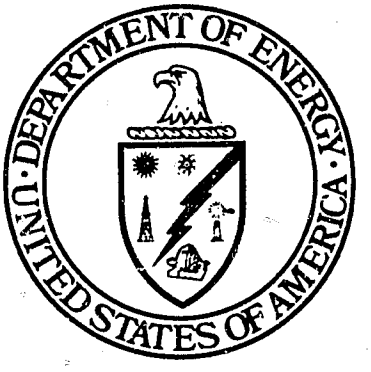
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U.S. Department of Energy
Washington, DC 20585

Environment, Safety and Health
Office of Environmental Audit



Environmental Survey
Preliminary Report

Sandia National Laboratories
and: Inhalation Toxicology Research Institute
Bendix Albuquerque Operations
Central Training Academy
Transportation Safeguards Division
Tonopah, Test Range

Albuquerque, New Mexico

April 1988

MASTER

PREFACE
TO
THE DEPARTMENT OF ENERGY
ENVIRONMENTAL SURVEY PRELIMINARY REPORT
FOR THE SANDIA NATIONAL LABORATORIES-ALBUQUERQUE

This report contains the preliminary findings based on the first phase of an Environmental Survey at the Department of Energy (DOE) Sandia National Laboratories located at Albuquerque, New Mexico. The Survey is being conducted by DOE Office of Environment, Safety and Health.

The Sandia Survey is a portion of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey is one of a series of initiatives announced on September 18, 1985, by Secretary of Energy John S. Herrington, to strengthen the environmental, safety and health programs and activities within DOE. The purpose of the Environmental Survey is to identify, via a "no-fault" baseline Survey of all the Department's major operating facilities, environmental problems and areas of environmental risk. The identified problem areas will be prioritized on a Department-wide basis in order of importance in 1989.

The findings in this report are subject to modification based on the results from the Sampling and Analysis phase of the Survey. The findings are also subject to modification based on comments from Albuquerque Operations Office concerning the technical accuracy of the findings. The modified preliminary findings and any other appropriate changes will be incorporated into an Interim Report. The Interim Report will serve as the site-specific source for environmental information generated by the Survey, and ultimately as the primary source of information for the DOE-wide prioritization of environmental problems in the Final Survey Report.

April 1988
Washington, D.C.

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PRELIMINARY

EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Sandia National Laboratories conducted August 17 through September 4, 1987.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with Sandia National Laboratories-Albuquerque (SNLA). The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at SNLA, and interviews with site personnel.

The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for SNLA. The Interim Report will reflect the final determinations of the SNLA Survey.

Site Description

SNLA occupies an area of approximately 15,600 acres located in various Technical Areas and test sites inside Kirtland Air Force Base (KAFB) southeast of Albuquerque, New Mexico. The facilities at SNLA are operated for DOE by the Sandia Corporation, which is a subsidiary of AT&T Technologies, Inc. The primary function of SNLA is the research and development of weapons which use nuclear explosives including design of the arming, fusing, and firing systems used in nuclear bombs and warheads. Other projects include nuclear reactor safety studies; development of safe transport and storage systems for special nuclear material including plutonium

and uranium; radioactive waste disposal techniques and site studies; pulsed power research; vertical axis wind turbine research; and fossil fuel and geothermal energy research.

The Environmental Survey of SNLA includes six other associated but organizationally or geographically separated facilities. These include Bendix Albuquerque Operations (BAO), the Inhalation Toxicology Research Institute (ITRI), the Life Sciences Laboratory (LS-1), the Central Training Academy (CTA), and the Transportation Safeguards Division (TSD), all of which are located within KAFB. A satellite test site called the Tonopah Test Range (TTR), which is located 140 miles northwest of Las Vegas, Nevada, was also included in this Survey. It should be noted that the term "SNLA" is used occasionally throughout this report to refer to the range of DOE operations within KAFB, and should not be construed as a sole reference to facilities operated by Sandia Corporation for DOE.

Summary of Findings

The major preliminary findings of the Environmental Survey at SNLA are:

- Toxic chemicals from current and past discharges at several locations in SNLA Technical Area I to sanitary sewers, may potentially contaminate the liquid effluents and sediments in the KAFB sewage lagoons and golf course pond. Some discharges are also directed to the City of Albuquerque publicly owned treatment works (POTW) and may contaminate the POTW sludge or pass through untreated and contaminate surface waters.

- There is a potential for groundwater contamination from ITRI as a result of hazardous substances disposed of in lined and unlined surface impoundments. The underlying groundwater has become or may become contaminated by these hazardous substances, and contaminants may migrate off-site.

- Contamination control and monitoring practices at SNLA do not ensure that radionuclide levels on materials and facilities, considered suitable for use or release without radiological control restrictions, satisfy certain

guideline levels recommended by the Nuclear Regulatory Commission (NRC) or DOE. Land areas, facilities, items of equipment, and materials with radionuclide concentrations exceeding recommended levels, may be released to the environment and/or for eventual use by the public. In some circumstances, the resulting radiation doses to individual members of the public could exceed established Federal limits of 100 mrem/year.

- Past and current discharges of photographic development chemicals, solvents, and potentially radioactive substances to the soil columns at SNLA Technical Areas II and III and 99XX facilities have occurred through the septic tank systems. Some 99XX facilities discharge liquid effluents directly to the ground surface. Soil and potential groundwater contamination may result.

- Infiltration of surface water into mixed waste burial areas (e.g., SNLA Technical Area II inactive site and Technical Area III classified site and open trench) increases the potential for migration of radionuclides and hazardous substances into the soil and groundwater.

- Prior discharges of solvents and acids as well as current releases of high levels of fluorides, chlorides, and sulfates from BAO Building 870 may have resulted in pollutants concentrating in the Albuquerque POTW. Disruption of the POTW and contamination of its sludge may result.

- SNLA trash contaminated with hazardous waste materials may have been improperly disposed of at the KAFB sanitary landfill.

- SNLA weapons component destructive testing and disposal at off-site locations may have resulted in the development of potential environmental contamination (e.g., soil, surface water and groundwater) at these locations.

Overall Conclusions

The Survey found no environmental problems at SNLA that represent an immediate threat to human life. The environmental problems identified at SNLA by the Survey

do confirm that the site is affected by a number of chronic environmental problems. These problems vary in terms of their magnitude and risk, as described in this report. Although the sampling and analysis performed by the SNLA Survey will assist in further identifying environmental problems at the site, a complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Response actions currently under way or planned at the site will contribute toward meeting this requirement.

Transmittal and Follow-up of Findings

The preliminary findings of the Environmental Survey of SNLA were shared with the Albuquerque Operations Office (AL) and the site contractor at the Survey closeout briefing held September 4, 1987. AL expects to develop a draft Action Plan to address the Survey preliminary findings in April 1988. Previously, AL presented the preliminary findings to the state regulatory agencies and regional EPA at a meeting on September 28, 1987. A final Action Plan addressing all the Survey findings cited herein will be prepared by AL within 45 days of receiving this Preliminary Report. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring environmental compliance and the status of the SNLA Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

DRAFT

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, conducted August 17 through September 4, 1987, at the United States Department of Energy (DOE) Sandia National Laboratories-Albuquerque (SNLA), New Mexico. As a Preliminary Report, the contents are subject to revisions, which will be made in a forthcoming Interim Report, based on Albuquerque Operations Office (AL) review and comments on technical accuracy, the results of the Sampling and Analysis program, and other information that may come to the Survey team's attention prior to issuance of the Interim Report. SNLA is currently operated for DOE by the Sandia Corporation, a subsidiary of AT&T Technologies, Inc.

The SNLA Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The SNLA Environmental Survey was conducted by an interdisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from the DOE Office of Environmental Audit. A complete list of Survey participants and their affiliations is included in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols in the DOE Environmental Survey Manual. Substantial use of existing information and of

interviews with knowledgeable field office and site-contractor personnel accounted for a large part of the on-site effort. A summary of the site-specific Survey activities is presented in Appendix B, and the Survey Plan is presented in Appendix C.

The preliminary Survey findings, in the form of existing and potential environmental problems, are presented in Sections 3.0 and 4.0. Section 3.0 includes those findings that pertain to a specific environmental medium (e.g., air or soil, surface water and groundwater), whereas Section 4.0 includes those that are non-media-specific (e.g., waste management, radiation, and quality assurance). Because the findings are highly varied in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections 3.0 and 4.0.

The criteria for placing a finding into one or more of the four categories are as follows:

Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental, Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.

Category II findings encompass one or more of the following situations:

- Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.

- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the timeframe of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other environmental management practices.

- Noncompliance with significant regulatory procedures, i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits.

Category II findings include those environmental problems where the risk is high but the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, more discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.

- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this category, the range of alternatives available for response, and the corresponding timeframes for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases as well

as multiyear budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a concentration that presents a concern for local populations or the environment that is sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations, even though below those established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term "environmental problem" is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I-III. Such findings can be based upon any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further

evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate Program Office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another between media categories is not appropriate or valid. The categorization and listing of findings in order of significance within each media category in this report is only the first step in a multistep iterative process to prioritize DOE problems.

The next portion of the SNLA Survey is the Sampling and Analysis (S&A) phase. Idaho National Engineering Laboratory (INEL), the S&A team for SNLA, will begin taking samples in early 1988. Prior to sampling, an S&A Plan will be prepared by DOE and INEL in accordance with the protocols in the DOE Environmental Survey Manual. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey, and to fill existing data gaps or weaknesses.

An Interim Report will be prepared 6 to 8 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve as the site-specific source for information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems.

It is clear that certain findings and observations contained in this report, especially those in Category II, can and should be addressed in the near term (i.e., prior to the DOE-wide prioritization effort). It is also clear that the findings and observations in this report are highly varied in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective action. The

information in this Preliminary Report will assist AL in the planning of these near-term responses.

AL expects to develop a draft Action Plan in April, 1988 in response to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the SNLA Survey Status Report dated September 28, 1987. The draft Action Plan for the SNLA Survey will be reviewed by the Office of Environmental Guidance and Compliance (OEG) which has immediate responsibility for monitoring the status and overseeing the adequacy of corrective actions taken by the Operations Office in response to the Survey findings.

As required in the December 2, 1987, memorandum from the Assistant Secretary for Environment, Safety and Health to the Operations Office Managers entitled, Follow-up of Environmental Survey Findings, AL will prepare and submit a final Action Plan to the Deputy Assistant Secretary (DAS) for Environment within 45 days of receiving this Preliminary Report. The final Action Plan for the SNLA Survey will address all of the preliminary findings cited herein, and incorporate OEG's comments on the draft Action Plan.

PRELIMINARY

2.0 GENERAL SITE INFORMATION

2.1 Site Setting

Sandia National Laboratories-Albuquerque (SNLA) is located on Kirtland Air Force Base (KAFB), south of the City of Albuquerque, in Bernalillo County, New Mexico. Sandia National Laboratories also includes laboratories in Livermore, California, and a major test range in Tonopah, Nevada. Sandia National Laboratories is owned and controlled by the United States Department of Energy (DOE), and is operated by Sandia Corporation, a subsidiary of AT&T Technologies, Inc. This report discusses only SNLA and other DOE owned and controlled facilities located on KAFB. Sandia National Laboratories, Livermore (SNLL) is discussed in a separate report. Appendix E of this report discusses the Tonopah Test Range (TTR). Operations began under Sandia Corporation at SNLA in 1949 and at TTR in 1957.

Several other DOE owned and controlled facilities are located on KAFB in addition to SNLA. These are:

- Bendix Albuquerque Operations (BAO), formerly operated by Sandia Corporation and presently operated by Bendix Corporation;
- The Inhalation Toxicology Research Institute (ITRI), operated by the Lovelace Biomedical Foundation;
- The Life Sciences Laboratory (LS-1), also referred to as the Biodynamics Facility, formerly operated by the Lovelace Biomedical Foundation and presently operated by Los Alamos National Laboratory (LANL);
- The Central Training Academy (CTA), formerly operated by SNLA and presently operated by Wackenhut Services, Inc.; and
- The Transportation Safeguards Division (TSD) operated by the Albuquerque Operations Office (AL).

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AL also controls some facilities on Manzano Base through SNLA. Manzano Base is located on and operated by KAFB.

Figure 2-1 is a general location map, showing the locations of KAFB and SNLA areas within the base. Figure 2-2 indicates the boundaries of SNLA controlled areas. KAFB is bounded on the west by the Albuquerque International Airport, on the north by the City of Albuquerque, on the north and east by Cibola National Forest, and on the south by the Isleta Indian Reservation. Cibola National Forest is controlled by the United States Forest Service (USFS). There are two restricted-access buffer zones on the southwest corner of the site, which separate public access areas and the Isleta Indian Reservation from KAFB and SNLA operations.

