160. EEG, 5/10/84, p. 5
161. Borns et al., 1983





162. Borns et al., 1983, Figures 3.6, 3.7, 3.8 and 3.9, pp. 58-61
163. Borns et al., 1983, pp. 69, 72
164. Barrows, 5/83
165. Anderson, 5/19/83
166. Barrows, 5/83
167. Anderson, 5/19/83
168. Borns et al., 1983, pp. 3, 10, 53
169. Borns et al., 1983, p. 69
170. Borns et al., 1983, pp. 3, 53
171. Borns et al., 1983, p. 10
172. Barrows et al., 1983, p. 25
173. Borns et al., 1983, p. 81
174. Borns et al., 1983, p. 81
175. Borns et al., 1983, p. 81
176. Barrows et al, 1983, p. 19
177. Barrows et al., 1983, p. 19
178. Barrows et al., 1983, p. 23
179. Barrows et al., 1983, p. 57
180. Barrows et al., 1983, p. 57
181. Barrows et al., 1983, p. 63
182. Barrows et al., 1983, p. 63
183. Barrows et al., 1983, p. 63
184. Barrows et al., 1983, p. 65
185. Barrows et al., 1983, p. 66
186. Barrows 1982, p. 1
187. Barrows, 1982, p. 4
188. Barrows, 1982, p. 5
189. Barrows, 1982, pp. 3-4
190. Barrows, 1982, pp. 6, 9
191. Barrows, 1982, p. 6
192. Barrows, 1982, p. 6
193. Barrows, 1982, p. 7
194. Barrows, 1982, p. 9
195. Barrows, 1982, p. 10
196. Barrows, 1982, p. 9
197. Barrows, 1982, pp. 11, 13
198. Barrows, 1982, p. 5
199. Barrows, 1982, p. 11
200. Barrows, 1982, p. 15
201. Barrows, 1982, p. 14
202. Barrows, 1982, p. 17
203. EEG-23, 1983, p. 84
204. Barrows, 1983, pp. 1-3
205. EEG-23, 1983, p. 84
206. Basic Data Report for WIPP-33, 1981, Figure 2, p. 11
207. Basic Data Report for WIPP-33, 1981, p. 6
208. Basic Data Report for WIPP-33, 1981, Table 2, p. 10
209. Basic Data Report for WIPP-33, 1981, Figure 2, p. 11
210. Basic Data Report for WIPP-33, 1981, Figure 2, p. 11
211. Basic Data Report for WIPP-33, 1981, p. 24
212. Basic Data Report for WIPP-33, 1981, Figure 2, p. 11
213. Channell, 6/27/83
214. Jarolimek et al., 1983, p. 4-1
215. Jarolimek et al., 1983, p. 4-2, and Figure 4, Sheet 1
216. Jarolimek et al., 1983, p. 4-2
217. Jarolimek et al., 1983, p. 4-3
218. Jarolimek et al., 1983, pp. 4-3, 4-4
219. Shukla, 1983, pp. 1-2, 4-4, 5-3
220. Shukla, 1983, p. 1-2, and Figure 1, Sheet 8
221. Shukla, 1983, p. 4-4
222. Shukla, 1983, pp. 4-3, 4-4
223. Shukla, 1983, p. 1-2
224. Shukla, 1983, p. 3-3
225. Shukla, 1983, Figure 4
226. Shukla, 1983, Figure 1
227. Shukla, 1983, p. 4-4
228. Shukla, 1983, p. 5-1
229. Shukla, 1983, p. 1-2
230. Shukla, 1983, pp. 5-3, 5-4
231. Shukla, 1983, p. 1-3
232. Chaturvedi, 9/30/82, descriptions of photographs
233. Chaturvedi, 9/30/82, descriptions of photographs

## BIBLIOGRAPHY


Ash, Donald W., and Ehrenzeller, Jeffrey, 1983, "Geochemical and Hydrological Analysis of Harrison Springs, Harrison County, Indiana," in Dougherty, ed., 1983, pp. 137-164.

Bachhuber, Frederick W., "Paleolimnology of Lake Estancia and the Quaternary History of the Estancia Valley, Central New Mexico," unpublished doctoral dissertation, Department of Geology, University of New Mexico, Albuquerque, New Mexico, September, 1971.

Bachman, George O., 1973, Surficial Features and Late Cenozoic History in Southeastern New Mexico, U.S. Geol. Survey Open-file report, USGS-4339-8, prepared under Agreement No. AT(40-1)-4339 for the U.S. Atomic Energy Commission, p. 17.

Bachman, George O., 1976, Cenozoic Deposits of Southeastern New Mexico and an Outline of the History of Evaporite Dissolution, Jour. Research U.S. Geol. Survey, Vol. 4, No. 2, Mar.-Apr. 1976, pp. 135-149.

Bachman, George O., 1980, Regional Geology and Cenozoic History of Pecos Region, Southeastern New Mexico, U.S. Geol. Survey Open-File Report 80-1099.

Bachman, George O., 1981, Geology of Nash Draw, Eddy County, New Mexico, U.S. Geol. Survey Open-File Report 81-31.

Bachman, George O., 1983, Regional Geology of Ochoan Evapo- rites, Northern Part of Delaware Basin, New Mexico Bureau of Mines and Mineral Resources Open File 184.

Bachman, George O., 1984, Regional Geology of Ochoan Evapo- rites, Northern Part of Delaware Basin, New Mexico Bureau of Mines and Mineral Resources Circular 184.

Bachman, George O., 1985, Assessment of Near-Surface Dissolution At and Near the Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico, Sandia National Laboratories Contractor Report, SAND 84-7178.

Barrows, Larry, 1982, "WIPP Geohydrology -- The Implications of Karst," Memo to Wendell D. Weart of Sandia National Laboratories, reprinted in EEG-32, 1985, Appendix A.

Barrows, Lawrence J., Shaffer, Sue-Ellen, Miller, Warren B., and Fett, John D., 1983, Waste Isolation Pilot Plant (WIPP) Site Gravity Survey and Interpretation, Sandia National Laboratories, SAND 82-2922.

Barry, R. G., 1983, "Late-Pleistocene Climatology," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 20, pp. 390-407.

Basic Data Report, Borehole WIPP-12 Deepening, 1982, U.S. Department of Energy, TME 3148.

Basic Data Report for Drillhole WIPP 14, 1982, Sandia National Laboratories and U.S. Geol. Survey,

Basic Data Report for Drillhole WIPP 33, 1981, Sandia National Laboratories and U.S. Geol. Survey, SAND 80-2011.

Bechtel, 1978, WIPP Topographic Mapping, for U. S. Depart- ment of Energy, Waste Isolation Pilot Plant, DOE Contract Number ET-78-04-4-169, Job Number 12484-2, Drawing Numbers 21-C-201 to 21-C-212.

Berger, Andre L., 1978, "Long-Term Variations of Caloric Insolation Resulting from the Earth's Orbital Elements," Quaternary Research, Vol. 9, pp. 139-167.

Bloom, Arthur L., 1978, Geomorphology, A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Bogli, Alfred, 1980, Karst Hydrology and Physical Speleology, Springer-Verlag, New York.

Borns, David J., Barrows, Lawrence J., Powers, Dennis W., and Snyder, Richard P., 1983, Deformation of Evaporites Near the Waste Isolation Pilot Plant (WIPP) Site, Sandia National Laboratories, SAND 82-1069.

Brakenridge, G. Robert, 1978, "Evidence for a Cold, Dry Full Glacial Climate in the American Southwest," Quaternary Research, Vol. 9, pp. 22-40.

Bretz, J. Harlen, and Horberg, Leland, 1949a, "Ogallala Formation West of the Llano Estacado," Journal of Geology, Vol. 57, pp. 477-490.

Bretz, J. Harlen, and Horberg, Leland, 1949b, "Caliche in Southeastern New Mexico," Journal of Geology, Vol. 57, pp. 491-511.

Brown, Charles N., 1956, "The Origin of Caliche on the Northeastern Llano Estacado, Texas," Journal of Geology, Vol. 64, No. 1, pp. 1-15.

Bryan, Kirk, 1929, "Solution-Facetted Limestone Pebbles," American Journal of Science, Fifth Series, Vol. XVIII, No. 105, pp. 193-208.

Bryant, Vaughn M., Jr., and Holloway, Richard G., 1985, "A Late-Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence," in Bryant and Holloway, eds., 1985, Chapter 2, pp. 39-70.

Bryant, Vaughn M., Jr., and Holloway, Richard G., eds., 1985, Pollen Records of Late-Quaternary North American Sediments, American Association of Stratigraphic Palynologists Foundation, Dallas, Texas.

Chaturvedi, Lokesh, and Rehfeldt, Kenneth, 1984, "Groundwater Occurrence and the Dissolution of Salt at the WIPPRadioactive Waste Repository Site," Eos, Transactions, American Geophysical Union, Vol. 65, No. 31, pp. 457-459.

Cooke, Ronald U., and Warren, Andrew, 1973, Geomorphology in Deserts, University of California Press, Berkeley.

Cooper, J. B., and Glanzman, V. M., 1971, Geohydrology of Project Gnome Site, Eddy County, New Mexico, U.S. Geol. Survey Professional Paper 712-A.

Covey, Curt, 1984, "The Earth's Orbit and the Ice Ages," Scientific American, 250, pp. 58-66.

Dickerson, Hoffer, and Callender, eds., 1980, Trans-Pecos Region, Southeastern New Mexico and West Texas, New Mexico Geological Society, Thirty-First Field Conference, November 6-8, 1980.

Dougherty, Percy H., ed., 1983, Environmental Karst, GeoSpeleo Publications, Cincinnati, Ohio.

Draft Environmental Impact Statement (DEIS), Waste Isolation Pilot Plant (WIPP), 1979, U.S. Department of Energy, DOE/EIS-0026-D, two volumes.

Dunne, Thomas, and Leopold, Luna B., 1978, Water in Environmental Planning, W. H. Freeman and Company, San Fran- cisco, California.

EEG-6, 1980, Geotechnical Considerations for Radiological Hazard Assessment of WIPP, A Report of a Meeting Held on January 17-18, 1980, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-8, 1980, Wofsy, Carla, The Significance of Certain Rustler Aquifer Parameters for Predicting Long-Term Radiation Doses from WIPP, Environmental Evaluation Group, Santa Fe, New Mexico.





EEG-16, 1982, Radionuclide Release, Transport and Consequence Modeling for WIPP, A Report of a Workshop Held on September 16-17, 1981, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-22, EEG Review Comments on the Geotechnical Reports Provided by DOE to EEG Under the Stipulated Agreement Through March 1, 1983, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-23, 1983, Neill, Robert H., Channell, James K., Chaturvedi, Lokesh, Little, Marshall S., Rehfeldt, Kenneth, and Spiegler, Peter, Evaluation of the Suitability of the WIPP Site, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-24, 1983, Neill, Robert H., and Channell, James K., Potential Problems from Shipment of High-Curie Content Contact-Handled transuranic (CH-TRU) Waste to WIPP, Environmental Evaluation Group, Santa Fe, New Mexico.

EEG-32, 1985, Chaturvedi, Lokesh, and Channell, James, The Rustler Formation as a Transport Medium for Contaminated Groundwater, Environmental Evaluation Group, Santa Fe, New Mexico.

Ferrall, Charles C., and Gibbons, John F., 1979, Core Study of Rustler Formation over the WIPP Site, prepared by Civil Systems Inc., for Sandia National Laboratories, CSI 2055-03.

Fetter, C. W., Jr., 1980, Applied Hydrogeology, Charles E. Merrill Publishing Company, Columbus, Ohio.

Final Environmental Impact Statement (FEIS), Waste Isolation Pilot Plant (WIPP), 1980, U.S. Department of Energy, DOE/EIS-0026, two volumes.

Frye, John C., and Swineford, Ada, 1947, "Solution Features on Cretaceous Sandstone in Central Kansas," American Journal of Science, Vol. 245, No. 6, pp. 366-379.

Frye, John C., and Leonard, A. Byron, 1965, "Quaternary of the Southern Great Plains," in Wright and Frey, eds., 1965, pp. 203-216.

Frye, John C., Glass, H. D., Leonard, A. Byron, and Coleman, Dennis D., 1974, Caliche and Clay Mineral Zonation of Ogallala Formation, Central-Eastern New Mexico, New Mexico Bureau of Mines and Mineral Resources Circular 144.

Galloway, Robert W., 1970, "The Full-Glacial Climate in the Southwestern United States," Annals of the Association of the American Geographers, Vol. 60, pp. 245-256.

Galloway, Robert W., 1983, "Full-Glacial Southwestern United States: Mild and Wet or Cold and Dry?," Quaternary Research, Volume 19, Number 2, March 1983, pp. 236-248.

Geohydrology Associates, Inc., 1978, Ground-Water Study Related to Proposed Expansion of Potash Mining Near Carlsbad, New Mexico, U.S. Bureau of Land Management, Contract No. YA-512-CT7-217, Denver, Colorado.

Gile, Leland H., 1961, "A Classification of ca Horizons in Soils of a Desert Region, Dona Ana County, New Mexico," Soil Science Society Proceedings, Vol. 25, pp. 52-61.

Gile, L. H., Peterson, F. F., and Grossman, R. B., 1966, "Morphological and Genetic Sequences of Carbonate Accumulation in Desert Soils," Soil Science, Vol. 101, No. 5, pp. 347-360.

Gilkey, M. M., and Stotelmeyer, Ronald B., 1965, Water Requirements and Uses in New Mexico Mineral Industries, U.S. Department of the Interior, Bureau of Mines Information Circular 8276.

Glass, H. D., Frye, John C., and Leonard, A. Byron, 1973, Clay Minerals in East-Central New Mexico, New Mexico Bureau of Mines and Mineral Resources Circular 139.

Gonzalez, Don Diego, 1983a, Groundwater Flow in the Rustler Formation, Waste Isolation Pilot Plant (WIPP), Southeast New Mexico (SENM): Interim Report, Sandia National Laboratories, SAND 82-1012.

Gonzalez, Don Diego, 1983b, Hydrogeochemical Parameters of Fluid-Bearing Zones in the Rustler and Bell Canyon Formations: Waste Isolation Pilot Plant (WIPP), Southeast New Mexico (SENM), Sandia National Laboratories, SAND 83-0210.

Goudie, A. S., 1983, "Calcrete," in Goudie and Pye, eds., 1983, Chapter 4, pp. 93-131.

Goudie, A. S., and Pye, Kenneth, eds., 1983, Chemical Sedimentsand Geomorphology: Precipitates and Residua in the Near-Surface Environment, Academic Press, London, England.

Hafsten, Ulf, 1961, "Pleistocene Development of Vegetation and Climate in the Southern High Plains as Evidenced by Pollen Analysis," in Wendorf, ed., 1961, pp. 59-91.

Hale, W. E., Hughes, L. S., and Cox, E. R., 1954, Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, New Mexico, Pecos River Commission and U.S. Geol. Survey.

Havens, John S., 1966, Recharge Studies on the High Plains in Northern Lea County, New Mexico, U.S. Geol. Survey Water-Supply Paper 1819-F.

Havens, John S., 1972, Malaga Bend Experimental Salinity Alleviation Project, A Comprehensive Interim Report, Eddy County, New Mexico, U.S. Geol. Survey and Pecos River Commission.

Havens, John S., and Wilkins, D. W., 1979, Experimental Salinity Alleviation at Malaga Bend of the Pecos River, Eddy County, New Mexico, U.S. Geol. Survey Water Resources Investigations 80-4.

Hawley, John W., Bachman, George O., and Manley, K., 1976, "Quaternary Stratigraphy in the Basin and Range and Great Plains Provinces, New Mexico and Western Texas," in Mahaney, ed., 1976, pp. 235-274.

Hecht, Alan D., ed., 1985, Paleoclimate Analysis and Modeling, John Wiley and Sons, New York.

Hunter, Regina L., 1985, A Regional Water Balance for the Waste Isolation Pilot Plant (WIPP) Site and Surrounding Area, Sandia National Laboratories, SAND 84-2233.

Imbrie, John, and Imbrie, John Z., 1980, "Modeling the Climatic Response to Orbital Variations," Science, Vol. 207, February 29, 1980, pp. 943-953.

Jarolimek, Timmer and Powers, 1983a, Correlation of Drillhole and Shaft Logs, D'Appolonia Consulting Engineers, Inc., TME 3179.

Jarolimek, Timmer and McKinney, 1983b, Geotechnical Activities in the Exploratory Shaft -- Selection of the Facility Interval, Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, U.S. Department of Energy, TME 3178.

Jennings, Joseph Newell, 1971, Karst, M.I.T. Press, Cambridge, Massachusetts.

Jones, C. L., 1978, Test Drilling for Potash Resources: Waste Isolation Pilot Plant Site, Eddy County, New Mexico, U.S. Geol. Survey Open-file Report 78-592, two volumes.

Judson, Sheldon, 1950, "Depressions of the Northern Portion of the Southern High Plains of Eastern New Mexico," Geological Society of America Bulletin, Vol. 61, pp. 253-274.

Kelley, Vincent C., 1980, "Gatuna Formation (Late Cenozoic), Pecos Valley, New Mexico and Trans-Pecos Texas," in Dickerson et al., eds., 1980, pp.

Kutzbach J. E., and Wright, H. E., Jr., 1985, "Simulation of the Climate of 18,000 Years BP: Results for the North American/North Atlantic/European Sector and Comparison with the Geologic Record of North America," Quaternary Science Reviews, Volume 4, Number 3, 1985, pp. 147-187.

Lanner, Ronald M., and Van Devender, Thomas R., 1981, "Late Pleistocene Pinon Pines in the Chihuahuan Desert," Quaternary Research, Vol. 15, pp. 278-290.

Lattman, Laurence H., 1983, "Effect of Caliche on Desert Processes," in Wells and Haragan, eds., 1983, Chapter 4, pp. 101-109.

Lee, Willis T., 1924, "Erosion by Solution and Fill," U.S. Geol. Survey Bulletin 760-D, pp. 107-121.

LeGrand, Harry E., 1973, "Hydrological and Ecological Problems of Karst Regions," Science, March 2, 1973, Vol.179, pp. 859-864.

LeGrand, Harry E., Stringfield, V. T., and La-Moreaux, P. E., 1976, "Hydrologic Features of United States Karst Regions," in Yevjevich, ed., 1976, pp. 31-46.

LeGrand, Harry E., 1983, "Perspective on Karst Hydrology," Journal of Hydrology, Vol. 61, pp. 343-355.

Logan, S. E., and Associates, Inc., 1983, "Modeling of Flow of Pressurized Brine and Hydrogen Sulfide Gas into the WIPP Repository During Construction," unpublished work performed for Environmental Evaluation Group, Santa Fe, New Mexico.

Mahaney, W. C., ed., 1976, Quaternary Stratigraphy of North America, Dowden, Hutchinson and Ross, Inc., Stroudsburg, Pennsylvania.

Mann, Thomas R., and Associates, Inc., 5115 Copper SE, Albuquerque, New Mexico, 87108, Color Contact Prints of WIPP Site, November 7, 1983,

McCormack, Ken, 1982, "Consulting Firm Says Poisonous Gas Endangers WIPP," New Life News, Santa Fe, New Mexico, July, 1982.

McKee, Edwin D., ed., 1979, A Study of Global Sand Seas, U. S. Geol. Survey Professional Paper 1052.

Melton, Frank A., 1940, "A Tentative Classification of Sand Dunes, Its Application to Dune History in the Southern High Plains," Journal of Geology, Vol. 48, No. 2, pp. 113-145.

Mercer, Jerry W., 1983, Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medanos Area, Southeastern New Mexico, U.S. Geol. Survey, Water-Resources Investigations Report 83-4016.

Milanovic, Petar, 1976, "Water Regime in Deep Karst, Case Study of the Ombla Spring Drainage," in Yevjevich, ed., 1976, pp. 165-188.

Milanovic, Petar, 1981, Karst Hydrogeology, Water Resources Publications, Fort Collins, Colorado.

Morgan, Arthur M., 1941, "Depth of Active Solution by Ground-waters in the Pecos Valley, New Mexico," American Geophysical Union Transactions, 1941, pp. 779-783.

Morgan, Arthur M., 1942, "Solution Phenomena in the Pecos Basin in New Mexico," American Geophysical Union Transactions, 1942, pp. 27-35.

Phillips, Richard Hayes, 1984, "WIPP Cover-Up: Geopolitics in the Land of Enchantment," unpublished graduate research paper and investigative report, Department of Geography, University of Oregon.







Popielak, R. S., Beauheim, R. L., Black, S. R., Coons, W. E., Ellingson, C. T., and Olsen, R. L., 1983, Brine Reservoirs in the Castile Formation, U.S. Department of Energy, TME 3153.

Powell, A. Michael, 1980, "Vegetation of Trans-Pecos Texas," in Dickerson et al., eds., 1980, pp. 299-302.

Powers, Dennis W., Lambert, Steven J., Shaffer, Sue-Ellen, Hill, Leslie R., and Weart, Wendell D., eds., 1978, Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico, Sandia National Laboratories, SAND 78-1596, two vols.

Price, W. Armstrong, 1933, "Reynosa Problem and Origin of Caliche," American Association of Petroleum Geologists Bulletin, No. 9, pp. 488-522.

Reeves, C. C., Jr., 1965, "Pleistocene Climate of the Llano Estacado," Journal of Geology, Vol. 73, pp. 181-188.

Reeves, C. C., Jr., 1966, "Pluvial Lake Basins of West Texas," Journal of Geology, Vol. 74, pp. 269-291.

Reeves, C. C., Jr., 1970, "Origin, Classification, and Geologic History of Caliche on the Southern High Plains, Texas and Eastern New Mexico," Journal of Geology, Vol. 78, pp. 352-362.

Reeves, C. C., Jr., 1973, "The Full-Glacial Climate of the Southern High Plains, West Texas," Journal of Geology, Vol. 81, pp. 693-704.

Reeves, C. C., Jr., 1976, "Quaternary Stratigraphy and Geologic History of Southern High Plains, Texas and New Mexico," in Mahaney, W. C., ed., 1976, pp. 213-234.

Robinson, Thomas W., and Lang, Walter B., 1938, Geology and Ground-Water Conditions of the Pecos River Valley in the Vicinity of Laguna Grande de la Sal, New Mexico, with special reference to the salt content of the river water, State Engineer of New Mexico, 12th and 13th Biennial Reports, pp. 77-100.

Sayre, Albert Nelson, 1937, Geology and Ground-Water Resources of Duval County, Texas, U.S. Geol. Survey Water Supply Paper 776, pp. 65-72.

Shukla, Dev K., 1983, Geotechnical Field Data Report No. 4, Geologic Mapping and Water Inflow Testing in the SPDV Ventilation Shaft, D'Appolonia Consulting Engineers, Inc., TME 3171, reprinted in TME 3177.

Sidwell, Raymond, 1943, "Caliche Deposits in Southern High Plains, Texas," American Journal of Science, Vol. 241, No. 4, pp. 257-261.

Smith, George I., and Street-Perrott, F. Alayne, 1983, "Pluvial Lakes of the Western United States," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 10, pp. 190-212.

Spaulding, W. Geoffrey, Leopold, Estella B., and Van Devender, Thomas R., 1983, "Late Wisconsin Paleoecology of the American Southwest," in Wright, H. E., Jr., ed., 1983, Volume 1, Chapter 14, pp. 259-293.

Street-Perrott, F. A., and Harrison, S. P., 1985, "Lake Levels and Climate Reconstruction," in Hecht, ed., 1985, Chapter 7, pp. 291-340.

Sweeting, Marjorie M., 1973, Karst Landforms, Columbia University Press, New York.

Thompson, Robert S., Larry Benson, and Eugene M. Hattori, 1986, "A Revised Chronology for the Last Pleistocene Lake Cycle in the Central Lahontan Basin," Quaternary Research, Volume 25, Number 1, January 1986, pp. 1-9).

Torbarov, Konstantin, 1976, "Estimation of Permeability and Effective Porosity in Karst on the Basis of Recession Curve Analysis," in Yevjevich, ed., 1976, pp. 121-136.

United States Department of Agriculture (USDA), 1971, Soil Survey, Eddy Area, New Mexico.

United States Geological Survey (USGS), 1974, Surface Water Supply of the United States 1966-1970, Part 8, Western Gulf of Mexico Basins, Volume 2, Basins from Lavaca River to Rio Grande, U. S. Geol. Survey Water-Supply Paper 2123.

Van Devender, Thomas R., 1977, "Holocene Woodlands in the Southwestern Deserts," Science, Vol. 198, October 14, 1977, pp. 189-192.

Van Devender, Thomas R., and Spaulding, W. Geoffrey, 1979, "Development of Vegetation and Climate in the South- western United States," Science, Vol. 204, May 18, 1979, pp. 701-710.

Vernekar, Anandu D., 1972, Long-Period Global Variations of Incoming Solar Radiation, Meteorological Monographs, Vol. 12, No. 34, American Meteorological Society, Boston, Massachusetts.

Vine, James D., 1960, "Recent Domal Structures in Southeastern New Mexico," Bulletin of the Association of American Petroleum Geologists, Vol. 44, No. 12, pp. 1903-1911.

Vine, James D., 1963, Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico, U.S. Geol. Survey Bulletin 1141-B.

Waste Isolation Pilot Plant Safety Analysis Report (WIPP SAR), 1980, revised 1983, U.S. Department of Energy, five volumes.

Weart, Wendell D., 1983, "Summary of Evaluation of the Waste Isolation Pilot Plant (WIPP) Site Suitability, Sandia National Laboratories," SAND 83-0450, reprinted by U.S. Department of Energy, 1983, in Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program, WIPP-DOE-161.

Wells, Philip V., 1966, "Late Pleistocene Vegetation and Degree of Pluvial Climatic Change in the Chihuahuan Desert," Science, Vol. 153, pp. 970-975.

Wells, Stephen G., and Haragan, Donald R., eds., 1983, Origin and Evolution of Deserts, University of New Mexico Press, Albuquerque.

Wendorf, Fred, ed., 1961, Paleoecology of the Llano Estacado, Museum of New Mexico Press, Fort Burgwin Research Center, Santa Fe, New Mexico.

Wendorf, Fred, 1961a, "A General Introduction to the Ecology of the Llano Estacado," in Wendorf, ed., 1961, pp. 12-21.

Wendorf, Fred, 1961b, "An Interpretation of Late Pleistocene Environments of the Llano Estacado," in Wendorf, ed., 1961, pp. 115-133.

Widdicombe, Roberta Eileen, 1979, "Quaternary Surficial Features in the Delaware Basin, Eddy and Lea Counties, New Mexico," unpublished master's thesis, Department of Geology, University of New Mexico, Albuquerque, New Mexico, December, 1979.

Wright, H. E., Jr., ed., 1983, Late-Quaternary Environments of the United States, University of Minnesota Press, Minneapolis, Volume 1, The Late Pleistocene, Stephen C. Porter, ed.

Yevjevich, Vujica, 1976, "Advanced Approaches to Karst Hydrology and Water Resource Systems," in Yevjevich, ed., 1976, pp. 210-

Yevjevich, Vujica, ed., 1976, Karst Hydrology and Water Resources, Water Resources Publications, Fort Collins, Colorado.



**BREACH SCENARIOS AT THE WIPP SITE**

**by Richard H. Phillips, Ph.D.**
**and David K. Mitchell, P.E.**

1 The WIPP site is located in a known mineral district. Potash resources, including sylvite [KCl] and langbeinite [$K_2Mg_2(SO_4)_3$], in the McNutt member of the Salado Formation, extend directly above the WIPP repository (FEIS, 1980, Figures 8-5, 9-1, 9-2). Oil and gas resources in the Delaware Mountain Group (and lower formations) extend directly underneath the WIPP repository (FEIS, 1980, Figure 8-6; EEG-62, 1996, Figure 2.2-6). This has been known since before the WIPP site was selected.

2 Under the original WIPP site selection criteria, only "areas more than two miles from deep drill holes" were considered (GCR, 1978, Figure 2-3). When a test hole called ERDA-6, drilled at the original WIPP site, encountered a pressurized brine reservoir in the upper anhydrite of the Castile Formation, between the Salado Formation and the Delaware Mountain Group, the site had to be abandoned. Because no other potentially suitable sites in the Delaware Basin could be found, a new map was drawn indicating "areas more than one mile from deep drill holes." (GCR, 1978, Figure 2-8) On this basis, the current WIPP site was selected.

3 Two test holes, ERDA-9 and WIPP-12, were drilled at the current WIPP site, penetrating 53 feet and 47 feet deep, respectively, into the Castile Formation, stopping short of any pressurized brine reservoir. Thus the FEIS concluded that brine reservoirs "are extremely unlikely near the repository." A Stipulated Agreement was later signed between DOE and the State of New Mexico requiring that borehole WIPP-12 be deepened. (WIPP-12 is located one mile north of the center of the WIPP site).

On November 22, 1981, pressurized brine associated with hydrogen sulfide gas was encountered in the upper Castile anhydrite, 240 feet below the Salado Formation. The brine flowed to the land surface at a rate of 45 gallons per minute (1540 barrels per day) for forty days. Total brine outflow was 60,000 barrels, or about 2.5 million gallons (DOE, 1982, TME 3148). Thus a geologic mechanism exists which is capable of flooding the WIPP repository, corroding the steel drums, dissolving the waste, and carrying contaminated water up the WIPP shafts to overlying aquifers or to the land surface (EEG-6, 1980, pp. 47-48).

4 The total volume of the WIPP-12 brine reservoir was later estimated at between 17 millon gallons (EEG-23, 1983, p. 29) and 30 million gallons (EEG-22, 1983, p. 79). By comparison, about 63 million gallons would be necessary to completely fill the WIPP repository (EEG-16, 1982, p. 45). It is likely that the WIPP-12 brine reservoir extends directly underneath the WIPP waste emplacement

panels (EEG-23, 1983, p. 31; Phillips, 1987, Figure 76; EEG-61, 1996, p. 2-3) Borehole ERDA-9 (located 320 feet from the center of the WIPP site) was never deepened; but less than 200 feet of vertically fractured anhydrite is all that separates the pressurized brine reservoir from ERDA-9, an existing pathway to the WIPP repository. The plan is to plug ERDA-9, but there is no proven technology for plugging boreholes in salt formations, and CARD doubts that it can be done successfully. 4

In 1983 the boundaries of the WIPP site were reduced, from an approximation of a circle with a three-mile radius (18,960 acres) to a perfect square, four miles on each side (10,240 acres). The DOE thereby relinquished control of 8,720 acres in what had been designated as Zone IV (EEG-23, 1983, Figure 26), within which DOE had intended to prevent secondary methods of oil recovery such as waterflooding or hydrofracturing, to prevent solution mining for potash, and to oversee the eventual plugging of oil and gas drill holes (FEIS, 1980, p. 8-4). The rationale, according to DOE, was that "the minimal amount of crude oil likely to exist within the WIPP site" made waterflooding adjacent to WIPP unlikely (EEG-55, 1994, p. 21; EEG-62, 1996, p. xiv). CARD has long suspected that one of the reasons for reducing the boundaries of the WIPP site was the presence of obvious karst features in Zone IV (e.g. boreholes WIPP-33 and WIPP-14) as described by Barrows (1982, pp. 6-8, reprinted in EEG-32, 1985, Appendix A; see also Barrows to Chaturvedi, 8/6/82, Appendix B; Barrows to Chaturvedi, 4/7/83, Appendix C). Whatever the reasons, there are now, within the old Zone IV, 14 oil wells and 6 gas wells. Altogether, there are now, within two miles of the current WIPP site boundary, 101 oil wells, 18 gas wells, 7 oil and gas wells, 4 brine injection wells, and 9 dry holes (EEG-62, 1996, Figure 2.2-2). 5 6 5

All of this is in direct violation of EPA standards for the siting of repositories for nuclear waste disposal, and with good reason. The very purpose of geologic disposal is to emplace the nuclear waste in an area unlikely to be disturbed during the necessary period of waste isolation. No deep geologic disposal site is more likely to be disturbed than one in a known mineral district. Here is the text of the relevant EPA standard: 7

> Places where there has been mining for resources, or where there is a reasonable expectation of exploration for scarce or easily accessible resources, or where there is a significant concentration of any material that is not widely available from other sources, should be avoided in selecting disposal sites. Resources to be considered shall include minerals, petroleum or natural gas ... Such places shall not be used for disposal of the wastes covered by this part unless the favorable characteristics of such places compensate for their greater likelihood of being disturbed in the future. (40 CFR 191.14e)





DOE claims that because the WIPP site was selected before the EPA standards were promulgated, the natural resources provision does not apply, and thus the WIPP site has been "grandfathered" into existence. CARD agrees with Neill et al. (EEG-61, 1996, p. xvi) that there is no "grandfather" provision in 40 CFR 191, and that there has been no formal acceptance of WIPP as a repository. 8

It is worth noting that langbeinite potash, unlike sylvite, contains no chlorine, and is a desirable fertilizer for soils that cannot tolerate additional chlorine. Langbeinite is a rare mineral, found only in the Carlsbad area and eastern Europe (DEIS, 1979, pp. 9-16, 9-18, 9-19; FEIS, 1980, pp. 9-21, 9-23).

The existence of potash within the WIPP site poses a number of dangers to the WIPP repository: (1) The DOE contends that "active institutional controls" will prevent potash mining within the WIPP site for 100 years after closure, even though the DOE has never committed to exercising such control and expects other government agencies to do so. After institutional controls are lost, potash mining could destroy most of the Salado Formation as a geologic barrier. (2) If water were to flood the potash mines, the water would travel laterally along marker beds in the Salado Formation, and could reach the WIPP shafts. (3) The potash mines themselves could serve as preferential pathways for migration of contaminated water from the WIPP repository. (4) Potash mining could cause fracturing, subsidence, and collapse of overlying strata, thereby increasing the hydraulic conductivity of the Rustler aquifers and damaging the casings of oil wells, as DOE acknowledges (SEIS, 1996, pp. 4-21, H-14). 9 10 11 12

Thus there is no such thing as an "undisturbed scenario." It is inevitable that the hydrology of the WIPP site and vicinity will be adversely affected by future potash mining. Accordingly, for purposes of performance assessment, groundwater flow in the Rustler Formation should not be modeled under steady-state assumptions. DOE states in the SEIS (p. H-14) that it has taken this into consideration by examining the impact of a 1000-fold increase in the hydraulic conductivity of the Culebra dolomite due to potash mining, but the reference given (DOE 1996f) is not listed in Appendix H. CARD expects to be granted ample time to analyze said reference after its identity is revealed to us. 13 14

One of the most plausible breach scenarios for WIPP involves exploratory drilling for oil and gas beneath the respository. After institutional controls are lost, which DOE expects to be 100 years after closure, someone could drill directly through the waste emplacement panels and penetrate a pressurized brine reservoir in the Castile Formation, creating an instant breach of the WIPP repository, and carrying contaminated brine to the Rustler aquifers or to the land surface. To DOE, pressurized brine reservoirs are only "hypothetical" (SEIS, 1996, Figures H-9, H-10, H-12, H-14), and an open borehole such as this would 15

only be a "potential" pathway between the brine reservoir and the WIPP repository (SEIS, 1996, p. H-48). According to DOE, this 15 pathway could flood the repository and flush "water," but not radionuclides, to the overlying Rustler aquifers (SEIS, 1996, p. H-48). Even though the WIPP-12 brine reservoir is under artesian pressure and flowed from a depth of 3016 feet to the land surface at a rate of 45 gallons per minute (DOE, 1982, TME 3148, p. 3), DOE assumes that, under this drilling intrusion scenario, it would take 10,000 years for radionuclides to migrate as much as 200 feet above the WIPP repository in concentrations equal to or 16 greater than one picocurie per liter (SEIS, 1996, Figure H-12). Accordingly, the dose to a member of the drilling crew is always within acceptable limits, never more than 520 millirem (SEIS, 1996, Table H-31). This dose is from ingestion of drill cuttings (SEIS, 1996, p. H-63) if a panel of contact-handled transuranic waste (CH-TRU) is penetrated. The dose from remote-handled transuranic waste (RH-TRU) is only 220 millirem (SEIS, 1996, Table H-31). This 17 defies common sense, because the maximum allowable surface dose for a canister of RH-TRU (1000 rem/hour), is 5000 times higher than for a canister of CH-TRU (200 millirem/hour). That is why the RH-TRU is remotely handled.