The AL facilities located on KAFB operate under a complex series of land use agreements among AL, KAFB, and USFS. The AL facilities and operations are located on land leased from KAFB, and also on land withdrawn from the USFS by either KAFB or AL.

KAFB is located on two mesas which are divided by Tijeras Arroyo, a canyon which runs from east to west. The two mesas are bounded on the east by the Manzano Mountains in Cibola National Forest, and on the west by the Rio Grande, which is about 5 miles from KAFB and which flows from north to south. The total area of KAFB is approximately 74 square miles, a quarter of which is controlled by the DOE. The mean elevation of KAFB is 5,348 feet. Elevations range from 4,920 feet at the Rio Grande to 10,682 feet at Sandia Crest, in the Sandia Mountains northeast of the site. The largest population center in Bernalillo County is Albuquerque, directly north of the site. In 1980, Albuquerque had a population of 331,767, according to census figures. The Isleta Indian Reservation, the next nearest population center to the site, had a population of 1,872 in 1980. Approximately 500,000 people live within a 50-mile radius of the site.

Bernalillo County, and the Albuquerque area in particular, has grown significantly in the past two decades. The estimated population of the county was 449,389 in

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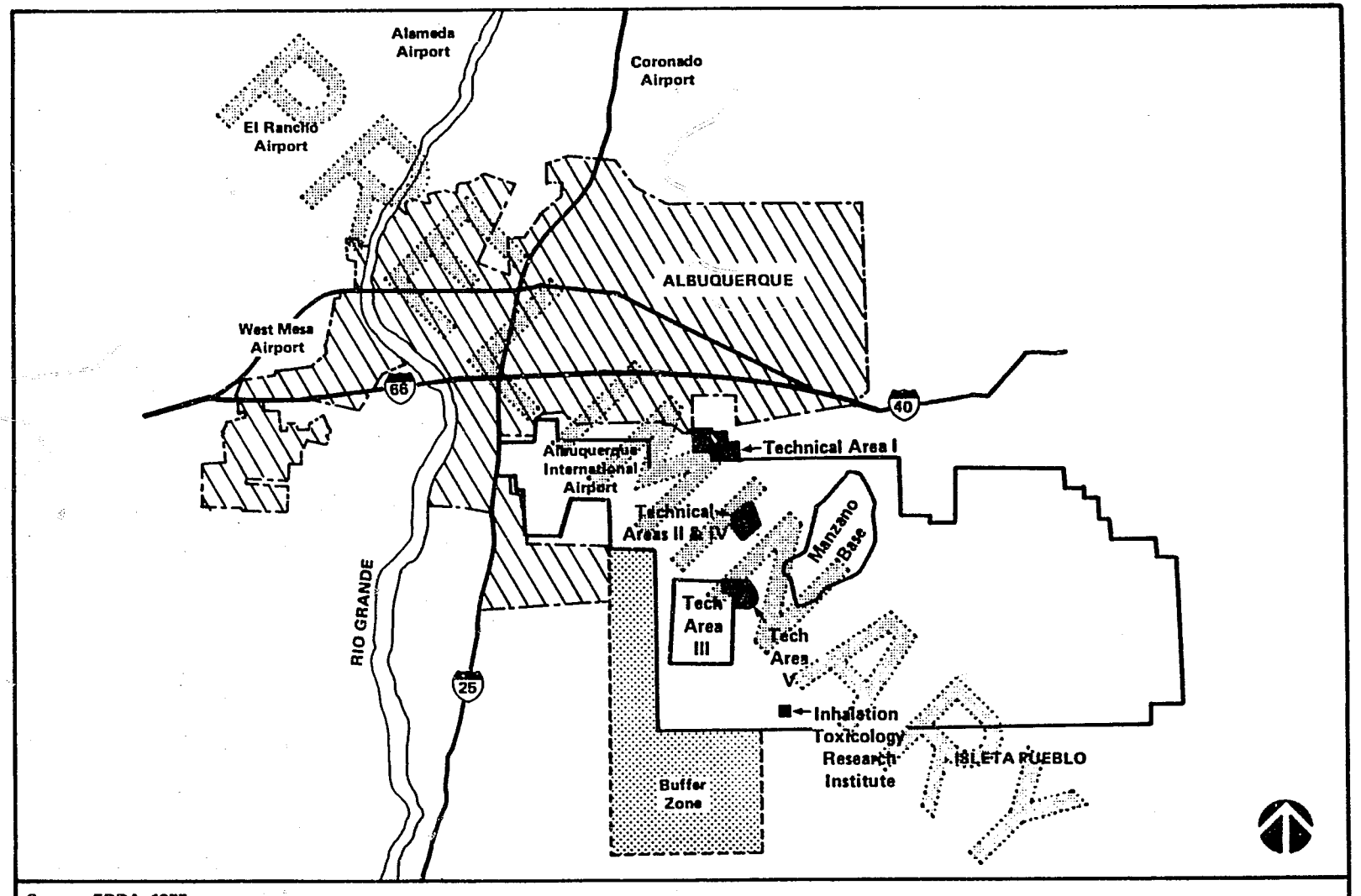
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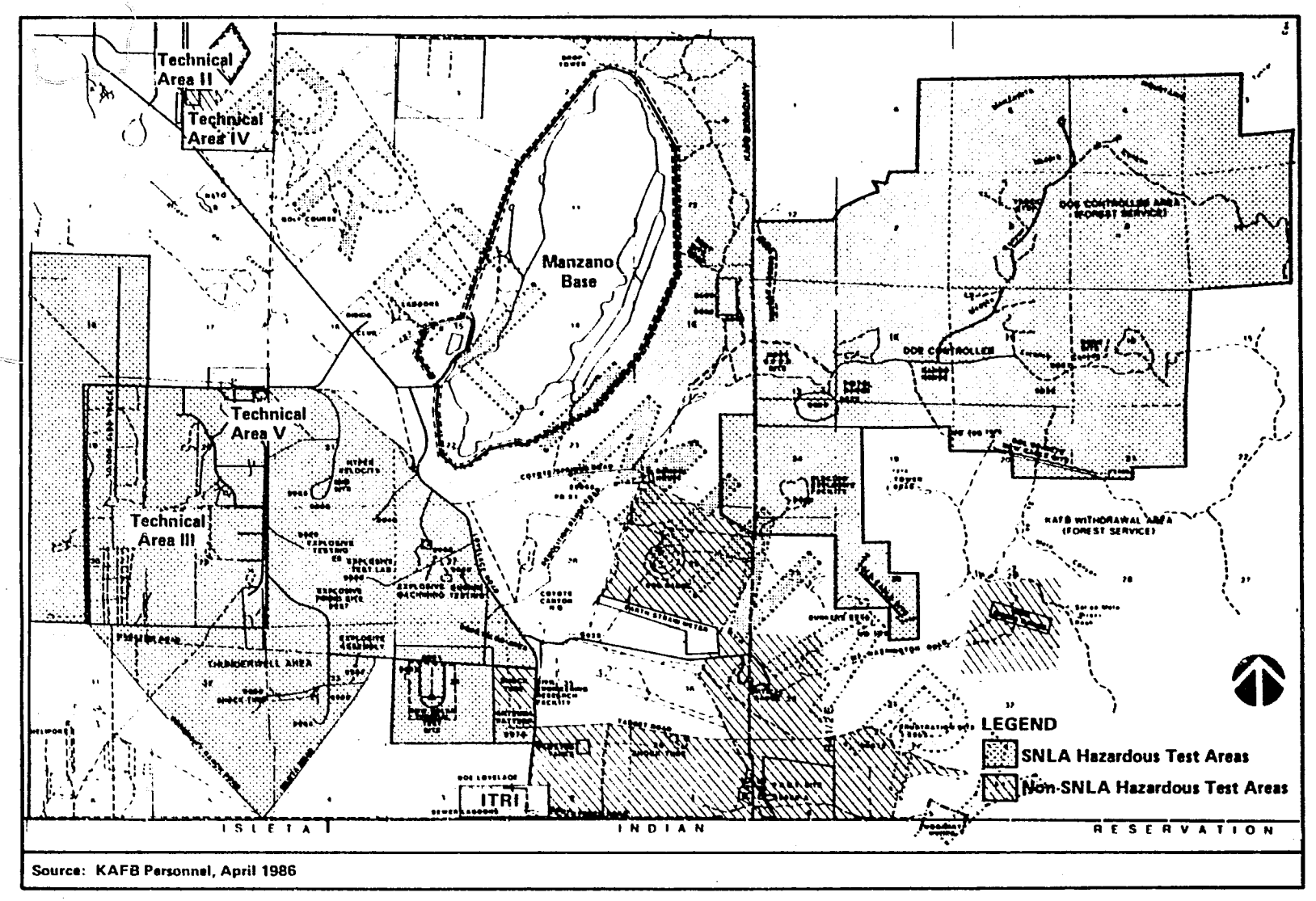
Bernalillo County, and the Albuquerque area in particular, has grown significantly in the past two decades. The estimated population of the county was 449,389 in



Source: ERDA, 1977

LOCATION OF SANDIA NATIONAL LABORATORIES
TECHNICAL AND TEST AREAS WITHIN
KIRTLAND AIR FORCE BASE

FIGURE 2-1



Source: KAFB Personnel, April 1986

BOUNDARIES OF AREAS CONTROLLED BY SNLA WITHIN THE KIRTLAND AIR FORCE BASE

FIGURE 2-2

1984, a 7 percent increase from the 1980 figure of 420,262. The population of the county was 331,774 in 1970.

The mesa surrounding the site is primarily populated by native desert vegetation such as cacti, sage, and juniper, and also shrubs and grasses, with few trees. Tumbleweeds are prolific in areas of disturbed soil. Precipitation on the crest and eastern slopes of the Sandia and Manzano Mountains is sufficient to support dense forests and grasses. Irrigation from groundwater and from the Rio Grande supports farming and fruit trees in the Rio Grande Valley. The City of Albuquerque has trees, shrubs, and other vegetation typically found in urban areas. Domestic and municipal water in the area is supplied by groundwater wells with an average depth of 1,000 feet.

The climate in the Albuquerque areas is arid continental, characteristic of high altitudes. Sunshine is abundant throughout the year, and more than 75 percent of daylight hours have sunshine. The area is dry, and the average annual relative humidity is 43 percent, falling to less than 20 percent in July. The average precipitation is about 8 inches per year, half of which occurs in the form of brief thundershowers during July through September. Winter months are generally dry with less than 2 inches of precipitation. Much of the winter precipitation is in the form of snow. The crest and eastern slopes of the Manzano and Sandia Mountains receive significantly more snow than the lower elevation mesas. The thundershower activity in the summer months is sufficient to cause intermittent flow and erosive conditions in the Tijeras Arroyo and other smaller arroyos on the site. There are no continuously running streams on KAFB.

Average monthly temperatures vary from 35° F in the month of January to 79° F in the month of July. Daily temperature ranges are wide, with nighttime temperatures considerably lower than daytime temperatures because of the high elevation and sparse cloud cover. Rapid nighttime ground cooling provides strong temperature inversions.

Prevailing winds on KAFB are from the southeast. Sustained winds of greater than 12 mph occur approximately 20 percent of the time at Albuquerque International Airport. Sustained winds greater than 25 mph occur less than 3 percent of the time. Strong winds which can be accompanied by blowing dust occur in the late winter

and early spring months. Nighttime temperature inversions can cause strong drainage winds down Tijeras Arroyo. The Albuquerque area recorded its first and only tornado in 1985.

2.2 Overview of Major Current Site Operations

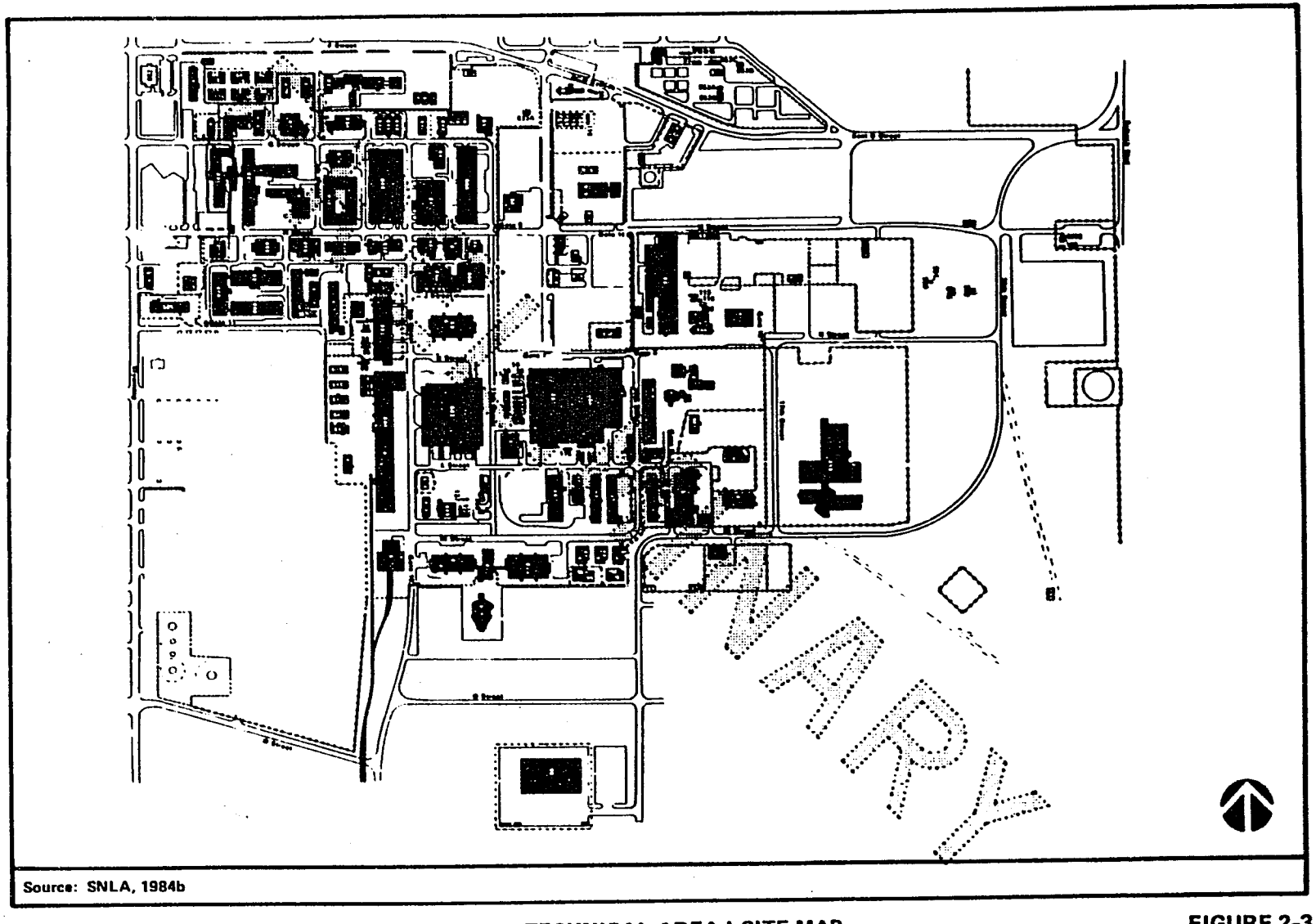
2.2.1 Sandia National Laboratories-Albuquerque

Sandia National Laboratories-Albuquerque (SNLA) began as an outgrowth of the Z Division of LANL in 1946. SNLA presently consists of five Technical Areas, which contain laboratory facilities, research and development facilities, and testing facilities, and several remote areas in which laboratory and field testing facilities are located. Each of the areas has unique and distinctive missions, which can vary and have historically varied in response to the requirements of the national defense program. Historical operations at SNLA Technical Areas and remote areas are therefore in some cases very different from current operations.

SNLA consists of five Technical Areas (I to V) and several remote areas, including the Coyote Canyon and Lurance Canyon test areas, the Old and New Aerial Cable test facilities, and the Thunder Range. A list of major buildings, facilities, and areas of SNLA is included in Appendix I.

Technical Area I

Technical Area I (see Figure 2-3) is primarily devoted to the development and design of weapons systems and systems components and on a limited basis, weapons system component fabrication. Physics, chemical, and electronics laboratories and weapons assembly facilities occupy some of the larger buildings. Also in Technical Area I are various development shops and laboratories, including a Plastics Shop, Glass Shop, foundry, several machine shops, and plating, photography, ceramics, vapor deposition, battery development, and coatings laboratories. Ongoing development efforts include thermal batteries, neutron generators, projectile shapes and materials, and electronic components. Technical Area I also includes facility engineering services such as carpentry and paint shops, environmental and health physics laboratories, hazardous waste and hazardous materials storage



Source: SNLA, 1984b

TECHNICAL AREA I SITE MAP

FIGURE 2-3

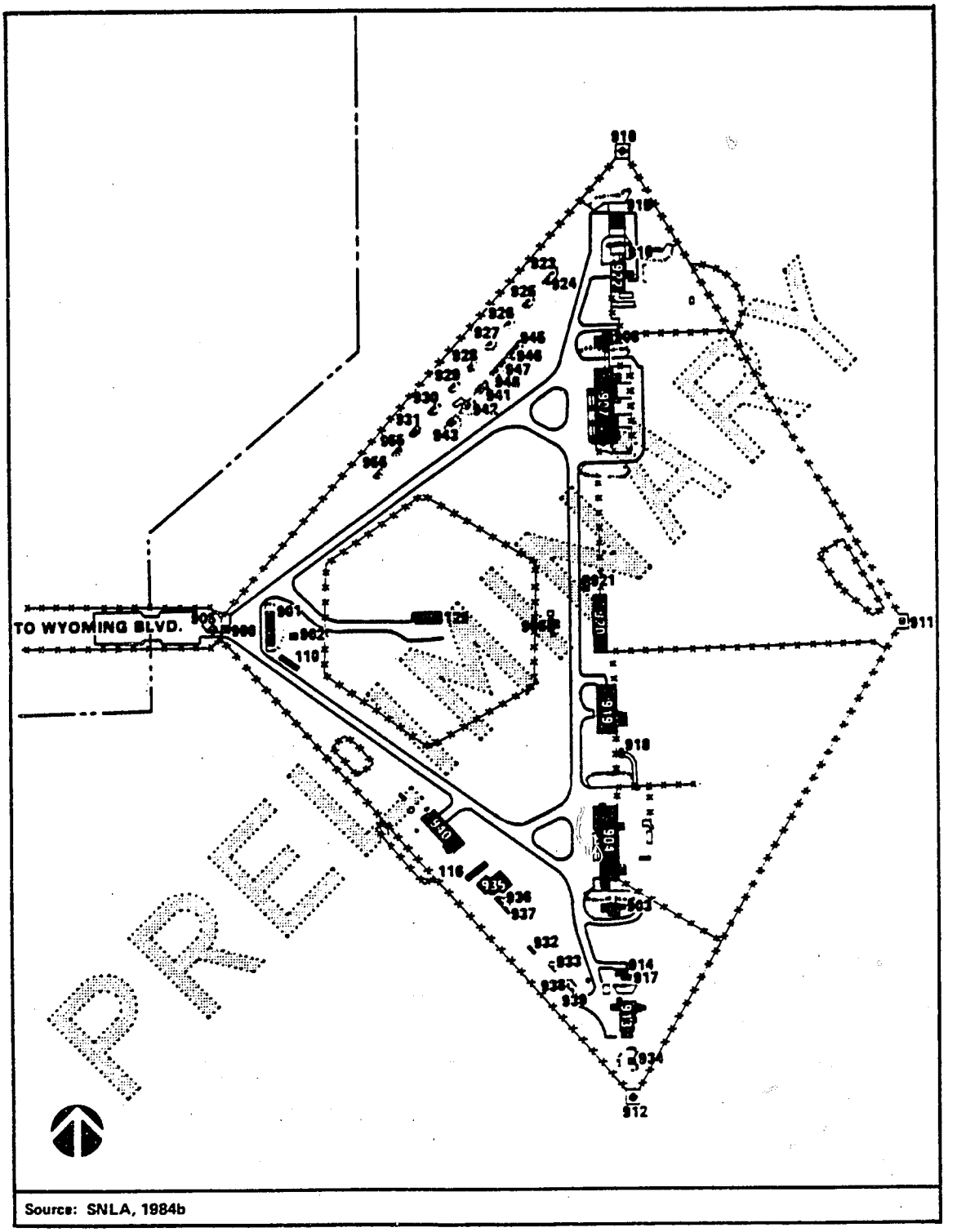
areas, emergency power generators, and a gas-fired steam plant. A detailed discussion of the laboratories and development shops contained in Technical Area I is contained in Appendix J.

Technical Area II

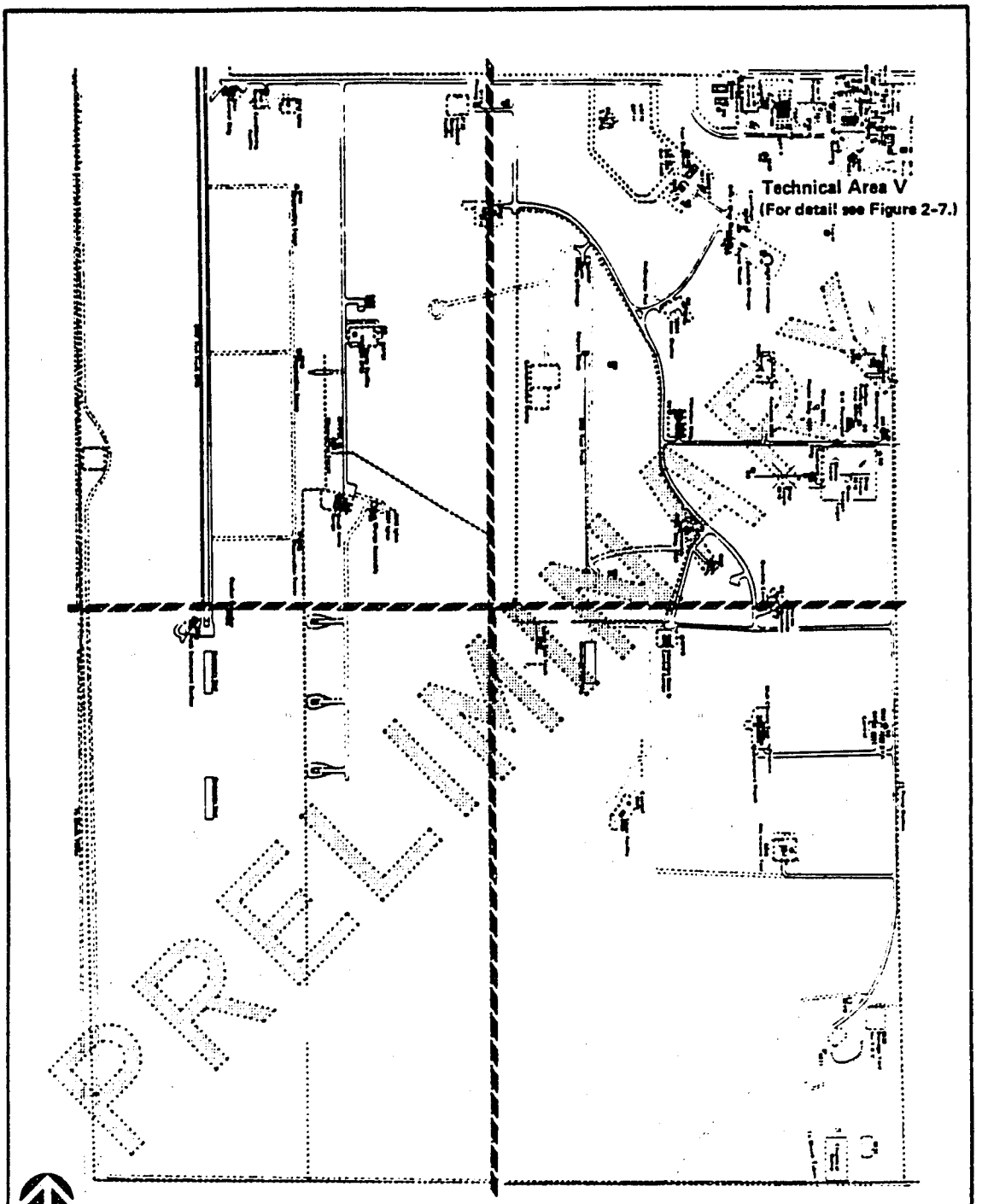
Technical Area II (see Figure 2-4), located directly south of Technical Area I, is used for small-scale explosives testing and characterization, explosive storage, and several other types of tests not involving explosives. Explosives test facilities conduct tests of detonators, aging of explosive detonators, time and temperature characterization of explosive detonations, and destructive testing of neutron generators. Other facilities are used for destructive testing of batteries, metal vapor deposition studies and military smoke generator tests. Technical Area II also contains an area in which classified wastes are disposed of in trenches. A detailed discussion of the laboratory and development shops in Technical Area II is contained in Appendix J.