Under the drilling intrusion scenario, DOE assumes that the borehole would be "plugged at abandonment using standard regulatory requirements and practices" (SEIS, 1996, p. H-49) "and thereafter maintains a relatively low permeability. ... For these assumed conditions, no releases to the Culebra were simulated." (SEIS, 18 1996, p. H-87) This enables DOE to consider radiation exposure only to the drilling crew, and nobody else. It defies common sense to assume that with 45 gallons per minute of brine contaminated with plutonium and associated with hydrogen sulfide gas flowing out of an exploratory oil well, the drilling crew is going to plug the hole. Moreover, DOE assumes that even if the hole is not cased during drilling, and contaminated brine were to reach the Rustler Formation, it would be transported only to a well used to supply water for cattle, which could then become a source of meat consumed 19 by a cattle rancher (SEIS, 1996, p. H-14). DOE does not consider that contaminated brine could be carried all the way to Nash Draw, Laguna Grande de la Sal, and the Pecos River, thus exposing large numbers of people, because this could violate EPA standards for radiation exposure.

The latest breach scenario, and perhaps the most serious, is known 20 as the Hartman Scenario. This involves brine injection, which the DOE refuses even to consider. This scenario is not hypothetical. It cannot be prevented by institutional control of the WIPP site. It is happening today. These are the facts:

Brine injection is utilized by oil companies for one of two reasons: (1) salt water disposal, which involves the injection of unwanted brine through a disposal well and into a permeable rock strata bounded above and below by impermeable rock strata; or





(2) waterflooding, which involves the injection of pressurized brine into an oil-bearing zone in order to force additional oil to flow toward a producing oil well (EEG-62, 1996, p. 2).

In 1991, Doyle Hartman, an independent oil operator, attempted to drill an oil well on the Bates lease, 40 miles east-southeast of the WIPP site. Known as the Bates #2 well, it was located about two miles from a brine injection well operated by Texaco for waterflooding purposes. In 1953 the Bates #1 well, located 100 feet away, had been drilled successfully; the well had been plugged and abandoned in 1988. The Bates #2 well encountered pressurized brine at a depth of 2240 feet, and drilling had to be terminated at 2280 feet. Brine flowed from the Bates #2 well at a rate of 840 gallons per minute, or 1200 barrels per hour, for 5.5 days. Fluid pressures were so high that the well could not be shut in for fear of an underground blowout. A total of 298 truckloads were required to haul the salt water away, and a pipeline had to be constructed to help alleviate the problem.

When the Bates #2 well was finally brought under control by using rapid-setting cement to shut off the flow, a shut-in pressure of 1000 psig was observed at the land surface. This equates to a pressure gradient of 0.966 psi per foot of depth, compared to the normal gradient of 0.525 psi per foot of depth for a column of saturated salt water. The only source in the vicinity with documented pressure gradients equal to or greater than those observed at the Bates #2 blowout was Texaco's fluid injection well, two miles to the south (Van Kirk, 9/16/94; Bredehoeft to Lovejoy, 1/8/97). Hartman sued Texaco, won the case, and was awarded $5.6 million in damages (EEG-62, 1996, p. 8).

It turned out that pressurized brine injected by Texaco at 3000 feet below the surface (EEG-62, 1996, p. 131) had risen 700 feet vertically and migrated two miles horizontally through an anhydrite marker bed in the lower Salado, the same formation in which the WIPP repository is located. A failed well casing, due to long exposure to corrosive brine, was the most logical pathway into the 21 Salado. The brine was being injected at pressures greater than lithostatic, high enough to induce massive hydraulic fracturing of the anhydrite marker bed over a large area that included the Bates #2 well (Bredehoeft to Lovejoy, 1/8/97). There are at least ten anhydrite marker beds in the lower Salado; they extend across the entire Delaware Basin, which is why they are called "marker beds." According to Dennis Powers of Sandia National Laboratories, the Hartman blowout probably occurred in Marker Bed 140 or 142 (EEG-62, 1996, p. 66), which are 67 feet and 104 feet, respectively, below the WIPP repository horizon.

Despite the 40-mile distance between the Bates #2 well and WIPP, 22 the characteristics of the Salado marker beds remain the same. If pressurized brine is injected and is able to leak through the casing of an oil well into an anhydrite marker bed, it can be

22 expected to induce fracturing and to travel two miles or more (Chaturvedi, in EEG-62, 1996, pp. 104-105). There are already 130 oil or gas wells within two miles of the WIPP site; four of them have been converted to brine injection wells (EEG-62, 1996, Figure 2.2-2), at least one of which is operating at a pressure that exceeds the lithostatic pressure at the repository horizon (EEG-62, 1996, p. xvii). The consequences of waterflooding of

23 the WIPP repository due to pressurized brine injection would be catastrophic (Van Kirk, 9/16/94, p. 12). If pressurized brine were injected into Marker Bed 139, which is four feet below the repository, the WIPP could be flooded with massive amounts of water, and dissolved radionuclides could be carried out of the repository, away from the WIPP site, and into the accessible environment (EEG-61, 1996, p. 6-3; EEG-62, 1996, p. 16).

24 It has been argued that waterflooding of the WIPP repository is unlikely because brine injection near WIPP takes place in the Bell Canyon Formation, at a much deeper horizon than at the Texaco well. Indeed, there are at least 15 brine injection wells within eight miles of the WIPP site (EEG-62, 1996, Figure 2.6-2), and all of them inject into the Bell Canyon Formation (EEG-62, 1996, p. 15). However, recent water level rises in the Culebra dolomite at WIPP test well H-9b, located 6.45 miles south of the WIPP site, are strongly correlated with brine injection into the Bell Canyon Formation, more than 4400 feet below the land surface, at a well (Devon Energy's Todd 26 Federal #3) located three miles away. There is more than 3700 feet of vertical separation between the Bell Canyon and the Culebra; between them lie the relatively impermeable salt beds of the Castile and the Salado; and yet injected brine was able to rise all the way to the Culebra. It is apparent that, in the vicinity of brine injection wells, the Castile and the Salado are not reliable geologic barriers (EEG-62, 1996, pp. 127-128, 132).

25 As Bredehoeft concludes: "The Hartman Scenario is not easily dismissed." (Bredehoeft to Lovejoy, 1/8/97). And yet the DOE does exactly that. DOE contends that, according to the criteria for compliance with EPA standards, "the most severe human intrusion scenario" that requires analysis is "inadvertent and intermittent drilling for resources" (40 CFR 194.33b1, cited in EEG-61, pp. 6-1, 6-2). DOE contends that "consequences greater than that of exploratory drilling" need not be considered (EEG-62, 1996, pp. xv, 16). Because the Hartman Scenario has more severe consequences than the drilling intrusion scenario, it need not be considered. CARD agrees with EEG; this "defies common sense." (EEG-61, p. SCR-6) The EPA criteria, at 40 CFR 194.32c, plainly require that DOE analyze the effects of "boreholes and leases that may be required for fluid injection activities." (EEG-62, 1996, p. 159) EPA, in

26 its Supplementary Information, Subpart D, requires that DOE analyze the effects of "water-flood injection for secondary recovery of oil, solution mining and the disposal by injection of brine accumulated during recovery of oil." Not to consider the





26 Hartman Scenario is flagrantly illustrative of a callous disregard for human life.

27 Ultimately, waste containment at WIPP depends upon DOE's ability to seal the shafts and plug the boreholes perfectly, forever, because the overlying Rustler aquifers cannot be relied upon even to retard the migration of radionuclides in groundwater. DOE's Compliance Certification Application (CCA) describes in some detail the "presently envisaged shaft seal system" (DOE/CAO 1996-2184, pp. 3-15 to 3-21). DOE admits to three potential flow paths within the shaft seal system: (1) through the seal materials themselves; (2) along the interface with surrounding rock; and (3) through the "disturbed rock zone" (DRZ) adjacent to the shaft wall. Even if the engineered seal materials are of low permeability, and even if construction methods ensure a tight interface between with the surrounding rock, the disturbed rock zone will be a groundwater flow path (DOE/CAO 1996-2184, p. 3-25). In DOE's words: "It is

28 well known that a DRZ develops in the rock adjacent to the shaft immediately after excavation. After closure of the shaft this fractured zone is initially a major flow path regardless of the material placed within the shaft" because whatever seal components are used will be more permeable than intact Salado salt (DOE/CAO 1996-2184, pp. 3-23, 3-24). In the WIPP ventilation shaft, the disturbed rock zone includes five "washed out zones" which had to be cased with liner plates to prevent further caving of the shaft wall (TME 3179, Figure 1). With this in mind, it will be useful to examine the components of DOE's "presently envisaged shaft seal system."

29 (1) Compacted earthen fill will extend from the land surface to the the top of the Dewey Lake Redbeds. Obviously, this will be more permeable than surrounding Gatuna and Santa Rosa sandstone.

30 (2) A concrete plug will extend 40 feet downward from the top of the Dewey Lake Redbeds. At this interval, DOE admits that the shaft will have to be "grouted before removal of the shaft lining to assure structural stability of the shaft wall."

31 (3) Compacted earthen fill will extend from the concrete plug through the Dewey Lake Redbeds to the Rustler Formation. This will be more permeable than surrounding sandstone and siltstone.

32 (4) Bentonite clay will extend through most of the Rustler Formation, including the Magenta and Culebra dolomite, both of which produce water in the WIPP shafts. The clay would be relatively impermeable, allowing Rustler groundwater to travel along the interface and through the disturbed rock zone.

33 (5) A concrete plug will be emplaced through 20 feet of the lower unnamed member of the Rustler Formation. Open fractures were observed at this horizon; groundwater will be able to travel along the interface and through the disturbed rock zone.

34 (6) An asphalt column will bridge the Rustler-Salado contact. Unsaturated Rustler groundwater will travel along the interface, dissolve the Salado salt, and enlarge the disturbed rock zone.

35 (7) A concrete plug will be emplaced through 23 feet of the Upper Salado. This is intended to fill "irregularities in the shaft wall," but will be ineffective because the disturbed rock zone will be continually enlarged by dissolution.

36 (8) Bentonite clay will extend through most of the Upper Salado. This will not prevent dissolution in the disturbed rock zone.

35 (9) Another 23-foot concrete plug will be emplaced near the top of the McNutt Potash Unit. Again, this will be unable to fill irregularities in a shaft wall undergoing active dissolution.

37 (10) A 560-foot column of crushed and compacted salt will extend from the concrete plug almost to the repository horizon. The crushed salt will be more permeable than the rock salt. DOE admits that salt column will offer "limited resistance to brine migration" for about 100 years after emplacement.

35 (11) Another 23-foot concrete plug, at the bottom of the salt column, will be unable to fill irregularities in the shaft wall.

36 (12) About 100 feet of bentonite clay will be emplaced at the bottom of the shafts, "to promote early healing of fractures in the surrounding salt." Again, the interface and the disturbed rock zone will be more permeable than the bentonite clay.

(13) A salt-saturated concrete monolith will be installed to fill the underground excavations at the repository horizon.

38 It is apparent that the "presently envisaged shaft seal system" will not be able to prevent the downward migration of unsaturated Rustler groundwater. It surely will not be able to withstand pressurized brine, whether from the Castile brine reservoir, from salt water disposal, or from waterflooding operations.

39 In addition to the four WIPP shafts, there are six deep boreholes within the WIPP site that penetrate deeper than the repository horizon. DOE seems aware of only four of them (WIPP-13, WIPP-12, ERDA-9 and DOE-1). There are also two deep drill holes (Badger Federal and Cotton Baby, identified in EEG-61, 1996, p. 3-7) which were abandoned by private operators (EEG-55, 1994, Figures 11, 12, 13; also shown in FEIS, 1980, Figure 8-6); these do not appear on the map of unplugged boreholes in DOE's Compliance Certification Application (DOE/CAO 1996-2184, Figure 3-9).

40 "The DOE had planned to develop special borehole plugging procedures for boreholes at the WIPP site. It now appears that conventional plugging procedures for commercial wells will be





40 followed." (EEG-61, 1996, p. 3-6) Thus it is with good reason that EPA requires DOE to assume, for purposes of performance assessment, "that the permeability of sealed boreholes will be affected by natural processes, and ... that the fraction of boreholes that will be sealed by man equals the fraction of boreholes which are currently sealed in the Delaware Basin." (40 CFR 194, Subpart C) DOE, in its Compliance Certification Application, speaks of shaft seals and borehole plugs in the present tense (DOE/CAO 1996-2184, pp. 3-19 to 3-21); DOE has no right to do so, as the technology for sealing shafts and plugging boreholes in salt formations has not

41 been demonstrated. In fact, DOE attempted in 1977 to plug the ERDA-10 borehole at the Gnome Site in Nash Draw. Four separate plugs were emplaced for a total length of 4430 feet (SAND 81-2034), but no report appears to be available describing the success or failure of the attempt.

42 Ever since WIPP tunnels were excavated, saturated brine from Salado marker beds has been seeping into the WIPP repository. This brine would be capable of flooding the WIPP tunnels, corroding the steel drums, and dissolving the waste, creating a radioactive slurry at the repository horizon. Because the brine is saturated it would not be capable of dissolving any more salt; and once the WIPP tunnels are filled, the contaminated brine would have no other place to go but up the WIPP shafts, in what is known as the "undisturbed scenario." It is CARD's position that the sealing of shafts and the plugging of boreholes are too important to be left to chance. The credibility of the WIPP site depends upon it. Until the technology is demonstrated, in the field, it is premature even to consider allowing WIPP to open.

**ALTERNATIVES TO RADIOACTIVE DUMPING**

43 There are alternatives to radioactive dumping. DOE dismisses them too easily. In the Final Environmental Impact Statement (FEIS, 1980), DOE devoted more than a thousand pages to geologic disposal, and only three pages to alternative technologies (pp. 3-2 to 3-5). In the Supplemental Environmental Impact Statement (SEIS, 1996), DOE devotes over seven hundred pages to geologic disposal, and only two pages to alternative technologies (pp. 3-43 to 3-45), often stating that these alternatives were considered and rejected in the FEIS. From beginning to end, DOE has skewed the NEPA process so as to make the decision to proceed with WIPP appear reasonable and inevitable. This is in direct violation of NEPA case law, which states that the Environmental Impact Statement should treat the decision "as an impending choice to be pondered, (not) as a foregone conclusion to be rationalized." [372 F. Supp. 223, 253 (1974)] (For a complete discourse on NEPA case law as it applies to WIPP, see "Radiactive Dumping: The State of the Art," reprinted in WIPP-DOE-173). These are some of the alternatives to radioactive dumping:

Transmutation of isotopes with long half-lives into isotopes with short half-lives could greatly reduce the necessary period of waste isolation. DOE rejected transmutation because: (1) the process would be carried out in a nuclear reactor; (2) the process has not yet been proven for large-scale facilities; (3) waste products would be created in the process, so that geologic disposal might still be necessary; and (4) transmutation could not be performed upon contact-handled transuranic waste (CH-TRU), which consists largely of contaminated laboratory materials. But transmutation might be feasible for remote-handled transuranic waste (RH-TRU) and high level waste (HLW), in which radioisotopes are more highly concentrated; and transmutation has been demonstrated, on an experimental basis at Los Alamos National Laboratories (LA-UR-94-3022; LA-UR-94-4351; LA-UR-95-1792).

44

Vitrification would combine RH-TRU and HLW with molten glass. The advantage to vitrification is that it would make the waste less mobile, and therefore easier to contain. The waste would be less able to be entrained in the air, and less able to be transported by groundwater. DOE rejected vitrification because of the large volume of CH-TRU, again failing to address the feasibility of the process for RH-TRU and HLW. DOE argued that a vitrification program would delay TRU waste disposal, skewing the decision-making process in favor of geologic disposal.

45

Engineered barriers in the form of improved waste containers could lengthen the period of time before waste in a geologic repository would come in contact with the host rock. In the FEIS (1980, pp. 9-159, 9-160), DOE hoped to develop a canister that could remain intact for 300 to 500 years, a span of time embracing ten half-lives of cesium-137 and strontium-90, which are the major heat-producers in HLW. Again, DOE does not consider improved waste containers for disposal of TRU at WIPP.

46

Taken together, these alternatives could make isolation of RH-TRU and HLW possible. Short-lived isotopes, in vitrified form, in containers designed to resist corrosion, emplaced in a geologic repository, might remain isolated from the environment for ten half-lives or more, during which time the radioactivity will have decreased by a factor of 1000. Instead, DOE plans to bury long-lived isotopes, untreated in any way, in steel drums, in direct contact with wet salt, the most corrosive host rock imaginable.

47

It is CARD's position that no waste should be brought to WIPP, not even CH-TRU. It should be stored in a monitorable and retrievable manner until a solution is found. The DOE admits (DEIS, 1979, p. 9-165) that the environmental effects of leaving the waste where it is, in the short term, would be less than the effects of retrieving it, identifying it, packaging it, trucking it, unpackaging it, lowering it down the WIPP shafts, and burying it at WIPP. The $17 billion that DOE plans to spend on WIPP could fund a genuine scientific effort to solve the problem.

48





**THE TRUTH ABOUT WIPP GEOLOGY AND HYDROLOGY**

**by Richard Hayes Phillips, Ph.D.**

1

1. **The WIPP site is wet.** It was supposed to be dry. This was the rationale behind disposing of nuclear waste in salt beds. The very fact that salt beds still exist is proof that they have been isolated from circulating groundwater ever since they were deposited. But the salt beds of the Salado Formation were formed when an ancient sea evaporated, leaving the salt behind. Trapped within the salt beds are pockets of brine that never evaporated. These brine pockets migrate toward areas of low pressure. As soon as the WIPP tunnels were excavated, brine began seeping into the roof and walls. This was unexpected.

1

2

2. **The waste brought to WIPP would be buried in steel drums placed in direct contact with the salt beds.** Those fancy containers you have heard about are for transportation only. When the waste gets to WIPP, the DOE will unpack the transportation containers and bury the waste in steel drums, just like they always do. Brine will continue to seep into the WIPP repository. In a matter of years the steel drums will corrode, and the brine will begin dissolving the waste, creating a slurry of radioactive waste and salt water.

3

3. **The WIPP site is already breached.** The Salado salt beds are deep underground, beneath the water table. When the DOE drilled the WIPP access shafts, they had to drill through groundwater aquifers in order to reach the salt beds. Also within the WIPP site are four deep boreholes penetrating deeper than the waste repository. These shafts and boreholes are ready-made pathways for contaminated water. DOE must be able to seal the shafts and plug the boreholes perfectly, forever, and we doubt that they can do it.

4

4. **There is pressurized brine beneath the WIPP repository.** This is not to be confused with the brine pockets in the Salado Formation. This is a brine reservoir, beneath the Salado, in the Castile Formation. When this brine reservoir was encountered at a borehole called WIPP-12, located one-half mile north of the waste repository, 1500 barrels a day flowed for forty days, all the way to the land surface. This is because the brine is under artesian pressure, and it is the geologic mechanism, the driving force, which could bring the slurry of radioactive waste and salt water to the overlying aquifers or to the land surface.

5

5. **The WIPP site is vulnerable to human intrusion.** There are extensive deposits of oil, gas and potash at the WIPP site. Oil and gas wells now surround the site, and the oil and gas fields extend directly beneath the waste repository. As long as DOE controls the site, oil and gas exploration can be prevented. But when institutional controls fail, someone searching for oil will drill directly through the waste repository and into the pressurized brine reservoir, creating an instant breach of containment. The brine will flow to the land surface if the oil well is cased, and into the groundwater aquifers if the oil well is not cased.

6

6. **The WIPP site is in karst.** In most cases, groundwater moves through porous rocks, like sandstone, flowing uniformly and predictably. The problem with karst is that groundwater flows more rapidly through less space, through fractures enlarged by solution, or through underground caverns. The aquifers above the Salado Formation, both the Rustler Formation and the Dewey Lake Redbeds, are karst, with caverns in dolomite and gypsum, even in sandstone and shale. The caverns get larger with time; and the larger the caverns, the less the amount of radiation that sticks to the rocks as contaminated water flows through them.

7

7. **Drinking water will be contaminated.** There are wells in the Dewey Lake Redbeds and the Rustler Formation, within and near the WIPP site, that contain potable, drinkable water. These aquifers discharge in Nash Draw, where salt lakes will be contaminated, and they will overflow eventually into the Pecos River.

8

8. **The WIPP site will get worse over time.** As more and more potash is mined in the Salado Formation, the overlying aquifers will slump and fracture. Every major rainstorm will recharge the Rustler Formation with fresh water to dissolve more dolomite and gypsum. The waste will be radioactive for a very long time. Ice ages, which are cyclical, are inevitable. The climate will change when the glacier advances. There will be more rainfall, less evaporation, and more groundwater, and the rocks will dissolve more rapidly.

*Richard Hayes Phillips holds a Ph.D. in karst geomorphology and hydrology from the University of Oregon. His dissertation is entitled: "The Prospects for Regional Groundwater Contamination due to Karst Landforms in Mescalero Caliche at the WIPP site near Carlsbad, New Mexico." During his field work he camped at the WIPP site for eight months and dug one thousand auger holes and ten backhoe trenches, exposing holes of all sizes in the Mescalero caliche and demonstrating that rainwater readily reaches the Dewey Lake Redbeds.*

TALKING POINTS ON THE SEIS-II
for CARD

SEIS-II BASIC PROBLEMS

1. **The main problem with the SEIS-2 is that they have not included the no-action alternative which CARD and the people of New Mexico have been demanding for more than 15 years–namely to treat the waste to meet the WAC at the generator sites and store it there up to some period of time (say 100 years) while studying a true solution for the problem.** The No-Action Alternative 2 in the SEIS describes treating the waste and storing it indefinitely at the generator sites without trying to find a true disposal solution. DOE expects that they will eventually lose control of the waste under this alternative and that many people would be eventually affected. DOE rejects their No-action Alternative 2 as having unacceptable health impacts. They have no alternative which keeps control while working on a solution. Several of the action alternatives require waste to be stored for more than 100 years, so they evidently feel they can keep control this long.

2. DOE is rushing to meet a deadline (November 1997) to open WIPP. **They haven't done all the tests necessary to characterize the site and the waste.** According to EEG-61 (page 1-2) *"...site characterization work is still continuing at the WIPP site...Some of these tests are being conducted now under a tight schedule and others have been abandoned or postponed because they do not fit in this tight schedule."*

3. There is **great reliance in the SEIS on the DOE's Draft Waste Management PEIS** (WMPEIS) to determine human health and other impacts at the treatment sites. The WMPEIS has been severely criticized as being incomplete and incorrect. Also, impacts have been adjusted from the WMPEIS for increased *volumes of waste as well as changes in key radionuclides. However, according to the SEIS itself (p A-3) "...only about 80 percent f the CH-TRU waste stream volumes and about 15 percent of the RH-TRU waste stream volumes have reported radionuclide inventories."* Therefore, actual impacts of key radionuclides either for the treatment sites, transport or for disposal at WIPP itself are largely unknown. **This makes all the health effects** (a major part of the SEIS II) **suspect.** They should be thrown out and redone when DOE has a better understanding of the waste.

WASTE

4. **Understanding the waste is crucial to understanding the potential impacts on human health (see above) as well as long-term repository performance.** DOE often relies on process knowledge (understanding what chemicals and radionuclides etc. were used in the process that resulted in the barrel of waste) to understand what is in a waste drum. According to EEG-61 (p. xiv) *"Various DOE documents present seriously conflicting pictures of the volume and radioactivity of the TRU waste available and expected to be generated....Reliance on process knowledge for waste characterization continues to be insufficiently justified. These conflicts and omissions provide little confidence in the DOE's inventory assessments."*

5. Waste drums must meet the Waste Acceptance Criteria (WAC) to show they are safe to ship to and be buried at **WIPP. DOE can't show that they have the ability to characterize the drums well enough to certify that they meet the WAC.** In 1991, out of 80 drums they had certified as meeting the WAC, 58% were found to be mis-certified when visually inspected. This rate is poorer than if they left it to chance and just picked drums randomly. Again, DOE is not ready to properly characterize the waste.



GEOLOGY

6 1. According to EEG 61 (P xiii) ***"A basic understanding of the hydrology of the site is yet to be attained.*** *The location of the water table at the WIPP site has not yet been identified...The Culebra dolomite plays an important part in the postulated breach scenarios yet knowledge of its recharge and discharge locations and the mechanics of flow and transport in this most important aquifer are currently inadequate. The postulated direction of flow as indicated by the potentiometric heads differs from that obtained from water chemistry–such differences do not lead to confidence in the DOE conceptual models. Several Culebra wells have shown as an yet unexplained rise in water levels in recent years;..."* Full knowledge of the site and the waste to be emplaced should be attained before anything is put in the ground. Again, DOE is rushing ahead without complete
7 understanding just as the Challenger Disaster scientists rushed ahead to meet their deadline without fully understanding certain design limitations of that project.

8 **2. DOE has chosen not to do the tests necessary to determine if karst conditions exist at the WIPP site itself.** If karst conditions do exist, travel times to the accessible environment for radionuclides that might be released from the repository could be shortened to as little as 15 years. Karst conditions must be definitely ruled out if waste is to be buried at WIPP.

9 3. DOE **does not address the problem of potentially short transport times in the Culebra Dolomite Formation because they state that there will be no contaminant releases into that formation if the repository is disturbed (for instance by being drilled into).** Because the DOE doesn't have a clear understanding of the hydrology of the site and has neglected to analyze all potential repository disturbance conditions, they have **not** proven that contaminants will not reach the Culebra Dolomite. According to the National Academy of Sciences, *"In efforts to site geologic repositories in other countries, a good quantitative understanding of the regional ground-water flow regime and the influence of the geological environment of the repository on radionuclide transport are often the most critical factors needed to determine whether or not a potential repository site can provide adequate long-term isolation of the waste. This is usually true for both the undisturbed and the disturbed cases."*

10 4. **The site is wet, not dry.** Brine is seeping into the site. This brine can mix with the waste and cause it to become a radioactive slurry that would be more easily transported into the accessible environment. Brine mixing
11 with the metal in the waste and the waste barrels as well as with the metal holding the repository together could increase gas generation.

THE SITE

12 1. **DOE continues to change regulations to fit the site, not find a site that fits safety requirements.** Their recent revision of the Land Withdrawal Act to eliminate the need to meet regulations to show they can contain the hazardous component of the waste is only the latest example of this.

13 **2. Why is it okay now to have the site on top of a highly pressurized brine reservoir when they previously moved it two times to avoid just this situation?**

14 3. **The site is surrounded by potash, oil and gas resources.** When DOE originally chose the site. they believed few natural resources were there. Now there are more than 120 oil and gas wells as well as extensive potash mining around the site. The area is riddled with boreholes.

a. **The SEIS II doesn't fully analyze the effects of potash mining or the synergistic effects of potash mining and oil and gas drilling**

b. **All those boreholes (including the test boreholes right on top of the site itself) are potential pathways for radionuclides to get to the accessible environment**

14 c.) **The SEIS II doesn't even mention water flooding for secondary recovery of oil and brine reinjection.** These practices are becoming more and more common around WIPP because of the numerous oil and gas wells surrounding the site. Water has been shown to travel for miles in the Salado and rise as much as 300 feet from below the Salado to the Culebra. From there it could travel up a poorly sealed borehole or to the Pecos River.

THE REPOSITORY

15 1. **DOE has yet to show it can permanently seal the shafts, rooms or panels of the repository in salt.** They haven't yet decided even what materials will be used to seal the shafts (SEIS-II p 3-12) Salt is very corrosive and eventually can eat away into concrete or metal. Also, in the rooms and panels, the salt can crumble away from the edges of the seals. DOE should be able to demonstrate that they can seal the repository before they put anything in it. **If the rooms and panels are sealed tightly, there is a potential for explosion from methane gas during the operational phase while workers are in the repository.** Indeed, the SEIS-II itself states on page 3-11 *"The panel closure system has been designed...to withstand a potential methane explosion from the accumulation of gas in the panel."*

16 2. **Gas generation in general is a problem** DOE has yet to show that they have this under control unless they incinerate or thermally treat the waste

17 3. **They have already made more than 286 connections to a fractured layer above the repository with rockbolts and have fractured and connected the floor of the waste rooms in panel 1 to a heavily fractured layer below the repository.** These 2 layers could be potential water transport pathways off the site–especially if they are injected with water from oil drilling activities.

18 4. **Institutional controls**–DOE claims they will control the site after closure and will put up markers and use records to keep people away. Yet DOE lost knowledge already of 2 active oil and gas leases and one gas well within the WIPP site–even though the well is visible from the highway!

19 5. **Retrievability**–Plans for retrievability (or Recovery, which is what it is called when the rooms have collapsed and the drums have been breached) are sketchy at best in the SEIS II

TRANSPORTATION

20 DOE states that *"..a volatile release of material containing TRU radionuclides or uranium oxide would not be reasonably foreseeable for a transportation accident."* because the flame temperatures of burning gasoline and diesel fuels are lower than the temperatures at which volatile releases of these substances occur. **DOE totally ignores the fact that there are at least 21 chemicals routinely transported on the highways, including propane and liquified natural gas, that have flame temperatures above that required to volatilze these substances.** There is, in fact a propane company whose trucks directly enter the WIPP route on highway 285 in southern New Mexico.

ECONOMIC IMPACTS

21 1. **DOE is not ready to emplace RH-TRU waste** which must go in the waste room walls first before CH-TRU waste can be stacked on the waste room floors. **This will cause higher costs to run the facility at partial capacity or to change the plans to emplace the RH-TRU waste later.**



2 **No-action Alternative 2 or the no-action alternative that CARD proposed in the first point above would be the least expensive by far.** ($2.7 billion compared with the proposed action of $19.1 billion) The money saved could go into studying the problem. **CARD's no-action alternative would also have the fewest deaths and health effects of all.**

22 **It is clear that DOE is not ready in a number of areas to open WIPP. Why push ahead when the prudent action is to more carefully evaluate and study the situation.**

23 Also, we have no guarantees that the WIPP mission won't change in the future. Either that the DOE will pick one of the alternatives rather than the proposed action, will mix alternatives or will change the mission to include high-level waste or spent fuel rods.

**TESTIMONY OF DR. RICHARD HAYES PHILLIPS**
**AS PRESENTED IN SANTA FE, NEW MEXICO,**
**JANUARY 10, 1997, WITH MINOR CHANGES**

My name is Richard Hayes Phillips. I am presently a geologic consultant for Citizens for Alternatives to Radioactive Dumping. I am speaking on behalf of All People's Coalition. I have a Ph.D. from the University of Oregon, 1987, in karst geomorphology and hydrology. My dissertation is entitled: "The Prospects for Regional Groundwater Contamination due to Karst Landforms in Mescalero Caliche at the WIPP Site near Carlsbad, New Mexico."

I began investigating the WIPP project and testifying against it in 1979 when the Draft Environmental Impact Statement (DEIS) was released to the public. Therefore I was not discouraged when I read on the Internet that WIPP is "on schedule to open in 1998." I remember when WIPP was on schedule to open in 1982.

Since I completed my dissertation field work in 1986 I have not been involved with the WIPP project, except in 1990 when I testified at the EPA hearings in Albuquerque and Santa Fe and afterwards led EPA officials on a field trip to observe geologic hazards at and near the WIPP site.

1 I am disappointed to see that the text of the Supplemental Environmental Impact Statement (SEIS) devotes only twelve and one-half pages to WIPP geology and hydrology, and this is only a cursory overview, not a concise summary of substantive findings.

2 It appears that DOE's hydrologic studies in the last ten years consist mainly of: (1) the drilling of nine new arrays of hydrologic test wells, the basic data for which I have been unable to locate through DOE, Sandia Labs, or Zimmerman Library; and (2)

3 computer modeling of groundwater flow through the Rustler Formation, using false assumptions as the basis for their models. Not that any further research was truly necessary; enough geologic information was available in 1986 to warrant the total abandonment

4 of the WIPP site. All the geologic mechanisms necessary for complete failure of waste containment are present at the WIPP site and have been well known for ten years or more. I have spoken on this matter too many times before, but I shall tell you, one more time, how the WIPP site will fail.

5 The problems begin with the salt beds in which the waste disposal area is located. The shafts are leaking, the roof is leaking, the walls are leaking, and the floor is cracking. All of this defeats the basic premise: the salt beds are supposed to be dry. The very fact that the salt beds still exist indicates that they had been isolated from circulating groundwater since they were deposited. But the salt beds are no longer dry.





The salt beds are located below the groundwater aquifers of the Rustler and Dewey Lake formations. In order to gain access to the salt beds, the DOE had to drill several shafts through the

5 groundwater aquifers, and so the shafts are leaking. There are pockets of brine in the salt beds, and brine migrates toward areas of low pressure, and the lowest pressure is found in the gaping tunnels which DOE has excavated in the salt, and so the roof is leaking and the walls are leaking. The stress induced by the excavation of tunnels has caused fractures in the clay seam immediately below the storage area, and so the floor is cracking. One more time: the shafts are leaking, the roof is leaking, the walls are leaking, and the floor is cracking.

6 Directly underneath the WIPP site is an artesian brine reservoir, under enough pressure that it flows all the way to the land surface whenever it is encountered in drill holes. Brine migrates toward a heat source, such as canisters of radioactive waste. Only 200 feet of vertically fractured anhydrite separates the pressurized brine reservoir from the ERDA-9 drillhole and the WIPP tunnels. Sooner or later, the brine will find its way to the WIPP tunnels, dissolve the waste, and carry plutonium to the overlying aquifers or to the land surface.

7 But DOE will not have to wait for this to happen, because the DOE has already breached the WIPP site with their own drill holes and access shafts. The DOE now needs to plug these holes and shafts, to seal them, perfectly, forever, or else the WIPP site can never be used. Why? Because the salt water leaking into the WIPP tunnels would corrode the steel canisters and dissolve the radioactive waste, and the shafts would provide ready-made pathways for contaminated water to reach the overlying aquifers. The DOE has already breached the WIPP site. The contaminated water would have no other place to go but up, because the water leaking into the WIPP tunnels is saturated with respect to salt; that is, it cannot dissolve any more salt, and so it would rise up the shafts as soon as it fills all the tunnels. One more time: the DOE has

7 already breached the WIPP site, and after twenty years of trying, the DOE has abandoned its efforts to develop the technology necessary to plug boreholes any more effectively than the oil and gas companies can.

8 Once plutonium reaches the groundwater aquifers of the Rustler Formation, it could reach the accessible environment in as little as 100 years. Why? Because the Rustler Formation is karst. I know the DOE doesn't like this word, so I'll say it again. Karst. The WIPP site is in a karstland. Karst terrains are characterized by sink holes and disappearing streams at the land surface, and underground caverns beneath the surface. Groundwater flows preferentially through fractures and almost unimpeded through gaping underground caverns, carrying radionuclides along with it.