Technical Area III

Technical Area III (see Figure 2-5) is located 5 miles south of Technical Area I, and contains approximately 20 test facilities, some of which are inactive. This area contains large-scale environmental testing facilities, including two sled tracks (6550 and 6740); two centrifuges; (6526); a climatic test chamber (6630); a radiant heat facility (6536); and a drop test tower (6510). These facilities are used to subject weapons components and other test units to the extreme conditions to which they may be subjected in actual use. Technical Area III also includes the Light-Initiated Explosives Facility (6715) and the Thermite Pressure Test Facility (6922). Other facilities in Technical Area III include the Classified-Waste Destructor (6583); the Metal-Melting and Solidification Facility (6630); the Radioactive Waste Burial Ground; the Chemical Waste Landfill; and a number of facilities which are no longer active. Inactive facilities in Technical Area III are discussed in Section 4.5.



TECHNICAL AREA II SITE MAP FIGURE 2-4



Source: SNLA, 1984b

TECHNICAL AREA III SITE MAP FIGURE 2-5

Technical Area IV

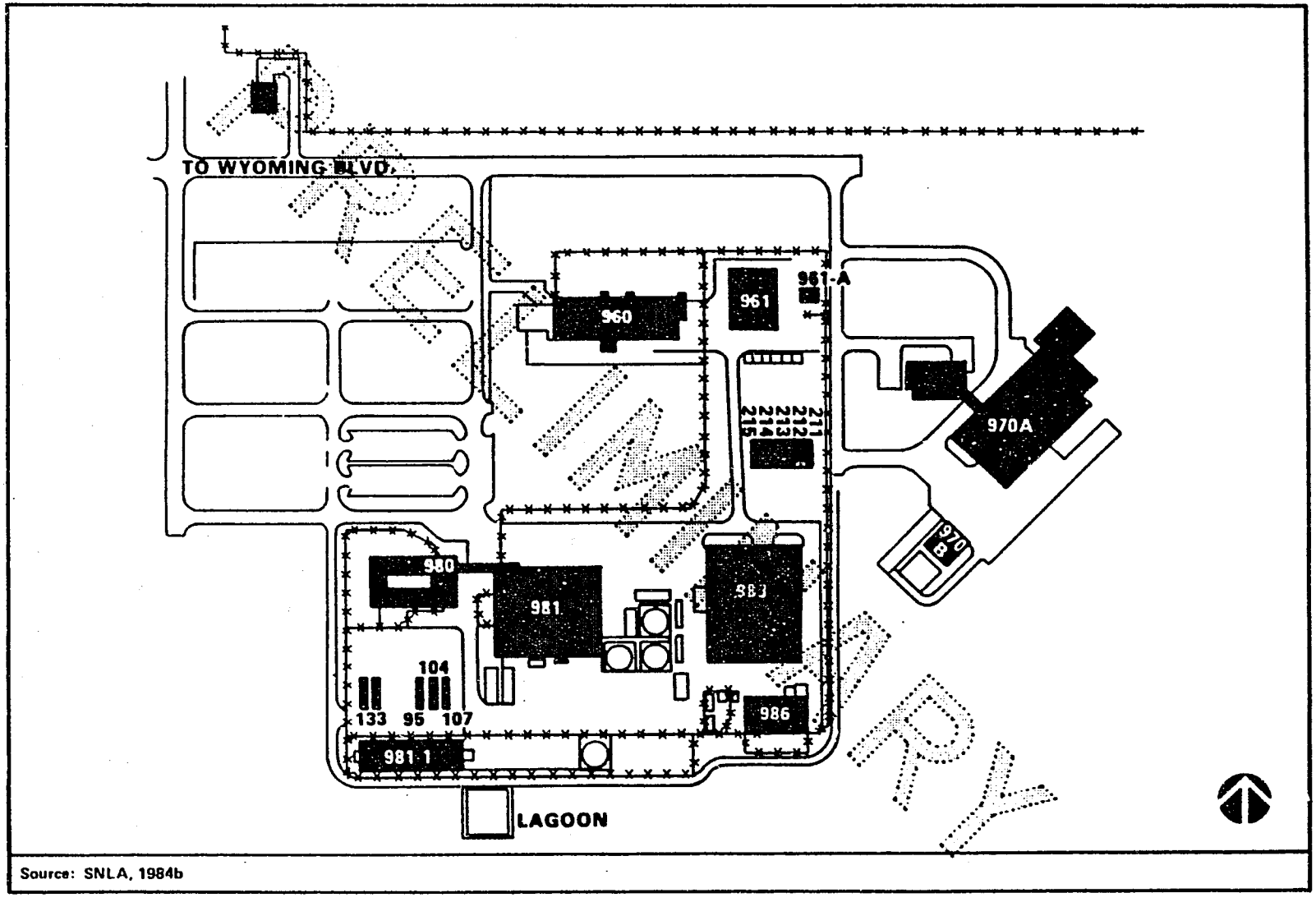
Technical Area IV (see Figure 2-6) is a relatively new area located adjacent to Technical Area II. This area contains the Particle Beam Fusion Accelerator (PBFA-II) which is used for fusion energy/research. Also in Technical Area IV is the HERMES II high energy X-ray source, used to test material response to radiation effects. The Simulation Technology Laboratory (STL) in Technical Area IV was under construction at the time of the Survey. STL will house several new high-energy irradiation facilities, including the HERMES III pulsed power facility and Saturn, an upgrade of PBFA-I, which will be used for testing X-ray effects on materials and components.

Technical Area V

Technical Area V (see Figure 2-7) is located adjacent to and directly east of Technical Area III, and contains three research reactors: the Sandia pulse reactors (SPR-II and SPR-III) and the annular core research reactor (ACRR). Both SPR-II and SPR-III are fast-burst reactors used for irradiation tests. The ACRR is capable of both pulsed and steady-state operation, and is also used for irradiation studies. Technical Area V also contains an Intense Gamma Irradiation Facility (GIF) and a Hot Cell Facility.

Remote Areas and Facilities

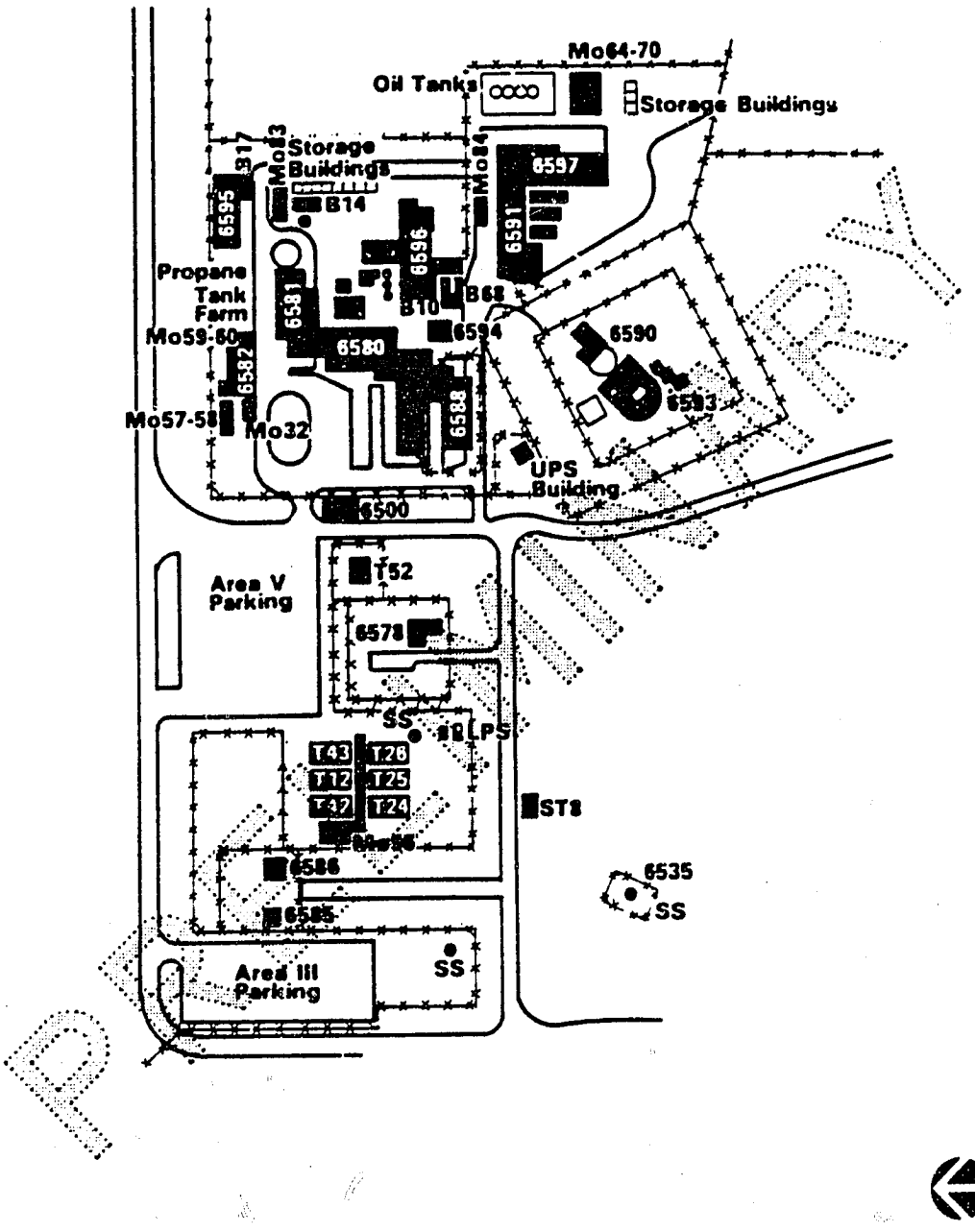
Figure 2-2 shows the remote areas of SNLA, which are those areas and facilities outside the five Technical Areas previously discussed. These areas and facilities are generally numbered in the 9800 and 9900 series; several areas, however, do not have numerical designations. Major remote areas are the Old and New Aerial Cable Sites located about 2 miles east of Technical Area III, which are used to conduct projectile tests; the Thunder Range (9964 to 9967), located to the immediate southeast of Technical Area III, which contains two shock tubes and other areas in which large-scale explosive tests are conducted; the burn site (9830) located to the northeast of the new cable facility, which contains one open-air and several enclosed facilities used to test the effects of fire on weapons components, transportation containers, electrical cables, etc.; and various explosives storage, assembly, and testing facilities, most located directly east of Technical Area III. These include the Detonator Test Facility (9930); the Explosives Machining



Source: SNLA, 1984b

TECHNICAL AREA IV SITE MAP

FIGURE 2-6



Source: SNLA, 1984b

TECHNICAL AREA V SITE MAP FIGURE 2-7

Facility (9960); the Steam Explosion Test Facility (9940); and an explosive test complex (9920/26). Other areas include the large molten core facility (9939), at which induction melting tests are conducted using depleted uranium and concrete; the solar tower (9981), used for solar energy research; and the hypervelocity gun site (9950/56), in which materials are subjected to impact tests. A number of the remote area facilities are now inactive. Inactive facilities in the remote areas are discussed in Section 4.5.

2.2.2 Inhalation Toxicology Research Institute

ITRI conducts inhalation exposure studies of various toxic and carcinogenic substances. The facility began operation in 1962 as the Fission Product Inhalation Laboratory, and was originally operated by the Lovelace Foundation for Medical Education and Research. In 1975 a subsidiary corporation of the Lovelace Foundation, the Lovelace Biomedical and Environmental Research Institute, Inc., was formed, which has as its sole purpose the operation of the ITRI. Both short-term and long-term inhalation studies are performed at ITRI to study the effects of exposure on animal respiratory systems using beagle dogs, mice, and other test animals. Test animals are exposed to alpha-emitting radionuclides, beta/gamma-emitting radionuclides, and toxic and carcinogenic substances in three separate areas of the facility. About 800 dogs and several thousand mice are presently at the facility.