9 Directly west of the WIPP site is Nash Draw, a huge depression

in the land surface, 15 miles long and 9 miles wide, caused by the coalescence of hundreds of sink holes due to underground caverns collapsing beneath them. The edge of Nash Draw is so close to the WIPP site as to raise these questions: How far east of Nash Draw do karst conditions extend? Does karst exist at the WIPP site itself? 9

At one time it was undeniable that karst existed at the WIPP site. Only 1.9 miles west of the WIPP repository is a huge collapse sink, 600 feet in diameter and 30 feet deep, partly filled with alluvial deposits, with an arroyo disappearing into it. The DOE drilled a borehole, known as WIPP-33, into this collapse sink and found not one, but five underground caverns, all in the same drill hole, one after another, one in siltstone, two in gypsum, and two in dolomite. Here was a golden opportunity to measure groundwater travel times under karst conditions at the WIPP site. Instead, DOE reduced the boundaries of the WIPP site so that WIPP-33 is now one-half mile outside the boundary. The karst has not gone away. The waste disposal area is no farther from WIPP-33 than it used to be. But WIPP-33 is no longer within the WIPP site, and DOE hoped that karst as an issue would go away. But I will not let it go away. 10

There are three other sink holes in almost a straight line, leading directly westward to WIPP-33, a clear indication of a groundwater flow path directly beneath them. These sink holes can be seen in the air photos, and they are partly filled with alluvial deposits just like WIPP-33. The easternmost sink hole has an arroyo disappearing into it, just like WIPP-33. This arroyo did not exist when I began my field work. I have the air photos to prove it. But in September 1985 there was a major rainstorm, ten inches of rain in two days, and a brand new arroyo appeared on the land surface and disappeared into this sink hole. I believe this was God's way of vindicating my work, giving proof that karst is an active process east of Nash Draw, 1.7 miles from the WIPP repository. Karst exists at the WIPP site. Karst exists at the WIPP site. Karst exists at the WIPP site. 11

In June 1986 another ten-inch rainstorm caused an increase in groundwater inflow from the Rustler Formation into the WIPP shafts. This is proof that the Rustler Formation is recharged by rainwater. If the Rustler aquifers contained only ancient water, left over from the Ice Ages, it would be saturated with dissolved solids; but instead we find that total dissolved solids in Rustler test wells vary by a factor of 70. The Rustler Formation is recharged by rainwater. There is nothing to prevent inflitrating rainwater from reaching the Rustler Formation. There is no overlying barrier. The Dewey Lake Redbeds are made of permeable siltstone and contain potable water. Ranchers near the WIPP site use it for drinking water and for their livestock. The Mescalero caliche, still claimed by DOE to be a barrier to rainwater infiltration, 12





is no barrier at all. It is totally absent in the karst sinkholes, and elsewhere it is commonly breached, resembling Swiss cheese, especially in the mile-long solution-subsidence trough which extends into the southwestern part of the WIPP site. The Rustler Formation is recharged by rainwater, and the DOE must account for this water.

DOE says the Rustler Formation discharges at brine springs at Malaga Bend on the Pecos River. In fact it is the brine aquifer at the top of the Salado salt formation which discharges there; this does not account for the Rustler groundwater. The Rustler Formation is exposed in Nash Draw, and it is there that the Rustler groundwater reaches the land surface, saturated with dissolved gypsum and dolomite, flowing at rates as high as 400 cubic feet per second into a Salt Lake four square miles in extent. The Rustler aquifers discharge into the Salt Lake. While it is true that some of the water flowing into the Salt Lake is effluent from the many potash refineries in Nash Draw, it is also true that the Salt Lake was more than three square miles in extent when only one small potash refinery existed. The Rustler aquifers discharge into the Salt Lake. In Nash Draw, brine evaporates at the rate of 90 inches per year. A very large amount of water must be flowing into the Salt Lake in order for it to exist in the face of such high evaporation, because the Salt Lake lies in a closed drainage basin. It has no outlet, either at the land surface or underground. Water flows into it, but not out of it. The Salt Lake loses water only by evaporation, and the inflow plus direct precipitation is equal to the evaporation. DOE must account for this water. 12

A cynic might say that it doesn't matter if contaminated water from the Rustler Formation, containing plutonium, discharges into the Salt Lake, because nobody uses the water in the Salt Lake for anything. But as recently as 1966 the Salt Lake overflowed into the Pecos River, 1.5 miles away, and that is how contaminated water from the WIPP site would reach the accessible environment, all at once, during a catastrophic flood. The Pecos River would be contaminated forever.

In a sentence: The brine that seeps into the WIPP tunnels will corrode the steel canisters, dissolve the radioactive waste, flood the tunnels with contaminated water, rise up the WIPP shafts, flow through fractures in the Rustler aquifers, find its way into karst caverns, carry radionuclides almost unimpeded to the Salt Lake, and contaminate the environment with plutonium when the Salt Lake overflows into the Pecos River.

**Comments on WIPP SEIS -II**
**by Jeff Radford for**
**Business People Concerned About WIPP**

**I. Introductory remarks.** Reflections on 20 years of following WIPP decision-making process. Most disturbing aspects.

1. Failure to draw the logical conclusion for WIPP from DOE's track record at other nuclear facilities;

2. The political, rather than scientific, basis upon which decision regarding WIPP are made, although those decisions are invariably couched in scientific and technical terms; and

1

3. The resistance of a corrupt institutional culture within DOE to well-intentioned reform initiatives such as those by Admiral Watkins and outgoing Energy Secretary Hazel O'Leary.

4. I could easily be accused of refusing to accept reality. If so, I'm in good company today with thousands of other citizens who deplore WIPP and with the DOE-Westinghouse crowd whose aversion to reality is even more remarkable.

2 How can DOE-Westinghouse-Battelle refuse to accept the reality that New Mexico will be contaminated by WIPP when so many other nuclear facilities are contaminated? Does the track record at Hanford, Argonne, Idaho National Engineering Lab, Lawrence Livermore, Los Alamos, Mound, the Nevada Test Site, Oak Ridge, Rocky Flats and Savannah River lead to any other conclusion but that WIPP will also contaminate its surroundings?

2. Statement of BPCAW purpose.

3 3. Knowing the project as I do, I would strongly urge that DOE abandon its proposed action and dismantle WIPP. For reasons that I and others, including prominent scientists who have studied the issues involved, have stated repeatedly in numerous settings such as this, WIPP should have been abandoned years ago. In fact, some of the project's

4 fatal flaws were known from the outset; others, like pressurized brine below the disposal chambers, were revealed as work progressed.



Rather than repeat the WIPP site's problems which have outlined numerous times previously, I would like to make the following points based on my review of the SEIS II:

5 A. I am disturbed by hints in the latest document that WIPP's mission will be expanded to include disposal of commercial and non-defense radioactive waste, as well as more remote-handled waste. I found such hints on pages 7 and 12 of the summary, in remarks such as: "Currently, the commercial and non-defense waste is not permitted."

6 B. I note that a decision will be made in the absence of a facility closure and decommissioning plan. While I deplore that breach, I have been convinced that a decision to proceed with WIPP was irreversibly made in the early 1980s.

7 C. Similarly, the SEIS II refers to recent hydrogeologic investigations that should have been conducted years ago when data derived might have forced DOE to a different conclusion.

8 D. New data, only scantily reported in the SEIS on page 4-15, demonstrates conclusively why WIPP should be abandoned: the proliferation of oil and gas wells in the immediate vicinity. The document notes, as we have known for years, but as reinforced by research done by the N.M. Environmental Evaluation Group (EEG), WIPP lies within "one of the most actively explored" oil and gas regions in the United States. As we all know, from

9 the very beginning of the site selection process for a nuclear waste disposal facility, such intense interest in mineral reserves was supposed to have ruled out developing the facility in this area. It is unconscionable and ultimately damnable that WIPP should be allowed to continue under these circumstances.

10 E. On page 4-34, we are told of the contamination at a federal nuclear experimental site near WIPP from Project Gnome. Interestingly and tellingly, radioactive contamination from the 1961 project was discovered and documented not by the DOE or its predecessors, but by the N.M. EEG in June 1995. I correlated that with a news report just a week ago, when radioactive contamination from Los Alamos National Laboratories was discovered in the Pajarito Plateau aquifer. Again, not discovered by DOE but by a state agency charged with oversight to DOE.

At Los Alamos, just as they have done continuously for WIPP, DOE just couldn't believe that it would contaminate the deep aquifer. According to the report in the December 31, 1996 Albuquerque Journal, "For years, lab environmental scientists have disputed evidence of contamination in the deepest groundwater deposit, the main aquifer that feeds

wells for nearby ranches and towns. Lab scientists had maintained that an imperious shield of rock made of welded volcanic ash, would prevent lab-generated contamination from reaching the main aquifer. [[[ Does that sound familiar to those of you who read the WIPP SEIS? DOE's capacity for denial is further illustrated as the article continues:] "When the lab's deep test wells first turned up contamination, lab scientists argued that testing or sampling errors accounted for the detected pollutants, according to John Parker acting director of the oversight bureau." Parker is then quoted as noting that finally DOE and other involved scientists agree that the deep aquifer really is contaminated. Parker is quoted as explaining, "It was just thought that activities at the lab were never going to impact the precious groundwater resources."

10 That tendency for denial is inherent in DOE's culture. It is thoroughly pervasive. Denial, denial, denial. Whatever problems are uncovered at WIPP, DOE and its associated managers and consultants are incapable of accepting the reality of WIPP's fatal flaws.

We citizens of New Mexico should not have to pay with our health and our lives for DOE's psychological problems. From beginning to end, the DOE's WIPP project has been laced with denial. It didn't matter that WIPP was inside a region of intense mineral interest... It didn't matter that the deep bedded salt was saturated with brine, not bone dry, as originally touted... It didn't matter that highly pressurized brine deposits exist under
11 the waste disposal chambers... It didn't matter that the nation's major potash reserves are right there... It didn't matter one of the largest karst features in the nation lies above WIPP... it didn't matter that oil and gas drilling into the area around WIPP has exceeded all expectations, greatly increasing prospects for disaster. Denial, denial, denial.

3 Perhaps finally reason and justice can be satisfied with one final denial: Deny approval for WIPP.







## Most Pressing Policy Concerns

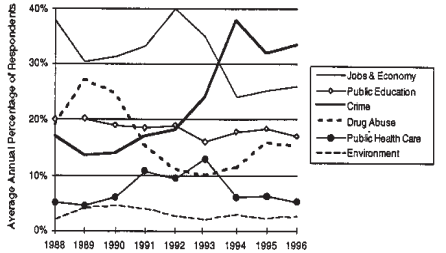
(continued from page 4)

a public health problem, so it may be the same group of citizens who stress these two issues. If so, then one could expect that increased concern about one issue would take away from the priority given to the other.

Crime and the economy also appear to have moved in relation to one another. One or the other has always been most frequently cited as the state's biggest problem, and since 1993 they have been the two most commonly named problems. From 1988 to 1992, the two moved in tandem, dropping in importance in 1989 then rising steadily until 1992. In 1993, though, increasing concern about crime came with decreasing emphasis on the economy until crime replaced the economy as the public's primary concern in 1994.

FIGURE 4

*What New Mexicans Perceive as the Biggest Problem in New Mexico from 1988 to 1996*




Note. These averages are based upon data from all *Quarterly Profile* surveys currently archived.



## Attitudes Toward WIPP

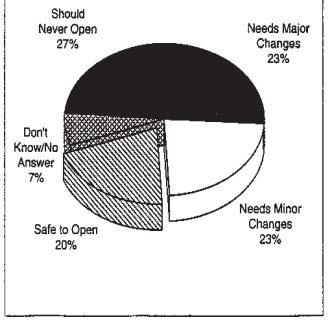
12 Since August 1990, the *Quarterly Profile* has consistently asked New Mexicans about their attitudes toward the Waste Isolation Pilot Plant (WIPP). In this survey, we asked respondents the following question: "There has been much controversy over WIPP, the Waste Isolation Pilot Plant in New Mexico, which is to serve as a permanent storage facility for low and medium level radioactive waste. Which of the following best represents your view? WIPP is (a) unsafe and should never be opened, (b) unsafe but may be made safe with MAJOR changes, (c) only slightly unsafe and can be made safe with MINOR changes; or (d) WIPP is safe to use as it is."

12 The responses to the question were generally similar to those that have been recorded since 1990: only one-in-five New Mexicans said that WIPP was safe to open as-is, 46% said it needs minor or major changes, and 27% said it should never be opened (see Figure 5).

When asked whether they would vote to open WIPP if a referendum were held, 54% said they would vote to keep it closed, 41% would vote to open it, 4% were unsure, and 1% said they would not vote. (Results were similar for both unregistered and registered respondents.) Given that WIPP can not open until it is certified by the Environmental Protection Agency (EPA) and other regulatory bodies, it may be surprising that as many as 41% would vote to open the plant prior to EPA certification. If WIPP is certified as safe to open, will support for WIPP increase? Future editions of the *Quarterly Profile* will follow this issue carefully.

FIGURE 5

*New Mexicans' Views on the Safety of WIPP*



FOCUS 1: GAMBLING IN NEW MEXICO

## Shifting Attitudes Toward Gambling

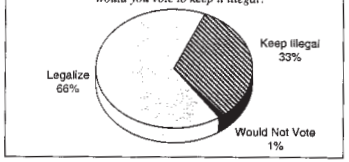
*(continued from page 1)*

Despite their strong opinions, the New Mexico citizens surveyed were divided on whether the issue merits a special session. Respondents were asked, "If you could advise your state legislators, would you urge them to spend state money to hold a special session on the Indian gaming issue, or would you tell them that they should not hold a special session?" Fifty-four percent favored holding a special session, and 46% opposed it.

When asked how they would vote on a referendum to "legalize Indian casino gambling in New Mexico," 66% of respondents said that they would vote in favor of the referendum (see Figure 1). Although we did not ask the same question in 1995, this result appears to signal an increase in support for Indian gaming. In 1995, 49% of New Mexicans supported Indian gaming, 37% opposed it, and 14% were undecided.

FIGURE 1

*"If you could vote on the issue, would you vote to legalize Indian casino gambling in New Mexico, or would you vote to keep it illegal?"*




FOCUS 2: WATER IN THE RIO GRANDE VALLEY

## Introduction

Given the state's ongoing concern about the availability of water, the *Quarterly Profile* asked New Mexicans a series of questions about how they use and view water in the middle Rio Grande Valley. Interviewers defined the valley as "the 170 mile stretch of river that runs from Cochiti Dam down to Elephant Butte Reservoir."

## How People Use the River

Thirty-percent of those surveyed said that they had spent some time along that stretch of river during the past year. Ten percent of all New Mexicans surveyed had visited the river once or twice, 9% had visited between three and five times, and 11% had visited it more than five times. We then asked those who had visited the river how they spent their time there. Figure 2 shows that the highest percentage (42%) said that they were hiking along the river. Between thirty and forty percent also said that they spent time fishing, camping, boating, or engaging in other activities.

FIGURE 2

*Percentage of Middle Rio Grande Valley Visitors Who Engage in Different Activities While on the River*

## How People Think the River Should Be Used

We asked all respondents how they thought the river from Cochiti Dam down to Elephant Butte Reservoir should be used. From a list of uses, Table 3 (on the following page) shows that a plurality of respondents (42%) believed the river's agricultural uses to be most important. Environmental and home-uses were the second most frequently cited important uses of the river, followed by recreation, cultural, and industrial applications of river water.

*(continued on page 3)*

Quarterly Profile
OF NEW MEXICO CITIZENS
A UNM INSTITUTE FOR PUBLIC POLICY SURVEY RESEARCH CENTER REPORT

*Subscriptions:* $30.00/year
Subscription requests and other inquiries:

Carol Brown (505/277-1099)
The University of New Mexico
Institute for Public Policy
Department of Political Science
Albuquerque, New Mexico 87131-1121

*Director:* Hank C. Jenkins-Smith
*Associate Director:* Carol L. Silva
*Administrator:* Carol Brown
*Quarterly Profile*
*Project Managers:* John Gastil and Carol Silva
*Survey Manager:* Hank Jenkins-Smith
*Contributors:* John Gastil
*Production/Layout:* Carol Brown

UNM INSTITUTE FOR PUBLIC POLICY

The Institute for Public Policy serves New Mexicans as a non-partisan forum for research, analysis, data collection and training. The Institute's Survey Research Center conducts surveys and research on the policy preferences and political attitudes of New Mexico citizens. The *Quarterly Profile* is distributed to federal, state, and local New Mexico policy makers, corporate and civic leaders, private organizations, the media and interested citizens.

SURVEY DATA

The UNM Institute for Public Policy conducted its survey of New Mexico citizens through telephone interviews with 1,011 adult New Mexicans August-September of 1996. The telephone numbers were selected randomly by computer. The results of the poll have a three percentage point margin of error at a 95 percent level of confidence, which means that 19 out of 20 times the findings should be within three percentage points of the results that would be obtained if all New Mexico households were surveyed. The margin of error is larger for subgroups of the sample because of the smaller number of observations. As with any survey a potential source of error is the possibility that variation in the wording of questions or the order in which questions are asked could produce different results.



**PERSPECTIVES ON WIPP HYDROLOGY**

David T. Snow, Ph.D., December, 1995

The Technical Exchange meeting of December 5-7, 1995, the first day of which I attended on behalf of CARD, was for DOE's contractors to provide to EPA and its contractors the essence of Non-Salado Hydrology, a major component in the pending licensing process. The Culebra Dolomite is assumed to be the prime conduit for groundwater transport of radionuclides to the accessible environment, escaping the repository via inadvertent intruding boreholes. If the public, not just the scientific community is entitled to confidence in waste disposal at WIPP, that can only be attained if there is unequivocal evidence that such vital processes as Culebra transport have been accurately characterized and adequately modeled in untested regions.

1

If the law gives the EPA authority to rule on DOE's application, or if at that time it is in DOE's sole discretion to store waste, both of those parties should realize that to initiate disposal will require more than agency approval supported by scientific counsel. It will require confidence in the scientific judgements by a grudging lay public, since the courts have similar, probably more rigorous requirements that the science involved be demonstrably credible. When the proponents cannot make rational selections among competing concepts, the public is justifiably distrustful and the courts may scornfully reject the proposal.

2

NEED FOR CONCEPTUAL CONCERT

It was with continuing disappointment that I found at the meeting that only one concept is being applied for flow and one for radionuclide transport; the Culebra is being modeled for transmissibility as a simple continuous porous medium with continuously-varying properties; for transport in performance assessment, it is being modeled inconsistently as horizontal, parralel plain fractures with only diffusion linking fractures to the matrix. These are instructive analogues for understanding the Culebra, but they don't deserve to be viewed as the only models to govern flow and transport. The regulators should ascertain whether or not there are other concepts operating that will be necessary for comprehension and numerical modeling of Culebra behavior. Instead of merely evaluating the concepts offered in the application, there is a need to evaluate the tests and data required to select the most appropriate concepts.

3

NEED FOR MODELING FRACTURED MEDIA

Large areas over and east of WIPP apparently fit a single-porosity (matrix) model with low transmissibility, perhaps because the steep, ubiquitous fractures remain gypsum-filled as barriers in those areas. Dissolution has opened them elsewhere,

4

providing anisotropic fracture permeabilities at least an order of magnitude greater than matrix permeability. A major, but unknown proportion of the fastest path to the accessible environment will cross transitional areas of partial dissolution where rare to common fracture openings exist that can greatly enhance transport rates. Throughout the site, flows are concentrated in any such fractures, thus Sandia's failure to characterize them poses severe limitations on analysis and modeling. Because adequate fracture data could be, but have not been obtained during the 20 years of drilling and testing, comprehensive models for fracture-dominated flow and transport cannot be utilized to interpret tests nor to predict behavior. By default or design, modeling has employed simple continuous media either fracture-free, or with idealized arrays of cubic or parallel fractures. Because traditional "layer-cake" hydrogeology represents aquifers as continuous porous media separated by continuous aquitards or aquicludes, DOE's hydrologists have been reticent in adapting and developing relevant discontinuous fractured-media theory I believe to be clearly essential for the WIPP site, for either three-dimensional groundwater basin circulation or for either leaky or ideally-confined two-dimensional transport along the Culebra dolomite.

NEED FOR MODELING KARST SYSTEMS

A realistic expectation is that basin-margin regions of the Rustler evaporite-clastic sequence possess a variety of karstic features consistent with observations in Nash Draw, extending from that solution-collapse area on the west eastward through all undisclosed transitions to the fully cemented areas east of WIPP. Large-aperture solution channels may transect regions of fracture-dominated dolomite (and perhaps anhydrite) devoid of mineral fillings, and probably to lesser degree also across transitional areas of variable-to-complete residual fracture filling. It may never be feasible to locate or characterize for transport all such widely-spaced solution features, though they can, and probably would dominate potential releases to the environment. But if a concerted effort to characterize the meter-scale fracture system were made, structurally superposed rare dissolution channel features would at least be recognized and conceptualized hydrologically. Then, models of each type realistic of the site can be evaluated according to their relative contributions to transport. Otherwise, the data deficiencies and bias towards continuous porous media will prevent evaluation of relevant fractured and karstic-media models.

NEED TO SELECT, NOT MONTE-CARLO SAMPLE CONCEPTS

Alternative conceptual models compete at various levels within the framework of computations, and in some instances, there have evolved rational means of selecting a single defensible model. When field data are scarce, earth scientists have disaggreements that more often than not block further progress. With respect to



flow and transport, it should be recognized that within the site, different models pertain to different regions, so the applicability of a model possibly appropriate to one region is unsuppportable for another because the physical geometry of the pore systems of neither are defined. Among scientists, such as the august group at the Technical Exchange, a consensus in favor of a single pervasive model throughout would be impossible if field characterization had revealed and tested uniquely different regions. Likewise, a comfortable credibility among informed citizens cannot be built when scientific indecision is evident.

Monte-Carlo sampling is a legitimate tool for generating a functional statistic such as travel-time distribution, from such independent variables as fracture apertures and spacings that also have statistical distributions. But Monte-Carlo sampling does not work among competing conceptual models as it is now being incorrectly applied. Concept sampling merely produces a statistic that is an average of the statistics for each unique concept, and if the statistics differ greatly in magnitudes, the average will be biased. Consequently, Monte-Carlo processing of plural concepts leads to unreliability of derived dependent measures, such as the Complimentary Cumulative Distribution Function. I feel that consensus among scientists has to be attained on a preponderance of issues, rationally defining which model applies to what region, according to its defined process. Likewise, we need to determine what relative contributions are made to the end-result when co-existing models both apply. For instance, continuous matrix-only transport may operate in regions of Culebra Dolomite demonstrably fracture-sealed, while more complex combinations operate in coupled fashion where a distribution of karst channels transects a fractured medium with porous matrix in regions of advanced dissolution. Transitional regions may constitute the majority of the transport path for radionuclides, wherein dispersive heterogeneity and anisotropy can strongly influence transport.

NEED FOR ADDITIONAL FIELD DATA

The currently applied continuous-media modeling in all regions is both cause and consequence of the deficiency of data that should have been collected to fully characterize the fracture system by such parameters as orientation, spacing, extent, aperture and filling, together with stratigraphic variations among parts of the Culebra and its confining units. These data could still be obtained in a program of slant-hole coring and flow testing. For years, DOE has acted as if it is too late to characterize, but history has shown that deadlines are temporary impediments; if the explorations, tests and analyses have not been done correctly, they will have to be done again.

Important parameters of dissolution, including variable percent removal of fillings of different fracture sets and variable dissolution of fractured and vugular bedding-plane horizons can be defined in the course of slant-hole coring and flow testing in various regions. But major karst conduits may not be located nor

characterized adequately by any presently conceivable program. Rather, the presence of karstic channels may be inferred, for example, by the highly-conductive fairway trending northerly from H-11 to DOE-1 and towards H-15, identified from interference testing. It has been factored into T-field derivation as a row of highly-conductive, continuous-media cells. Likewise maps of Culebra fresh-water head preceding shaft sinking (e.g., 1981) and following eventual full recovery of the shaft drainage effects both show irregularities suggesting a sink south of the WIPP withdrawal boundary. Those are features absent from head distributions mapped for either the overlying Magenta Dolomite or the underlying Rustler-Salado contact. Drainage to one or more old oil wells necessarily penetrating all those strata should have influenced more than just the Culebra. A major heterogeneity, such as an undisclosed solution channel snaking along the Culebra interval is suggested. If neither drilling nor geophysics can pinpoint such features for hydraulic testing, it should be carefully considered whether or not transport computations are sufficiently reliable without such characterization, and whether computations can inspire the sort of confidence required for licensing in absence of sufficient characterization.

12

NEED FOR EXCELLENCE, OR TO CUT LOSSES

More than 20 years and up to $10 billion expended to date have not been wholly wasted even if hindsight proves the time and resource allocations to have been poorly optimized for conceptual insight and quantitative definition. It is simply true that geology is never simple enough for callous characterization, and that optimistic investigators oversell their prowess and underestimate the problems. Judging by the litany of shortcomings identified by others as well as the undersigned at the Technical Exchange, I conclude that a license application is currently futile. Even assuming due diligence and ample funding, if the uncertainties inherent to state-of-the-art hydrologic characterization are found upon careful consideration to be so consequential and insurmountable as to be fatal, a budget-conscious Congress should perhaps consider project postponement in favor of alternative storage schemes that would buy time for technological improvements elsewhere. Otherwise, broad funding for prolonged study across a variety of fields will be needed, to include such areas as geology, hydrology, contaminant transport, chemical sorption, seals design and engineered barriers, to mention a few. The conceptual uncertainties must be minimized by focussed testing and field data collection, if a safe project is ever to be completed.

13

14



May 31, 9?

Dear Sirs:

My family and I strongly oppose the opening of the Wipp site for the disposal of Nuclear Waste. We particularly oppose the proposed granting of a variance to the D.O.E. for the disposal of hazardous waste.

1

2

There is no scientific evidence that Nuclear waste can be safely stored at the Wipp site or that the transportation of Hazardous waste can be executed, without serious shipping accidents. An on site accident release of even 1% radiation would cause a tremendous potential for acute hazard to our local economics, environmental air quality and to the health of babies, children and adults. The unborn fetus is at exceptional risk.

1

3

There has been little or no thought given to the training of local policemen, firemen and hospitals in the event that an accident should occur in the transport of Nuclear Waste not to the extremely specialized equipment that would be required to handle people who are contaminated. Very little study has been made concerning the fact that ~~that~~ most emergency response personel will not have the skill or equipment to clean up a nuclear accident. Once a spill has occurred the surrounding area would become radio-active over a wide area. local people and all life would become poisoned. The destruction of the natural resources would gradually take place. Our much loved land in parts of New Mexico would face desertion.

4

5

6 Many exceptional people have chosen to live in New Mexico because of its pure air, blue skies, clear water and beautiful landscapes. All of this natural beauty and healthful lifestyle is never threatened by the Wipp Project.

Very Sincerely,

Mansi Kern



sahci Consultants to Nuclear Medicine • Radiology • Nuclear Industry

STAN A. HUBER CONSULTANTS, INC. □ 200 NORTH CEDAR ROAD □ NEW LENOX, IL 60451 □ (815) 485-6161 □ FAX (815) 485-4433

March 10, 1997

Harold Johnson
NEPA Document Manager
Attn: SEIS Comments
P.O. Box 9800
Albuquerque, NM 87119

RE: Comments on TRUPACT Shipments and Disposal

Dear Mr. Johnson:

Stan A. Huber Consultants, Inc. (SAHCI) has been in discussions with Mike Brown, Westinghouse/DOE, since February of 1995, regarding shipment opportunities. SAHCI proposed using 55 gallon shielded containers. These containers are constructed with Depleted Uranium (DU) and Concrete. The TRUPACT was made for these size containers.

1 The material used to build the containers is recycled-contaminated material. The cost of this material is inexpensive, therefore, the containers would be inexpensive. We estimated approximately $300 per container. This inexpensive container was, and should be, attractive to Westinghouse and the DOE. Savings as high as $3700 per container would be reached. Mike Brown estimated that approximately 200,000 containers would be needed. This would be a large savings for the U.S. DOE. In return, the taxpayers of the United States would save a large amount of money.

In December of 1996, SAHCI received 300 yards$^3$ of DU contaminated sand. This sand was intended to be the "shielding" ingredient for the shielded containers. Early January of 1997, Mike Brown informed us that a committee at the WIPP Facility had decided that WIPP would not accept DU Shielded Containers due to "possible " safety concerns.

DUCRETE has been tested for approximately 10 years. It was proven to be a safe product. The DU that we use has been fired as ammunition, transported in buckets, and placed in the direct environment for the past 17 years. If the DU was water soluble or pyrophoric, those reactions would have already happened.

2 Mike Brown informed us, verbally, that the DU would not be accepted because it may be soluble in water. If this is a concern at WIPP, then a greater concern should be the actual salt walls dissolving, and the whole WIPP facility would also be unsafe for TRU waste.

SAHCI has spent a lot of time and effort on these containers, and would appreciate a written response explaining why our containers would not be considered. As stated in the second paragraph, these containers would be a great opportunity for the United States Department of Energy to save taxpayers money.

Thank you for your time.

Sincerely,
Stan A. Huber Consultants, Inc.

Steven M Herman
Nuclear Consultant



7/13/97

Dear Environmental Protection Agency and Department Of Energy:

1 I am greatly concerned that our government is forging ahead with plans to open WIPP. I must admit that while I used to have considerable trust in the wisdom of our leaders and their concerns for the public's well being, their track record has consistently eroded that trust until now it is sadly quite abated. My comments will provide specific concerns about WIPP as the issue at hand but I will also provide some comments on more general issues as well. I hope you will pardon my seeming digression. It is vital, I believe, to consider the economic, social, and political contexts of specific issues such as WIPP. It is these contexts which so often provide the effective underlying factors that really determine the outcome of such deliberations.

2 Continued proliferation of nuclear waste is unconscionable. It threatens all in its proximity for tens and even hundreds of thousands of years. With such a long half-life, proximity is enlarged considerably to what extent not now possible to foresee. After the cold war has ended there are no cogent and compelling reasons for continuing the production of plutonium and nuclear weapons except economically driven political ones. Responsible leadership would not bend to inflict such potentially deleterious ecological consequences upon people and the environment that it is charged to protect. But alas we are living at such times that our leaders are beholden to the corporate interests of avarice who fund their elections. The welfare of the public is too often relegated to sound-bite public relations pronouncements while the onslaught of degradation marches on. I would

think that our decision makers would consider the legacy of their decisions to their children. However, their myopic vision must cause them to believe that their progeny will be immune to any such problems because they are accustomed to living so far away from the poorer sections which have always born the brunt of such decisions.

According to my research, a full 60% of the waste destined for WIPP has not yet been produced. Los Alamos has been chosen to take 3 over the work of a very Rocky Flats, Colorado which had to be closed due to the ecological damage inflicted upon its environs due to its lethal job. Los Alamos will or already has begun producing nuclear trigger pitts essential to the manufacture of nuclear bombs. This 4 will account for much, I suspect, of the not yet manufactured plutonium waste destined for WIPP, unless it is slated for a storage facility taking higher level radioactivity elsewhere. There is a plan for 38,000 shipments totalling 50 tons or 100,000 pounds of plutonium to be shipped from a reaking Rocky Flats. I find it exceedingly frustrating that our nation, which prides itself on its moral rectitude, continues churning out such potentially lethal and long lasting dosages of death, especially at a time when the "evil empire" has crumbled. The peace dividend from a vanquished 50 year foe never materialized. The Defense Department budget continues its ascent to the heavens.

I will now provide specific objections to storing radioactive waste at the proposed WIPP facility. We must not forget that this trash, unlike most, will be deadly for hundreds of thousands of years:

1) The site is wet. When chosen in 1974, geologic tests were not 5 performed. What were originally thought to be dry salt beds have been



found to be seeping water. Since then, the site has been inundated with water that shows no signs of stopping. The nuclear waste is to be stored in metal barrels that can be intruded upon by the rust 5 inducing brine which is created by the salt and water. Resulting leakage from rusted barrels would find its way into the nearby Nash Draw and Pecos River considerably before much of the half-life breakdown had rendered the slurry safe. Its name Waste Isolation Pilot Project is a misnomer because the waste would not be isolated but introduced sooner or later to its vulnerable environs.

2) Pressurized brine beneath the proposed repository can errupt to 6 the surface, carrying nuclear waste with it, contaminating everything it contacts.

3) Bore holes have been dug through ground water aquifers at the 7 site. These aquifers will become contaminated quickly after the brine errodes the barrels releasing radioactive slurry.

4) Potential human error and intrusions on the site have been 8 downplayed and are considerable risk factors should WIPP begin accepting nuclear waste.

The Departments of Energy and Defense have done little to erase their public images, taking many years to create, of being callous and oft irresponsible government entities. Often during the cold war, the 9 slogan of "national security interest" was used to obfuscate lethal enterprises such as experiments subjecting radioactivity to dark skinned Americans, or nuclear bomb tests in Nevada with American soldiers watching in nearby unprotected bunkers. Recent and nearby problems in the nuclear industry include Sandia Labs which "suspended

work on its nuclear research center and three nearby facilities as a precaution two months after a reactor malfunctioned and automatically shut down...Management was not told of the problem for 10 days, officials said." (USA today 2/6/97). The Los Alamos Labs were recently fined $100,000 in response to a suit filed by Concerned Citizens for Nuclear Safety (CCNS), a New Mexico based citizen's group, which identified problems in LANL's operation. When will our leaders have the courage and fortitude to stand up to the corporate behemoths who are driving such potential ecological disasters such as the proposed WIPP site. As long as political office is paid for by these corporate interests, the type of person who might so stand-tall is self deflected from even trying with such a beholdent price for office. 9

I work at a rural health clinic that is on the WIPP route, New Mexico route 285 on the Taos side, near where Taos and Rio Arriba Counties meet. I fear that if an accident in transporting nuclear waste were to occur on Rt. 285, my agency, which does excellent work providing health care to the residents of our area, would be totally ill equipped to deal with it. The irradiation of people, livestock, and waterways that could occur would be devastating. 10

New Mexico is a poor and sparsely populated state. Much like a third world country in the midst of The United States. Large Native American and Hispanic populations and one of the poorest per capita incomes in the nation make it a seeemingly easy target for the nation's nuclear trash. The time has come for abuses to poor people by the rich who live far away comes to a close. The WIPP issue is one amongst many where ecological degradation and human suffering is foisted upon people without the resources to defend themselves. Our 11



inexhaustible resources that it once was erroneously believed to contain at an earlier and less earth ravaged stage of our history. The attitude that continues to amass weapons of mass destruction and places the lethal leftovers of that manufacturing process in an ill suited WIPP site must change. We must learn from our Native American brothers and sisters how to lovingly husband the bounty that is the earth. This necessary and reformed relationship with earth will also kindle a re-awakening of sacredness and love in our hearts which has been shrunken in the grasp of a fear based avarice.

Someday we will heal and create a world worthy of our children's trust. Until then we warp them into a basic misstrust, like we have been, to accomodate to a deceitful and fear driven mercenary existence. But we may no longer have much time. With the amount of destructive and pollutive power proliferating right now, we must heal quickly or it may be soon too late to turn the situation around.

Please respond to my specific numbered objections and send me a copy of the EIS addendum for WIPP. Thank you for this opportunity to communicate with you about this very important issue to the lives and quality of life of the citizens of New Mexico. I ask that you consider my comments with a mind not closed by the expedient and preformed conclusions of your job assignment. I realize that the last statement is based in my jaded expectations. These were formed from over 25 years of seeing how our government functions. Please prove me wrong and stop WIPP. It is the right thing to do. We are really all in this together. 12 13

Sincerely,

Elliott H. Libman, MSW

P.O. Box 630

El Prado, New Mexico 87529

(505) 751-2145



EEG-64

**REVIEW OF THE DRAFT SUPPLEMENT TO THE WIPP ENVIRONMENTAL IMPACT STATEMENT DOE/EIS-0026-S-2**

Robert H. Neill
James K. Channell
Peter Spiegler
Lokesh Chaturvedi

Environmental Evaluation Group
New Mexico

April 1997

EEG-64
DOE/AL58309-64

# REVIEW OF THE DRAFT SUPPLEMENT TO THE WIPP ENVIRONMENTAL IMPACT STATEMENT DOE/EIS-0026-S-2

Robert H. Neill
James K. Channell
Peter Spiegler
Lokesh Chaturvedi

Environmental Evaluation Group
7007 Wyoming Boulevard NE, Suite F-2
Albuquerque, New Mexico 87109

and

P.O. Box 3149, 505 North Main Street
Carlsbad, NM 88221

April 1997



## FOREWORD

The purpose of the New Mexico Environmental Evaluation Group (EEG) is to conduct an independent technical evaluation of the Waste Isolation Pilot Plant (WIPP) Project to ensure the protection of the public health and safety and the environment. The WIPP Project, located in southeastern New Mexico, is being constructed as a repository for the disposal of transuranic (TRU) radioactive wastes generated by the national defense programs. The EEG was established in 1978 with funds provided by the U.S. Department of Energy (DOE) to the State of New Mexico. Public Law 100-456, the National Defense Authorization Act, Fiscal Year 1989, Section 1433, assigned EEG to the New Mexico Institute of Mining and Technology and continued the original contract DE-AC04-79AL10752 through DOE contract DE-AC04-89AL58309. The National Defense Authorization Act for Fiscal Year 1994, Public Law 103-160, continues the authorization.

EEG performs independent technical analyses of the suitability of the proposed site; the design of the repository, its planned operation, and its long-term integrity; suitability and safety of the transportation systems; suitability of the Waste Acceptance Criteria and the generator sites' compliance with them; and related subjects. These analyses include assessments of reports issued by the DOE and its contractors, other federal agencies and organizations, as they relate to the potential health, safety and environmental impacts from WIPP. Another important function of EEG is the independent environmental monitoring of background radioactivity in air, water, and soil, both on-site and off-site.

Robert H. Neill
Director

**EEG STAFF**

Sally C. Ballard, B.S., Laboratory Scientist
William T. Bartlett, Ph.D., Health Physicist
Radene Bradley, Secretary III
James K. Channell, Ph.D., Environmental Engineer/Health Physicist
Lokesh Chaturvedi, Ph.D., Deputy Director & Engineering Geologist
Thomas M. Clemo, Ph. D., Senior Scientist
Patricia D. Fairchild, Secretary III
Donald H. Gray, M.A., Environmental Specialist
Jim W. Kenney, M.S., Environmental Scientist/Supervisor
Lanny King, Assistant Environmental Technician
Betsy J. Kraus, M.S., Technical Editor/Librarian
Robert H. Neill, M.S., Director
Dale Rucker, M.S., Engineer/Computer Modeler
Jill Shortencarier, Administrative Secretary
Matthew K. Silva, Ph.D., Chemical Engineer
Susan Stokum, Administrative Secretary
Ben A. Walker, B.A., Quality Assurance Specialist
Brenda J. West, B.A., Administrative Officer





**ACKNOWLEDGMENTS**

We acknowledge the technical contributions of the following EEG and former EEG staff to this review: William T. Bartlett, Thomas M. Clemo, William W.-L. Lee, and Matthew K. Silva.

The editorial support of Betsy J. Kraus and the secretarial support of Patricia D. Fairchild, Jill Shortencarier, and Radene Bradley contributed substantially to the quality and timeliness of this report.

TABLE OF CONTENTS


FOREWORD . . . . . iii

EEG STAFF . . . . . iv

ACKNOWLEDGEMENTS . . . . . v

OUTSTANDING CONCERNS . . . . . 1

SUMMARY . . . . . 5

GLOSSARY . . . . . 9

ACRONMYNS . . . . . 11

SUMMARY CHAPTER . . . . . 12

CHAPTER 1 . . . . . 19

CHAPTER 2 . . . . . 21

CHAPTER 3 . . . . . 24

CHAPTER 4 . . . . . 31

CHAPTER 5 . . . . . 37

CHAPTER 6 . . . . . 49

LIST OF ACRONYMS . . . . . 50

APPENDIX A WASTE INVENTORY . . . . . A-1

APPENDIX B SUMMARY OF WM PEIS AND ITS USE IN DETERMINING HUMAN HEALTH IMPACTS . . . . . B-1

APPENDIX C AIR QUALITY . . . . . C-1

APPENDIX D LIFE-CYCLE COSTS AND ECONOMIC IMPACTS . . . D-1

APPENDIX E TRANSPORTATION . . . . . E-1

APPENDIX F HUMAN HEALTH . . . . . F-1

APPENDIX G FACILITY ACCIDENTS . . . . . G-1

APPENDIX H LONG-TERM CONSEQUENCE ANALYSIS FOR PROPOSED ACTION AND ACTION ALTERNATIVES . H-1

APPENDIX I LONG-TERM CONSEQUENCES OF NO ACTION ALTERNATIVE 2 . . . . . I-1

LIST OF EEG REPORTS . . . . . RL-1

**LIST OF TABLES**

Table 1. EEG Summary of Expected and Possible Deaths Listed in SEIS-II. . . . . 17

Table 2. EEG Comparison of SEIS-II and SAR WIPP Accident Consequences . . . . . 40

Table 3. EEG Comparison of Accident Scenario Frequencies in SEIS-II and 1996 SAR . . . . . 41

Table A-1 EEG Comparison of Inventories Used in Different DOE Documents . . . . . A-5

**LIST OF FIGURES**

Figure 1. Proven and Probable Hydrocarbon Reserves for Brushy Canyon. . 32

Figure 2. Formation production . . . . . 32

Figure 3. Interest in resources near WIPP . . . . . 33

Figure 4. Estimated areal extent of potash reserves. . . . . 34

Figure 5. Actual growth of oil production. . . . . 34

Figure 6. Solution mining of the Salado Formation. . . . . 35

Figure 7. Postulated correlation between oil field salt water injection and water level rises . . . . . 36





**OUTSTANDING CONCERNS**

EEG has published reviews of the previous DOE Environmental Impact Statements (EIS) on WIPP including:

EEG-3 *Radiological Health Review of the Draft Environmental Impact Statement (DOE/EIS-0026-D) Waste Isolation Pilot Plant, U.S. Department of Energy*, August 1979

EEG-10 *Radiological Health Review of the Final Environmental Impact Statement (DOE/EIS-0026) Waste Isolation Pilot Plant, U.S. Department of Energy*, January 1981

EEG-41 *Review of the Draft Supplement Environmental Impact Statement, DOE Waste Isolation Pilot Plant*, July 1989.

Written comments also were provided to DOE on the Final 1990 Supplement to the EIS on WIPP in April 1990. The 1996 Draft Supplement to the EIS (SEIS-II), DOE/EIS-0026-S-2, was received on November 25, 1996, and this review contains our analysis of that document. The 90 day deadline for comments established by DOE was not adequate to do a thorough job since it was necessary to also review the final DOE Compliance Certification Application (CCA) as well as the Safety Analysis Report (SAR) in the same time frame.

**Our principal concerns are as follows**

- The long-term disposal impact of the Proposed Action is being addressed in much more detail through the DOE Compliance Certification Application (CCA) which provides one year for review. Evaluating alternatives to the Proposed Action outlined in the SEIS cannot be meaningfully addressed in sufficient detail in 90 days.

- Chapter 6 lists all regulatory agencies and the status of permits for WIPP. One regulatory agency is notably absent. It is DOE. The Department has the legal authority to self regulate operational activities at WIPP. The status of WIPP's compliance with DOE Orders or even a list of DOE Orders is conspicuously absent. Indeed, DOE has the authority to self-approve the Draft Supplement to the EIS but fails to describe the internal system to be used. As an example, the DOE long-term disposal calculations in the SEIS are approved by DOE and in the CCA by EPA.

- Parameters and analyses differ in the various DOE WIPP documents such as the SEIS-II, the Compliance Certification Application (CCA) and the Safety Analysis Report (SAR).

- The alternatives are not reasonably viable. As DOE notes, alternative #1 and alternative #3 are in violation of the WIPP Land Withdrawal Act. Alternative #2 exceeds the limits of RH-TRU in the NM/DOE C&C Agreement. The problems of underground stability in leaving the repository open for 150 to 190 years (which would also require new shafts and surface facilities) are not addressed. It would make more sense to complete WIPP and then propose a second repository, tailored to the unique needs of RH-TRU waste emplacement including limits on thermal loading and criticality. The SEIS should address this alternative.

- The alternatives include almost doubling the authorized waste volume, bringing non-defense TRU waste and commercial TRU waste. Increasing the curie inventory would increase the amount of transuranics allowed to be released.

- While several EEG documents are cited, there are a number of relevant EEG publications that the SEIS-II authors have not cited that are directly relevant to the environmental impact of WIPP.

- The text indicates that DOE has a need to dispose of all TRU wastes and does not consistently recognize that only defense TRU wastes can be disposed at WIPP according





to law. Transuranic wastes generated by non-defense activities or civilian nuclear activities of the Department are not eligible for disposal at WIPP. (This point is recognized later by DOE on page 5-7, lines 5 and 6). To avoid confusion, non-authorized waste issues should be clearly identified.

- The document acknowledges that the expected quantity of RH-TRU waste of 35,000 $m^3$ far exceeds the WIPP design capacity of 7,080 $m^3$. But the Basic Inventory Table for the Proposed Action shows 35,000 $m^3$ and the Draft PEIS shows all TRU waste as coming to WIPP. Since RH-TRU waste is not scheduled for shipment for several years, the effective capacity for RH-TRU will only be about 4,300 $m^3$ with the present design. SEIS-II makes no mention of the need to modify the waste emplacement design in order to accommodate 7,080 $m^3$ of RH-TRU. Again, footnotes indicate that only the authorized amounts would be disposed at WIPP but it is needlessly confusing.

- EEG is pleased that DOE is seriously considering treatment of radioactive wastes. For years EEG has noted that waste is respirable, soluble and confined by a carbon steel Type A drum. The 20 year longevity requirement for the drum has been deleted by DOE from the WAC as has the 1% limit on respirable particles. In contrast, certain low level wastes are required by NRC to have a 300 year design life for the waste container or the waste form. We believe that modifying the waste form through thermal treatment and shredding and grouting should be vigorously pursued to accommodate the anticipated volume of TRU waste which is twice the capacity of WIPP.

- The inhalation risks to people on the surface from future human intrusion were deemed inconsequential and not calculated in the SEIS-II despite earlier work by both EEG (EEG-11) in January 1982 and DOE (TME 3151) in July 1982 that concluded inhalation is a significant concern.

- Unwarranted claims of conservatism for long-term performance calculations are made in the SEIS-II.

- EEG compared the results of the routine and accidental risks from truck transportation to WIPP with findings in EEG-46 ("Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) Wastes to WIPP Along Selected Highway Routes in New Mexico Using RADTRAN IV," Anthony F. Gallegos and James K. Channell, EEG-46, August 1990). Agreement was quite close when allowance was made for differences in miles traveled and other assumptions. Therefore we believe the assessment of transportation risks in SEIS-II is reasonable and adequately conservative.

- For over 20 years, the Department's policy has been to dispose of defense transuranic waste at WIPP rather than leave it at the generator sites indefinitely. The August 1995 DOE Draft Waste Management Programmatic Environmental Impact Statement provides calculations that indicate leaving the waste at the generating sites indefinitely rather than disposal at WIPP would result in fewer cancer fatalities, a smaller collective radiation dose, and a cheaper cost. The SEIS-II needs to explain the reasons why technical objections have not been raised by CAO on these 8/95 DOE conclusions. It is important for credibility that a detailed analysis of the basis of these diametrically opposed conclusions be provided. (SEIS-II, page 3-46 and PEIS, page 8-86).

- Calculations of the long-term consequences should use the analyses submitted in the EPA Application. SEIS-II used methods and data in the Draft Application. EEG had extensive comments on the draft and published them in EEG-61.





**SUMMARY**

EEG's review of the WIPP Disposal Phase Draft Supplemental Environmental Impact Statement (SEIS-II) concentrated on the radiological aspects of the Proposed Action, including transportation. The alternatives were reviewed in less detail. Some calculations were checked, mostly for the Proposed Action. Because of time constraints, there was little review of Hazardous Chemicals, Economics, or other Environmental Assessments.

SEIS-II was written as a pre-decision document with the Alternatives all plausible and eligible to be selected. Also, the inventory of TRU waste for disposal went well beyond that portion of TRU waste that has been historically considered to be the WIPP inventory. This broadened scope is probably appropriate for an EIS but it is confusing to the reviewer who is aware of the statutory limits of wastes that are allowed to come to WIPP at the present time. EEG has attempted to keep the broadened scope of SEIS-II in mind during our review.

A number of calculations, logic, and perhaps typographical errors were found and are pointed out in the detailed comments. Also, omissions that we believe should be included are mentioned. The more important issues are discussed below.

**Alternatives**

EEG is bothered by the choice of Alternatives considered. Compared to the Proposed Action, they deal with larger volumes of TRU waste, continue over a much longer period of time and have been evaluated in a more preliminary manner. There is a question of whether these were intended to be viable options. Certainly there is a need for real options to dispose of TRU wastes not included in the WIPP statutory limits.

EEG recommends that short-term, partial solution options be included in the Final SEIS-II and be considered in the Record of Decision (ROD).

**Related Documents**

SEIS-II recognizes and refers to other important WIPP related documents such as the Compliance Certification Application (CCA), Baseline Inventory Report (BIR - Revisions 2 and 3), and the Safety Analysis Report (SAR). However, SEIS-II, which was published after the CCA and the latest SAR, does not incorporate the latest information or use the same methodology as these documents. The use of different methodology and results in DOE documents published around the same time is inconsistent, confusing and unnecessary. EEG recommends that the Final SEIS-II use methodologies and results from the CCA and the latest SAR because these documents contain more detailed and peer reviewed analyses.

**Transportation**

EEG checked the transportation calculations in Appendix E and compared these results to those contained in EEG-46. It is concluded that the assessment of transportation risks in SEIS-II is reasonable and adequately conservative.

Analyses in SEIS-II indicated potential advantages to using rail rather than truck transportation for wastes. The rail analyses were not as rigorous as those for truck transportation. However, the findings were consistent with analyses in the FEIS, SEIS-I, and other documents. There appears to have been no serious re-evaluation of WIPP's "truck only" policy in the approximately 12 years since it was established. EEG believes that DOE should take this opportunity to seriously re-evaluate the merits of a "truck/rail mix" or a "maximum rail" policy for WIPP wastes.

**Questionable Assumptions**

There are a number of questionable assumptions, omissions, or errors in SEIS-II. These are mentioned in the page-by-page comments. The more important ones are given below. The page location in SEIS-II is given in parenthesis.

Human Intrusion at 100 years. The assumption is made that drilling into the repository 100 years after repository closure would lead to maximum consequences. This determination cannot





yet be made. Increased releases from higher pressures in the repository after 100 years may more than offset radionuclide reductions due to radioactive decay. (page 5-45).

Use of 75th Percentile Values. It is argued that the use of 75th percentile parameter values in modeling of long-term releases due to human intrusion will yield consequences that fall in the "upper tail of a full probabilistic analysis." In the actual analysis SEIS-II used median values for most of these parameters and came up with values of radionuclide releases to the surface that were identical to those with median values (Table H-24). We conclude that these are not upper tail releases. (page 5-40).

Family Farm Scenario and Inhalation Doses. The decision was made in SEIS-II that a family farm scenario with inhalation doses from resuspended drilling mud pit material was inappropriate. This is directly contrary with conclusions in SEIS-I as well as EEG and Westinghouse reports. (page 5-41).

Modification of BRAGFLO Volumes. The z distance in a two-dimensional grid was increased by factors of approximately 8 (see Table H-8) in order to accommodate the larger waste volumes in Action Alternatives 1, 2, and 3. This violates the two-dimensional assumption of the BRAGFLO grid. A three-dimensional analysis may be needed to give reliable results. Table H-8 is confusing.

Emplacement of RH-TRU Wastes. Values are given for the volumes of CH-TRU and (especially) RH-TRU wastes that will have to be put into Panels 9 and 10 in order to meet design capacity for the Proposed Action. There is no indication of whether such an increase is possible. (page 3-12).

Conversion Error. Numerous Figures in the Summary Chapter, Chapter 5, and appendix H show the wrong conversion factor from $Ci/m^3$ to pCi/l. The correct conversion factor is 1 $pCi/l = 10^{-9}$ $Ci/m^3$. There is uncertainty about which value is used in the plots and this is potentially important. (pages S-51 and 5-43).

**RH-TRU Cask**. The statement is made that "The Department is currently awaiting NRC certification of the RH-72B cask. DOE had not submitted an application to NRC for certification of the RH-72B cask at the time the SEIS-II was published.





GLOSSARY

**Page GL. Line 1.**
The definition of backfill as "materials placed in storage panels or drifts" is too ambiguous. CH-TRU waste and RH-TRU waste as well as the drums and containers are placed in storage panels, but they do not qualify as backfill.

**Page GL-2. Line 4.**
The definition of background radiation does not include global fallout as it exists in the environment. Global fallout is considered to be man made radiation.

**Page GL-2. Line 12.**
The glossary should include a definition for the Becquerel since it includes a definition for the curie.

**Page GL-3. Lines 28-32.**
The definition of contact-handled transuranic waste should start with the term "TRU waste" instead of the word "waste".

**Page GL-3. Line 13.**
The spelling of sievert is incorrect. Also, the sievert is abbreviated as Sv.

**Page GL-5.** The definition of disposal should use the definition in the WIPP Land Withdrawal Act.

**Page GL-5.** The definition of disposal phase should use the definition in the WIPP Land Withdrawal Act.

**Page GL-5. Lines 33-36.**
The definition of absorbed dose should also include the mks unit known as the gray and abbreviated as Gy.

**Page GL-5. Lines 37 through 39.**
The definition of dose conversion factor should use "resultant dose equivalent" instead of "resultant radiation dose."

**Page GL-9. Lines 4 through 7.**
The definition of high-level waste should include unreprocessed spent fuel.

**Page GL-9. Lines 22 through 26.**
The definition of the phrase "immediately dangerous to health" only includes" maximum airborne concentration". The phrase also applies to a dose rate, e.g. 1,000 rem/hour.

**Page GL-14. Lines 16 through 20.**
The definition of remote-handled transuranic waste should start with the term "TRU waste" instead of the word "waste". Also, while the radiation level at the outer surface of the container is less than 1,000 rem/hour, there is a volume limit of 12,500 cu ft for wastes that have radiation doses that are greater than 100 rem/hr at the outer surface.

**Page GL-18. Lines 1 through 4.**
The definition of WIPP should be changed. WIPP is no longer an experimental facility.





**ACRONYMS**

**Page AC-1. Line 19.**
Only BIR-2 is defined. BIR-3 should also be defined since it is described on page 1-8.

**Page AC-1. Line 42.**
The AC-section has an acronym for design-basis earthquake, but it does not have an acronym for design-basis criteria.

**Page AC-3. Line 46.**
PA stands for Performance Assessment. The acronym for Preliminary Performance Assessment would be PPA.

**Page AC-4. Line 15.**
At present the RH-72B cask is only a proposed RH-TRU shipping container. The design was not submitted by the DOE to the NRC until 12/96.

**Page AC-4. Line 33.**
The definition of SWIFT-II should indicate that it is computer software.

**Page MC-2. Table MC-1.**
The table should include other conversion factors such as a conversion factor from Psi to Pa and conversion factors from darcy to other units of permeability.

SUMMARY CHAPTER

**Page S-1. Lines 40 and 41.**

The statement "DOE subsequently decided to perform the tests in aboveground laboratories instead of at WIPP" is misleading. Most of the tests planned for the test phase (e.g. the alcove tests, which comprised the majority of the wastes in the experiments) are not being performed anywhere.

**Page S-2. First Full Paragraph.**

The relation of SEIS-II to the Draft WM PEIS is described in this paragraph. DOE apparently believes they need to follow the approach of the WM PEIS and also to consider the disposal of all DOE TRU wastes. This goes beyond the portion of the defense TRU wastes that has historically been considered for disposal at WIPP and includes commercial TRU as well as non-defense TRU. The desire of DOE to consider the universe of TRU waste is understandable and it could probably be argued that NEPA requires it. But it is confusing to the reader who is aware of the statutory limits of wastes that are allowed to come to WIPP at the present time. Also, additional wastes and alternatives have not been evaluated in the detail that the Proposed Action has been. It is realized that a Draft EIS is supposed to be written as a pre-decisional document.

**Page S-3. Related Documents.**

The major planning and compliance documents that are integrated with SEIS-II that are related to decisions on WIPP are listed and described briefly. A generic comment is that the contents of SEIS-II are not current with the latest DOE documents that were issued before the SEIS (e.g. the CCA and Baseline Inventory Report, Revision 3). Also, SEIS-II developed its own assumptions and methodology rather than using that developed in other official WIPP Project documents (e.g. WIPP Operational Accident modeling was different than that in the Safety Analysis Report). These differences are confusing and unnecessary.





**Page S-4. Comprehensive Disposal Recommendations.**

The Comprehensive Disposal Recommendations (in preparation, schedule uncertain) document will recommend "disposal options and the time tables for all TRU waste under DOE control." It is unclear how the ROD that is expected with the Final SEIS-II will relate to the Comprehensive Disposal Recommendations. Are these expected before Final SEIS-II? If not, wouldn't the ROD be preempting the Recommendations? Or, is SEIS-II the first step in preparing for the disposition of all TRU wastes under DOE control at WIPP?

**Page S-4. List of DOE Decisions.**

Although this is mentioned later, it would be helpful to mention here those potential decisions which could be made under current WIPP Authorization and those which would require new Congressional Authorization.

Extensive comments are made later on the truck vs. rail issue. It is hoped that this decision is open and will be seriously re-evaluated.

**Page S-9. Emplacement Volumes.**

The text and various tables give different values for emplaced volumes of waste in No Action Alternative 2. Table S-3 says 135,000 $m^3$ CH, 35,000 RH (32,000 being treated). Figures S-2 and S-3 show 143,000 $m^3$ CH-TRU and 50,000 $m^3$ RH-TRU (both post-treatment). The text (page S-16) says 170,000 $m^3$ total. Table 3-16 and the text (on page 3-42) say 135,000 $m^3$ CH and 35,000 $m^3$ RH. It is unclear what becomes of the additional 15,000 $m^3$ of RH-TRU in NAA 2 (which is included in the Proposed Action as excess RH-TRU). This is confusing and needs to be clarified.

**Page S-13. Lines 19-20.**

The berm is to be constructed around the perimeter of the waste panel footprint (not of the Site).

**Pages S-13 to S-19. Alternative Actions.**

A general conclusion on the alternatives evaluated is that they are so different from the proposed action as to stretch credibility. The entire TRU waste universe is included. Implementation times of 150-190 years that use present-day technology are mind boggling and there is no indication that the SEIS-II analysis has seriously considered the problem of keeping the underground, shaft, and surface facilities at WIPP open until the latter half of the 22th Century. Nor have the institutional problems that might occur over such long time periods been mentioned.

Three of the Alternatives not considered (deep borehole disposal, greater confinement, and geologic repositories at sites other than WIPP) appear to be as reasonable as the ones chosen.

The concept of making piece meal decisions on solving the TRU waste disposal problem is as reasonable as the Alternatives listed here. For example: (1) make the decision of how to dispose of those wastes that are authorized to come to WIPP; (2) then evaluate how all or a portion of the remaining TRU wastes will be disposed of. It may be better to evaluate these remaining wastes in more than one category (e.g., RH-TRU as one category and buried waste as another).

**Page S-14. Text Box.**

See comments on this text box (Conservatism of TRU Waste Inventory Estimate) under page 3-6.

**Page S-16.**

It is noted that No Action Alternative 1, which would have thermally treated wastes, provides for overpacking of waste at 20-year intervals. No Action Alternative 2, which does not have treated wastes, has no plans for repackaging. This is an example of how the alternatives provide different levels of assurance that must be kept in mind when making decisions between alternatives.





**Page S-23. Sixth Paragraph.**

The value of 0.3 LCF reported for the population dose around the Hanford Site is incorrect. The Hanford Site Environmental Report for Calendar Year 1994 (PNL 10574) reports a total dose of 0.6 person-rem to the population of 380,000 persons. This would be $3 \times 10^{-4}$ LCF. The values for INEL and NTS also seem to be too high but have not been checked.

**Page S-29.**

See comments on this text box (Long Disposal Periods and SEIS-II Results) under page 5-49.

**Page S-32. Noise.**

It would be useful to state the normal non-WIPP truck traffic through Carlsbad as a comparison to the relative noise effect of WIPP traffic.

**Page 5-33. Socioeconomics.**

The life-cycle cost analyses for Action Alternatives 1, 2, and 3 apparently does not include the cost of exhuming the CH-TRU waste disposed of before 1970.

**Page S-34. Table S-5.**

It is surprising that No Action Alternative 2 (NAA2) waste treatment costs are only 16% of those for the proposed Action. There is no itemized waste treatment cost in Appendix D for the No Action Alternative 2. However, NAA2 is planning to treat all newly generated waste to WAC standards (73,000 $m^3$ CH and 32,000 $m^3$ RH). The proposed action would treat 168,500 $m^3$ CH and 50,000 $m^3$ RH. This needs to be explained. The sum of the parts of the proposed action is $18.7B while the total cost is $19.1B. While rounding off is expected, this fails to account for $0.4B or 2.2% of total.

**Pages S-42 through S-44.**

The analysis for Alternatives 1, 2, and 3 apparently do not include the radiological health impacts from exhuming the pre-1970 disposed TRU waste, which is not considered in the

WM PEIS either, and which in the past was considered important. These radiological health impacts could be important when comparing Alternatives 1, 2, and 3 with the Proposed Action and No-Action Alternatives 1 and 2.

**Pages S-51 through S-55.**

The conversion factor on Figures S-5 through S-9 relating $Ci/m^3$ to pCi/l is incorrect. The correct value is 1 pCi/l = $10^{-9}$ $Ci/m^3$. This is important. See comment under page 5-43.

**Page S-61 to S-68. Table S-7.**

This table summarizes all the calculated health and safety effects from transportation, routine treatment and disposal operations, and from accidents. Deaths from transportation and operational accidents, Latent Cancer Fatalities (LCFs) from radiation exposure, cancer incidence from hazardous chemicals, and fatalities from truck pollution are all considered. Presumably, this information will be used in deciding on alternatives. However, SEIS-II does not discuss the relative merits of the alternatives in light of these estimated health and safety effects. Neither is any indication given of how they will be used in decision making. We have several observations.

The estimated cancer incidence from exposure to hazardous chemicals is below 0.05 in all alternatives. This is less than 5% of the expected radiological LCFs in NAA2 and is less than 1% in all other alternatives. The effect of hazardous chemical exposure can be ignored in choosing between alternatives.

**EEG Summary of Health and Safety Effects.**

EEG has condensed from the Table S-7 tabulation the expected deaths (of all kinds) for each of the Alternatives as shown in Table 1. Also included are the more significant high consequence/low probability accidents (which are not expected to happen) and the consequences of long-term releases.





Table 1

EEG Summary of Expected and Possible Deaths Listed in SEIS-II

| Effect | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Proposed | AA1 | AA2a | AA2b | AA2c | AA3 | NAA1a | NAA1b | NAA2 |
| Routine Radiation (LCFs) | | | | | | | | | |
| Truck Transportation | 3.3 | 12 | 5.4 | 5.4 | 6.6 | 15 | 0.11 | 0.57 | -- |
| Operations | 2.6 | 3.8 | 11 | 8.5 | 4.3 | 4.3 | 11 | 8.7 | 1.1 |
| Accidents | | | | | | | | | |
| Truck Fatalities | 6 | 19 | 9 | 9 | 12 | 25 | 0 | 1 | -- |
| Other Fatalities | 6 | 10 | 15 | 13 | 12 | 12 | 1.3 | 1.1 | 1.3 |
| Agg. Rad. (LCFs) Truck | 0.4 | 0.8 | 0.4 | 0.4 | 0.7 | 1.2 | .0068 | .02 | -- |
| TOTAL DEATHS | 18 | 46 | 41 | 36 | 36 | 58 | 12 | 11 | 2.4 |
| High Consequence Accident Deaths (LCFs) | | | | | | | | | |
| Storage Facilities | 2 | 300 | 10 | 10 | 2 | 10 | 10 | 10 | 300 |
| WIPP Disposal | 4 | 4 | 24 | 24 | 24 | 24 | -- | -- | -- |
| Long Term Releases (LCFs) | | | | | | | | | |
| 10,000 year Aggregate | <0.9 | -- | -- | -- | -- | -- | <2325 | <2325 | 2325 |
| Original Waste Volume($10^3m^3$) | 218 | 336 | 313 | 313 | 313 | 312 | 313 | 313 | 170 |
| Deaths/$10^3m^3$ | .084 | 0.14 | 0.13 | 0.12 | 0.11 | 0.18 | .040 | .036 | .014 |

All values from Table S-7, pages S-62 through S-68, SEIS-II.

If these estimates are assumed to reasonably reflect the differences between the Alternatives one can come to several conclusions:

- The Proposed Action disposes of waste at a lower expected death per volume of waste ratio than any of the Action alternatives. However, all of these ratios are within a factor of about two. The primary variables affecting the deaths/volume ratio are the miles of transportation and amount of treatment required;

- AA1 and NAA2 have very high consequence storage accidents. This is because of long-term above ground storage of waste treated only to WAC standards;

- The aggregate LCFs from long-term release for NAA2 are very high because of assumed loss of institutional control of WAC standard wastes stored above or near the surface. NAA1 LCFs were not calculated but would also be substantial. The thermal treatment of wastes would be expected to provide some reductions during the early part of the 10,000 year period because of greater waste stability.

The Health and Safety aspect of the decision on alternatives would seem to basically reduce to a trade-off between a few expected deaths during the disposal period and a possibility of a much larger number of future LCFs from accidents or environmental releases. A secondary consideration is whether some types of death (e.g. a transportation accident fatality rather than a radiation caused LCF) and the effects on some population groups (workers versus the general public) are more acceptable than others.

In making this decision one needs to keep in mind the uncertainly in these comparative estimates. Also, these various alternatives are not identical and provide different levels of assurance.





**CHAPTER 1**

**Page 1-1. Lines 5 through 16.**
The section does not make it clear that only defense TRU can be disposed at WIPP. Instead, the section discusses the need to dispose of all TRU wastes generated by the Department.

**Page 1-1. Lines 37 through 39 or Footnote 1.**
The footnote indicates that the DOE has sole authority to decide if waste should be disposed of at WIPP. In 1992 Congress reassigned the authority to approve disposal at WIPP from the DOE to the EPA.

**Page 1-1. Box entitled TRANSURANIC WASTE.**
Since the description of TRU waste includes the maximum dose rate for CH-TRU waste, the description of TRU wastes should also include the maximum dose rate for RH-TRU waste, which is 1,000 rem/hour.

**Page 1-1. Box entitled TRANSURANIC WASTE.**
The material in the box defines transuranic waste but fails to incorporate the adjective "defense" to modify the noun. The inference is that non-defense DOE TRU waste is eligible for disposal at WIPP.

**Page 1-1. Section 1.2 OVERVIEW.**
Since the SEIS describes the history to TRU waste disposal, it should include the history of the unilateral decision by the DOE to redefine the threshold of TRU from 10 nCi/g to 100 nCi/g.

**Page 1-5. Table 1-2.**
The fifth WIPP NEPA document notes that a 1982 deviated gas well at WIPP was discovered by the DOE in 1991.

**Page 1-7. Footnote.**
Statement: "Overpacking involves placing the 55-gallon drums inside another container and essentially provides double containment of the TRU waste."

The statement is incorrect. Overpacking does not provide "double containment" of a Type A drum in the context of the NRC packaging regulations 10 CFR Part 71.

**Page 1-8. Lines 23 through 26.**
The purpose of the WIPP/SAR is summarized, but does not do justice to the formal commitment by DOE and the State of New Mexico.

*Waste Isolation Pilot Plant Safety Analysis Report, Revision 1 (SAR)* Rev. 1 (DOE 1995 i)
"The intent of this document is to demonstrate the safe disposal of CH-TRU waste in compliance with DOE orders."

The Consultation and Cooperation Agreement between NM and DOE states that the SAR"... constitutes the most comprehensive document concerning WIPP both in general and specifically as related to public health and safety as well as other matters." Include this statement as well as a commitment for RH-TRU waste as well.





**CHAPTER 2**

**Page 2-1. Lines 9 through 19.**
The Geography of the nuclear weapon complex is described.

States that contain the 10 additional sites are identified in *Identification of Additional TRU Waste Generator Sites*. It appears that the TRU waste generated at the 10 additional sites is not defense TRU waste and is thus not eligible for disposal at the WIPP under the current law.

**Page 2-2. Section 2.1.1 Introduction.**
The SEIS includes plans to dispose of non-defense TRU waste at WIPP which violates the existing laws. DOE should include a discussion on their plans to modify the law to include commercial and non-defense TRU wastes.

**Page 2-2. Section 2.1.1.**
The DOE states that the total inventory will now be almost double the amounts authorized for disposal under the WIPP Land Withdrawal Act. The total expected inventory is 312,500 $m^3$. The authorized volume is 175,000 $m^3$. Describe the plans for dealing with this excess volume, including amendments to the law.

**Page 2-2. Text Box entitled WASTE ACCEPTANCE CRITERIA (WAC). Lines 17 and 18.**
Statement: "For the purposes of SEIS-II analyses, all waste would be treated at a minimum to the current planning-basis WAC."

Since the current WAC does not require treatment of most wastes, it is misleading to describe untreated waste as "treated at a minimum to the current planning-basis WAC."

**Page 2-2. Text Box entitled WASTE ACCEPTANCE CRITERIA (WAC). Line 1.**
It is stated that the WAC was first developed in 1989.

The statement is incorrect. The first set of criteria were issued in 1979. There is no recognition of the work the EEG has done on the WAC (for example, the report EEG-4, Little, Marshall S., *Review Comments on the Report of the Steering Committee on Waste Acceptance Criteria for the Waste Isolation Pilot Plant* dated February 1980).

**Page 2-3. Section 2.1.2 TRU Waste.**

The section fails to show that there is a volume limit of 12,500 $ft^3$ for disposal at WIPP of RH-TRU waste between 100 rem/hour and 1,000 rem/hour.

**Page 2-3. Text Box entitled *TRU WASTE TRANSPORTATION PACKAGING.***

Lines 10 and 11. Statement: "The Department is currently awaiting NRC certification of the RH-72B cask."

The statement is misleading, since the Department did not submit an application to the NRC for certification until December 1996.

**Page 2-3. The text refers to a "specially adapted rail car".**

EEG is unaware of an existing rail car nor have we received plans of a design. Please provide them in text.

**Page 2-5. 1,800 PE-Ci/Drum.**

It is correct that the WAC allows 1,800 PE-Ci CH-TRU drums if the waste is over packed or solidified. EEG has expressed some reservations about this limit. Also, an 1,800 PE-Ci drum could not be shipped in TRUPACT-II because the drum would exceed the 40 watt thermal limit.

**Page 2-5. Footnote.**

The text cites an August 1995 Draft PEIS which has not been issued in final form and an unidentified undated more recent estimate. Provide specifies.





**Page 2-6. Table 2-2.**

Statement: "There is uncertainty in the total waste volume figures presented in Table 2-2 and 2-3."

The discussion should include numbers that provide an indication of the uncertainties in the waste volumes of the six alternatives.

**Page 2-7. Table 2-3.**

Commercial/Non-defense TRU waste is not eligible for disposal at WIPP and should be deleted from the Table.

**CHAPTER 3**

**Page 3-1. Lines 31 through 37.**

Statement: "Decisions based on SEIS-II may be a combination of the option presented within alternatives analyzed. This means that portions of two or more of the alternatives analyzed in SEIS-II may be combined and used by the Department for the management or disposal of TRU waste." It would help to clarify this statement if the Final SEIS-II provided hypothetical examples of how the different Alternatives might be combined. The text box on page 5-51 does not provide this clarification.

Proposed Action

**Page 3-2.**

While there is a clear understanding of the Proposed Action, the description includes activities not in the Proposed Action described in the SEIS. The RH-TRU waste increased considerably, from 7,000 $m^3$ to 35,000 $m^3$, and the volume projections show thermal treatment of the waste reduces the volume. These are not included in the Proposed Action submitted by DOE to EPA in the 10/28/96 Compliance Certification Application. Revise this section on the Proposed Action to only include items that are in the Proposed Action.