ITRI is located southeast of SNLA Technical Area III, near the site boundary. The Isleta Indian Reservation is located directly south of the facility. The ITRI facility consists of exposure laboratories and associated biological laboratories, dog kennels, human and animal sanitary sewage lagoons, and inactive radioactive waste management units. Electrical power is provided to ITRI from the Public Service Company of New Mexico through a KAFB owned and maintained electrical distribution system. Water is provided from KAFB and City of Albuquerque wells through a KAFB, SNLA, and ITRI distribution system. ITRI operates a central boiler plant to produce steam and hot water for heating.

ITRI's main building is divided into several areas, based on the types of constituents tested and/or the function of the area. The Alpha Wing is used to conduct studies of alpha-emitting radionuclides, and the Beta/Gamma Wing is used to conduct

beta/gamma-emitting radionuclide studies. The Special Studies Area is used to conduct studies of nonradioactive compounds, including known and suspected carcinogens and toxic metals. A chemical/radiological analytical laboratory is located in a separate building. Support service areas at ITRI include the boiler room, located in the main laboratory building, and emergency diesel engines and a pathological-waste destructor, located in separate buildings.

2.2.3 Bendix Albuquerque Operations

Bendix Albuquerque Operations (BAO) is a facility devoted to the production of very large-scale integrated (VLSI) circuits. It is located in Building 870 of Technical Area I of SNLA, and is operated by Bendix Corporation. Building 870 was constructed in 1984 by SNLA and operated as a VLSI development facility until 1986, at which time control of the facility, now a production rather than development operation, was transferred from SNLA to Bendix.

Although located within the physical boundaries of SNLA, BAO functions relatively independently of SNLA, with its own production and management staff, waste management organization, purchasing organization, etc. SNLA provides environmental monitoring services and utility services to BAO.

2.2.4 Life Sciences Laboratory

LS-1, also referred to as the Biodynamics Facility, conducts experiments related to the effects of explosive blasts on animals (generally sheep). The facility is located approximately 1 mile north of ITRI, and consists of an explosive test range; Lake Christian, which is used to conduct underwater explosive blast tests; necropsy laboratories; and a photography laboratory. The facility has been in operation for about 30 years, and is presently operated by LANL.

2.2.5 Central Training Academy

The CTA, organized in 1984, is a training facility for DOE safeguards and security personnel. The CTA operates several training facilities and offices on the old Manzano Administrative Area, which is directly outside the Manzano Base boundary and administered by KAFB. The Live Fire Range (LFR), used for live

ammunition weapons training and exercises, is located approximately 6 miles east of the administrative area, in Coyote Canyon. The LFR is located on USFS land that has been withdrawn by the USAF and subsequently permitted to DOE.

2.2.6 Transportation Safeguards Division

The TSD operates the Transportation Safeguards Academy located in Lurance and Madera Canyons. Operators of the safe and secure transport system are trained at classrooms and field exercise stations where simulated nuclear weapon transportation accidents/incidents are conducted. A part of this training includes simulated terrorist attacks using laser-tagging simulated weapons. Approximately 50 staff and instructors are assigned to TSD.

2.3 City/County, State, and Federal Concerns

2.3.1 Meetings with Regulatory Officials

Representatives of the Survey team met with representatives of the City of Albuquerque, the State of New Mexico, USFS, and KAFB on July 9, 1987, as a part of the pre-Survey site visit. At this meeting, the Survey objectives and scope for the site were presented and the various representatives were provided an opportunity to present their concerns and to suggest areas where emphasis during the Survey should be placed. The involved agencies all expressed interest in the Survey and expressed a desire to receive a copy of the Interim Report.

The agencies raised the following issues concerning the site:

- "Cradle-to-grave" tracking of materials handled by DOE contractors and subcontractors, specifically concerning wastewater which passes from their direct control in treatment and disposal;
- Airborne emissions from the ITRI facility;
- Documentation of past discharges to watercourses, primarily related to stormwater discharges and their potential contamination;

- Evaluation of current discharges to watercourses, if any, including stormwater discharges;

- Documentation of DOE contractor activities occurring on USFS lands;

- KAFB waste disposal practices related to the processing and handling of wastes generated by DOE contractors;

- Availability of Survey team sample analyses to the regulatory authorities, particularly results relating to stormwater and surface-water discharges; and

- Evaluation of the existence of unpermitted surface-water outfalls.

No representatives from the U.S. Environmental Protection Agency (EPA) - Region VI were in attendance at the pre-Survey site visit meeting. EPA provided its concerns in a conference telephone conversation between Mr. James Highland and others of Region VI and Mr. Vincent Fayne, DOE Survey Team Leader on August 21, 1987. The following issues were raised by EPA:

- Media interest in the Survey status report is expected; this report should be provided to EPA Region VI;

- Chemical discharges to the KAFB lagoons/golf course resulting from DOE operations;

- Status of inactive radioactive waste sites, landfills, etc., at the site;

- Status of solid waste management units at the site;

- Addressing issues raised in the RCRA Facility Assessment prepared by EPA. [A copy of the Assessment was provided to the Survey team];

- Applicability of National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations to DOE contractor operations;

- Applicability of Federal New Source Performance Standards (NSPS) for air emission sources to DOE contractor operations;

- Inclusion of underground storage tanks (USTs) at the site in the Survey report;

- Inclusion of underground injection wells at the site in the Survey report. (No injection wells were located during the Survey at SNLA, BAO, or ITRI);

- Inclusion of PCB equipment/disposal at the site in the Survey report;

- Inclusion of air emission sources and solid waste management units (SWMUs) in the Survey report.

2.3.2 Federal Compliance Schedules

None of the DOE operations at the site are under Federal compliance orders.

2.3.3 State and City/County Compliance Schedules

2.3.3.1 City of Albuquerque Visible Emissions Standards

SNLA operates one open-air and three enclosed burn facilities, located at the burn site, which are used to test the effects of fires on weapons components, transportation containers, etc. These facilities burn No. 2 fuel oil and burn tests are conducted several times per year. Until recently, the air emissions from these tests did not meet the City of Albuquerque Visible Emission Standard of 20 percent opacity (6-minute average), and in 1986 the facilities were operated under a variance granted by the city. The city expressed some reluctance to renew the variance in 1987; and in response SNLA modified the enclosed burn facilities in an effort to reduce visible emissions to levels which would comply with the city standard. At the time of the Survey, two of three of the enclosed units had been modified. One has been tested and the emissions certified by the city as in compliance with the Visible Emissions Standard. The other two units had not been subject to formal visible emissions tests at the time of the Survey, and were still under the variance. The modified burn facility, as well as a new enclosed burn

facility to be constructed at the burn site, is expected to meet the Visible Emissions Standard when tested, based on emissions data from informal tests. The open-air burn facility cannot be modified to comply with the Visible Emissions Standard, and will continue to be operated under a variance from the city. A proposed new open-air burn facility is also expected to require a variance.

2.3.3.2 Kirtland Air Force Base Wastewaster Lagoons/Golf Course

On August 6, 1987, the New Mexico Health and Environment Department, Environmental Improvement Division (EID), issued a notice of violation to the KAFB Base Commander regarding the detection of 1,1,1-trichloroethane (TCA) in the sewage lagoons at KAFB. The notice stated that since "TCA may be a regulated hazardous waste depending on mode of usage, the Lagoons and the Golf course may be considered hazardous waste units subject to requirements of the New Mexico Hazardous Waste Act and the New Mexico Hazardous Waste Management Regulations (HWMR-3)." The notice required that KAFB: (1) identify any processes and/or operations conducted since November 1980 that may have generated a waste stream containing TCA for those waste streams that may have reached the lagoons; and (2) provide a list of the processes identified for each organization on KAFB. KAFB subsequently enlisted the assistance of SNLA in completing this assessment of processes and/or operations.

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3.0 MEDIA-SPECIFIC SURVEY FINDINGS

3.1 Air

The U.S. Department of Energy (DOE) Albuquerque Operations (AL) facilities located on Kirtland Air Force Base (KAFB) are sources of hazardous air pollutants regulated by the City of Albuquerque and by the State of New Mexico, and radioactive air emissions regulated by the U.S. Environmental Protection Agency (EPA). Discussion in the following sections relates to the ambient air quality in the Bernalillo County area, air emissions sources and controls, the facility environmental monitoring program, and findings and observations related to air emissions.

3.1.1 Background Environmental Information

Bernalillo County operates a network of air quality monitoring stations for sulfur dioxide, carbon monoxide, ozone, total particulates, and lead. Air quality in Bernalillo County conforms to Federal ambient standards for all criteria pollutants with the exception of carbon monoxide and particulates. The county is designated a Federal nonattainment area for carbon monoxide.

The facilities at KAFB use thousands of different chemicals and trade-name products, and emit, or have the potential to emit, volatile organic compounds (VOCs), acids, toxic metals, toxic gases, and carcinogens from the varied operations at Sandia National Laboratories-Albuquerque (SNLA), Bendix Albuquerque Operations (BAO), and the Inhalation Toxicology Research Institute (ITRI). Air emission sources and controls are discussed by area as follows:

SNLA	Technical Areas I-V
SNLA	Burn Facilities
SNLA	Field Test Areas
SNLA	Remote Areas
BAO	
ITRI	

A summary of major plant buildings is included in Appendix I. Emission control systems and monitoring of radionuclides are discussed in Section 4.3. With the

exception of the SNLA metal vapor deposition laboratories, no continuous monitoring of toxic or criteria air pollutant concentrations is conducted at SNLA, BAO, or ITRI.

3.1.1.1 Albuquerque/Bernalillo County Air Pollution Control Program

The City of Albuquerque and Bernalillo County are unique in their autonomy with regard to air quality regulations. Both Albuquerque and Bernalillo County have enacted local air quality ordinances, and therefore the State of New Mexico allows the city and county jurisdiction over air quality regulation and air emission source permitting, provided that all standards are at least as stringent as the corresponding state standard. The program is administered by the Air Pollution Division of the Environmental Health and Energy Department of the City of Albuquerque (Albuquerque APD) and all air emission source permits for facilities located at KAFB are written by the division. Table 3-1 presents the City of Albuquerque, State of New Mexico, and Federal Ambient Air Quality Standards (AAQS) for Criteria and Hazardous Air Pollutants. As shown in Table 3-1, the city/county has some unique standards (e.g., the annual ambient air quality standard for carbon monoxide) and other standards considerably more stringent than the corresponding state and Federal standards (e.g., the ambient air quality standard for ozone). The city/county standards and the compliance status of the city/county area are further discussed in Section 3.1.1.4.

3.1.1.2 Local Meteorological Data and Atmospheric Dispersion

Local meteorological data are obtained from Albuquerque International Airport, approximately 2 miles due west of the site. The average wind speed measured at the airport from 1951 to 1980 was 9.0 mph. The prevailing wind direction is from the southeast. The average monthly wind speed for Albuquerque is shown in Table 3-2 along with the prevailing wind direction and highest recorded wind speed for each month. Winds generally flow across KAFB toward Albuquerque during the summer and fall and from the north toward the Isleta Indian Reservation in the winter. The Rio Grande Valley is substantially insulated from regional wind flow patterns by the high mesas and mountains which surround it, and calm conditions can occasionally occur (GRC, 1987).