**Page 3-2.**

Paragraph 2. The text indicates that the proposed volume of RH-TRU is much less than that allowed by the WIPP Land Withdrawal Act. Not so. While the expected number of curies in RH-TRU are less than the LWA permits, the volume of RH-TRU is considerably greater and the WIPP repository's current design will not accommodate the greater volume.

**Page 3-5.**

"All waste has been assumed to be treated and packaged to planning basis WAC." There are no requirements in the WAC to treat waste.





**Page 3-6. Text Box.**

The conservatism of TRU Waste Inventory Estimates text box is limited to the volumes of estimated TRU waste. There is no discussion of the radioactive inventory (in curies or PE-Ci) and its uncertainty. Also, credit is taken for conservatism when the reverse is true. For example:

First bullet. It is more accurate to consider the inventory as uncertain, rather than overestimated. Also, overestimating the TRU waste volume (and of the alpha emitting inventory) permits a larger quantity of plutonium to be released in meeting the EPA 40 CFR 191 Containment Requirements. Update the reference from Rev. 2 to Rev. 3 of the BIR.

Second bullet. The additional Inventory includes TRU waste burial prior to 1970 when the definition of the threshold was 10 nCi/g rather than the current 100 nCi/g. Although DOE indicates that 80,000 $m^3$ would be excavated from the 141,000 $m^3$ that was previously disposed, no indication is provided as to whether it is the higher or lower concentration waste. Logically it would be the higher, making the calculation less conservative. No explanation is provided why 80,000 $m^3$ of buried waste would be exhumed and 60,000 $m^3$ of other buried waste left in place.

Third bullet. Assuming that 7,000 $m^3$ of RH-TRU will be emplaced in the repository, when the available capacity may be only 4,300 $m^3$, may overestimate the amount of actinides allowed to be released.

Fifth bullet. The assumption that 100% of the TRU waste would be treated as TRU mixed waste is no longer true.

**Page 3-8.**

Since the text cites U.S. DOT regulations (49 CFR Part 391) for driver qualification, also cite the appropriate U.S. DOT regulations for routing (49 CFR 177) and the type A container certification (49 CFR 173).

**Page 3-9. 3.1.3.1**

"The Department estimates that it would require up to three years to excavate a panel."

Why would it take 3 years to excavate 7 rooms when 4 rooms were excavated in 6 weeks for the SPDV Program? Revise the estimate.

**Page 3-9.**

"The facility would be inspected a minimum of 4 times a year by the Mine Safety and Health Administration." State that the WIPP Land Withdrawal Act requires this.

**Page 3-9.**

Shipping Routes. It would be helpful to specify the DOT regulations to change routes including public hearing procedures.

**Page 3-12. 3.1.3.4 Emplacement of RH-TRU Waste.**

This section states that RH-TRU waste will need to be placed in the access tunnels (Panels 9 and 10). In order to reach design capacity Panels 9 and 10 will each have to be modified to accommodate 944 $m^3$ of RH-TRU (compared to 649 $m^3$ in a panel) and 17,500 $m^3$ of CH-TRU (compared to 16,700 in a panel). Is it physically possible to do this? Please specify the necessary design changes to the repository.

**Page 3-12.**

Please provide information for a seal that would prevent water from entering the repository and impede gas and brine from migrating out.

**Page 3-12.**

Closure and decommissioning. Use the definitions of disposal phase and disposal used in the WIPP Land Withdrawal Act. The definitions in the text do not match those in the Act.

**Page 3-12.**

The projected area above the 10 panel equivalents is said to be 100 acres. It is about 125 acres.





**Page 3-12.**

Is the proposed fence outside of the 150 acre berm?

**Page 3-13.**

The commitment to place markers at the site makes no mention that they are required by (PL102-579) and need to be approved by EPA (40 CFR 191).

**Page 3-14.**

The text states that it is reasonable to examine alternatives that include disposing of all DOE-owned and controlled TRU waste at WIPP. It should also be reasonable to discuss plans to amend the law and explain why DOE did not ask Congress to amend the WIPP LWA at the same time this section was written.

**Page 3-14.**

Action Alternative 1 would nearly double the repository waste volume. However the SEIS-II does not address the necessary redesign nor operational problems associated with keeping the repository open for 160 years.

**Page 3-14.**

Problems associated with storage at Consolidation Sites for 160 years are not discussed. DOE has taken the position that such storage would be impracticable and offering this as a viable alternative appears to reverse the Department's position totally.

**Page 3-15 and A-14. Tables 3-2 and A-6.**

The total volume for column 2, Additional Inventory, should be 139,000 not 136,000.

**Page 3-18.**

While the text states that the number of panels would be increased from 8 to 68, no specifics are provided on the design to accommodate this. We question whether the current design would be optimum if CH-TRU was not going to be emplaced in the rooms.

**Page 3-19.**
The surface projection for 68 panels would be about 850 acres rather than the 680 acres estimated if the design is unchanged.

**Page 3-19. Text Box, Long Disposal Periods and SEIS Results.**
Statement: "The long disposal periods could be shortened by constructing additional shafts, employing additional shifts, or changing the design criteria for thermal loading." The assumptions mentioned in the statement are more reasonable than the assumptions of 160-190 year disposal periods. The analysis of AA1, 2, 3 should contain more detailed and quantitative information about how the periods could be shortened.

**Page 3-43.**
The SEIS states that alternatives such as transmutation, co-processing with high level waste, and disposal in space were not considered in detail. The desire to use current technology for projects to be completed in 30 or 40 years is understandable. However, it seems unwise for 160-190 year projects. The alternatives that are discussed in the text are also not considered in detail. Problems associated with keeping the mine open for 180 years are not discussed nor are plans to increase the number of panels from 8 to 68.

An alternative not considered at all, which is similar to Action Alternatives 2 and 3, would consist of acid digestion of certain TRU waste followed by volume reduction and solidification. During the 1970s and 1980s the DOE had a research program at Hanford on the acid digestion of TRU waste. The alternative might be preferable to Action alternative 2, which involves a costly thermal treatment process.

**Page 3-44. Lines 2 through 8.**
Statement: *"While the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (DOE 1996b)* considered this process to be a reasonable alternative for analysis the relative large volume of TRU waste (compared to the volume of fissile material) would produce much more waste than the currently planned high-level waste repository could dispose of. This alternative would further delay TRU waste disposal until such a time as sufficient high-level waste





repository space was available. In addition, transportation and safety concerns associated with high level waste would need to be addressed."

The statement is not correct. Because of thermal loading constraints, a high-level repository is mostly empty space that may have to be back-filled. The currently planned high-level waste repository at Yucca Mountain will have over 100 miles of tunnel. However, a high-level waste repository is not expected to be operational for more than 10 years. The transportation and safety concerns associated with high-level waste will be addressed in the licensing of a high-level waste repository. The major difficulty with this alternative is that a high-level waste repository will be licensed by the NRC and Congress does not want the disposal of defense TRU waste to be under the jurisdiction of the NRC.

**Page 3-44. Lines 18 and 19.**
Statement: "*Underground detonation*. Such detonations would produce a large amount of hazardous fission products."

The statement implies that the underground detonation can only be carried out with nuclear devices. This is not correct and the statement should be clarified.

**Page 3-45. Lines 17 through 22.**
The following statement is made in the discussion entitled *Alternative Engineered Barriers:* "The Department examined these as alternatives and determined based on the evaluation conducted in the *Engineered Alternatives Cost/Benefit Study Final Report* (DOE 1995c) that they were less effective than the engineered barriers examined in SEIS-II."

There is no discussion of engineered barriers in SEIS-II. However, of the 4 disposal options analyzed, Action Alternatives 2 and 3 include an engineered barrier (waste treatment).

**Page 3-45. Lines 11 through 16.**
In the discussion entitled *Geologic Repositories at Sites Other than WIPP,* it is implied that salt is a more favorable disposal media than granite, basalt, and tuff. The reference for this conclusion is the 1980 FEIS for WIPP.

Much has been written on the disposal of nuclear waste since 1980. With regards to spent fuel and high level waste, the DOE maintains that the unsaturated zone in tuff is the most favorable medium. Also, Sweden has successfully constructed and is successfully operating a repository in granite for intermediate level waste.

**Page 3-46.**

"The SEIS-II Proposed Action is similar to the Draft WM PEIS Decentralized Alternative". The Decentralized Alternative described in the WM PEIS is more expensive than the No Action Alternative ($1.7B vs. $7.4B). It also has more worker deaths (4 vs. less than 0.5) and a larger collective dose to workers (1,500 person-rem compared to 20 person-rem). These PEIS findings are similar to those in SEIS-II. The text should clearly explain why these results are totally opposite the DOE conclusion to consolidate the material for disposal at a particular site.





**CHAPTER 4**

**Page 4-1.**

The 1996 Amendments to the 1992 WIPP Land Withdrawal Act are not recognized.

**Page 4-6.**

The text states that backfill is not required for subsidence control or repository performance, but may be placed into the repository for final disposition.

DOE committed to backfill with salt in the 1980 FEIS.

**Page 4-9 (Box).**

"..... has resulted in confirmation of the Salado's extremely low permeability."

1 This statement is meaningless. The Salado pure salt has extremely low permeability, impure salt is more permeable, and the fractured anhydrite beds and the clay/anhydrite and clay/halite interfaces are permeable enough to transmit a substantial amount of brine for gas generation.

"...elevated gas pressure may slow down or stop brine inflow, thereby slowing gas-generating processes."

2 The important point is that sufficient gas is expected to be generated to result in lithostatic pressure in the repository. Once the pressure is dissipated through fractures, brine inflow is expected to resume.

"Geophysical surveys indicate that pressurized brine reservoirs in the Castile Formation occur as three or four discrete pockets." No new geophysical surveys have been conducted to detect Castile brine over the WIPP repository since the publication of SEIS-I. No basis has been provided to alter the previous interpretation of the 1987 TDEM survey over the WIPP site found in SEIS-I, as follows:

3 "A continuous deep conducting zone underlies the region of the WIPP waste - emplacement panels." (DOE/EIS-0026-FS, Vol. 1, p. 4-71).

and

"In this report, the brines underlying the repository are assumed to be present, as they are at WIPP-12" (DOE/EIS-0026-FS, Vol. 1, p. 4-73).

3 The EEG position is that, based on the size of the brine reservoir intercepted by the borehole WIPP-12 and the results of the TDEM survey, the WIPP repository is underlain by a continuation of the brine reservoir that was encountered by WIPP-12.

**Page 4-10.**

"Major tectonic activity (movements of the earth's crust) associated with the development of the Delaware Basin ended over 250 million years ago, and the WIPP site has been geologically stable ever since."

4 Since its deposition in the Delaware Basin in the late Permian times, the WIPP area has been uplifted, submerged, tilted, intruded by igneous dikes, deformed or dissolved by water, and eroded. In addition, according to Lambert and Canter (1984), Castile brine reservoirs were formed during the past 360,000 years to 800,000 years by an episodic process that "could have resulted from an intermittent hydraulic connection between the Capitan Limestone and Castile anhydrites." (SEIS-I, Vol. 1, p. 4-71).

The WIPP site has not remained geologically stable for 250 million years.

**Comments on Page 4-15.**

**Natural Resource Exploration and Development.**

*Hydrocarbons*

Hydrocarbon resource is a very important issue and merits much more than a cursory overview by three short paragraphs.

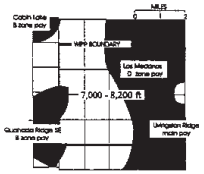



**Figure 1.** Proven and Probable Hydrocarbon Reserves for Brushy Canyon (after Broadhead et al, 1995, as published in EEG-62).

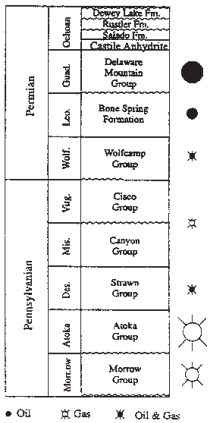



**Figure 2.** Formation Production (after Broadhead et al, 1995 as published in EEG-62).





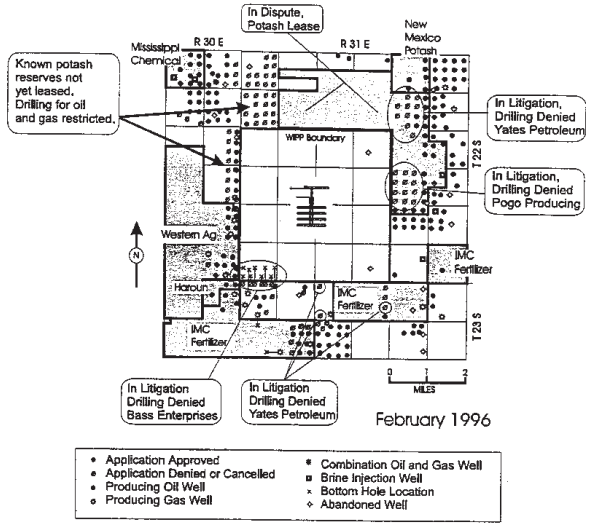



**Figure 3.** Interest in resources near WIPP (see EEG-62 for more detailed discussions).

The SEIS should have at least a series of maps showing proven and probable reserves at the various reservoir depths (eg. Figure 1), an illustration of the geologic cross section of the area resources and current production (eg. Figure 2), and a current map indicating drilling interest in the area and the extent of drilling delayed due to the presence of potash (eg. Figure 3). See EEG-62 (Silva, 1996) for a discussion of these figures.

Due to the extensive changes from the FEIS, there should also be a detailed discussion of the anticipated resource recovery activities. Topics should include:

- The massive hydrofracturing required by the oil reservoirs surrounding the WIPP.
- Extensive brine injection surrounding the WIPP due to the need for salt water disposal.
- Brine injection for pressure maintenance to enhance oil recovery.

- Documented concerns by the potash industry of the potential impact of fluid injection on the Salado Formation.
- The estimated value of hydrocarbon resources in the area.
- Areas for which there are no estimates due to the lack of drilling and testing as a result of the presence of potash.

*Potash*

This section should have maps showing the extent of lease grade potash reserves including the extent of potash reserves under the WIPP Site. Further, the SEIS should rely on the official position of the Department of Interior. The text should then discuss the maps and the impact of WIPP on the potash industry and the potential impact of potash mining on the WIPP based on potash reserve estimates by the Department of Interior.

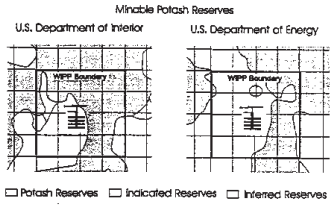



**Figure 4**. Estimated areal extent of potash reserves.

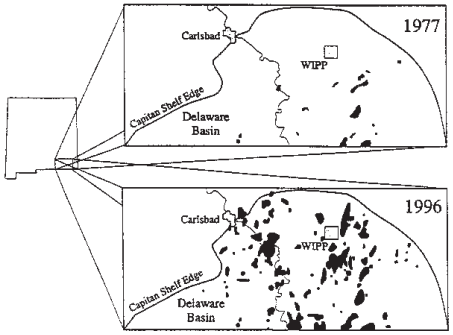



**Figure 5**. Actual growth of oil production.

Halite

The increase in oil and gas drilling activities, shown in Figure 5, continues to put demands on the need for brine supplies in the areas of new drilling.





There needs to be a section discussing the decades long activity of solution mining of halite, shown in Figure 6, from the Salado Formation to produce brine for drilling oil and gas wells throughout southeast New Mexico.

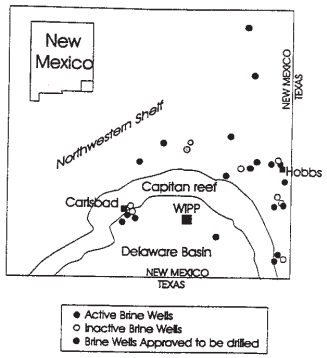



**Figure 6**. Solution mining of the Salado Formation.

**Pages 4-18, 4-19 Salado Formation Hydrology**. This section should describe the higher permeability of the Salado marker beds which act as conduits for flow of water and gas in the Salado.

5

Also, the assumption of Darcy Flow is not a conservative but a reasonable assumption. According to Beauheim, et al. (SAND 92-0533), "An assumption of Darcy flow through the evaporites is thought to be a reasonable interpretive approach because Darcy-flow models are able to replicate the flow and pressure behavior observed during entire testing sequences involving different types of tests performed with different hydraulic gradients."

**Pages 4-19, 4-20 Castile Formation Hydrology.**

6

The discussion in this section is incorrect in certain aspects and incomplete in others. There are not two but at least thirteen reported boreholes at and near the WIPP site which encountered pressurized brine in the Castile Formation. When the borehole WIPP-12 encountered pressurized brine at the WIPP site in 1981, more than 1.14 million gallons (4.3 million liters) of brine "unavoidably" flowed to the surface and was collected in a large pond on the surface before the well was brought under control (See DOE report on Brine Reservoirs, WIPP/TME 3153, P. H-9). The pore volume of this brine occurrence was estimated by DOE to be 714 million gallons (2.7 million $m^3$). Accommodation of this volume requires the assumption that the brine reservoir intercepted by WIPP-12 spreads under the repository. The TDEM survey confirmed the existence of brine under the repository. Assumption of four distinct brine reservoirs underlying the repository has no basis. A more justifiable assumption is that the pressurized brine reservoir encountered by WIPP-12 extends under the repository.

**Page 4-21.**
The discussion of the water level rises in the Culebra Aquifer and the potential impact of salt water disposal wells would be clearer by preparing and presenting a figure such as the one shown here and published in EEG-62.

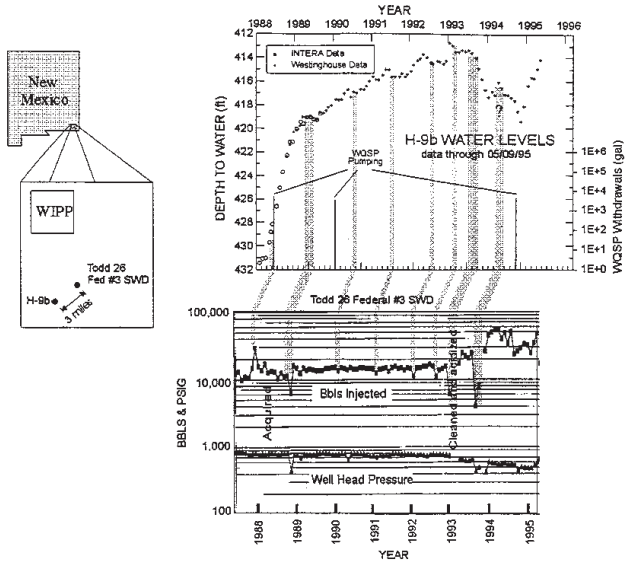



**Figure 7**. Postulated correlation between oilfield salt water injection and water level rises.

The discussion of potash mining and subsidence would benefit from a more detailed discussion of 40 CFR 194, the CCA, and a map of the extent of potash reserves as determined by the Department of Interior.





**CHAPTER 5**

**Page 5-4.**

The statement is made (3 lines above Section 5.1.2) that "No activity is occurring under these leases, and the Department may acquire these leases in the Future." The current status of these leases, including the producing gas wells and the recent court judgement, deserve a more detailed description in the final SEIS.

**Page 5-9. Table 5-2.**

The total in the second column (Basic Inventory RH-TRU Wastes) should be $4,800 million (not $4,500 million). Estimates should be rounded off using a consistent system.

**Page 5-11. Transportation.**

Detailed transportation comments are included in the Appendix E comments and are not repeated in these comments. Calculations were checked and compared to the results reported in previous EEG reports. The transportation risks reported in SEIS-II are reasonable and adequately conservative.

**Page 5-13.**

Highway route-controlled quantities (HRCQ) are discussed in the last paragraph. HRCQs are defined in 49 CFR 173.403(1) and routing is described in 49 CFR Part 177.825. The reference cited is not specific or useful. The statement that a majority of WIPP shipments are not HRCQs is misleading. Any waste shipment containing over 6 Ci of $^{239}Pu$ or $^{240}Pu$, 9 Ci of $^{238}Pu$, and 24 Ci of $^{241}Am$ is a HRCQ. Virtually all WIPP CH-TRU shipments will be HRCQs. Interestingly, the average RH-TRU inventory falls below the HRCQ limits and so the majority of RH-TRU shipments probably are not HRCQs.

**Page 5-16.**

The Footnote to Table 5-7 states that "shipments would stop at sites chosen, in part, for their lack of population,...." Have such sites been chosen and is their usage required? Unless the answer to both questions is 'yes', this claim should not be made.

**Page 5-18. Lines 11 and 12.**

The statement is made that, the State inspectors "dose would be limited by administrative rules and the inspector would be rotated to a new position." Unless DOE knows the requirements of the various States they should not take credit for actions by the States.

Table 5-8 is said to indicate that Site and State inspectors would receive the highest probability of health effects. Table 5-8 and Appendix E indicates that the rest stop employee has the highest probability.

**Page 5-21. Lines 18 and 19.**

The population density should be stated as "3,861 persons per square kilometer"

**Page 5-26. Table 5-11.**

Footnote d states that the MEI for RH-TRU is located at SRS. There is no RH-TRU at SRS.

**Page 5-33. Lines 3 and 4 from bottom.**

The assumption that there would be no dose to the maximally exposed involved worker in the T1 and T2 accidents is apparently based on the assumption stated on page G-11 ("The involved workers, positioned outside of the glovebox, were assumed to exit the facility immediately and thus would escape impact"). The assumed geometry and operational procedures need to be described in more detail so that the reasonableness of this assumption could be evaluated.

**Page 5-34.**

The text box on criticality contains information on the amount of Fissile Gram Equivalents present in the WIPP Waste streams that is inconsistent with Table 1, Appendix B2 of the Baseline Inventory Report Revision 3. This Table shows there are 2,800 $m^3$ of RFETS residue waste with an average concentration per 0.208 $m^3$ drum of 13.7 Ci $^{239}Pu$ and 53.6 Ci of $^{241}Pu$. This is an average of 218 FGE per 0.208 $m^3$ (55-gallon) drum. The permissible limit is 200 FGE/55-gallon drum. Furthermore, Table 1 indicates there are about 151 $m^3$ of waste at SRS, INEL, and Hanford that have average concentrations that exceed 200 FGE/ 55-gallon drum. This discrepancy needs to be reconciled and the Final SEIS-II should use the values published in the latest BIR. Also, the final disposition of wastes that exceed 200 FGE/drum should be stated.





7

The RFETS residues deserve more attention in SEIS-II than they have received. On February 20, 1997, the NRC granted DOE Revision 8 to the TRUPACT-II Certificate of Compliance. This Revision allows use of a pipe overpack to transport up to 200 FGE of residues in a pipe that is positioned inside a 55-gallon drum. The volumes of this pipe component would be either about 11 liters or about 45 liters. Up to 2,800 FGE of waste can be placed in a TRUPACT-II containing 14 of these pipe overpacks. The limit for 55-gallon drums or Standard Waste Boxes is only 325 FGE per TRUPACT-II. Some of these residues must be much more concentrated than the average concentration or DOE would not have needed to develop the pipe overpack. So now DOE can ship up to 2,800 FGE in a TRUPACT or 8,400 FGE on a trailer containing 3 TRUPACTs. Eight kilograms of plutonium is considered a significant quantity by IAEA because it is the approximate amount required to manufacture a nuclear explosive device. Such a shipment could be a candidate for a terrorist act of diversion during transportation. the Final SEIS-II should discuss the precautions that will be taken to present diversion of high FGE waste shipments.

**Page 5-35.**

We were able to approximately reproduce the LCFs for the RH-TRU Waste Storage Accident in Table 5-17 by using the overall release factor for stored CH-TRU waste from Page G-40 ($3.125 \times 10^{-6}$) rather than the values described on this page for RH-TRU ($6.25 \times 10^{-8}$). This overall RH-TRU release factor seems unreasonably low. Once again, the SEIS-II calculations are difficult to check because the specific input values are not given. It was necessary to retrieve numbers from two locations in Appendix G and one in Appendix A. We trust these were the values used in the calculation. Please provide more detail to enable the reader to reconstruct the calculation.

**Page 5-35 to 37.**

WIPP disposal accidents and their consequences are summarized in this section. More detail is provided in Appendix G.4. The WIPP Safety Analysis Report also contains a suite of WIPP disposal accident consequences. The SEIS-II scenarios and SAR Scenarios are not identical. They differ in numbering, description, assumptions, and consequences. A comparison of the consequences of common scenarios is shown in the following table

Table 2

EEG Comparison of SEIS-II and SAR
WIPP Accident Consequences

| | Ratio of SEIS-II/SAR Latent Cancer Fatalities | | |
|---|---|---|---|
| Scenario | MEI Public | Non-involved Worker | Involved Worker |
| CH 7 Spont. Ignition, UG | 0.72 | 1.75 | — |
| CH 3 Puncture, Drop in WHB | 1.7 | 0.25 | 2.7 |
| CH 4 Drop in WHB | 2.0 | 0.29 | 3.6 |
| CH 5 Waste Hoist | 30. | 4.0 | — |
| CH 9 Drop in UG | 1.0 | 0.15 | 15.6 |
| CH 11 Roof Fall | 10. | 1.9 | — |

There is no clear pattern to the above ratios. MEI and Involved Worker consequences are mostly greater in SEIS-II, while non-involved worker consequences are mixed. It is unnecessary and confusing to use different scenarios and assumptions in the SEIS-II than were used in the SAR. The scenarios in the SAR evolved over a number of years and influenced by discussions between DOE/Westinghouse and EEG. These SAR scenarios are more specific to WIPP conditions and should be used in the final SEIS-II.

**Page 5-36.**

As shown in the following Table, the frequency of various accident scenarios are different in SEIS-II than in the 1996 Draft Safety Analysis Report (SAR). An explanation should be provided.





Table 3

EEG Comparison of Accident Scenario Frequencies
in SEIS-II and 1996 SAR

| Table 5-18, Disposal | Annual Occurrence Frequency | |
|---|---|---|
| Accident Scenarios | Draft SEIS-II | Draft 1996 SAR |
| W1, WHB Drum Drop | 0.1 | 0.011 (CH4) |
| W2, WHB Drum Puncture | 0.1 | 0.006 (CH3) |
| W3, Underground Drum Drop | 0.01 | 0.015 (CH9) |
| W4, Underground Drum Puncture | 0.01 | 0.015 (CH9) |
| W5, Underground Container Fire | 0.01 | No scenario |
| W6, Hoist Failure | 1E-4 | 1.4E-9 |
| W7, Roof Fall | 0.01 Panel 1 | 4.3E-7 (CH11) |
| W8, RH-TRU Canister Breach | 1E-4 to 1E-6 | no scenario |

**Page 5-39. Long-Term Post-Closure Performance.**

The text says that the analysis in Draft SEIS-II are based on results computed for the Draft No-Migration Variance Petition and the Draft Compliance Certification Application (Draft CCA). Also, that "The final SEIS-II will re-examine its long-term performance assessment in light of any changes in methodology adopted for the compliance certification application." This re-examination should be made. It is unfortunate that Draft SEIS-II, even though it was released after the Final CCA was sent to EPA, could not incorporate the same methodology and results for the Proposed Action. We have comments on the current analysis.

**Page 5-40 & 41. 75th Percentile Values.**

The rationale for using median and 75th percentile parameter values is described: "The 75th percentile parameter values are used to yield model results that should fall in the upper tail of a full probabilistic analysis." But it is then said (lines 1-3 on page 5-41) that there is remarkably little difference between the mean and 75 percentile values. In fact Table H-24 indicates that direct radionuclide releases to the ground surface are identical for the median and 75th percentile values.

This is inconsistent with the CCA (see Figure 6-40) where the median values on the CCDF plot are 67% of the mean value at 0.1 Probability and 40% of the mean value at 0.001 Probability. The reason for this discrepancy is probably because more parameters were sampled over a distribution of values in the CCA than in SEIS-II. For example, the CCA sampled some parameters in the following areas that SEIS-II did not: (1) shaft materials; (2) gas generation, (3) the Culebra aquifer; (4) borehole plugs; and (5) borehole shear resistance. The SEIS-II calculation is, in most cases, using the same parameter values for the 75th percentile as for the median.

The methodology does not yield results that "fall in the upper tail of a full probabilistic analysis."

**Page 5-40 & 41. Family Farm Scenario.**

The decision was made to not include the family farm scenario (500 meters from drill cuttings) that was used in SEIS-I because the land was poor, little water was available, and water quality is poor. All of these facts are correct but there are ranch houses nearby and the majority of the dose (>99% in SEIS-I, Tables 5.63 and 5.64) is from inhalation. EEG-11[1] calculated CEDE inhalation doses of about 175 mrem/y at 360 m from 13 Ci of TRU radionuclides brought to the surface and deposited in a brine pit. Doses to nearby residents should be included in SEIS-II.

**Page 5-41. Third Paragraph.**

It is stated that "No population impacts were calculated because only small amounts of radioactive material would be brought to the surface, remain in a wet, relatively nondispersable form, and would

[1]Channell, James K., "Calculated Radiation Doses from Radionuclides Brought to the Surface if Future Drilling Intercepts the WIPP Repository and Pressurized Brine," NM Environmental Evaluation Group, EEG-11, January 1982.





remain localized." The material brought to the surface will not remain wet. The mud pit will dry, enabling wind erosion to transport the radioactive material over long distances. It is quite possible that the mud pit will be dry prior to dismantling the drill rig and be disturbed by that process, exposing those workers to the risk of inhaling radioactive dust.

The assumption of wet, non-dispersable material in the brine pond is inconsistent with assumptions used in SEIS-I, EEG-11 and TME-3151.[2] Both EEG-11 and TME-3151 calculated inhalation doses to the population within 50 miles from wind erosion. EEG-11 estimated a population dose of 39 person-rem per year (50-year Committed Effective Dose Equivalent) and assumed the exposure would last for many years. TME-3151 projected a population-dose of 76 person-rem CEDE for the one year period before the pond is covered.

Intrusion into the repository would definitely expose the neighboring population to risk. This risk should be calculated.

**Page 5-42. 4th line from bottom.**

Reference is made to the 5-kilometer subsurface lateral boundary. The appropriate boundary of concern is the WIPP site boundary which is less than 3 km from the waste panels to the south (down gradient in the Culebra aquifer).

**Page 5-43. Figure 5-1.**

There is a $10^6$ conversion error on this Figure (and on lines 18-19 on page 5-42) that is repeated on numerous other Figures in this Chapter and Appendix H. A concentration of 1 pCi/l is equal to $10^{-9}\ Ci/m^3 \left[(1\frac{pCi}{l})(10^{-12}\ \frac{Ci}{pCi})(10^3\frac{l}{m^3}) = 10^{-9}\frac{Ci}{m^3}\right]$ not $10^{-15}$ Ci/m³. This mistake raises an uncertainty about which value was used in plotting the extent of migration areas in the various figures. This is important; it must be clarified, corrected, and the areas re-plotted if necessary.

[2] Radiological Consequence of Brine Release by Human Intrusion into WIPP," US DOE, TME-3151, July 1982.

**Page 5-44. Last paragraph.**

This paragraph (which concludes on the top of page 5-45) concludes that intrusion at 100 years will have the maximum consequences. This determination cannot be made until calculations are made with an acceptable spallings model. Large spallings releases are possible at higher repository pressures which are expected to increase after 100 years. These increased spallings releases could more than offset the reduction in curies from radioactive decay.

**Page 5-46. Fourth Paragraph.**

The statement is made here (and elsewhere) that "no radionuclides or hazardous materials would be released into the Culebra within 10,000 years of repository closure for the deep drilling scenario under the proposed action." This is inconsistent with calculations in the CCA which show radionuclide release to the Culebra is a significant fraction of the E1, E2, and E1E2 scenario realizations. Calculations in the Final SEIS-II for the Proposed action need to be consistent with the CCA.

**Page 5-48. Section 5.1.12.5.**

The statement is made that if all the stored excess RH-TRU waste were released it would cause less than 2 deaths over a 10,000 year period but that if stored it would result in less than 2 worker deaths per 100 years. This suggests that it would be better to release the waste than to store it! This section should go beyond the statement that population may increase around the sites and present a rationale for storing the waste.

**Page 5-49. Text Box.**

We have several comments about the Long Disposal Periods on SEIS-II results discussed in the text box:

(1) The problems of keeping a facility open for 160 to 190 years are undoubtedly much more complex than SEIS-II suggests. The current shafts and drifts almost certainly can't be maintained for that long and surface facilities would probably also need to be replaced. Institutional problems would also be expected. The discussion also suggests that large work forces would be employed on these long periods and would thus be uneconomical. The concept of committing to any plan for this long a time is unprecedented and probably unwise;





(2) Thermal loading in the repository should not be a major problem. The excavated waste disposal area in the Proposed Plan is about 27 acres (for CH-TRU wastes). This would permit 270 Kw with the present criteria of 10 Kw/acre. The inventory in Appendix A (Tables A-31 and A-33) for Action Alternative 2 would generate less than 170 kilowatts;

(3) We agree that differences in long-term alternatives should be compared in long-term aggregate impacts rather than annual impacts. These comparisons should include the same universe of wastes, regardless of how they are managed.

**Page 5-51. Text Box.**

The discussion in this text box on Factors to Consider in Combining Alternatives provides useful information. The brief statements on Waste Treatment and Waste Management should be expanded because they contain much of the rationale for choosing the Proposed Action.

**Page 5-59. Rail Accident Methodology.**

The conclusion that the number of rail accidents using dedicated trains will be 23 times that expected for regular rail service is unrealistic. The methodology used could be used to calculate a wide range of numbers, including zero additional accidents (with the assumption that no new locomotives would ever be used). Some of the potential benefits from dedicated trains (e.g., lower potential accident rate per mile, more control over waste package, and shorter shipment times) should be discussed. It is noted that both regular train and dedicated train shipments have less impacts than truck shipments (Table 5-29 versus Tables 5-25, 5-26, 5-28).

**Page 5-60.**

Detailed evaluations of rail mileage in the SEIS-I and other earlier documents indicates that rail mileage from the major generating sites to WIPP is 16%-26% greater than truck mileage, not similar as claimed here.

**Page 5-67.**

The Radiological Impacts storage accidents for Action Alternative 1 in Table 5-34 are from Table G-28. We reproduced the calculation for population and MEI LCFs from the Earthquake Scenario. However,

the maximally exposed non-involved worker should have only 0.4 LCFs and not 0.7 LCFs for a dose of 1,050 person-rem. We calculated only 760 person-rem for this accident.

**Page 5-85. 2nd Line Beneath Table.**
What is the justification for assuming that thermal treatment of waste reduces the release fraction by a factor of 1,000?

**Page 5-104. Section 5.3.**
The impacts of disturbed and undisturbed cases of potash mining and brine reservoirs have not been adequately evaluated for the various Action Alternatives.

**Page 5-142. Lines 7-9.**
The assumption (for No Action Alternative 1) that DOE would indefinitely maintain institutional control at all of the storage sites is inconsistent with regulatory requirements at WIPP. Active institutional control may be allowed by EPA for 100 years at WIPP and credit (or partial credit) for up to 600 additional years of passive institutional control may be allowed. An assumption of perpetual institutional control for a No Action Alternative unfairly biases its comparison with the Proposed Action.

**Page 5-145. Table 5-88.**
The lifetime waste treatment impacts to involved workers in No Action Alternative 2 are only 0.08 LCFs. Yet for the Proposed Action they are 1.7 LCFs (Table 5-13). NAA 2 would treat 43% of the CH-TRU volume and 64% of the RH-TRU volume as the Proposed Action. Both actions treat waste to the WAC criteria at the generating sites. Why are the human health impacts for the Proposed Action 20 times as great?

**Page 5-148. Section 5.6.12.**
Detailed comments of intruder scenario modeling for long-term postclosure will be included in the comments on Appendix I.





The discussion of why the Record of Decision (ROD) for the FEIS and SEIS-I came to the conclusion that a No Action Alternative was "unacceptable" is very good.

**Page 5-153. First paragraph.**
The estimated 2,325 radiological LCFs in 10,000 years from environmental releases at all storage sites is noted. The EPA allowed limit for WIPP amounts to a maximum of 42 LCF's over 10,000 years. If the limit is met, the analysis indicates that disposal at WIPP is clearly more protective than storage at the generating sites.

**Page 5-154. Lines 34 through 38.**
Statement: "In contaminated areas, currently remote-controlled mining equipment or equipment modified with off-the-shelf systems may be used. Where practical, removal operations would be performed remotely. All support, radiation and air quality monitoring and geotechnical surveying would be performed remotely in the contaminated areas."

The discussion of waste recovery in section 5.7.2 relies almost entirely on remote controlled activities as expressed in the above statement. At present, remote controlled handling of CH-TRU and RH-TRU does not exist. The discussion of radiological impacts in section 5.7.2.1 Operational Impacts of Waste Recovery, has no basis or justification.

**Page 5-155. Second complete paragraph.**
This discussion mentions the greater external radiation hazard from waste recovery (compared to waste emplacement). However, inhalation exposures from dealing with breached containers and contaminated salt could also be significant and this needs to be recognized in the Final SEIS-II.

**Page 5-156. Second complete paragraph.**
Was any analysis involved in arriving at the conclusion that health impacts to the public and non-involved workers from recovery operations was 1,000 times that in Action Alternative 3?

**Page 5-159. Lines 6 to 9 bottom.**

The statement is made that DOE is considering transportation of fissile materials for storage and disposition. Is this being considered for WIPP?

**Page 5-161. Lines 5 and 6.**

More information is needed on the statement: "Emissions of radionuclides would be 134% of the standards for the alternatives that would involve treatment to the LDRs at LANL;" Page 5-88 mentions a $9x10^{-5}$ chance of an LCF but doesn't mention standards. Is this the 10 millirem/year NESHAPs Standard?

**Page 5-162. Last paragraph.**

The elimination of former "Control Zone IV" made this land available for oil and gas recovery as well as for potash mining. There are a number of producing wells in this area now. Water flooding is also permitted and is occurring.

**Page 5-163. Section 5.11.**

The LWA prohibits the extraction of mineral and hydrocarbon resources from the Land Withdrawal Area in perpetuity, not just during the period of disposal operations.





**CHAPTER 6**

Chapter 6 lists all the regulatory agencies and the status of permits for WIPP. One regulatory agency is notably absent. It is DOE. The Department has the legal authority to self regulate operational activities at WIPP. The status of WIPP's compliance with DOE Orders or even a list of DOE Orders is conspicuously absent. Indeed, DOE has the authority to self-approve the Draft Supplement to the EIS but fails to describe the internal system to be used. For example, the DOE long-term disposal calculations in the SEIS are approved by DOE and in the CCA by EPA.

**LIST OF ACRONYMS**

| | |
|---|---|
| BIR: | Baseline Inventory Report |
| CCA: | Compliance Certification Application |
| CAO: | Carlsbad Area Office |
| CCDF: | Complementary Cumulative Distribution Function |
| CEDE: | Committed Effective Dose Equivalent |
| CH-TRU: | Contact Handled TRU Waste |
| DOE: | U.S. Department of Energy |
| DOT: | U.S. Department of Transportation |
| EIS: | Environmental Impact Statement |
| EPA: | U.S. Environmental Protection Agency |
| FEIS: | Final EIS |
| FGE: | Fissile Gram Equivalent |
| HRCQ: | Highway Route-Controlled Quantity |
| INEL: | Idaho National Engineering Laboratory |
| IRF: | Impact Release Fractions |
| LDR: | Land Disposal Regulations |
| LWA: | Land Withdrawal Act |
| LCF: | Latent Cancer Fatality |
| MEI: | Maximum Exposed Individual |
| NESHAPS: | National Emissions Standards for Hazardous Air Pollutants |
| NTS: | Nevada Test Site |
| NRC: | U.S. Nuclear Regulatory Commission |
| RH-TRU: | Remote Handled Transuranic Waste |
| ROD: | Record of Decision |
| RFETS: | Rocky Flats Environmental Technology Site |
| SAR: | Safety Analysis Report |
| SEIS: | Supplemental EIS |
| SRS: | Savannah River Site |
| TEDE: | Total Effective Dose Equivalent |





**LIST OF ACRONMYS (CONTINUED)**

| | |
|---|---|
| TRU: | Transuranic |
| WAC: | Waste Acceptance Criteria |
| WIPP: | Waste Isolation Pilot Plant |
| WM PEIS: | Waste Management Programmatic EIS |

## APPENDIX A
## WASTE INVENTORY

Comments on Appendix A are made in the page order they occur. The importance attached to these comments by EEG can be inferred from the text of the comment. Comments related to waste inventory that occur in the Summary or the Chapters will be addressed in those locations.

**Page A-2. Lines 19 through 22.**

Statement: "The volume of TRU waste for the SEIS-II Basic Inventory is estimated at 135,000 cubic meters (4.7 million cubic feet) for CH-TRU waste and 35,000 cubic meters (1.2 million cubic feet) for RH-TRU waste. These estimates are based on current volumes of stored waste and waste expected to be generated through the year 2033."

The estimates of 135,000 cubic meters for CH-TRU and 35,000 cubic meters for RH-TRU involve significant uncertainties that should be estimated and discussed. A generic weakness of SEIS-II is a lack of discussion of uncertainty in the TRU inventory over the past 18 years.

**Page A-6. Lines 22 through 25.**

Statement: "Some heat is generated by TRU waste due to the interaction of alpha radiation, emitted in the radioactive decay of plutonium isotopes, with the walls of the waste container."

The heat is not generated in the wall of the waste containers. It is generated in the waste. The alpha particle range is too short to reach the walls of the waste containers.

**Page A-7. Lines 2 and 3.**

Statement: "The amount of gas generated is a function of the amount of heat produced from radioactive decay and the amount of plastic material present in the TRU waste."





The amount of gas generated is not a function of the amount of heat produced from radioactive decay. The amount of hydrogen gas generated is a function of the amount of energy deposited by ionizing radiation in the hydrogenous material present in the TRU waste and from anoxic corrosion of the drums.

**Page A-8. Lines 9 through 14.**

The estimated values for $V_{site}$ could also be expressed as: $V_{site} = V_{stored} + (38/28[V_{projected} - V_{stored}])$.

In this form the writing of equation A-1 is consistent with the writing of equation A-7 and A-8. Also, to be consistent $V_{stored}$ should be defined as TRU waste volume stored at the generator storage site through 1995. The use of "in 1995" is ambiguous.

**Page A-8. Lines 27 through 33 and Page A-10. Table A-4.**

Estimated total volumes of previously disposed TRU waste by site are discussed and presented.

The volumes of previously disposed TRU wastes are based on manifests that were written before 1970. If the waste is excavated and repackaged, the volumes will be significantly different due to compaction and the inclusion of contaminated soils. A discussion of the uncertainty in these volumes should be included.

**Page A-12. Lines 5-7.**

The statement is made that "only a few waste forms need packaging to meet thermal power limits, provided that plastic wrap is not used when the drums are filled (bagless posting)." Table A-16 indicates that average concentrations in about 19,400 $m^3$ (about 14%) of stored plus projected wastes do exceed the thermal power limits for bagless posting. Furthermore, our understanding is that the majority of presently stored wastes containers uses bags. Please comment. Does DOE plan to repackage wastes to remove bags? The plans to repackage and treat stored waste in order to meet the WIPP WAC limits should be explicitly addressed in detail in the SEIS-II.

**Page A-12. Lines 8 through 17.**
The calculation of $V_{Expansion}$ is discussed.

The calculation of $V_{Expansion}$ cannot readily be followed since the input data are contained in other documents such as TRUCON. Tables of adjustment factors similar to those provided in Tables B-2 and B-3 of Appendix B should be provided. See page A-22 to A-28 comment below.

**Page A-12. Lines 19 through 24.**
The statement is made that some of SRS waste would be processed to become RH-TRU. There is no evidence in the SEIS-II or other documents reviewed that there will be any RH-TRU at SRS.

**Page A-13. Lines 21 through 23.**
The Statement is made. "A 65-percent reduction in the TRU waste volume to be disposed of was assumed due to LDR thermal treatment of both CH-TRU and RH-TRU."

No justification is presented for the assumption of a 65-percent reduction factor in the TRU waste volume due to LDR thermal treatment. Also, it is questionable whether a 65-percent reduction should be applied to the additional inventory, since it has been compacted and will contain considerable amounts of soil.

**Page A-13. Lines 35 through 38.**
The statement: "A density change assumption, therefore, is made such that a 55 gallon drum containing the slag would weigh 454 kilograms (1,000 pounds). Waste density values are used in the determination of the number of shipments (Section A.3.9). See Table A-2 for the CH-TRU average drum weights used to determine the number of shipments."

Table A-2 does not provide data for a drum weighing 454 kilograms. It's not clear from Table A-2 whether it is permissible to use any number of waste drums between 11 and 42 as long as the weight of drums plus dunnage does not exceed the payload per shipment.





**Page A-16. Table A-8.**
The values for INEL and total in the columns labeled Post-Treatment Disposal Volume are in error. The values for INEL should be 10,000, 20,000, 30,000 $m^3$, instead of 10,000, 31,000, 41,000 $m^3$. The values for total at the bottom of the page should be 47,000, 49,000, 96,000 $m^3$ in Tables A-8, A-9, and A-10.

**Page A-20. Table A-12.**
The values for RFETS Total in the columns labeled Post-Treatment Disposal Volume are in error. The values for RFETS should be 13,000, ---, and 13,000 instead of and 19,000, ---, 19,000, and the values for Total at the bottom of the page should be 162,000, 166,000 and 329,000 $m^3$.

**Page A-22 to A-28.**
This section calculates the number of waste shipments for the various alternatives. The methodology is explained about shipping weights (Table A-2) and volume expansion to meet thermal limits (Equation A-2) earlier in the Appendix However, all assumptions were not given (e.g. how volumes were scaled to full repository size and whether the number of drums per shipment is interpolated between values given in Table A-2). For LANL CH-TRU Proposed Action shipments our calculated values were 6% lower than the 5,009 shipments indicated in Table A-15.

**Page A-23. Table A-14.**
The use of the term "Newly Generated Waste" for waste that doesn't exist is misleading. Use "To be-Generated Waste."

**Page A-23. Table A-14.**
The values in Table A-14 have not been rounded off, which is unlike Tables A-3 thru 13. Also, the columns labeled Existing Stored Volume should be relabeled Stored (1995) to be consistent with Table A-3.

8

**Page A-28. Table A-17.**

The PE-Ci/m$^3$ values for RFETS residues in Table A-17 are incorrect. From the inventory in Table A-23 it is apparent that the concentration should be about 17.3 PE-Ci per 55-gallon drum or 83.7 PE-Ci/m$^3$.

**Page A-33 to A-40.**

The method described here for scaling up radionuclide inventories is said to rely heavily on the Baseline Inventory Report, Revision 2 and the 1995 Integrated Data Base. Yet the results are different from those presented in the CCA and BIR Revision 3 as shown in Table 4. Values are also different for Pu-241, Am-241, Pu-240, Co-137 and Sr-90.

Table A-1

EEG Comparison of Inventories Used in Different DOE Documents

| Source | CH-TRU | | RH-TRU | |
|---|---|---|---|---|
| | $^{238}$Pu CI | $^{239}$Pu | $^{238}$Pu | $^{239}$Pu |
| CCA at 2033 | $1.94x10^6$ | $7.85x10^5$ | $1.07x10^3$ | $1.0x10^4$ |
| BIR Rev 3,2033 | $1.93x10^6$ | $7.85x10^5$ | $1.07x10^3$ | $1.0x10^4$ |
| Table A-27&28 | $1.70x10^6$ | $6.82x10^5$ | $6.48x10^2$ | $3.93x10^3$ |

We were not able to reproduce the volume factors reported in Table A-25 for the Proposed Action. Our values were about 3.5% higher for CH-TRU at LANL and SRS when using $V_{IDB}$ values from the 1994 IDB in equation A-8. This Appendix did not specify what volumes were used or how the inventory was scaled to a full repository.

More importantly, we do not see any reason for SEIS-II to derive a different disposal inventory for the Proposed Action. The Final SEIS-II should use the same values as the CCA.





**APPENDIX B**

**SUMMARY OF WM PEIS AND ITS USE IN DETERMINING HUMAN HEALTH IMPACTS**

**Page B-9. Line 5 or equation B-1.**

The equation for site adjustment factors is presented. Equation B-1 is confusing and needs additional brackets and explanations. The subscript $_{site}$ appears inside the square bracket and the subscript $_{keysite}$ appears outside the square bracket. The definition of $SF_{site}$ contains the word site and the phrase key contributing sites. The definition of $V_{sites}$ and $V_{WM\ PEIS}$ contain the word site only. The definition of $C_{SEIS}$ and $C_{WM\ PEIS}$ contain the phrase "site Key" only. It appears that there is a multiplication of data from $_{site}$ tables with data from $_{keysite}$ tables. Finally, the large curved brackets have the subscript $_{alternative,\ subalternative}$ where alternative pertains to the SEIS-II and subalternative pertains to the Draft WM PEIS, which suggests that $SF_{site}$ is a matrix.

**Page B-9. Lines 14 through 16.**

Statement: "Key contributing sites were determined by ranking the sites by cancer incidence risk for each alternative. The sites with the largest risk were then selected until a contribution of at least 90 percent of the total cancer incidence risk as reported in the Draft WM PEIS was reached."

It is not clear what this paragraph has to do with the calculation of site adjustment factors. Presumably it deals with the evaluation of the ratio of site key radionuclide concentration in SEIS-II/site key radionuclide concentration in the Draft WM PEIS.

**Page B-9. Lines 31 through 33.**

Statement: "Key radionuclides are those defined in Appendix D of the Draft WM PEIS as the single radionuclide contributing the highest risk cancer fatality at each site under each alternative. Key radionuclides are identified in Appendix D of the Draft WM PEIS."

Equation B-1 deals with "site key radionuclides" and not "key radionuclides."

**Page B-11. Line 17 equation B-2.**

The equation for adjusting the site-specific cancer incidence values of the WM PEIS is presented.

Equation B-2 is confusing and may contain misplaced subscripts. Again the subscript $_{site}$ appears inside rounded brackets and the subscript $_{keysite}$ appears outside the same rounded brackets. Presumably the subscript $_{keysite}$ should be beneath the summation symbol. Also the large square brackets that enclose R(adj) $_{WM\ PEIS}$ have the subscript $_{alternative,\ subalternative}$ which suggest that R(adj) $_{WM\ PEIS}$ is a matrix. $SF_{site}$, which is inside the large square brackets also involved the subscript $_{alternative,\ subalternative}$.

**Page B-12. Table B-4.**

The site adjustment factor for LANL should be 0.13 since this is the value used in the results of the calculations that are presented in Table B-5. The rounded off value of 0.1 is not used in the calculations.





**APPENDIX C**
**AIR QUALITY**

No Comments

APPENDIX D

LIFE-CYCLE COSTS AND ECONOMIC IMPACTS

**Page D-1. Section D.1. Life-Cycle Cost.**

The section does not indicate that life-cycle costs were determined for exhuming the CH-TRU waste disposed before 1970. It does not appear that these costs were analyzed in the draft WM PEIS.

**Page D-2. Table D-1.**

The bottom part of the table calculated the Volume Adjustment Factor. The volumes in column 5, SEIS-II CH-TRU Waste, column 6, and column 7, SEIS-II RH-TRU Waste, should be rounded off to be consistent with Table A-5. Also, the RH-TRU volumes are quite different in the two tables. The lack of consistency is confusing. It should indicate that the volumes are in cubic meters.

**Page D-3. Table D-2.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-6 and A-7.

**Page D-4. Table D-3.**

Volumes in columns 5, 6, and 7 should be rounded off to be consistent with Tables A-8 and A-11.

**Page D-5. Table D-4.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-9 and A-11.

**Page D-5. Table D-5.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-10 and A-11.





**Page D-6. Table D-6.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-12 and A-13.

**Page D-7. Table D-7.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-8 and A-11.

**Page D-8. Table D-8.**

Volumes in columns 5, 6, and 7, should be rounded off to be consistent with Tables A-9 and A-11.

**Page D-10. Line 4.**

The discount factor is presented as (1/1+r). There appears to be an error. It is not possible to reproduce the numbers in Table D-10 using the above formula for the discount factor.

**Page D-10. Table D-10.**

The rounding off of numbers is very crude. The values for Inflation-Adjusted Discount Rate of r=3 percent and r=5 percent in column 3 are the same. It is not possible to come close to the numbers in row 3 using a discount factor of $1/1.05^{35}$. Rounding off to the nearest $0.5 B in column 3 on a value of $3.5B does not build confidence. This amounts to 15%.

**APPENDIX E**
**TRANSPORTATION**

The Appendix E, review concentrates on the discussions and calculations relevant to the radiological aspects of the Proposed Action for truck transportation, since this is the most likely final choice for waste shipments to WIPP. Implications of the alternative actions, rail transport, and hazardous chemical impacts were evaluated in less detail.

EEG reviewed various DOE WIPP transportation documents over the years and produced several related reports. None are referenced. One report ("Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) wastes to WIPP along Selected Highway routes in New Mexico using RADTRAN IV," Anthony F. Gallegos and James K. Channell, EEG-46, August 1990) is particularly relevant to Appendix E. EEG-46 is a reasonable and adequately conservative evaluation of transportation risks. Our review of Appendix E is a comparison with EEG-46. Consideration was given to the fact that Appendix E is a nationwide assessment and changes in assumptions have occurred since 1990.

**Page E-2.**
The statement "The SARP application for the RH-72B shipping cask is to be submitted to the NRC in September of 1996 is incorrect." It was submitted in December of 1996.

**TRUCK TRANSPORTATION**

Routes and Mileage

The proposed waste shipment routes to WIPP agree with our understanding. The distance reported in Table E-5 from LANL to the WIPP site (549 km, with 512 km being rural, 34 suburban and 3 urban) agrees favorably with that used in EEG-46 (548 km, with 509 km rural and 39 km suburban). Distances from the other sites were not checked, but appear reasonable.





Non-radiological Accidents

DOE reported accident, injury, and fatality impacts per roundtrip shipment from each site to WIPP in Table E-8. However, since accident rates per kilometer were not given, the values in Table E-8 could not be checked. The back-calculated accident rates for the LANL to WIPP route ($1.62 \times 10^{-6}$/km in suburban areas and $3.13 \times 10^{-7}$/km for rural areas) are reasonably close to the values used in EEG-46 ($3.21 \times 10^{-6}$/km rural and $1.78 \times 10^{-6}$/km urban and $1.78 \times 10^{-6}$/km suburban).

Accident per shipment data from Table E-8 and the number of shipments values from Tables E-1 and E-2 were used to check the total values for the proposed values in Table E-9. Agreement was within 3% and differences were probably due to rounding error. The EEG-46 value of 5.0 accidents (while carrying wastes) in New Mexico extrapolated to 52 CH-TRU roundtrip accidents. This was adequate agreement (-10%) with the SEIS-II value of 58 accidents.

We agree with the value of 0.165 (rounded to 0.2) LCFs from vehicle pollution in urban areas.

Accident Free Radiation Doses

In Table E-10 (RADTRAN INPUT, Etc.) it is not clear why the number of people exposed per stop and the exposure distance is different for CH-TRU and RH-TRU.

The aggregate accident-free dose to occupational and nonoccupational persons is presented in Table E-14. The non-occupational value for CH-TRU (4,200 person-rem) is similar to the value obtained (4,050 person-rem) by scaling up the EEG-46 value of 330 person-rem by a mileage factor of $40.7 \times 10^6$ mi/$7.8 \times 10^6$ = 5.22 and a Transportation index (TI) adjustment of 4.0/1.7 mrem. This is good agreement.

The aggregate occupational dose of 710 person-rem was reproduced within 1% from methodology in SAND 84-0036 (RADTRAN III) and when using the actual average TI value (1.5 mrem/hr.) from Table E-11. This dose was not calculated directly in EEG-46.

Scenarios for calculating doses to the maximum exposed individual (MEI) are described on page E-32 and the doses are shown in Table E-15. The scenario description does not provide all the assumptions necessary to make the calculations. We were able to reproduce the CH-TRU doses for the Departure Inspector, the State Inspector, and the rest stop employee within ± 12% by using either the TI values reported in Table E-11 or the 4 rem/h value (that the text said was being used). The scenarios are sufficiently conservative so that the MEI doses in Table E-15 adequately represent the doses to members of the public and to occupational workers that do not wear dosimeters.

The calculated risk to these MEIs are not large. However, the doses average several hundred millirem/year for 10 years. This is somewhat greater than the 100 mrem/y value that most national and international agencies believe should not be exceeded from all radiation exposure combined (radiation doses from natural background and medical usage are not included in the 100 mrem/y value). These considerations suggest that the following operational control procedures should be implemented:

(1) persons who routinely inspect vehicles should be classified as radiation workers and required to wear dosimeters;

(2) normal procedures should not allow trucks carrying CH-TRU or RH-TRU wastes to routinely stop for long periods of time at locations where public exposure is likely to occur.

**Maximum Transportation Accident Doses**

EEG-46 calculated a maximum of 10 LCFs from a category VIII accident in North Carlsbad with an average SRS shipment (1,670 PE-Ci in 3 TRUPACTS). The probability of this event was calculated as $4.7 \times 10^{-8}$. SEIS-II calculated a bounding accident value of 16 LCF with a maximum allowable PE-Ci content in a TRUPACT-II (928 PE-Ci) and 3 LCF with an average inventory (191 PE-Ci). There were numerous differences in assumptions and there is an uncertainty about the actual population density used in EEG-46.





Attempts to extrapolate EEG-46 LCFs resulted in only about 60% of the doses reported in SEIS. The SEIS-II bounding values are appropriately conservative and indicate that very low probability accidents could have serious consequences.

It was noted in the PEIS (page E-77) that "waste shipments from LANL were found to result in the highest potential transportation accident doses." SEIS-II did not give highest potential transportation accident doses by site. The WM PEIS (footnote to Table E-26) assumed that all 3 TRUPACTs would fail in an accident. SEIS-II (page E-42) assumed only one would fail.

**Aggregate Radiological Impact from Accidents**

The aggregate radiological impacts from accidents in Table E-22 present the expected population dose (person-rem) from multiplying the person-rems for each accident by the probability of occurrence. The total dose for the Proposed Action is 850 person-rem (829 from CH-TRU shipments and 15 from RH-TRU. These doses are over two orders of magnitude greater than would be predicted from EEG-46 even after scaling for total system mileage. Most of this difference can be attributed to the higher impact release fractions (IRF) for accident categories V, VI, and VII used in SEIS-II. These IRF values are 100, 40, and 4 times (for categories V, VI, VII) those used in EEG-46. These categories have a much higher probability of occurrence and actually contribute more to the expected doses than category VIII accidents. It is concluded that these aggregate population doses from accidents are appropriately conservative.

**Rail Shipments**

On page 3-7 the SEIS gives four reasons why truck only transport was chosen: (1) limited interest by rail carriers; (2) higher cost of dedicated trains relative to truck shipments; (3) cost of acquiring additional TRUPACT-IIs; and (4) rail carriers would not assure DOE that transport could occur in less than 60 days. SEIS-II discusses 7 issues (bottom of page E-58 and top of page E-60) that need to be addressed before a decision can be made to use rail transport. The present uncertainties mentioned for these issues are largely true. However, it is unclear whether DOE has seriously re-evaluated this issue since the decision about 12 years ago to have truck

only transport to WIPP. There is no indication in DOE/WIPP 93-050 (Comparative Study of WIPP Transportation Alternatives, February 1994) that the decision was really re-evaluated.

The values reported in Tables E-29 through E-32 were "determined by adjusting the transportation impacts from truck shipments" (page E-58). Examples of questionable assumptions used in this analysis are:

(1) The average speed in all population zones was said to be 55 miles per hour for truck transport. This is inconsistent with Table E-10;

(2) The total miles assumed to be the same for truck and rail. SEIS-I actually developed rail route distances (see Table D.4.2). Distances by rail were 16%-26% greater for all of the major generating sites;

(3) The origin of the 89% rural, 10% suburban, and 1% urban breakdown is not given. The mileage - average for the distances in SEIS-I (weighted for the number of SEIS-II shipments) is 87%, 12%, and 1%;

(4) The basis for the assumption that the number of individuals sharing the transportation corridor is at least two orders of magnitude less is not given;

(5) We cannot reproduce the value in equation E-5 from equation E-4. The value of TI in E-4 should be 0.033 (from the previous page). Also, a value is needed for N (number of rail shipment transfers per shipment). If N were about 3.2 and TI was .033 the dose would be $1.7x60^{-4}$(TI)M;

(6) The logic for assuming that the aggregate radiological consequences of rail accidents were identical to truck accidents (first paragraph under E.7.3, page E-62) is unclear (same miles traveled times less frequency for rail accidents = same as truck). Is this because the release would be double in rail accidents?





A comparison of the Rail Transportation impacts in Tables E-29 (Action Alternative 1) and E-30 (Action Alternative 2) indicates there are less effects from rail transport than from truck transport (Tables E-9 and E-14. This suggests that SEIS-II should provide a better rationale for using truck only transportation or else seriously re-evaluate whether a truck and rail mix might be preferable.

**Alternatives**

The results of Alternative Impacts from accidents, vehicle pollution, and routine radiation exposure that are presented in various tables were studied to see if the values were reasonable compared to the Proposed Action. In all cases, the values appear to deviate in the expected direction from the Proposed Action and the magnitude of the deviation seemed reasonable. More description in the text explaining these differences would be helpful however. For example, is the lower (relative to the Proposed Action) non-occupational radiation dose total in Table E-14 for CH-TRU waste in Alternatives 2A and 2B due solely to the fact that there are fewer miles travelled (which can be implied from Table E-9)? Does this calculation use the TI values from Table E-11, or does it use a TI of 4 in both cases?

The statement on page E-53 that for thermally treated waste "The release fraction would be reduced by a factor of 1,000, ....." is not referenced or justified. Some reduction would be expected, but a three order-of-magnitude reduction requires justification.

A large number of comparisons are made about the transportation effects between alternatives in Appendix E. These comparisons include expected radiological and non-radiological risks from both incident free and accident conditions. The consequences of severe low probability accidents are also evaluated. Yet there is no discussion in this Appendix of using this information to aid in the selection of the appropriate action. The impression given at this time is that the Proposed Action is the only one being considered.

**Page E-43. Equation E-1.**

There appears to be a typographical error. Equation E-1 has a parameter named FMPI while the explanatory text has a parameter named FMRPI.

**Page E-45. Equation E-2.**

There appears to be a typographical error. Equation E-2 has a parameter named FMRT while the explanatory text has a parameter named FMRPT.

**Page E-64. Section E.8.2.**

There is a conversion error in the first paragraph of this section: $3.4 \times 10^6$ cubic meters is equal to $1.2 \times 10^8$ cubic feet (not $10^6$).





**APPENDIX F**
**HUMAN HEALTH**
**(from Routine Operations)**

**Page F-14. Section F.2.3.3 External dose of Involved Workers.**

No units are given in Tables F-11 through F-15. This should be corrected in the Final SEIS-II.

**Page F-17, last paragraph.**

The statement that only a small volume of waste would require packaging is perhaps misleading. "Repackaging" is intended, not "packaging". As mentioned under page A-12 comments, about 14% of wastes exceed thermal limits even with bagless posting and a significant percentage of existing wastes are believed to contain bags. Also note that the Draft SAR Appendix A states that DOE plans to repackage or process 88% of the existing CH-TRU waste.

**Page F-18, first paragraph.**

Dose rates are said to be reducible by administrative controls but no credit is taken for this. Credit should not be taken because there is no commitment to exercising administrative controls.

**Page F-18. Equation F-1.**

No reference is provided as to where the input data of $D_{id}$ and $C_{ic}$ can be found. Without these input data, it is not possible to verify independently the average surface dose rate in Table F-17.

**Page F-20.**

The reason for calculating the worker lifetime dose on a per waste panel basis is not apparent since the exposure assumptions are unrelated to the filling of a panel. All that is needed is the assumption of the hours per year that the worker is present at 1 meter from the drum and the average 1-meter dose rate from Table F-17. The workers should have exposure time limited to 345 hours per year in order to have the annual dose $\leq$ 1 rem for an average 1-meter dose rate of 2.9 mrem/hr. Furthermore the assumption in Table F-18 that the 10 panels will be completed

in 20 years is inconsistent with the rationale described in the last paragraph of page F-20 that would require 23.2 years in order to hold doses to 1 rem/year. These calculations do not appear to address exposures from the installation of MgO around the drums.

**Page F-21.**

Attempts to reproduce two of the individual dose values for storage site workers for alternative 1 resulted in values that were +12% and -17% of the Table F-22 values. In this effort we started with the average 1-meter dose rate in Table F-17 and decayed screening values from Table F-12 over the 20 to 55 year period to obtain average annual dose rates for the 35 years. Ingrowth of $^{241}Am$ from decay of $^{241}Pu$ was also included. It would be helpful to reviewers if SEIS-II gave more details of the calculations so they could be checked without making numerous assumptions.

The SEIS-II chose to evaluate the radiological effects of routine operations involving lag storage and no action alternatives on the 35-year working lifetime of individual workers. These results are presented in Table F-22 and this is an appropriate way to evaluate the risk to an individual worker or a (35-year) generation of workers. However, it does not indicate the cumulative effect over several generations (for the various action alternatives) and perpetually for the No Action Alternatives. The method used makes the human health effects (LCFs) of the alternatives appear better in comparison with the proposed action than it would be if multi-generational effects were included.

**Page F-21. Equation F-3.**

No reference is provided for the input data of $V_{CH,S}$ and T. The definition of T as a worker throughput rate of one worker per 1,000 cubic meters is confusing. It is not possibly to verify independently the values in Table F-19.

**Page F-25.**

The involved worker lifetime radiological impacts from routine CH-TRU waste disposal operations in Table F-21 total 720 person-rem for the entire disposal phase. This total is





derived from 36 workers x 20 rem/worker =720. The WIPP Safety Analysis Report (DOE/WIPP-Draft - 2065 Revision 1, Table 7.1-2) used 36.9 rem/year for 38 persons and a 35 year disposal period. This totals 1,292 person-rem and a dose of 34 rem/per person. This is 1.8 times the worker population dose used in SEIS-II. The main difference is in assuming a 35 year disposal phase rather than a 20 year phase. DOE should present consistent methodology and results in its related WIPP documents.

The individual lifetime worker doses in Table F-22 for RFETS are excessively high. Both Action Alternative 1 and No Action Alternative 2 exceed occupational limits (5 rem/y) every year for 35 years. Surely such doses would not be allowed. These doses need to be explained or the text needs to be corrected.

**APPENDIX G**
**FACILITY ACCIDENTS**

There is no statement that SEIS-II is in compliance with the report, U.S. Department of Energy, 1993, *Recommendation for the Preparation of Environmental Assessment and Impacts Statement,* Washington, DC: Office of National Environmental Policy Act Oversight nor that it is in compliance with the DOE/New Mexico C & C Agreement. The second statement in the WM PEIS, APPENDIX F, Treatment and Storage Facility Accidents, F.1.1. SUMMARY, indicates compliance with the above cited document.

**Page G-1. Lines 31 and 32.**
Statement: "The health impacts from acute exposures to radionuclides from accidental releases were calculated as described in Appendix F."

The statement is incorrect. Appendix F deals with human health impacts that may result from exposures to radioactive materials and hazardous chemicals during routine storage operations at waste storage sites and during routine disposal operations at the WIPP.

**Page G-2. Lines 3 through 5.**
Dose-to-risk conversion factors for a population are given with a unit of /rem.

The unit is incorrect. The unit for dose to risk conversion factor for a population is /(person-rem). The dose-to-risk conversion factors are correctly presented on page F-2.

**Page G-8. Table G-4.**
If Pu-238 and Pu-240 are considered to be major contributors to dose at ORNL, Pu-239 should also be listed in that category.





**Page G-13. Line 40.**
Statement: "Because of the serious nature of the accident, the involved workers were assumed to be fatally injured."

There should be an indication of the number of workers involved.

**Page G-14. Table G-9.**
The text on page G-13 states that thermally treated waste is placed in 5 drums simultaneously. Scenario T4 shows 4.9 drums. The difference is small, but the lack of consistency is confusing.

**Page G-17. Line 4.**
Q is defined as the radionuclide or hazardous metal inventory of a waste container (from Appendix A). Appendix A provides radionuclide inventories only on a per treatment site basis. Additional calculations are required to convert the data to a per drum basis. It is not possible to independently verify the health impacts data presented in Tables G-13, G-16, and G-19.

**Page G-18. Equation G-2 and line 6.**
The quantity E/Q is known as the relative concentration (NUREG 1.145 or WIPP/SAR). The quantity is not defined in the Glossary and E/Q cannot be found in Acronyms and Abbreviations. In Table G-12, E/Q is referred to as the atmospheric dispersion factor. There should be consistency and the omission from the Glossary and from the Acronyms and Abbreviation should be corrected. This term has historically been labeled as $\chi/Q$ (Chi/Q). The use of the E/Q terminology is unnecessary and confusing.

**Page G-18. Table G-11.**
Column 3 of Table G-11 presents "population-Weighted E/Q (sec/cubic meter)".

The quantity "Population-Weighted E/Q" is not defined in the Glossary. Presumably, the units of "Population-Weighted E/Q" should be (person-sec)/(cubic meter). The parameter and its correct units should be included in the glossary.

**Page G-21. Lines 11 through 15.**

Statement: "Acute releases were assumed to be dispersed in one direction, so population impacts were estimated for a single, maximally exposed, 22.5 degree sector (out to 80 kilometers [50 miles]) and not for the entire 80-kilometer (50 mile) region population. Population weighted atmospheric dispersion values were calculated and used to determine the maximally-impacted sector, considering both the change in air concentration over distance and the population impacts in a single 22.5-degree sector."

The description does not make it possible to independently verify the calculations. The discussion should include equations for the calculations of the population-weighted atmospheric dispersion values and for the calculations of the population impacts in a single 22.5 degree sector.

**Page G-30. Lines 3 through 5.**

Statement: "Intakes of radionuclides could result in a dose of up to 14,800 rem, with a corresponding probability of an LCF of greater than 1."

Numerically, a probability is a dimensionless number with values between 0.0 and 1.0. 0.0 indicates that the event cannot occur and 1.0 indicates that the event will occur with absolute certainty. A probability cannot be greater than 1.0. Also, a TEDE of 14,800 rem may be a lethal dose (rather than an LCF) even for transuranic wastes where internal doses are delivered over many years.

**Page G-36. Lines 28 and 29.**

Statement: "The fission products contributing the most to external dose rates were Cs-137/Ba-137m and Co-60,...."

Co-60 is an activation product and not a fission product.





**G-42. Table G-28.**

Insufficient data are provided in the text to verify the dose calculations. The text does not provide a reference for the dose conversion factor, DCF, for PE-Ci, and it is not possible to calculate the source term for accident scenario 3 (earthquake) because there is no reference to the number of waste drums involved.

**Page G-46. Table G-31.**

See comment page G-42. Table G-28.

**Page G-49. Table G-33.**

See comment page G-42. Table G-28.

APPENDIX H

LONG-TERM CONSEQUENCE ANALYSIS FOR PROPOSED ACTION AND ACTION ALTERNATIVES

A general comment is that EEG believes that the Final SEIS-II should use methodology, codes, and selected data from the CCA. Any modifications to the October 1996 CCA available prior to writing the Final SEIS-II should also be incorporated.

9 The EEG has identified a number of concerns on the long-term consequence analysis in our review of the Compliance Certification Application (CCA). A number of plausible scenarios have not been analyzed, many conceptual models of breach are invalid, and many parameter values selected for analysis are wrong. The EEG has submitted detailed comments on the CCA to the EPA and plans to publish a report (EEG-65) outlining these concerns, in the near future. These concerns should be taken into account before a record of decision is developed.