TABLE 3-1

CITY, STATE, AND FEDERAL STANDARDS FOR CRITERIA AND HAZARDOUS AIR POLLUTANTS AND VISIBILITY

	City of Albuquerque	State of New Mexico	Federal Primary	Federal Secondary
Arsenic, Copper, and Zinc	10 µg/m^3 -30-Day Average In Any Combination	No Standard	No Standard	No Standard
Asbestos	0.01 µg/m^3 -30-Day Average	0.01 µg/m^3 -30-Day Average	No Standard	No Standard
Beryllium	0.01 µg/m^3 -30-Day Average	0.01 µg/m^3 -30-Day Average	No Standard	No Standard
Carbon Monoxide	15 mg/m^3 (13 ppm) For Any 1-Hour Period - Not To Be Exceeded More Than Once Per Year 4.6 mg/m^3 (4 ppm) Annual Average	13.1 ppm - 1-Hour Average 8.7 ppm - 8-Hour Average No Annual Standard	35 ppm 1-Hour Average 9 ppm 8-Hour Average No Annual Standard	35 ppm 1-Hour Average 9 ppm 8-Hour Average No Annual Standard
Hydrocarbons (Non Methane)	100 µg/m^3 (0.15 ppm) Maximum 3-Hour Concentration - (6:00 AM to 9:00 AM) - Not To Be Exceeded More Than Once Per Year	0.19 ppm - (126.7 µg/m^3) 3-Hour Average	160 µg/m^3 (0.24 ppm) Maximum 3-Hour Concentration - (6:00 AM - 9:00 AM)	Same as Primary Standard

TABLE 3-1

CITY, STATE, AND FEDERAL STANDARDS FOR CRITERIA AND HAZARDOUS AIR POLLUTANTS AND VISIBILITY (Continued)

	City of Albuquerque	State of New Mexico	Federal Primary	Federal Secondary
Heavy Metals (Atomic Number >21)	[Specific to Arsenic, Copper and Zinc]	10 µg/m^3 -30-Day Average	No Standard	No Standard
Hydrogen Sulfide	0.003 ppm - 1-Hour Average	0.01 ppm - 1-Hour Average	No Standard	No Standard
Lead	3 µg/m^3 -30-Day Average	[Included in Heavy Metals Standard]	1.5 µg/m^3 - Quarterly Mean	1.5 µg/m^3 - Quarterly Mean
Nitrogen Oxides (as NO_2)	100 µg/m^3 -Annual Arithmetic Average 117 µg/m^3 -24-Hour Average	0.05 ppm (100 µg/m^3) - Annual Average 0.10 ppm (200 µg/m^3) - 24-Hour Average	0.05 ppm (100 µg/m^3) - Annual Average No 24-Hour Standard	0.05 ppm (100 µg/m^3) - Annual Average No 24-Hour Standard
Photochemical Oxidants (Ozone)	0.01 ppm (20 µg/m^3) - 1-Hour Average	0.06 ppm - (117 µg/m^3) - 1 Hour Average	0.12 ppm (235 µg/m^3) - 1-Hour Average	0.12 ppm (235 µg/m^3) - 1-Hour Average
Sulfur Dioxide	0.035 ppm (92 µg/m^3) - Annual Average 0.004 ppm (11 µg/m^3) - 24 Hour Average	0.02 ppm (53 µg/m^3) - Annual Average 0.10 ppm (260 µg/m^3) - 24-Hour Average	0.03 ppm (80 µg/m^3) - Annual Average 0.14 ppm (365 µ/m^3) - 24-Hour Average	No Annual Standard No 24-Hour Standard 0.50 ppm (1300 µg/m^3) - 3-Hour Average
Total Reduced Sulfur	0.003 ppm - 1-Hour Average	0.003 ppm - 1-Hour Average	No Standard	No Standard

TABLE 3-1

CITY, STATE, AND FEDERAL STANDARDS FOR CRITERIA AND HAZARDOUS AIR POLLUTANTS AND VISIBILITY (Continued)

	City of Albuquerque	State of New Mexico	Federal Primary	Federal Secondary
Total Suspended Particulates	150 µg/m³ - 24-Hour Average 60 µg/m³ - Annual Geometric Mean	150 µg/m³ - 24-Hour Average 110 µg/m³ - 7-Day Average 90 µg/m³ - 30-Day Average 60 µg/m³ - Annual Geometric Mean	260 µg/m³ - 24-Hour Average 75 µg/m³ - Annual Geometric Mean	150 µg/m³ - 24-Hour Average 60 µg/m³ - Annual Geometric Mean
Visibility (Soiling Index)	0.3 COHS/1000 Linear Feet of Air - Annual Average	0.4 COHS/1000 Linear Feet of Air - Annual Average	No Standard	No Standard

Source: Albuquerque APD, 1987; New Mexico EID, 1986

COHS Coefficient of Haze Units

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TABLE 3-2

AVERAGE MONTHLY WIND SPEED AND DIRECTION FOR ALBUQUERQUE, NEW MEXICO

Month	Mean Speed (mph)	Prevailing Direction	Highest Recorded Speed (mph)	Direction
January	8.1	N	61	E
February	8.8	N	68	NW
March	10.2	SE	80	NW
April	11.1	S	72	S
May	10.5	S	72	W
June	10.0	S	82	SE
July	9.1	SE	68	E
August	8.2	SE	61	SE
September	8.6	SE	62	SE
October	8.3	SE	66	N
November	7.9	N	57	NW
December	7.7	N	90	SE

Source: GRC, 1987

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3.1.1.3 Atmospheric Stability and Inversion Characteristics

Daily temperature ranges in central New Mexico are wide because of the high elevation, low humidity, and sparse cloud cover. Average nighttime temperatures are about 30°F cooler than daytime temperatures in the winter months and up to about 40°F cooler in the summer months. During the winter, rapid radiant heat losses beginning at dusk and continuing into early evening, particularly under a clear sky, can cause temperature inversions in the absence of winds. Temperature inversions inhibit atmospheric turbulence and thereby atmospheric dispersion. There have been frequent exceedances of the city and Federal carbon monoxide standards during inversion conditions. Nighttime inversion conditions can also cause strong drainage winds to flow down Tijeras Arroyo.

3.1.1.4 Ambient Air Quality Data/Attainment Status

The State of New Mexico operates ambient air quality monitoring stations for criteria pollutants in the City of Albuquerque and throughout Bernalillo County. Data are collected for sulfur dioxide, nitrogen oxides, carbon monoxide, particulates, ozone, and lead. New Mexico ambient air quality data for 1983 and 1984 are summarized in Table 3-3 for Bernalillo County and adjacent Sandoval County. The air quality in Albuquerque/Bernalillo County was better than Federal air quality standards for all criteria pollutants with the exception of carbon monoxide and particulates. In 1983 and 1984, the entire county was out of compliance with the Federal, state, and city ambient air quality standard for carbon monoxide, and portions of the City of Albuquerque failed to meet the Federal primary and/or secondary annual standards for particulates. (The state and city standards are identical to the Federal secondary standard.) The City of Albuquerque and Bernalillo County are in compliance with the Federal air quality standard for ozone, but are not in compliance with the New Mexico State and City of Albuquerque standards for ozone. (The state ozone standard is about 50 percent of the Federal standard.)

TABLE 3-3

ALBUQUERQUE AMBIENT AIR QUALITY DATA - 1983-1984

Station Number		City, County	Nitrogen Oxides (ppm)		Ozone (ppm)			Sulfur Dioxide (µg/m³)		Carbon Monoxide (ppm)		Total Suspended Particulate		Lead
			Highest 24-Hour	Annual Average	Highest Hourly	2nd Highest Hourly	Number of Days Above 0.06 ppm	Highest 24-Hour	Highest 3-Hour	Highest Hourly	Highest 8-Hour Average	Highest 24-Hour	Annual Geo-metric Mean	Highest Calendar Quarter Average
2E	1983	Albuquerque, Bernalillo								18.0	11.0			
	1984									16.0	10.0			
2J	1983	Albuquerque, Bernalillo										131	56	
	1984											NA	NA	
22E	1983	Albuquerque, Bernalillo								25.0	14.0	178	55	
	1984									19.0	13.0	193	60	
22K	1983	Albuquerque, Bernalillo								26.0	18.0	179	84	
	1984									24.0	16.0	208	96	
22R	1983	Albuquerque, Bernalillo			0.09	0.09	190							
	1984				NA	NA	NA							
22	1983	Albuquerque, Bernalillo	NA (0.05)*	0.02	0.10	0.10	181	0.01	0.02	18.0	11.0	145	62	
	1984		NA (0.07)**	0.02	0.09	0.09	183	0.01	0.02	18.0	11.0	207	91	
22I	1983	Albuquerque, Bernalillo			0.10	0.09	210							
	1984				0.11	0.10	228							
22F	1983	Albuquerque, Bernalillo			0.10	0.10	208							
	1984				0.10	0.09	249							
22H	1983	Albuquerque, Bernalillo			0.11	0.09	186			7.0	4.0	196	102	
	1984				0.08	0.08	215			NA	NA	316	90	
22J	1983	Bernalillo, Sandoval			0.11	0.09	39							
	1984				0.11	0.10	55							
22E	1983	Albuquerque, Bernalillo												0.50 (1st)
	1984													0.40 (4th)
22K	1983	Albuquerque, Bernalillo												0.95 (1st)
	1984													0.78 (4th)

Source: New Mexico EID, 1986

NA Not Available

* 1981 Data

** 1982 Data

Elevated concentrations of carbon monoxide and ozone in Albuquerque and Bernalillo County are attributed primarily to the increased emissions from mobile sources, particularly automobiles, in the Albuquerque metropolitan area. Wood-burning stoves/fireplaces and industrial sources also contribute to high levels of carbon monoxide. Elevated ozone concentrations are attributed to hydrocarbon emissions from industrial sources and mobile sources and related activities such as fuel distribution systems. High particulate concentrations result from fugitive dust generated by construction activities, unpaved roads, etc. In 1983 Albuquerque implemented a motor vehicle inspection/maintenance (I/M) program, which is one method mandated by EPA to reduce air emissions of carbon monoxide and hydrocarbons from mobile sources. The program was discontinued in 1984 and was again under consideration at the time of the Survey. The city also instituted the wood-burning advisory program in 1983. This provides information to the public concerning the use of wood-burning stoves/fireplaces, based on ambient air quality and meteorological conditions.

Ambient ozone concentrations in Albuquerque are close to exceeding the Federal air quality standard of 0.12 ppm, and it is expected that the standard may be exceeded in the future if emissions of hydrocarbons continue to increase. In response to this concern, the city has promulgated regulations requiring the control of hydrocarbon emissions from fuel distribution systems and other sources, which will take effect if and when ozone concentrations in the city exceed the Federal air quality standard.

3.1.2 General Description of Pollution Sources and Controls

3.1.2.1 Sandia National Laboratories-Albuquerque

SNLA operations emit a wide variety of criteria and hazardous pollutants to the atmosphere. In general, the air emission sources at SNLA, with the exception of combustion sources, are below the minimum source size, or otherwise do not fall within city, state, or Federal regulations. Some combustion units and some toxic metal (e.g., beryllium) emissions sources require permits from the city.

Carbon monoxide, oxides of sulfur and nitrogen, and visible emissions are emitted from fuel-burning sources, including various enclosed and open-air test burn units,

emergency power generators, and waste destruction units (the SNLA gas-fired steam plant has minimal visible emissions). Toxic gases (e.g., arsine, phosphine) are emitted from vapor deposition laboratories, and toxic metals (e.g., barium, beryllium, depleted uranium) are emitted from explosives testing and machining operations. Lead is emitted from rocket motor firings and from foundry and machining operations. Various hydrocarbon compounds, both exempt and non-exempt* are emitted throughout SNLA from development shops, laboratory operations, and cleaning and maintenance activities. Other pollutants emitted from SNLA operations include acid gases (e.g., hydrofluoric acid, hydrochloric acid), particulate metals, and small quantities of cyanide compounds from plating, plastics, and metal treating shops.

Technical Area I Air Pollution Sources and Controls

Steam Plant - Building 605

There are six dual-fuel-fired (natural gas/No. 2 fuel oil) steam boilers and one standby diesel generator located in Building 605 outside the Technical Area I fenceline. This facility provides steam to Technical Area I, Technical Area II, and parts of Technical Areas III and IV for heating and utility service. The operating data and status of each unit, including the diesel generator, are listed in Table 3-4.

Under normal operating conditions, boilers 5 and 6 are used as the primary steam units. All boilers are routinely fired with natural gas supplied by the local gas company. Dual-fuel units are test-fired (usually once per week) using oil to ensure that the oil system is maintained in working condition in case gas service is interrupted. The standby diesel engine is tested once per month to ensure operability in the event of a power outage. Some visible smoke is emitted during

*Non-exempt compounds are regulated by the state as VOCs, which are ozone precursors; exempt compounds are not regulated as VOCs.

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TABLE 3-4

OPERATING CHARACTERISTICS AND STATUS OF DUAL-FUEL-FIRED STEAM BOILERS AND STATIONARY DIESEL ENGINE IN BUILDING 605

Unit and Number	Date Installed	Fuel	Heat Input (mmBtu/hr)	Steam/Electric Output (Lb/Hr, KW)	Status
Boiler 1	1949	Gas/Oil	72	60,000	Backup
Boiler 2	1949	Gas/Oil	72	60,000	Backup
Boiler 3	1949	Gas/Oil	72	60,000	Backup
Boiler 4	1949	Gas/Oil	72	60,000	Down*
Boiler 5	1964	Gas Only	120	100,000	Primary
Boiler 6	1970	Gas/Oil	180	150,000	Primary
Diesel 1	1970	Diesel	--	350 KW	Standby

Source: Millard et al., 1987
*Unit was being overhauled at time of the survey.

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startup, but these emissions generally persist for less than 5 minutes and do not violate city visible emissions standards. The boiler stacks (six) show no visible emissions when either oil or gas is fired. Consumption of natural gas is approximately 1 million ft^3/yr. The City of Albuquerque has advised SNLA that the boilers do not require air emissions permits because of their small size (Lareau, 1983).