10 Some of the EEG concerns published in our review of the draft CCA (EEG-61) have been incorporated in Section H-8 of this Appendix. The discussion in this section shows that most of these issues remain unresolved. We recommend, therefore, that no decision on the basis of SEIS-II analysis be made until these concerns are resolved in the process of the CCA review and the EPA's certification rule-making process.

**Pages H-7&8. 75th Percentile Values.**

There is no justification for the claim that the 75th Percentile Values as used lead to a realization that is "within 1% of the maximum release statistically possible." See comments under Page 5-40 & 41.

**Page H-8. Last full paragraph.**

The analysis is said to have shown no releases into the Culebra dolomite. This is inconsistent with the CCA, which showed releases in a number of realizations.





**Page H-24. Next to last paragraph.**

Contrary to the statement in this paragraph, the impacts of chemical retardation are being calculated in the PA for the CCA.

**Page H-30. Table H-7.**

These solubility values are from the DCCA. They are somewhat higher than those being used in the CCA because of the effect of MgO backfill. Final SEIS-II should use the CCA values.

**Page H-34. Lines 1 through 6.**

Reference is made to Figure H-7 and to Table H-8.

It is difficult to follow what the relationship is between Figure H-7 and the data in Table H-8. There is no explanation on how the last row of Table H-8, entitled Total Repository Volume, is obtained. It is not clear what the relationship is between Rest of Repository, Separately Modeled Panel Volume, and Total Repository Volume. Some additional clarification should be presented.

**Page H-36. Table H-8.**

The z distance in a two-dimensional grid was increased by factors of approximately 8 in order to accommodate the larger waste volumes in Action Alternatives 1, 2, and 3. This violates the two- dimensional assumption of the BRAGFLO grid. A three-dimensional analysis may be needed to give reliable results.

**Page H-49. Table H-22.**

The CCA used much smaller brine reservoir values than the volume estimated for WIPP-12. EEG has reservations about this CCA assumption. Also, the compressibility value shown should be for rock compressibility, not pore compressibility (pore compressibility = rock compressibility ÷ effective porosity).

**Page H-52. Lines 1 and 2.**

Statement: "The pressure release of the waste panel, as a result of the exploratory drilling event at 100 years post-closure, is clearly evident for Case 2 and 4 in Figure H-8."

In Figure H-8, the pressure release for cases 2 and 4 appears to occur at 400 years post-closure. No explanation is provided in the text for the delay in pressure release from 100 years post-closure (time of drilling event) to 400 years post-closure (time of pressure release). Also, Figure H-8 indicates a significant pressure increase between 700 years and 1,300 year post-closure for cases 2 and 4. Finally, the asymptotic behavior for cases 2 and 4 at 10,000 years post-closure is significantly different. Are the differences in the brine pressure for cases 2 and 4 the result of error propagation in numerical solutions of the differential equations? Some discussion should be provided in the text.

**Page H-52, Figure H-9.**

The appropriate conversion factor between pCi/l and $Ci/m^3$ is 1 pCi/l = $10^{-9}$ $Ci/m^3$ (not $10^{-15}$ pCi/l). See page 5-43 comment.

**Page H-55 and Later. Table H-24.**

No attempt was made to check the reasonableness of the assumptions and calculations of releases and doses to the driller. It is noted in Table H-24 that the value for Pu-240 is incorrect. It will be a few percent of the Pu-239 value, not less than 0.01%.

**Page H-57. Last paragraph.**

Because of the pCi/l to $Ci/m^3$ conversion error mentioned, we are unsure whether the 1 pCi/l value quoted here is correct or whether the value is $10^{-6}$ pCi/l.

**Page H-60. Lines 1 and 2.**

Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for case 7 and 9 in this figure."





Figure H-11 indicates a pressure release at almost 500 years post-closure. This is significantly different from 100 years post-closure, which is the time of the drilling event. No explanation is provided in the text for this delay. Are the differences in the asymptotic behavior at 10,000 years post-closure between cases 6 and 8 and cases 7 and 9 the result of error propagation in the numerical solutions of the differential equations? An explanation should be provided in the accompanying text.

**Page H-62. Table H-29.**

For the radionuclides of Am-241, Cm-244, Pu-238, Pu-239, Pu-240, Pu-241, U-233, and U-234, column 3, CH-TRU and RH-TRU Waste Panel, is the sum of column 1, CH-TRU Waste Panel, and column 2, RH-TRU Waste Panel. For other radionuclides such as Ac-227, Cm-243, Cs-137, Pa-231, Sr-90, and Y-90, column 3 is not the sum of columns 1 and 2. A more detailed explanation for columns 1, 2, and 3 should be provided in the accompanying text.

**Page H-66. Lines 25 and 26.**

Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for cases 12 and 14 in the figure."

Unlike the spiked brine pressure curves for cases 2 and 4 in Figure H-8 and for cases 7 and 9 in Figures H-11, the brine pressure curves for cases 12 and 14 are smooth and peak close to 1,500 years post closure. No explanation is provided for the difference in behavior of the brine pressure curve for cases 12 and 14 from cases 2, 4, 7, and 9.

**Page H-72. Lines 15 and 16.**

Statement: "The pressure release of the waste panel as a result of the exploratory drilling event at 100 years post-closure is clearly evident for cases 17 and 19 in this figure."

See comment page H-52, lines 1 and 2. See also comment page H-60, lines 1 and 2.

**Page H-74. Table H-39.**

See comment Page H-62. Table H-29.





**APPENDIX I**

**LONG-TERM CONSEQUENCES OF NO ACTION ALTERNATIVE 2**

This Appendix was reviewed for general approach, assumptions used, and conclusions reached. Little was done to check calculations. The calculations were done in a preliminary manner compared to those for the Proposed Action and (especially) in the CCA. Therefore it is not possible to compare results in more than general terms.

**Page I-1. Last paragraph.**

The statement is made that both the FEIS and SEIS-I records of decision (ROD) determined that the No Action Alternative was unacceptable "because of the potential impacts of natural, low-probability events and human intrusion at storage facilities after government control of the site is lost." Presumably, this will also be the decision in the SEIS-II ROD. However, this Draft SEIS-II has not addressed the issue of whether it is appropriate to trade-off predictable early fatalities from accidents and routine radiation exposure against the threat of low-probability events far in the future. Nor is there an estimate of the probabilities that these future events will occur.

**Page I-3. Section 1.2.1.**

The set of assumptions used for inadvertent human intrusion impacts are appropriately conservative.

**Page I-6. Equation 1-2.**

The convolution integral appears first in equation I-2. All the explanations pertaining to the convolution integral given much later with equation I-7, should be given first with equation I-2.

**Page I-9. Equation 1-7.**

The symbol for the convolution operation is used twice, the second time inside an integral.

The use of the convolution symbol inside the integral is incorrect. A symbol representing multiplication should be used inside the integral.

**Page I-11. Next to last paragraph.**

The dimensions given here (66 cm diameter and 91 cm height) for a 55-gallon drum differ from those used in WIPP Performance Assessment (60.2 cm diameter and 89.2 cm height). Use of the PA dimensions gives a surface-area-to-volume ratio of 0.11 $cm^{-1}$.

**Page I-12. Line 3.**

The effective lifetime of 500 years for cemented TRU waste forms in this analysis may not be conservative.

**Page I-12. Line 9.**

Statement: "BIR-2 specifies a waste volume and waste density for each of 10 waste material types (Table I-1). These waste material types were categorized into one of the generated TRU waste-form categories modeled in this analysis."

The reference in parenthesis to Table I-1 belongs at the end of the second sentence.

**Page I-12. Lines 23 through 25.**

Statement: "These relative quantities were multiplied by the total TRU Waste volumes for the site (see appendix A) to determine final site volumes for each TRU waste form category. Volumes are also reported in Table I-2."

It is not possible to obtain the waste volumes reported in Table I-2 (columns 3 and 4) by multiplying the waste volumes of Table A-14 by the relative quantities given in Table I-2 (columns 1 and 2).





**Page I-17. Fourth Paragraph.**

Buried wastes are assumed to not release any wastes by surface erosion/dispersion mechanisms. Yet Table I-6 predicts that 6 of the 7 major sites will have enough surface erosion to expose wastes in less than 10,000 years. The assumption used may maximize groundwater contamination. Does it necessarily maximize total population dose?

**Page I-27. Table I-7.**

Our calculations (for inhalation and soil ingestion only) of driller impacts at LANL and SRS gave values that were 1.6 and 3.1 times as high as the values in this table. We had to make several assumptions that should have been provided.

**Page I-31. Twelveth line from bottom.**

The maximum dose of 14.5 rem should be per lifetime (not per year).

**Page I-31. Figure I-4.**

Why are the lifetime doses for MEIs at all sites totalled? These are all different individuals and there is no significance to a total dose.

**Pages I-33, 34. Figure I-5 and Table I-11.**

The curves in Figure I-5 can be used to approximate the total of 2,325 LCFs over 10,000 years mentioned on page I-31. Our estimate was about 10% higher than this.

It is interesting to compare these estimated LCFs with values that are permitted for geological disposal of TRU wastes in 40 CFR 191. However, in doing so, we realize that these estimates do not have the level of detail and justification required in 40 CFR 191.

The standards in 40 CFR 191 (which apply to WIPP) were based on the assumption that a permissible limit was 10 LCFs per million curies of alpha-emitting transuranic radionuclides with half-lives longer than 20 years. This scales to about 42 LCFs in 10,000 years for the various

inventories listed in Appendix A. The estimate in this Appendix of 2,325 LCFs for NAA 2 is over 50 times higher than would be allowed at WIPP.

A conclusion that long-term storage is much worse is site specific. If one uses the curves in Figure I-5 and the inventories in Tables A-36 and A-38 to determine the amount of activity stored at each site it can be shown that wastes left at SRS, Hanford, and ORNL would be under the 40 CFR 191 limit. Again, there is the caveat that these calculations are less detailed and justified than would be required to show compliance with 40 CFR 191.





**LIST OF EEG REPORTS**


EEG-1 Goad, Donna. 1979. A Compilation of Site Selection Criteria Considerations and Concerns Appearing in the Literature on the Deep Disposal of Radioactive Wastes. Santa Fe, NM: Environmental Evaluation Group. EEG-1.

EEG-2 Environmental Evaluation Group. 1979. Review Comments on Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico SAND 78-1596, Volume I and II, December 1978. Santa Fe, NM: Environmental Evaluation Group. EEG-2.

EEG-3 Neill, Robert H., James K. Channell, Carla Wofsy, and Moses A. Greenfield, eds. 1979. Radiological Health Review of the Draft Environmental Impact Statement (DOE/EIS-0026-D) Waste Isolation Pilot Plant, U.S. Department of Energy. Santa Fe, NM: Environmental Evaluation Group. EEG-3.

EEG-4 Little, Marshall S. 1980. Review Comments on the Report of the Steering Committee on Waste Acceptance Criteria for the Waste Isolation Pilot Plant. Santa Fe, NM: Environmental Evaluation Group. EEG-4.

EEG-5 Channell, James K. 1980. Calculated Radiation Doses From Deposition of Material Released in Hypothetical Transportation Accidents Involving WIPP-Related Radioactive Wastes. Santa Fe, NM: Environmental Evaluation Group. EEG-5.

EEG-6 Environmental Evaluation Group. 1980. Geotechnical Considerations for Radiological Hazard Assessment of WIPP: A Report of a Meeting Held on January 17-18, 1980. Santa Fe, NM: Environmental Evaluation Group. EEG-6.

EEG-7 Chaturvedi, Lokesh. 1980. WIPP Site and Vicinity Geological Field Trip. A Report of a Field Trip to the Proposed Waste Isolation Pilot Plant Project in Southeastern New Mexico, June 16 to 18, 1980. Santa Fe, NM: Environmental Evaluation Group. EEG-7

EEG-8 Wofsy, Carla. 1980. The Significance of Certain Rustler Aquifer Parameters for Predicting Long-Term Radiation Doses from WIPP. Santa Fe, MM: Environmental Evaluation Group. EEG-8.

EEG-9 Spiegler, Peter. 1981. An Approach to Calculating Upper Bounds on Maximum Individual Doses From the Use of Contaminated Well Water Following a WIPP Repository Breach. Santa Fe, NM: Environmental Evaluation Group. EEG-9

**LIST OF EEG REPORTS (CONTINUED)**


EEG-10 Environmental Evaluation Group. 1981. Radiological Health Review of the Final Environmental Impact Statement (DOE/EIS-0026) Waste Isolation Pilot Plant, U. S. Department of Energy. Santa Fe, NM: Environmental Evaluation Group. EEG-10.

EEG-11 Channell, James K. 1982. Calculated Radiation Doses From Radionuclides Brought to the Surface if Future Drilling Intercepts the WIPP Repository and Pressurized Brine. Santa Fe, NM: Environmental Evaluation Group. EEG-11.

EEG-12 Little, Marshall S. 1982. Potential Release Scenario and Radiological Consequence Evaluation of Mineral Resources at WIPP. Santa Fe, NM: Environmental Evaluation Group. EEG-12.

EEG-13 Spiegler, Peter. 1982. Analysis of the Potential Formation of a Breccia Chimney Beneath the WIPP Repository. Santa Fe, NM: Environmental Evaluation Group. EEG-13.

EEG-14 Not published.

EEG-15 Bard, Stephen T. 1982. Estimated Radiation Doses Resulting if an Exploratory Borehole Penetrates a Pressurized Brine Reservoir Assumed to Exist Below the WIPP Repository Horizon - A Single Hole Scenario. Santa Fe, NM: Environmental Evaluation Group. EEG-15.

EEG-16 Environmental Evaluation Group. 1982. Radionuclide Release, Transport and Consequence Modeling for WIPP. A Report of a Workshop Held on September 16-17, 1981. Santa Fe, NM: Environmental Evaluation Group. EEG-16.

EEG-17 Spiegler, Peter. 1982. Hydrologic Analyses of Two Brine Encounters in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site. Santa Fe, NM: Environmental Evaluation Group. EEG-17.

EEG-18 Spiegler, Peter and Dave Updegraff. 1983. Origin of the Brines Near WIPP from the Drill Holes ERDA-6 and WIPP-12 Based on Stable Isotope Concentration of Hydrogen and Oxygen. Santa Fe, NM: Environmental Evaluation Group. EEG-18.

EEG-19 Channell, James K. 1982. Review Comments on Environmental Analysis Cost Reduction Proposals (WIPP/DOE-136) July 1982. Santa Fe, NM: Environmental Evaluation Group. EEG-19.






**LIST OF EEG REPORTS (CONTINUED)**


EEG-20 Baca, Thomas E. 1983. An Evaluation of the Non-Radiological Environmental Problems Relating to the WIPP. Santa Fe, NM: Environmental Evaluation Group. EEG-20.

EEG-21 Faith, Stuart, Peter Spiegler and Kenneth Rehfeldt. 1983. The Geochemistry of Two Pressurized Brines From the Castile Formation in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site. Santa Fe, NM: Environmental Evaluation Group. EEG-21.

EEG-22 Environmental Evaluation Group. 1983. EEG Review Comments on the Geotechnical Reports Provided by DOE to EEG Under the Stipulated Agreement Through March 1, 1983. Santa Fe, NM: Environmental Evaluation Group. EEG-22.

EEG-23 Neill, Robert H., James K. Channell, Lokesh Chaturvedi, Marshall S. Little, Kenneth Rehfeldt and Peter Spiegler. 1983. Evaluation of the Suitability of the WIPP Site. Santa Fe, NM: Environmental Evaluation Group. EEG-23.

EEG-24 Neill, Robert H. and James K. Channell. 1983. Potential Problems From Shipment of High-Curie Content Contact-Handled Transuranic (CH-TRU) Waste to WIPP. Santa Fe, NM: Environmental Evaluation Group. EEG-24.

EEG-25 Chaturvedi, Lokesh. 1984. Occurrence of Gases in the Salado Formation. Santa Fe, NM: Environmental Evaluation Group. EEG-25.

EEG-26 Spiegler, Peter. 1984. Proposed Preoperational Environmental Monitoring Program for WIPP. Santa Fe, NM: Environmental Evaluation Group. EEG-26.

EEG-27 Rehfeldt, Kenneth. 1984. Sensitivity Analysis of Solute Transport in Fractures and Determination of Anisotropy Within the Culebra Dolomite. Santa Fe, NM: Environmental Evaluation Group. EEG-27.

EEG-28 Knowles, H. B. 1984. Radiation Shielding in the Hot Cell Facility at the Waste Isolation Pilot Plant: A Review. Santa Fe, NM: Environmental Evaluation Group. EEG-28.

EEG-29 Little, Marshall S. 1985. Evaluation of the Safety Analysis Report for the Waste Isolation Pilot Plant Project. Santa Fe, NM: Environmental Evaluation Group. EEG-29.

**LIST OF EEG REPORTS (CONTINUED)**


EEG-30 Dougherty, Frank. 1985. Evaluation of the Waste Isolation Pilot Plant Classification of Systems, Structures and Components. Santa Fe, NM: Environmental Evaluation Group. EEG-30.

EEG-31 Ramey, Dan. 1985. Chemistry of the Rustler Fluids. Santa Fe, NM: Environmental Evaluation Group. EEG-31.

EEG-32 Chaturvedi, Lokesh and James K. Channell. 1985. The Rustler Formation as a Transport Medium for Contaminated Groundwater. Santa Fe, NM: Environmental Evaluation Group. EEG-32.

EEG-33 Channell, James K., John C. Rodgers and Robert H. Neill. 1986. Adequacy of TRUPACT-I Design for Transporting Contact-Handled Transuranic Wastes to WIPP. Santa Fe, NM: Environmental Evaluation Group. EEG-33.

EEG-34 Chaturvedi, Lokesh, ed. 1987. The Rustler Formation at the WIPP Site. Santa Fe, NM: Environmental Evaluation Group. EEG-34.

EEG-35 Chapman, Jenny B. 1986. Stable Isotopes in Southeastern New Mexico Groundwater: Implications for Dating Recharge in the WIPP Area. Santa Fe, NM: Environmental Evaluation Group. EEG-35.

EEG-36 Lowenstein, Tim K. 1987. Post Burial Alteration of the Permian Rustler Formation Evaporites, WIPP Site, New Mexico. Santa Fe, NM: Environmental Evaluation Group. EEG-36.

EEG-37 Rodgers, John C. 1987. Exhaust Stack Monitoring Issues at the Waste Isolation Pilot Plant. Santa Fe, NM: Environmental Evaluation Group. EEG-37.

EEG-38 Rodgers, John C. and Jim W. Kenney. 1988. A Critical Assessment of Continuous Air Monitoring Systems at the Waste Isolation Pilot Plant. Santa Fe, NM: Environmental Evaluation Group. EEG-38.

EEG-39 Chapman, Jenny B. 1988. Chemical and Radiochemical Characteristics of Groundwater in the Culebra Dolomite, Southeastern New Mexico. Santa Fe, NM: Environmental Evaluation Group. EEG-39.

EEG-40 Environmental Evaluation Group. 1989. Review of the Final Safety Analyses Report (Draft), DOE Waste Isolation Pilot Plant, December 1988. Santa Fe, NM: Environmental Evaluation Group. EEG-40






**LIST OF EEG REPORTS (CONTINUED)**


EEG-41 Environmental Evaluation Group. 1989. Review of the Draft Supplement Environmental Impact Statement, DOE Waste Isolation Pilot Plant, July 1989. Albuquerque, NM: Environmental Evaluation Group. EEG-41.

EEG-42 Chaturvedi, Lokesh. 1989. Evaluation of the DOE Plans for Radioactive Experiments and Operational Demonstration at WIPP. Albuquerque, NM: Environmental Evaluation Group. EEG-42.

EEG-43 Kenney, Jim W., John Rodgers, Jenny Chapman and Kevin Shenk. 1990. Preoperational Radiation Surveillance of the WIPP Project by EEG. Albuquerque, NM: Environmental Evaluation Group. EEG-43.

EEG-44 Greenfield, Moses A. 1990. Probabilities of a Catastrophic Waste Hoist Accident at the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group. EEG-44.

EEG-45 Silva, Matthew K. 1990. Preliminary Investigation Into the Explosion Potential of Volatile Organic Compounds in WIPP CH-TRU Waste. Albuquerque, NM: Environmental Evaluation Group. EEG-45.

EEG-46 Gallegos, Anthony and James K. Channell. 1990. Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) Wastes to WIPP Along Selected Highway Routes in New Mexico Using RADTRAN IV. Albuquerque, NM: Environmental Evaluation Group. EEG-46.

EEG-47 Kenney, Jim W. and Sally C. Ballard. 1990. Preoperational Radiation Surveillance of the WIPP Project by EEG During 1989. Albuquerque, NM: Environmental Evaluation Group. EEG-47.

EEG-48 Silva, Matthew. 1991. An Assessment of the Flammability and Explosion Potential of Transuranic Waste. Albuquerque, NM: Environmental Evaluation Group. EEG-48.

EEG-49 Kenney, Jim. 1991. Preoperational Radiation Surveillance of the WIPP Project by EEG During 1990. Albuquerque, NM: Environmental Evaluation Group. EEG-49.

EEG-50 Silva, Matthew K. and James K. Channell. 1992. Implications of Oil and Gas Leases at the WIPP on Compliance with EPA TRU Waste Disposal Standards. Albuquerque, NM: Environmental Evaluation Group. EEG-50.

**LIST OF EEG REPORTS (CONTINUED)**


EEG-51 Kenney, Jim W. 1992. Preoperational Radiation Surveillance of the WIPP Project by EEG During 1991. Albuquerque, NM: Environmental Evaluation Group. EEG-51.

EEG-52 Bartlett, William T. 1993. An Evaluation of the Air Effluent and Workplace Radioactivity Monitoring at the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group. EEG-52.

EEG-53 Greenfield, Moses A. and Thomas J. Sargent. 1993. A Probabilistic Analysis of a Catastrophic Transuranic Waste Hoist Accident at the WIPP. Albuquerque, NM: Environmental Evaluation Group. EEG-53.

EEG-54 Kenney, Jim W. 1994. Preoperational Radiation Surveillance of the WIPP Project by EEG During 1992. Albuquerque, NM: Environmental Evaluation Group. EEG-54.

EEG-55 Silva, Matthew K. 1994. Implications of the Presence of the Petroleum Resources on the Integrity of the WIPP. Albuquerque, NM: Environmental Evaluation Group. EEG-55.

EEG-56 Silva, Matthew K. and Robert H. Neill. 1994. Unresolved Issues for the Disposal of Remote-Handled Transuranic Waste in the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group. EEG-56

EEG-57 Lee, William W.-L., Lokesh Chaturvedi, Matthew K. Silva, Ruth Weiner, and Robert H. Neill, 1994. An Appraisal of the 1992 Preliminary Performance Assessment for the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group. EEG-57.

EEG-58 Kenney, Jim W., Paula S. Downes, Donald H. Gray, and Sally C. Ballard, 1995. Radionuclide Baseline in soil near Project Gnome and the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group. EEG-58.

EEG-59 Greenfield, Moses A. and Thomas J. Sargent, 1995. An Analysis of the Annual Probability of Failure of the Waste Hoist Brake System at the Waste Isolation Pilot Plant (WIPP). Albuquerque, NM: Environmental Evaluation Group. EEG-59.






**LIST OF EEG REPORTS (CONTINUED)**


EEG-60 Bartlett, William T. and Ben Walker, 1996. The Influence of Salt Aerosol on Alpha Radiation Detection by WIPP Continuous Air Monitors. Albuquerque, NM: Environmental Evaluation Group. EEG-60.

EEG-61 Neill, Robert H., Lokesh Chaturvedi, William W.-L. Lee, Thomas M. Clemo, Matthew K. Silva, Jim W. Kenney, William T. Bartlett, and Ben A. Walker, 1996. Review of the WIPP Draft Application to Show Compliance with EPA Transuranic Waste Disposal Standards. Albuquerque, NM: Environmental Evaluation Group. EEG-61.

EEG-62 Silva, Matthew K. 1996. Fluid Injection for Salt Water Disposal and Enhanced Oil Recovery as a Potential Problem for the WIPP: Proceedings of a June 1995 Workshop and Analysis. Albuquerque, NM: Environmental Evaluation Group. EEG-62.

EEG-63 Maleki, Hamid and Lokesh Chaturvedi. 1996. Stability Evaluation of the E140 Drift and Panel 1 Rooms at WIPP. Albuquerque, NM: Environmental Evaluation Group. EEG-63.

EEG-64 Neill, Robert H., James K. Channell and Peter Spiegler. 1997. Review of the Draft Supplement to the Environmental Impact Statement DOE/EIS-0026-S-2. Albuquerque, NM: Environmental Evaluation Group. EEG-64.

Battelle
. . . Putting Technology To Work

DVC No. 041
Page 1 of 4

**Waste Isolation Pilot Plant**
**Disposal Phase Supplemental Environmental Impact Statement**

**DOCUMENTATION OF VERBAL COMMUNICATION**

**Recorded By:** George Marino
**Date and Time:** February 20, 1997
**Subject:** Los Alamos County Council WIPP Meeting

☐ **Telecon:** ☐ **Meeting:** ☑ **Other:**
☐ **Carlsbad:** ☐ **Albuquerque:**

**Distribution**
H. Johnson, DOE/CAO
C. Waymen, DOE/CAO
P. Kilgore, DOE/CAO
M. McFadden, DOE/CAO
M. Daugherty, DOE/CAO
K. Hunter, DOE/CAO
J. Mewhinney, DOE/CAO
L. Swartz, Battelle
R. Reddick, Battelle
F. Douglas, Battelle
S. Ross, Battelle
T. Ikenberry, Northwest
M. Bergaron, Northwest
D. Lechel, Lechel Inc.
P. Sanchez, SNL
K. Donovan, WID
M. Whateley, WID
R. Chavez, WID
J. Lloyd, WID
W. Most, WID
A. Marshall, CTAC/ASI
WIPP/SEIS File – 1.1.3
External Corr. – 1.1.1
Admin. Record – 2.3

**PARTICIPANTS**

| Name | Organization | Telephone | Facsimile |
|---|---|---|---|
| Harold Johnson | DOE/CAO | (505) 234-7349 | (505) 887-6970 |

**DISCUSSION TOPICS**

| Item | Description of Discussion |
|---|---|
| 1. | LA County Council Resolution (see attached). |

1 **Al Brooks**
Where did the 10,000-year requirement come from? It's ridiculous.

**Robb Minor**
Why have other governments and nuclear industries of other nations been more successful in convincing the public of the benefits of the nuclear industry? We can't compete economically with these other countries.

2 **Dr. Ed Stein**
3 I'm a pro-WIPP man. If I could wave a wand and open WIPP tomorrow, I would. Since DOE funds EEG, will their jobs go away if WIPP opens? How are Don Hancock and the Southwest Research and Information Center funded? How is the state oversight group funded? These groups all have ulterior motives for opposing WIPP - just like cold fusion, whose proponents drummed it up and got funding so it could pay their salaries.

4 **Diane Albert**
Is the public more concerned about transporting the waste or about storing the waste at WIPP? I think it's good to have activists, good to have balance, good to have people that ask questions. What disturbs me is there is a lot of fear because people don't understand science. The United States schools are not teaching good science. Most people have poor risk assessment ability. It doesn't make sense to be opposed to WIPP. If you address the root cause of the opposition, the lack of understanding of science and risk assessment, then there would be an overall savings.

5 **Charlamaine Shaller (Monitor Editor)**
I am concerned because DOE did not hold a public hearing in Los Alamos. The people of Los





Battelle
. . . Putting Technology To Work

DVC No. 041
Page 2 of 4

Alamos are some of the people who are most affected by the WIPP project and they should have an opportunity to speak. If people are left out, you're asking for an imbalance in responses. It is difficult for people who work to attend meetings in Santa Fe.

6 Also, when you come to public meetings such as this, you should be adequately prepared, such as having the address of where to send public comments handy.

The "Los Alamos Monitor" would like to continue to receive press releases about WIPP, and they would like to continue to carry WIPP-related items.

7 I've heard that there is money available to communities along the WIPP route for emergency response training. How do communities receive this money?

8 **Glen Graves**
No one questions the need to have the best environment for our children and grandchildren. WIPP
9 will further that. I'm in favor of WIPP. The people opposed to this project don't know about risk assessment. I think that DOE should sit down with the opposition and explain the worst case transportation scenario, which would be to run over a Volkswagen, not a Chernobyl-type incident. Explain this worst case, explain that there would be no breach of the transportation container, no contamination. The opposition doesn't know that. You have to explain it to the lay person. Set up a give-and-take in a less formal environment [than a public hearing].

10 **Mike Dempsey**
WIPP is totally safe. It is the safest mine you'll ever see, and it is the best in every way. The air monitoring program at WIPP is excellent. The truck drivers are well trained and have clean, safe trucks. I see WIPP drums packaged every day, and there is nothing in them that you couldn't touch with gloved hands. These drums are much safer underground at WIPP than in tent-like structures at LANL. A salt structure is the best place for a repository. Salt makes the waste immobile. The people at TA-55 are behind WIPP.

11 I'm tired of people picking on WIPP. I am for all of the action alternatives, and I think that we should use WIPP to dispose of different types of waste, not just TRU waste.

12 **Glen Lockhardt**
I think that public hearings are an opportunity for people to voice their concerns and if people don't show up to comment, you can assume that they are supporters.

13 There is 12,000 cubic meters of waste stored at LANL. If you placed the drums end to end, the length would be half the distance to Santa Fe. There is going to be even more waste generated from cleanup. This waste will be generated even if LANL were to close. Storing waste as-is is more hazardous than disposing of it at WIPP, including the transportation risks.

14 The SEIS-II forced the reader to think too much. For example, for the no action alternative, you had to take the 2.7 million dollars and multiply it by 100 to make it comparable to the other alternatives. At the Santa Fe hearings the public said the no action alternative was cheaper, even though this isn't true. It makes it easier for the public to distort the facts. You need to put it in comparable terms.

15 DOE should change the name of the facility after the Record of Decision. There is automatic opposition whenever the name "WIPP" is mentioned. If the facility has a new name, people won't react in a conditioned manner.

Comment V-1, Page 3 of 5

Battelle
. . . Putting Technology To Work

DVC No. 041
Page 3 of 4

16 The emergency response training should be publicized. DOE should explain why there is this training and who is responsible for the training. For example, at one of the public hearings, there was a volunteer firefighter from San Ildefanso Pueblo who has been a firefighter for ten years and has never received emergency response training or even heard about it. For DOE to say that it is not their responsibility but the responsibility of the Office of the Governor is not a good response. There needs to be more public emergency response training and DOE needs to get more local governments involved.

The people opposed to WIPP fall into three categories:

- Those that don't like the nuclear weapons complex and therefore don't like WIPP
- Those that don't trust science to find a solution to the nuclear waste problem
- Those that don't trust that waste can safely be transported

16 For these people there are no workable alternatives. I strongly support the SEIS-II and WIPP.

**Wally McCorkle**

17 All the data in SEIS-II needs to be presented in the same time frame. The costs need to be given in present dollars.

18 I firmly support WIPP. The opponents to this project have an irrational fear that radiation causes cancer.

19 The NEPA process forces DOE to consider the most conservative scenario and it shouldn't be that way. You need to relate this conservatism in everyday terms so people can understand it.

20 The "Albuquerque Journal" published an article that identified WIPP as a pork barrel project because DOE is spending a lot of money and it is not being used.

21 I would have preferred a public hearing in Los Alamos, but I am pleased the Los Alamos County Council arranged for this public meeting.

**Bruce (Labratt?) LeBrun**

22 Los Alamos is driving the certification program home. We are fully ready to ship when WIPP opens. Los Alamos has the best set of TRU waste professionals, and we'll be ready to ship when WIPP opens. Others may be the first to ship waste to WIPP, but LANL waste will be the first to arrive at WIPP.

**Rob Minor**

23 I'm in favor of WIPP and opening it as soon as possible.

**David Wass**

24 I have seen the trucks, the containers, and the equipment. If all the trucks on the highway were this safe, there would be fewer highway accidents.

I have seen the corrosion of drums in storage. The decision needs to be made to open WIPP.

**George Chandler**

25 Under the Proposed Action, only defense TRU waste from a certain time frame would be stored at WIPP. Other wastes in the alternatives would be considered but not stored because it would extend the operation of WIPP 100 years. What will happen to this waste? Is there a potential to store these wastes at WIPP?



Comment V-1, Page 4 of 5

Battelle
. . . Putting Technology To Work

DVC No. 041
Page 4 of 4

**Glen Graves**

26 Are public tours of WIPP still available? I strongly recommend that anyone who hasn't been down to WIPP should go and take a tour of the facility before it opens. WIPP is the neatest, cleanest, and best equipped storage facility you could ever see.

**Glen Lockhardt**

27 I'd like to thank Chris Chandler and the Los Alamos County Council for pushing for this public meeting here in Los Alamos.

**Actions**

| Item | Description of Action | Assigned To | Date Due |
|---|---|---|---|
| 1. | Battelle employees extracted public comments based on a videotape of the hearing and not on an official transcript. | G. Marino/B. Nanez | |

| Concurrence of DOE or Other Participant: | | | Approved for Release: |
|---|---|---|---|
| Signed by: | Harold Johnson (Name) | 1/20/97 (Date) | |
| Verbal: | (Name) | (Date) | |
| Not Possible: | | | Randy J. Rechlin Project/Program Manager |

**INCORPORATED COUNTY OF LOS ALAMOS RESOLUTION NO. 97-03**

**A RESOLUTION SUPPORTING THE PROPOSED ACTION CONTAINED IN THE WIPP DRAFT SUPPLEMENTAL EIS**

**WHEREAS,** the Los Alamos National Laboratory is a Department of Energy facility located in the Incorporated County of Los Alamos; and

**WHEREAS,** the Los Alamos National Laboratory presently stores approximately 11,000 cubic meters of transuranic waste ("TRU") in temporary storage sites; and

28 **WHEREAS,** sound scientific data supports the proposition that permanent storage of TRU waste at the Waste Isolation Pilot Plant ("WIPP") is safer and more environmentally sound than current practices of storage at the various Department of Energy sites, including the Los Alamos National Laboratory; and

**WHEREAS,** the risks associated with transportation of waste will be mitigated by safety practices proposed by the Department of Energy; and

**WHEREAS,** there is no known alternative to WIPP that will provide a comparable or better means of storing TRU waste; and

**WHEREAS,** the Department of Energy is presently seeking public comment on alternatives proposed in its *WIPP Disposal Phase Draft Supplemental Environmental Impact Statement* ("SEIS-II"); and

**WHEREAS,** the Proposed Action of SEIS-II best serves the need for a safe, permanent storage facility to the extent allowed by law.

28 **NOW, THEREFORE, BE IT RESOLVED** that the Incorporated County of Los Alamos supports prompt implementation of the Proposed Action contained in the SEIS-II and that a copy of this Resolution be sent to the Department of Energy for inclusion in the SEIS-II public record.

**PASSED, ADOPTED, SIGNED, APPROVED, AND EFFECTIVE** this 3rd day of February 1997 at Los Alamos, New Mexico.

COUNCIL OF THE INCORPORATED
COUNTY OF LOS ALAMOS, NEW MEXICO

LAWRY MANN
Council Vice Chair

ATTEST: (Seal)

Nita K. Taylor
Los Alamos County Clerk

This page intentionally left blank.

This page intentionally left blank.

## INDEX TO EXTRACTED COMMENTS

Volume I of this *Comment Response Supplement* contains transcripts of the January 1997 public hearings and associated exhibits; Volume II contains public comments received via various forms of correspondence during the public comment period. This index lists the commenter's name and the number assigned to the specific document(s) where his or her comments appear. The index then directs the reader to the page where the commenter's *first extracted comment* in a transcript, exhibit, or piece of correspondence appears (not necessarily the first page). Page numbers for additional extracted comments following in sequence are not listed; however, when a commenter testified more than once at a public hearing, page numbers are given for the first extracted comment each time that commenter's testimony resumed.