Stationary Emergency Power Diesel Generators - Building 892

At the time of the Survey, four emergency power diesel engines were being constructed in Building 892. The construction is scheduled to be completed in December 1987. The three existing diesel engines in Building 892 had been removed previously. The new engines will be used to provide emergency power to Technical Area I in the event of a power outage and will also be periodically tested. The engines are rated at 600 KW each. SNLA has received a permit to construct the engines from the City of Albuquerque (Harley, 1986). The diesel engines must comply with visible emission standards and nitrogen oxide and carbon monoxide emission limitations. Nitrogen oxide and carbon monoxide emissions are limited by permit conditions to 13.4 lb/hr and 2.5 lb/hr, respectively. Stack emissions tests will be required to demonstrate compliance.

Standby, Remote, and Portable Diesel Generators

SNLA maintains several hundred portable and standby diesel generators and a small number of gasoline generators throughout the facility for the purposes of emergency electric power generation and to provide electric power to areas such as the cable sites where electric utility service is not available. There are about 20 generators located in Technical Area I and about 90 in Technical Area III. About 100 are located in other areas of SNLA. These are primarily small units rated from 15 KW to 30 KW electric capacity; units range from as large as 200 KW to 2.5 KW electric capacity. The generators are periodically tested and are generally operated on a nonroutine basis. Diesel engines used to provide electric service to remote areas such as the cable sites are operated during working hours. The diesel engines emit small amounts of combustion products including carbon monoxide, nitrogen oxides, and hydrocarbons to the atmosphere.

Metal Organic Chemical Vapor Deposition Laboratories - Buildings 806 and 893

The metal organic chemical vapor deposition (MOCVD) laboratories located in Buildings 806 and 893 conduct experiments in growing semiconductors from metal hydrides and organometallic materials. Small quantities of toxic and corrosive gases including arsine, phosphine, silane, hydrogen selenide, and hydrogen chloride are used in the metal deposition studies. Consumption of arsine and phosphine is approximately one 30 ft^3 cylinder each month in the Building 806 Laboratory and approximately one 2,400-psi cylinder every 2 years in the Building 893 Laboratory. The MOCVD reactors are vented separately from the room ventilation system, and exhaust through a coarse filter, activated charcoal filter and afterburner, which absorb and oxidize arsenic and other metal compounds. Concentrations of arsine in the exhaust are continuously monitored, and are generally lower than 50 ppb, the threshold limit value (TLV) for arsine.

Plastics Shop - Building 834

The Plastics Shop fabricates parts from various types of plastics, and parts are encapsulated using various epoxy resins. Resins are mixed in hoods and dispensed, usually under vacuum, with a curing agent into a mold. The resin-filled molds are heat-cured in ventilated ovens. Many of the resin bases and curing agents used in the Plastics Shop operations contain toxic substances including epichlorohydrin, toluene diisocyanate (TDI), urethanes, and various amines. The resin bases and curing agents are primarily incorporated into the products being encapsulated. However, as they are handled under vacuum and cured in ventilated ovens, some potential exists for volatilization of the resin bases and curing agents and/or generation of decomposition products containing cyanides, urethanes, or amines.

SNLA has not conducted any monitoring or characterization of the oven or vacuum exhausts. Based on the amount of resin and foam compounds used, emissions are expected to be small. Small quantities of acetone, 1,1,1-trichloroethane, and other solvents are emitted from parts cleaning/vapor degreasing and other operations in the Plastics Shop.

Carbon/Graphite Machine Shop - Building 840

Machining of potentially toxic materials other than beryllium and radioactive materials is confined to the carbon/graphite machine shop, located in two rooms adjacent to the large-scale machine shop in Building 840. Materials which may be machined in this area include graphite and various composite materials, as listed in Table 3-5. Individual machine tools in this area are exhausted by flexible hoses, which exhaust through a fan to a bag filter located outside Building 840. The filter bags are replaced every 3 months by an off-site contractor. Bag filters are generally on the order of 99 percent efficient in collecting fine dust. Dust emissions from the machining operations are therefore expected to be small.

Heat Treatment Facility - Building 840

Metal parts are heat-treated in this facility. The facility includes box furnaces, fluidized beds, and hot salt baths. Three salt baths, one containing sodium and potassium nitrate, one containing sodium and barium chloride, and one containing sodium cyanide, are used to treat steel. The sodium and potassium nitrate bath contains 500 pounds of salt; the other two baths each contain 300 pounds of salt. The baths are electrically heated, and require about 3 hours to achieve temperature from the solid state. Each salt bath is equipped with slot vents above the bath cover, which exhaust heat and fumes generated when the baths are uncovered. All three baths exhaust through a fan to a stack outside Building 840. No emission controls are applied to the exhaust. The vapor pressures of the salts used are very low at the temperatures of the baths, and vaporization of the salts into the exhaust is minimal.

Ceramics Laboratory - Building 840

The Ceramics Laboratory prepares and machines various types of ceramic materials for development purposes. Materials used include lead oxide (PbO), titanium dioxide (TiO_2), zirconium oxide (ZrO), alumina (Al_2O_3), and silicon/germanium (Si/Ge). The Ceramics Laboratory was formerly used for the preparation and machining of PZT (lead zircon titanate) and PZLT (lead zircon lanthanum titanate) electro-optic materials. PZT/PZLT processing equipment is now maintained for development purposes, and on the order of 5 pounds of PZT/PZLT are processed

TABLE 3-5

MATERIALS MACHINED IN BUILDING 840 GRAPHITE MACHINE SHOP

Metals	Non-Metals
Aluminum	Quartz
Low Carbon Steel	Glass Ceramics
Stainless Steel	Ceramic
Tool Steel	Foam
Tantalum	Rubber
Titanium	Phenolic
Tungsten	Silica Phenolic
Molydenum	Carbon Phenolic
Carbide	Graphite
Boron Carbide	Lava
Aluminum Boron	Coal
Boron Nitride	Oil Shale
	Marble, Granite
	Limestone
	Salt
	Concrete
	Magnesium Oxide
	Zirconium Oxide
	Nylon, Nylatron
	Lucite, Lexan
	Polycarbonate
	Polypropylene
	Kevlar

Source: Information provided verbally by SNLA, 1987

annually. Small quantities of materials containing depleted uranium have occasionally been machined in this facility in the past. Depleted uranium has not been handled in the Ceramics Laboratory in approximately 5 years.

PZT and PZLT materials are prepared from metal oxides. Small-batch mixing/grinding is done in a hood which exhausts to an electrostatic precipitator (ESP). Large-batch equipment, including a calciner, extruder, grinder, furnace, and drying ovens also exhausts to the ESP. Other machines having flexible hose-type local ventilation and other hoods also exhaust to the ESP. Electrostatic precipitators are generally highly efficient in collecting particulate from mixing/grinding-type operations. The potential emissions of lead from the Ceramics Laboratory are very small, based on the present low throughput of PZT and PZLT and the high-efficiency control system.

Coatings Laboratory - Building 841

The Coatings Laboratory uses various types of solvent-based and water-based paints, silicone compounds, etc., to coat a variety of materials, including metals and plastics. Materials are prepared for painting by vapor blasting, acid/caustic etching, and/or solvent cleaning.

Parts are coated either manually in the Coatings Laboratory or in a large walk-in paint spray room. The room is equipped with internal fiberglass filters and a roof fan. As coating droplets are collected on the filters, the pressure drop across the filters increases. A pressure drop sensor visually alarms when pressure drop becomes too high, indicating that the filters require changing. Filters are changed by the Maintenance Department.

Parts are allowed to air-dry, or are dried in a walk-in electric oven. This oven is also equipped with internal filters and a separate exhaust system. The oven filters and ventilation system do not have an alarmed pressure drop sensor as does the paint spray room, as substantially less coating material is collected on the oven filters.

Organic solvents are the major pollutants emitted from the Coatings Laboratory. Solvents used in the Coatings Laboratory in addition to those in the solvent-based coatings include xylene, methyl ethyl ketone, toluene, and similar solvents. Filter

systems in the paint spray room and drying oven will remove particulate material such as metal-based pigments from the exhaust gases, but will not collect the major portion of volatile solvents. Inventory records for the Coatings Laboratory are not complete, and SNLA purchasing records provide the only inventory data available. It is estimated that the Coatings Laboratory represents a significant percentage of the total solvent emissions inventory from SNLA.

Foundry - Building 841

The Foundry, located in Building 841, fabricates molded parts from metals, primarily aluminum, brass, and lead. The principal metal cast in the foundry is aluminum. Several hundred thousand pounds of aluminum and approximately 20,000 pounds per year of lead and 1,000 pounds per year of brass are cast. The heat and fumes from the furnaces exhaust through a single stack and fan, with an exhaust rate of approximately 15,000 ft^3/minute. The foundry room is ventilated by roof fans. No controls are applied for metal fume emissions from the furnaces. Chlorine gas is used to degas hydrogen gas from the aluminum melt, to control the quality of the aluminum castings. Approximate chlorine consumption is 1,500 pounds annually. No emission controls are applied to the furnace exhaust for control of chlorine emissions, as emissions are small. Chlorine detectors, set to audible alarm at 10 ppm, are used to monitor the chlorine concentration in the storage shed and Foundry room air.

Sand molds are fabricated from two types of Foundry sand. Beroid sand, also referred to as red oil sand, is a barium-containing sand. This sand is mixed with silica and 40-weight oil in an enclosed mixer equipped with a cartridge-type filter. The sand is fairly coarse and emissions are expected to be small. Airset sand is mixed with a two-part resin compound in a ratio greater than 99 parts sand to 1 part setting compound. Approximately one 55-gallon drum of resin is used every 3 months. The sand and resin are mixed in an automatic mixing machine referred to as a Mueller machine. The setting resin is a toxic compound containing isocyanates. The SNLA Industrial Hygiene group conducted a study of room air concentrations of isocyanates in the Foundry room after the machine was installed in 1985, and determined that the concentration was much lower than the occupational exposure standard.

Molten metal (aluminum, lead, or brass) is poured into the sand molds in the Foundry room. The cast metal parts are cleaned in one of two dry sandblasters. Both are manually operated and use 60-mesh garnet sand. Lead particulate may be incorporated into the sand when lead castings are cleaned. Dust emissions from the smaller sandblaster are controlled by a bag filter. The bags are manually cleaned twice a month by a manual shaker system. Filter bags are replaced by the Maintenance group as required. The larger sandblaster is an approximately 10-foot by 40-foot walk-in unit. Dust emissions from the large unit are controlled by a bag filter located outside Building 841. The bags are cleaned by an automatic shaker system, and the collected fines are automatically emptied into 55-gallon drums, which are changed every 2 months. The filter bags were replaced at the beginning of 1987. Dust emissions from the two sandblasters are small.

As previously discussed, approximately 20,000 pounds of lead are cast in the Foundry each year. Ambient lead concentrations in the Foundry room have been measured from an industrial hygiene standpoint; however, the stack emissions of lead have not been evaluated. Lead emissions from the furnaces are estimated to be on the order of 100 lb/yr based on the annual throughput of lead and its vapor pressure at temperatures near the melting point. As lead is not cast on a continuous basis in the Foundry, lead emissions are not expected to result in any exceedance of the City of Albuquerque or Federal ambient air quality standards for lead ($3\mu g/m^3$ 30-day average and $1.5\mu g/m^3$ quarterly mean, respectively).

Printed Circuits Laboratory - Building 841

The Printed Circuits Laboratory fabricates one-of-a-kind printed circuit (PC) boards for development purposes. Film or liquid photoresist (a complex organic mixture) and solder mask (also a complex organic mixture) is applied to PC boards and developed using ultraviolet light. The photoresist applicators are exhausted to a roof vent through a central fan. The solder mask is applied in a vacuum laminator. The two ultraviolet exposure units generate small quantities of ozone, and are also ventilated. The film developer, a conveyorized unit, uses cold 1,1,1-trichloroethane to develop the PC boards. The solvent is recirculated through the unit, and is periodically disposed of as hazardous waste. The developer room and unit are exhausted by separate fans. The final developer has a vent and duct at each end, which exhaust to a single fan.

The etchroom contains two conveyorized production machines and two experimental etching machines. One production machine uses a ferric chloride etchant, the other ammonium chloride. The ferric chloride machine was not operational at the time of the Survey because leaks had been found. Both ferric chloride and ammonium chloride are corrosive, and the machines generally last only about 5 years. The machines are vented to a roof fan. Fumes from the machines had visibly corroded metal ductwork within the etchroom. The corrosion is indicative of ferric chloride and ammonium chloride emissions from the machines.