The index appears in full in both volumes of this supplement. Page numbers beginning with a "TE" prefix indicate that the extracted comment appears in a transcript or exhibit in Volume I. Page numbers beginning with a "PC" prefix indicate that the extracted comment appears in the public comments contained in Volume II.


| Name | Document Number | Page Number |
|---|---|---|
| **A** | | |
| Aaron, Madeline | ALB2 | TE2-24 |
| Adams, T.C. | A-003 | PC-6 |
| Ahern, Julie | ALB6 | TE6-47 |
| Albert, Diane | V1 | PC-659 |
| Allen, Lorraine | CA1 | TE16-48 |
| | SF4 | TE10-7 |
| Allen, Richard | A-007 | PC-8 |
| Allen, Sierra | SF8 | TE14-40 |
| Allender, Rex | ALB2 | TE2-25 |
| Anderson, Norling | C-067 | PC-91 |
| Anderson, Paul | ALB5 | TE5-26 |
| Anonymous | C-120 | PC-130 |
| Arthur, Herbert | C-137 | PC-323 |
| Asghar, Sean | ALB2 | TE2-14 |
| Atencio, Benny | SF2 | TE8-18 |
| Avens, Larry | C-043 | PC-77 |
| **B** | | |
| Babka, Judith | C-103 | PC-118 |
| Baca, Dolores | SF2 | TE8-25 |
| Baca, Tom | SF1 | TE7-49 |
| Bachicha, Rafaelita | C-110 | PC-123 |
| Bacon, Bren | SF7 | TE13-43 |
| Baker, Marge J. | C-007 | PC-55 |
| Barnaby, Bruce | SF7 | TE13-23 |
| Barr, Mary | SF2 | TE8-38 |
| Barraclough, Jack | BO1 | TE17-30 |
| Bartosch, James | ALB6 | TE6-43 |
| Batt, Phillip | BO1 | TE17-11 |
| Baum, Louise | SF5 | TE11-18 |
| Baumgertel, Pamela | SF6 | TE12-13 |
| Becker, Kathryn | DE1 | TE15-62 |
| Beems, William | ALB6 | TE6-1 |
| Beethe, Ron | ALB1 | TE1-11 |
| Berg, Jeff | SF5 | TE11-23 |
| Bertini, Hugo | C-093 | PC-108 |
| Bixby, Tai | SF2 | TE8-15 |
| Bjornsen, Fritz | BO1 | TE17-39 |
| Black, Jack | CA1 | TE16-19 |
| Blaisdell, Robin | BO1 | TE17-19 |
| Bloss, Fred | CA1 | TE16-40 |
| Bobo, Robert | C-061 | PC-88 |
| Bonime, Karen | ALB6 | TE6-47 |
| Bonneau, Bonnie | C-133 | PC-318 |
| | SF7 | TE13-26 |
| Booher, Sam W. | C-085 | PC-102 |
| Boren, Richard | CA1 | TE16-4 |
| Botwin, Wendy Lynne | C-157 | PC-397 |
| Brailsford, Beatrice | BO1 | TE17-55 |
| Brechin, Vernon J. | C-001 | PC-52 |
| Bregstone, Roberta | DE1 | TE15-38 |
| Briggs, W.E. | C-074 | PC-94 |
| Brink, Deborah M. | C-107 | PC-121 |
| Brissenden, Mary | C-076 | PC-96 |
| Brody, Blanche | C-038 | PC-74 |
| Brooks, Al | V1 | PC-659 |
| Brooks, Alfred | C-082 | PC-100 |
| | OR2 | TE20-10 |
| Brown, Nancy | SF7 | TE13-55 |
| Brown, Pam | RL1 | TE18-6 |

| Name | Document Number | Page Number |
|---|---|---|
| Buckland, Carl W. | C-072 | PC-93 |
| Budow, Norman | SF3 | TE9-33 |
| Bunting, Amy V. | E-054 | TE13-67 |
| | SF7 | TE13-9 |
| Bunting, Dory | ALB4 | TE4-5 |
| Buonaiuto, Michael | SF5 | TE11-19 |
| Buonaiuto, Shelley | C-086 | PC-102 |
| **C** | | |
| Caldwell, Cecil | C-114 | PC-125 |
| Card, Barbara | SF2 | TE8-37 |
| Carde, Margret | C-141 | PC-325 |
| | DE1 | TE15-23 |
| | SF1 | TE7-17 |
| Carter-Long, Lawrence | ALB4 | TE4-16 |
| Center, Laura | SF6 | TE12-10 |
| Chandler, Chris | SF5 | TE11-13 |
| Chandler, George | V1 | PC-660 |
| Ciarlo, James | DE1 | TE15-56 |
| Cibas, Gedi | A-002 | PC-5 |
| Citizens for Alternatives to Radioactive Dumping | C-163E | PC-596 |
| | E-050 | TE12-54 |
| Clark, Pat | BO1 | TE17-23 |
| | E-069 | TE17-73 |
| | E-070 | TE17-74 |
| Clark, Richard | ALB4 | TE4-19 |
| Cliburn, Jill | SF7 | TE13-36 |
| Clifton, Stephanie | SF5 | TE11-38 |
| Cohen, Margaret | SF7 | TE13-24 |
| Cole, Kayce | C-021 | PC-63 |
| Cole, Sam | DE1 | TE15-26 |
| Collins, Michael | SF5 | TE11-31 |
| Combs, Michael | SF8 | TE14-42 |
| Commander, John | BO1 | TE17-35 |
| Conroy, Barbara | C-024 | PC-65 |
| | SF7 | TE13-51 |
| Cook, F.R. | RL1 | TE18-10 |
| Cooke, Charlotte | SF7 | TE13-44 |
| Cooke, Kerry | BO1 | TE17-52 |
| Corazon, Virginia | ALB4 | TE4-32 |
| Corbett, Benjamin | DE1 | TE15-29 |
| Cory, Wendy | ALB4 | TE4-22 |
| Cowan, Sarah | SF5 | TE11-22 |
| Cowley, Jill M. | C-098 | PC-112 |
| Cox, Grady | RL1 | TE18-7 |
| Craig, Larry | BO1 | TE17-16 |
| Crapo, Mike | BO1 | TE17-13 |
| Crawford, Todd | NA1 | TE21-2 |
| Croes, John | OR2 | TE20-7 |
| Cummings, Mark | C-018 | PC-62 |
| Currier, Mike | CA1 | TE16-12 |
| Curry, Lawrence | ALB2 | TE2-38 |
| Curtis, Susan | SF5 | TE11-15 |
| Curtis-Briley, Siona | SF5 | TE11-17 |
| **D** | | |
| Dant, Richard | C-126 | PC-136 |
| Dasburg, Ann | SF6 | TE12-3 |
| Davis, Ted | ALB6 | TE6-39 |
| Deckert, Frank J. | A-006 | PC-8 |
| Degan, Janet | SF6 | TE12-18 |
| Dempsey, Mike | C-080 | PC-99 |
| | V1 | PC-659 |
| Dendahl, John | SF2 | TE8-9 |
| Deyo, Richard | SF1 | TE7-2 |
| Diane, Susan | SF8 | TE14-9 |
| Dolan, Michael | DE1 | TE15-13 |
| Dooley, Michael | ALB3 | TE3-42 |
| Downey, Nate | SF7 | TE13-25 |
| Downey, Vicki | SF4 | TE10-50 |
| Duffin, Tom | CA1 | TE16-41 |
| Duncan, Ian | SF6 | TE12-16 |
| **E** | | |
| Eldredge, Maureen | C-158 | PC-398 |
| Elling, John | SF2 | TE8-21 |
| Elliott, Erica | SF6 | TE12-5 |
| Ellison, Brian V. | C-020 | PC-63 |
| Erb, Gary | DE1 | TE15-9 |
| Ericson, Eric | SF7 | TE13-17 |
| Estep, Scott W. | C-111 | PC-123 |
| Evans, Quinn | SF8 | TE14-47 |
| Ewald, Linda | C-090 | PC-106 |
| **F** | | |
| Farmer, Delbert | BO1 | TE17-7, TE17-22 |
| Fauci, Joanie | BO1 | TE17-66 |
| Federle, Charles | C-068 | PC-91 |
| Fernley, Landi | C-148 | PC-342 |
| Fidel, Marcus | ALB4 | TE4-19 |
| Finch, Peggy, Jerry, James | C-155 | PC-394 |
| Fiske, Maryann | ALB3 | TE3-34 |
| Fitzharris, Barbara | C-140 | PC-324 |
| Florshein, Tom and Nancy | C-026 | PC-67 |

| Name | Document Number | Page Number |
|---|---|---|
| Floyd, Dennis R. | C-112 | PC-124 |
| Forrest, Bob | SF4 | TE10-15 |
| Forthofer, Ronald | C-048 | PC-79 |
| Foy, Michelle | DE1 | TE15-35 |
| Frazier, Wade | NA1 | TE21-5 |
| | NA2 | TE22-8 |
| Freund, George | BO1 | TE17-34 |
| Frie, Robert | C-094 | PC-108 |
| Friess, Aanya Adler | ALB5 | TE5-13 |
| Fronapfel, Thomas J. | A-014 | PC-51 |
| Fulkerson, William | C-135 | PC-320 |
| Fuller, Alfred | SF6 | TE12-7 |
| Fuller, Guy | SF6 | TE12-8 |
| Funchess, Dan | CA1 | TE16-57 |
| **G** | | |
| Gallegos, Alonzo | SF2 | TE8-24 |
| Gallegos, Pia | SF6 | TE12-28 |
| Garringer, Mike | CA1 | TE16-23 |
| Garrity, James Emmett | ALB6 | TE6-38 |
| Gatuskin, Zelda | ALB2 | TE2-39, TE2-48 |
| Gawarecki, Susan L. | C-130 | PC-140 |
| Gerber, Jerry L. | C-106 | PC-120 |
| Giglia, Jessica A. | C-134 | PC-320 |
| Gladstein, Miyabi | DE1 | TE15-65 |
| Goad, Charles | ALB4 | TE4-2, TE4-9 |
| Gonzalez, Jimmy Joe | SF2 | TE8-19 |
| Goodman, Lois | SF1 | TE7-21 |
| Goodwill, Foster | DE1 | TE15-38 |
| Gormley, Kent | ALB5 | TE5-24 |
| Gormley, Pere Barber | ALB5 | TE5-24, TE5-30 |
| Gould, Bill | SF3 | TE9-20 |
| Granquist, David | DE1 | TE15-68 |
| Graves, Glen | V1 | PC-659, PC-660 |
| Gray, Alice H. | C-070 | PC-92 |
| Gray, Don | CA1 | TE16-8 |
| Greager, Tim M. | C-089 | PC-105 |
| Greenwald, Janet | ALB1 | TE1-22, TE1-28, TE1-34 |
| | ALB2 | TE2-31, TE2-43, TE2-50 |
| | ALB3 | TE3-46 |
| | ALB4 | TE4-33 |
| Greenwald, Janet (continued) | ALB5 | TE5-21, TE5-33 |
| | SF8 | TE14-34 |
| Groff, Richard | ALB5 | TE5-17 |
| Gudgell, Dallas | BO1 | TE17-64 |
| Gunderson, Steven | A-005 | PC-7 |
| **H** | | |
| Hadden, Blaine | ALB1 | TE1-9 |
| Hall, Mary | SF1 | TE7-43 |
| Hall, Patricia | BO1 | TE17-24 |
| | E-071 | TE17-76 |
| Hamilton, Alan | SF7 | TE13-21 |
| Hampson, W.L. | C-096 | PC-110 |
| | C-146 | PC-341 |
| Hancock, Don | ALB2 | TE2-7 |
| | C-131 | PC-142 |
| | OR1 | TE19-1, TE19-9 |
| | OR2 | TE20-5 |
| | SF1 | TE7-32 |
| | SF2 | TE8-2 |
| Hanley, Lorraine | C-049 | PC-80 |
| Hannan, Jim | C-035 | PC-73 |
| Hanscom, Andrew | DE1 | TE15-32 |
| Hansen, Anna | SF6 | TE12-19 |
| Harless, Jim | C-077 | PC-97 |
| Harris, Garland | SF6 | TE12-23 |
| Harris, Sam | SF2 | TE8-33 |
| Harrison, Susannah | SF6 | TE12-8 |
| Hatfield, Scott | DE1 | TE15-66 |
| Heaton, John | CA1 | TE16-35 |
| | SF4 | TE10-5 |
| Helburn, Nicholas | DE1 | TE15-10 |
| Helean, Mick | SF7 | TE13-55 |
| Henderson, Rebecca | SF6 | TE12-6 |
| Hensel, David | C-053 | PC-82 |
| Herman, Sheldon | SF6 | TE12-4 |
| Herman, Steven M. | C-165 | PC-605 |
| Herzl, Judy | C-139 | PC-324 |
| Hess, Louise | C-075 | PC-95 |
| Hibbard, Deborah | SF6 | TE12-30 |
| Hibbs, Linda | E-056 | TE13-71 (TE12-42) |
| | SF7 | TE13-31, TE13-35 |
| Hickerson, Al | CA1 | TE16-3 |
| Higginbotham, Alexis | C-003 | PC-53 |
| Hill, Alethea L. | C-078 | PC-98 |
| Hilty, Alexis | CA1 | TE16-37 |

| Name | Document Number | Page Number |
|---|---|---|
| Hobson, Stan | BO1 | TE17-38 |
| Hoeprich, Nena | C-147 | PC-342 |
| Hoff, Marilyn | SF5 | TE11-9 |
| Hoffman, Michael | DE1 | TE15-8 |
| Holeman, Tim | DE1 | TE15-14 |
| Holm, Victor | C-113 | PC-125 |
| | DE1 | TE15-66 |
| Homans, Dee | C-065 | PC-90 |
| Hookham, Valerie | C-105 | PC-120 |
| Hoover, Mark | ALB1 | TE1-31 |
| Hopkins, Steve | BO1 | TE17-49 |
| Hosking, Chuck | ALB3 | TE3-30 |
| Huebner, Martin | BO1 | TE17-37, TE17-69 |
| | C-153 | PC-391 |
| Hutchison, Ralph | C-156 | PC-395 |
| | OR1 | TE19-5, TE19-11 |
| Hyder, Charles | ALB2 | TE2-25, TE2-30 |
| | E-012 | TE3-55 |
| **I** | | |
| Ianaeby, Clan | SF1 | TE7-52 |
| **J** | | |
| James, Eric | ALB1 | TE1-16 |
| Jansky, Michael | A-001 | PC-3 |
| Jaramillo, Debbie | E-046 | TE12-39 |
| Jennings, Thomas E. | C-102 | PC-117 |
| Johnson, Barbara H. | C-125 | PC-133 |
| Johnson, E. | C-023 | PC-65 |
| Johnson, Nina | C-031 | PC-71 |
| Johnston, Retta | SF7 | TE13-57 |
| Judd, Nancy | SF2 | TE8-41 |
| **K** | | |
| Kalberer, Peter | ALB3 | TE3-40 |
| Katherine, Anna | SF3 | TE9-29 |
| Katz, Alicia | SF5 | TE11-26 |
| Kaul, Judy | ALB2 | TE2-42 |
| Kenney, Richard A. | C-129 | PC-137 |
| Kerlinsky, Dan | ALB6 | TE6-8 |
| Kern, Mansi | C-164 | PC-604 |
| Kidd, Don | ALB2 | TE2-28 |
| | CA1 | TE16-52 |
| King, Joan O. | C-032 | PC-71 |
| Kinney, Harry | ALB2 | TE2-18 |
| Kinsey, Mariel | SF6 | TE12-12 |
| Kinsey, Robert | DE1 | TE15-34 |
| Koch, James | CA1 | TE16-42 |
| Kotler, Virginia | ALB2 | TE2-16 |
| Kreider, Jr., Howard | C-050 | PC-80 |
| Kresge, Michele | BO1 | TE17-61 |
| Kriho, Laura | DE1 | TE15-32 |
| Kunko, Len and Jeanne | C-005 | PC-54 |
| **L** | | |
| Lage, Katherine | SF8 | TE14-26 |
| Lakshman, Jai | SF3 | TE9-12 |
| Larragoite, Pat | SF4 | TE10-54 |
| Larson, Linda | SF7 | TE13-33 |
| Lassiter, Caroly Mae | SF5 | TE11-37 |
| Laughlin, Robin | SF8 | TE14-14 |
| Laurie, Sharon | SF5 | TE11-30 |
| Lawless, Bill | E-084 | TE22-22 |
| Lawrence, Mike | E-002 | TE1-38 |
| Leahigh, John | ALB2 | TE2-35 |
| Leavell, Carroll | CA1 | TE16-56 |
| LeBrun, Bruce | SF4 | TE10-21 |
| | V1 | PC-660 |
| Lee, Dennis | NA1 | TE21-9 |
| | NA2 | TE22-17 |
| Lee, Mark | SF1 | TE7-30 |
| | SF5 | TE11-12 |
| Lee, Peli | SF7 | TE13-20 |
| Lee, Robert | CA1 | TE16-13 |
| Leming, Earl | A-010 | PC-32 |
| Lenderman, Andy | ALB4 | TE4-11 |
| Lewis, Jim | ALB1 | TE1-26 |
| Libman, Elliott H. | C-166 | PC-606 |
| Light, Robert S. | E-032 | TE9-37 |
| | E-033 | TE9-38 |
| | SF3 | TE9-2 |
| Likar, Vince | DE1 | TE15-21 |
| Lipman, Ben | DE1 | TE15-29 |
| Lockhardt, Glen | V1 | PC-659, PC-660 |
| Lockhart, Milton G. | SF4 | TE10-14 |
| | SF5 | TE11-6 |
| Lockridge, Ross | C-122 | PC-132 |
| Loftus, Charles M. | CA1 | TE16-27 |
| Logan, Dr. Stanley | E-052 | TE13-63 |
| | SF7 | TE13-13 |
| Lovato, Anhara | SF3 | TE9-26 |
| Lowe, Rosemary | SF7 | TE13-12 |
| Lyman, Lindy | C-149 | PC-344 |

| Name | Document Number | Page Number |
|---|---|---|
| Lysne, Jim | C-039 | PC-75 |
| Lysne, Lee | SF7 | TE13-46 |
| Lytle, Allen | SF8 | TE14-19 |
| Lytle, Pam | C-022 | PC-64 |
| **M** | | |
| Mack, Jon | SF4 | TE10-15 |
| Mack, Kay | DE1 | TE15-17 |
| Macon, Todd | SF7 | TE13-19 |
| Magill, Walter | DE1 | TE15-40 |
| Maienschein, Fred | OR1 | TE19-20 |
| Mainz, Penny | ALB3 | TE3-21 |
| Malcolm, Richard | CA1 | TE16-32 |
| Malten, Willem | SF8 | TE14-40 |
| Mann, Lawry | SF5 | TE11-15 |
| | V1 | PC-661 |
| March, Marian Cook | C-056 | PC-84 |
| Maret, Susan | C-159 | PC-399 |
| Markle, Dr. George | CA1 | TE16-39 |
| Marlow, Keith W. | C-002 | PC-53 |
| Marlow, Tony | SF7 | TE13-28 |
| Marschak, Amy | DE1 | TE15-63 |
| Marshall, Terry | CA1 | TE16-33 |
| | SF4 | TE10-2 |
| Marshall, Tom | BO1 | TE17-9, TE17-58 |
| | C-154 | PC-393 |
| Marshall, Tom (continued) | DE1 | TE15-59 |
| Martin, Craig | C-016 | PC-61 |
| Martin, Fay M. | C-084 | PC-101 |
| Massey, Steve | E-038 | TE10-65 |
| | SF4 | TE10-21 |
| Matthews, James | C-010 | PC-57 |
| Mattis, Marvin | SF7 | TE13-16 |
| Mattis, Naomi | SF7 | TE13-56 |
| Maughan, Ralph W. | C-066 | PC-90 |
| Mazeaud, Dominique | SF7 | TE13-49 |
| McCall, John | ALB5 | TE5-14, TE5-22 |
| McCausland, Claude | CA1 | TE16-25 |
| McCorkle, Wally | V1 | PC-660 |
| McCune, Bonita | SF4 | TE10-10, TE10-34 |
| McDonald, Melissa | SF7 | TE13-24 |
| McEnaney, Robert | BO1 | TE17-68 |
| | C-121 | PC-131 |
| McGrath, Jamal | ALB2 | TE2-32 |
| McMullen, Penelope | SF7 | TE13-3 |
| Means, Dick | CA1 | TE16-21 |
| Measom, David | DE1 | TE15-13 |
| Mento, Jack | DE1 | TE15-12 |
| Merrill, Carol | C-123 | PC-132 |
| Mesite, James F. | C-025 | PC-67 |
| Messick, Jerry | ALB4 | TE4-23 |
| | E-015 | TE4-38 |
| Metcalf, Tom | ALB6 | TE6-36 |
| Michelle, Victoria | ALB6 | TE6-7 |
| Middleton, Dana | C-109 | PC-122 |
| Miller, Basia | SF1 | TE7-42 |
| Miller, George L. | C-058 | PC-85 |
| Miller, Mark | ALB1 | TE1-8 |
| Miller, Virginia | SF1 | TE7-27 |
| Minor, Dorothy and Robb | C-045 | PC-78 |
| Minor, Robb | C-144 | PC-340 |
| | V1 | PC-660 |
| Mitchell, David | ALB3 | TE3-3, TE3-24, TE3-43 |
| Mohling, Judith | DE1 | TE15-45 |
| Mohling, Tor | DE1 | TE15-61 |
| Mohr, Amy | SF5 | TE11-24 |
| Moniak, Don | C-151 | PC-346 |
| Montano, Katherine | SF8 | TE14-51 |
| Montes, Juan | SF4 | TE10-52 |
| Moore, Chris | SF1 | TE7-37 |
| Moore, Ed | NA2 | TE22-1 |
| Moore, LeRoy | DE1 | TE15-7 |
| Moore, Tom | E-063 | TE15-71 |
| Moreno, Maria | SF5 | TE11-33 |
| Morgan, Thomas | SF8 | TE14-38 |
| Morris, Wayne | C-047 | PC-79 |
| Moskowitz, Alan | ALB6 | TE6-31 |
| Motley, Michael | SF3 | TE9-18 |
| Moyers, Jeff | C-060 | PC-87 |
| | C-138 | PC-323 |
| Murray, Bob | CA1 | TE16-43 |
| Myerson, Reno | SF5 | TE11-28 |
| **N** | | |
| Narvaes, Amory | DE1 | TE15-55 |
| Navarro, Karen | ALB3 | TE3-35 |
| Nebelsick, Rebecca | BO1 | TE17-54 |
| | E-077 | TE17-79 |
| Neill, Robert H. | ALB5 | TE5-2, TE5-18 |
| | C-152 | PC-351 |
| | C-167 | PC-628 |
| | E-016 | TE5-39 |
| | E-024 | TE7-59 |
| | SF1 | TE7-8 |

| Name | Document Number | Page Number |
|---|---|---|
| Newton, George | ALB1 | TE1-13 |
| Nichols, Jean | SF8 | TE14-14 |
| Niles, Ken | RL1 | TE18-5 |
| Nixon, Amy | ALB6 | TE6-34 |
| Novak, Jan and Judith | C-029 | PC-70 |
| Nuget, Christen | CA1 | TE16-17 |
| **O** | | |
| O'Connor, Mary Fran | C-128 | PC-137 |
| O'Neal, Lauren | C-116 | PC-127 |
| O'Neill, Catherine | ALB6 | TE6-5 |
| Obenshain, Dair | ALB6 | TE6-28 |
| Ohmstede, William | C-046 | PC-78 |
| Oliaro, Joseph | SF4 | TE10-39 |
| Olson, Justin | ALB5 | TE5-29 |
| Olson, Mary | C-150 | PC-344 |
| Ortega, Debra | DE1 | TE15-5 |
| Ortiz, Christine | C-040 | PC-75 |
| Ortiz, Marie | C-042 | PC-76 |
| Osborn, Jess | SF8 | TE14-35 |
| Otter, John | SF8 | TE14-23 |
| Owen, Robert | C-097 | PC-112 |
| **P** | | |
| Pace, David | ALB6 | TE6-15 |
| Packie, Rick | ALB2 | TE2-52 |
| Pare, Diantha F. | C-083 | PC-101 |
| Parrill, Victoria | C-088 | PC-104 |
| Partain, William L. | C-161 | PC-403 |
| Paul, Liz | BO1 | TE17-28 |
| Pecka, Jeffrey | DE1 | TE15-1 |
| Peele, Bob | OR1 | TE19-16 |
| Peretz, Fred | OR2 | TE20-11 |
| Perin, Steve | ALB6 | TE6-42 |
| Perkowski, Gary | CA1 | TE16-46 |
| Peterson, R.J. | C-062 | PC-88 |
| Phelps, James | OR1 | TE19-19 |
| Phillips, Richard H. | C-163A | PC-419 |
| | C-163B | PC-577 |
| | C-163C | PC-590 |
| | C-163D | PC-595 |
| | C-163F | PC-598 |
| | SF8 | TE14-29 |
| Phillips, Suzanne | SF7 | TE13-6 |
| Pierson, Norah | SF7 | TE13-60 |
| Pillay, K.K.S. | C-095 | PC-109 |
| Platts, Betty | SF3 | TE9-7 |
| Poe, Lee | E-083 | TE22-21 |
| | NA2 | TE22-3 |
| Pohl, Lois | C-011 | PC-057 |
| Polanchyck, Scott | DE1 | TE15-65 |
| Ponce, Eleanor | C-012 | PC-058 |
| | SF3 | TE9-10 |
| Pongratz, Morris B. | C-142 | PC-339 |
| Potvin, Michael | C-064 | PC-089 |
| Pratt, Judy | ALB6 | TE6-20 |
| Preston, Ken | OR2 | TE20-11 |
| Pribble, Lois | ALB3 | TE3-39 |
| Priest, Nova | SF7 | TE13-58 |
| Prince, Peggy | SF1 | TE7-45, TE7-53 |
| | SF5 | TE11-34 |
| Proctor, David | C-118 | PC-128 |
| Pyle, Sasha | SF3 | TE9-23 |
| **Q** | | |
| Quinn, Warren E. | C-073 | PC-094 |
| Quintela, Tom | CA1 | TE16-44 |
| **R** | | |
| Radford, Jeff | ALB2 | TE2-20 |
| | C-163G | PC-600 |
| Rajala, Eric | ALB1 | TE1-16 |
| Rakow, Sally | A-009 | PC-027 |
| Rauch, Thomas M. | C-127 | PC-136 |
| Ravndal, Virginia | SF8 | TE14-25 |
| Reade, Deborah | ALB2 | TE2-44 |
| | SF4 | TE10-22 |
| Reason, Myla | SF3 | TE9-7 |
| Reel, Stanley | OR1 | TE19-8 |
| Regan, Elaine | ALB2 | TE2-24 |
| Reimers, Diana | C-057 | PC-084 |
| Reinhardt, Erwin | C-079 | PC-098 |
| Rendt, Lilly | ALB5 | TE5-10, TE5-19 |
| Rhodes, Jeri | ALB4 | TE4-13 |
| Rice, Charles | C-087 | PC-103 |
| Rice, Chuck | BO1 | TE17-25 |
| Rich, Jeffrey | ALB3 | TE3-37 |
| Richards, Betty | CA1 | TE16-25 |
| Richards, Robert | ALB6 | TE6-21 |
| Richardson, Nausika | SF1 | TE7-13 |
| Rippeteau, Bruce | C-099 | PC-114 |
| Riseley, Mary | SF4 | TE10-27 |
| Robins, Joan | ALB6 | TE6-12 |

| Name | Document Number | Page Number |
|---|---|---|
| Rodriguez, Susan | ALB5 | TE5-7 |
| Romero, Emilio | SF5 | TE11-27 |
| Roos, Alice | SF1 | TE7-24 |
| Rose, Joe | ALB1 | TE1-19 |
| Rosen, Louis | SF6 | TE12-2 |
| Rosen, Stan | SF1 | TE7-47 |
| Rosser, Amy | DE1 | TE15-39 |
| Rudd, Mark | ALB1 | TE1-7 |
| **S** | | |
| Salisbury, Jennifer | A-013 | PC-047 |
| | SF4 | TE10-43 |
| Salzmann, Karin | SF8 | TE14-25 |
| Sanchez, Corrine | SF4 | TE10-47 |
| Sanchez, J. Gilbert | SF4 | TE10-56 |
| Sanchez, Kathy | SF4 | TE10-41 |
| Sanchez, Paul E. | C-055 | PC-083 |
| Sandford, Tom | C-019 | PC-062 |
| Santelli, Maria | ALB1 | TE1-14 |
| Savignac, Noel | ALB1 | TE1-12 |
| Savorra, John | C-092 | PC-107 |
| Schaefer, William | C-069 | PC-092 |
| Schaller, Charmian | V1 | PC-659 |
| Schinnerer, Mark | CA1 | TE16-49 |
| Schmidt, Ray | SF1 | TE7-12 |
| Schonbeck, Niels | C-091 | PC-107 |
| Schrader, Don | ALB3 | TE3-13 |
| Schroeder, Sandra | ALB2 | TE2-41 |
| Seaman, Magdalen | DE1 | TE15-53 |
| Seese, Linda | C-034 | PC-072 |
| Seibel, Lety | SF1 | TE7-15 |
| Seibel, Tom | SF1 | TE7-16 |
| Seydel, Robin | ALB3 | TE3-17 |
| Seymour, Marion | SF2 | TE8-33 |
| Shah, Subhas | ALB4 | TE4-6 |
| Shelton, Jay | SF2 | TE8-26 |
| | SF8 | TE14-3 |
| Shendall, Karl | OR1 | TE19-17 |
| Shepard, Burleigh | SF6 | TE12-18 |
| Shepard, David | ALB3 | TE3-4 |
| | ALB5 | TE5-31 |
| Shepherd, Les | SF4 | TE10-33 |
| Shoup, George | SF4 | TE10-9 |
| Shropshire, Richard | C-108 | PC-122 |
| Shuker, Scott | SF5 | TE11-7 |
| Sica, Fred | BO1 | TE17-33 |
| Sigal, Lorene | OR2 | TE20-8 |
| Sigsredt, Shawn | SF2 | TE8-21 |
| Simonov, Erica | C-037 | PC-074 |
| Skinner, Elliott | SF2 | TE8-34 |
| Skinner, Elliott (continued) | SF8 | TE14-1, TE14-45 |
| Slay, Bob | C-104 | PC-119 |
| Smiley, Scott | DE1 | TE15-63 |
| Snow, David T. | C-163H | PC-602 |
| Sol, Maria | SF8 | TE14-18 |
| Sollitt, Shannyn | SF3 | TE9-32 |
| Solomon, Ame | SF8 | TE14-22 |
| Sommers, Shari | ALB4 | TE4-21 |
| Sougstad, Ruth | SF8 | TE14-16 |
| Sparaco, Lisa | ALB1 | TE1-23 |
| Spencer, Sally | C-044 | PC-77 |
| Sperling, Linda | ALB3 | TE3-31 |
| Sprinkle, James K. | C-004 | PC-54 |
| St. John, Bill | CA1 | TE16-25 |
| | SF4 | TE10-26 |
| Stanley, Melinda | ALB5 | TE5-28 |
| Stayner, Diane | C-071 | PC-93 |
| Steele, Mary | ALB4 | TE4-30 |
| Stein, Ed | V1 | PC-659 |
| Steinhoff, Monika | SF7 | TE13-38 |
| Stix, Amy | SF6 | TE12-10 |
| Stout, Sarah | C-036 | PC-73 |
| Stratton, William R. | C-101 | PC-117 |
| Stroud, Cliff | CA1 | TE16-51 |
| | SF4 | TE10-9 |
| Suderman, Carole J. | C-030 | PC-70 |
| Sullivan, Kathleen | C-162 | PC-403 |
| | DE1 | TE15-11, TE15-43, TE15-47 |
| | SF2 | TE8-11 |
| Sutherland, Julie R. | C-160 | PC-401 |
| | SF7 | TE13-41 |
| Swanson, Sonja | SF5 | TE11-36 |
| Swedlund, Cathy | SF3 | TE9-5 |
| **T** | | |
| Tadolini, Stephen C. | C-006 | PC-55 |
| Tashel, Carole | SF7 | TE13-2 |
| Taylor, Willie R. | A-011 | PC-34 |
| Tenney, Debra | ALB6 | TE6-23 |
| Thomas-Weger, Jon | ALB4 | TE4-34 |
| Thompson, Don | ALB4 | TE4-9 |
| Thompson, Sally Alice | ALB1 | TE1-20, TE1-26 |
| Thrasher, Robert | C-081 | PC-100 |
| Thurlow, Andrew | DE1 | TE15-50 |
| Tinno, Keith | C-132 | PC-315 |
| Trever, Kathleen E. | A-012 | PC-35 |

| Name | Document Number | Page Number |
|---|---|---|
| Trigg, Bruce | ALB3 | TE3-15 |
| | E-008 | TE3-49 |
| Trump, Mark | C-054 | PC-83 |
| Tsinhnahjinnie, Tsosie | ALB6 | TE6-18 |
| Tsosie, Carl | SF8 | TE14-11 |
| Tully, Jon | CA1 | TE16-22 |
| Turner, Doug | OR2 | TE20-8 |
| Tyrrell, Patrick | ALB6 | TE6-33 |

## U

| | | |
|---|---|---|
| Udall, Tom | A-008 | PC-9 |
| | SF1 | TE7-39 |
| Uhrich, Jack | ALB3 | TE3-32 |
| Unknown, Michael | C-063 | PC-89 |
| Usrey, Elgan H. | A-010 | PC-31 |

## V

| | | |
|---|---|---|
| Van Hecke, James F. | C-017 | PC-061 |
| VanZandt, Tom | C-013 | PC-059 |
| Velasquez, Geri | C-015 | PC-060 |
| Voigt, Glenna | ALB6 | TE6-30 |
| Voinovich, George | A-004 | PC-006 |
| Volpentest, Sam | C-059 | PC-086 |
| Vuk, Melvin M. | C-052 | PC-082 |
| | C-115 | PC-126 |

## W

| | | |
|---|---|---|
| Walton, Barbara A. | OR2 | TE20-8 |
| Wass, David | V1 | PC-660 |
| Watson, N. | C-136 | PC-322 |
| Watson, Robert D. | C-009 | PC-056 |
| Weaver, Larry | C-100 | PC-116 |
| Weiner, Rich | ALB6 | TE6-44 |
| Weiner, Ruth | ALB6 | TE6-3 |
| | E-021 | TE6-51 |
| Weinstock, Lesley | ALB2 | TE2-36 |
| Weisberg, Maurice | ALB2 | TE2-11 |
| | E-005 | TE2-55 |
| West, Elizabeth | SF5 | TE11-20 |
| Wexler, Merida | ALB4 | TE4-28 |
| Wheeler, Jeanne | SF5 | TE11-17 |
| White, Jack | CA1 | TE16-19 |
| Whitlock, Brian | BO1 | TE17-17 |
| Whittenberg, Linda | C-008 | PC-056 |
| Wiebalk, Angela | ALB4 | TE4-27 |
| Wiggins, Chuck | SF4 | TE10-26 |
| Williams, Sharon | ALB6 | TE6-26 |
| Williams, Tom | C-051 | PC-081 |
| Williamson, Kent | C-033 | PC-072 |
| Willson, Harry | ALB3 | TE3-22 |
| Wilson, Justin P. | A-010 | PC-030 |
| Wilson, Nancy | C-014 | PC-060 |
| Wishau, Roger | C-143 | PC-339 |
| Wohl, Eva | SF3 | TE9-6 |
| Wood, C.M. | C-028 | PC-069 |
| Worth, Kenneth | DE1 | TE15-53 |

## Y

| | | |
|---|---|---|
| Young, Jill | C-027 | PC-068 |
| Young, Roy | C-124 | PC-133 |
| | DE1 | TE15-35 |

## Z

| | | |
|---|---|---|
| Zelevansky, Nina | C-041 | PC-076 |