The plating baths, used to plate the PC boards with various metals, are located in a room adjacent to the etching machines. Three small (about 1 foot by 2 feet) copper sulfate baths and one lead/tin bath are ventilated by slot exhausts. The baths did not have covers installed at the time of the Survey; covers were scheduled to be installed in late 1987 (the original covers proved to be inconvenient to the operator). At the time of the Survey, the slot exhausts were not working. The exhausts vent to the same fan as the two etching machines, and the fan was not working because of corrosion from etching machine fumes. A new fan was scheduled to be installed as soon as procured.

A conveyorized film stripper (degreaser) uses cold methylene chloride to remove film masks from the PC boards. The unit uses refrigerated cooling water, and is ventilated at each end. The solvent pump, water flow, and refrigeration are alarmed. About 440 gallons/month of methylene chloride, mostly disposed of in drums, are used in this unit. A water-cooled vapor degreaser using 1,1,1-trichloroethane is also located in this area, and was in use at the time of the Survey. The unit is equipped with a cover and automatic timer which shuts down the solvent heaters during off-shift hours. The vapor degreaser is exhausted separately from the film stripper. The degreasers and film developers and strippers emit solvents to the atmosphere through evaporation into the machine exhausts. It is estimated that the Printed Circuits Laboratory represents a significant percentage of the total solvent emissions inventory from SNLA.

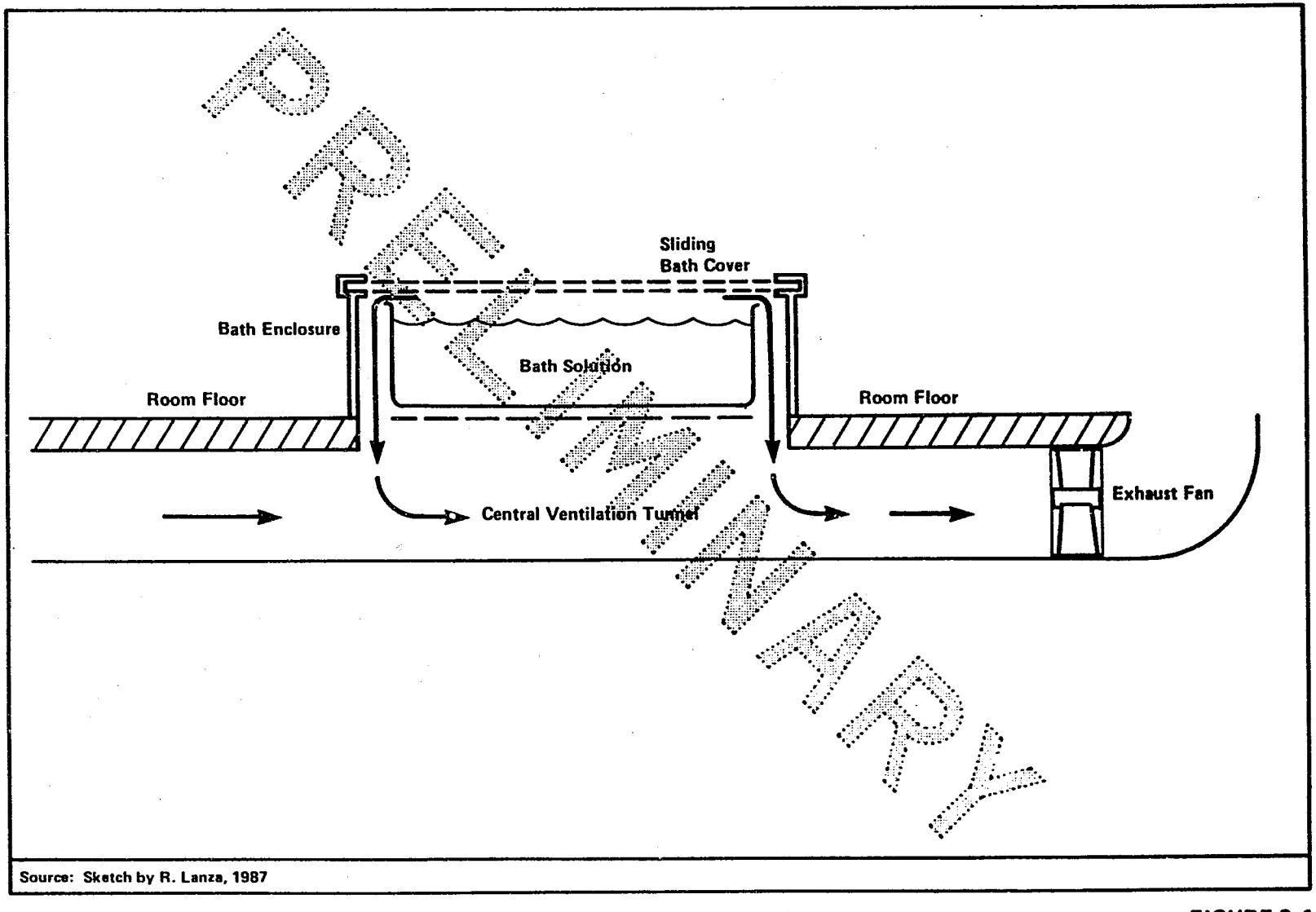
An automatic solder application machine, referred to as the solder hot-air leveler, is used to apply solder to PC boards. The board is dipped in lead solder/flux, and then hot air is blown through the board. About 200 pounds of lead solder are used in

this machine each month. The dross is periodically removed from the machine and disposed of as hazardous waste. The hot air is exhausted to a hood without emission controls. An industrial hygiene study was conducted in the leveler room before the ventilation system was installed. Results of the study indicated the need for ventilation for worker protection. Concentrations of lead in the room without ventilation were on the order of 30 µg/m^3, and were reduced to near 5 µg/m^3 with ventilation, indicating that lead emissions from the ventilation system are of low concentration. Emissions from the hot air leveler are not expected to result in exceedances of ambient air standards for lead.

Plating Shop - Building 841

This area contains large plating baths, which are used for plating various materials with nickel, copper, cadmium, gold, and silver. The main plating room contains large (3 feet by 4 feet) 175-gallon baths of sulfuric and nitric acids (used to anodize copper and aluminum), hydrochloric acid, phosphoric acid, cadmium cyanide, nickel sulfate, copper sulfate, copper cyanide, sodium dichromate, and other solutions. All baths have sliding covers and are covered when not in use. Some baths, including the sulfuric acid and nickel baths, are heated to about 140°F. All baths are exhausted by a common downdraft ventilation system, which ventilates each tank below its cover. A schematic diagram of the plating shop ventilation system is shown in Figure 3-1. No emission controls or monitoring are applied to the ventilation system. The bath covers do not control bath evaporation, as the exhaust vents are located below the covers.

The Plating Shop precious metal room is enclosed and separate from the main plating room. This room contains room-temperature gold and silver cyanide baths, and one heated (140°F) high-purity gold bath. The baths are not emptied, and makeup solution is added as required. The baths have removable covers and are exhausted by the same downflow exhaust system as for the main plating room baths. The precious-metal room also contains two chemical hoods. According to the operator, no cyanides are handled in these hoods.



Source: Sketch by R. Lanza, 1987

SCHEMATIC DIAGRAM OF PLATING LABORATORY
DOWNFLOW VENTILATION SYSTEM

FIGURE 3-1

Small quantities of acid vapors and cyanides are expected to be emitted from the plating baths on a continuous basis from evaporation, as the bath covers do not isolate the baths from the ventilation airflow. No assessment of the concentration of acid vapors or cyanides in the exhaust has been performed. Active generation of cyanide fumes can occur if the pH of the cyanide baths is inadvertently lowered. Normally, the concentrations of cyanides and acid vapors in the exhaust from the baths are expected to be small, based on the characteristics of the baths.

Glass Shop - Building 864

The Glass Shop, located in Building 864, fabricates glass, glass/metal, and glass/ceramic parts in support of weapons and explosives development and other operations at SNLA. More than 100 different raw materials are used, mostly such compounds as aluminum oxide, various borates and phosphates, silicates, potassium nitrates, etc. The raw materials are charged to one of two calcining furnaces to remove water. Approximately 1 to 2 pounds of raw materials are mixed in a downdraft-type hood, and then are charged to one of the eight electric melting furnaces, which are hooded and vented to the building roof. The number of glass melts per year is about 500. Small amounts of particulates may be exhausted from the furnaces.

Glass parts may be etched in a hydrogen fluoride (HF) solution. The HF tank is completely enclosed and hooded, and small amounts of HF fumes may be exhausted during use. A hooded area in the acid room is also used for etching glass with HF. This room also contains a water-cooled vapor degreaser, which uses 1,1,1-trichloroethane to clean glass parts. Glass/metal parts are cleaned and etched with cold 1,1,1-trichloroethane, acetone, dilute potassium dichromate, HCl, HF, and other solvents and acids in downdraft-type hoods located in a separate room, which also contains an ultrasonic refrigerated vapor degreaser. This degreaser uses 1,1,1-trichloroethane, and at the time of the Survey was not hooded. A ventilation system was scheduled to be installed. The Glass Shop emits small quantities of 1,1,1-trichloroethane and other solvents, and HF and other acids to the atmosphere.

Toxic Metal Machine Shop - Building 869

The Toxic Metal Machine Shop, located in Building 869, is used to machine parts from beryllium, depleted uranium, and occasionally cadmium, hafnium, thorium, and other toxic metals. The shop contains two lathes, an electronic discharge machine, one mill, and one bandsaw. The shop machines uranium and beryllium on a routine basis, and is required to keep records of both uranium and beryllium shipments. Approximately 100 kilograms of uranium and several dozen roughly 2-inch pieces of beryllium are machined each year. Larger pieces of beryllium are occasionally machined, but none have been worked since 1985. Other metals are machined on a non-routine basis. Special procedures are developed in consultation with the Industrial Hygiene/Health Physics Groups for nonroutine work. Standard procedures have been developed for uranium and beryllium work.

Both uranium and beryllium are machined wet, with flexible trunks used for local ventilation. The coolant is an aqueous mixture which is used once and disposed of as hazardous waste by the Waste Management Division. Machine parts are cleaned with either glass cleaner (beryllium) or a wire brush (depleted uranium). Equipment used to machine depleted uranium is swiped by the Health Protection Group after each use. Uranium chips are returned with the finished part to their points of origin or disposed of in the radioactive waste burial ground. Beryllium chips are disposed of by the Waste Management Division.

Both the local ventilation trunks and room vents exhaust to a single-stage high-efficiency particulate air (HEPA) filter with roughing filter located on the roof of Building 869. The design particulate removal efficiency of the filter is 99.97 percent. The filters are replaced by an off-site contractor on an as-needed basis, and a flow-rate study was performed by the contractor in 1987. The HEPA filter exhausts to a fan and stack which rises 12 feet above the building. The stack exhaust is not monitored for beryllium or uranium emissions.

The operation of the Toxic Metal Machine Shop was reviewed by the city and by EPA Region VI in 1982, and found to meet the requirements of NESHAP (Burnett, 1982; Carlyon, 1983). Beryllium emissions from stationary sources must not exceed 10 grams per day. EPA has not required any sampling or monitoring of beryllium

emissions from the facility, but has indicated that relocation of the machine shop would require an emissions test (EPA, 1984).

Battery Development - Building 894

The Battery Development Laboratory conducts development studies of various types of thermal and ambient temperature batteries. The facility fabricates and tests lithium/thionyl chloride batteries and emits small amounts of thionyl chloride both from production of battery-grade thionyl chloride and from battery failure during destructive testing. The laboratory also has the potential to emit small quantities of particulate metals, including lithium, silicon, vanadium pentoxide, and nickel, all of which are battery materials. On the order of grams to kilograms of these materials are handled and emissions are therefore expected to be minimal. The facility also emits small amounts of solvents, including 1,1,1-trichloroethane, used for parts cleaning and degreasing.

Technical Area II Air Pollution Sources and Controls

Technical Area II is primarily used for small-scale explosives testing and development studies. Small quantities of acid and toxic gases are emitted from development facilities. Air emissions from explosives testing in this area are minimal. The types of explosives typically used in Technical Area II explosive test facilities are discussed in Appendix K.

Metal Vapor Deposition Laboratory - Building 913

This facility is used to conduct metal vapor deposition studies using nickel carbonyl (NiCO) and chromium carbonyl (CrCO). Two similar systems located in ventilated hoods are used, one operated at atmospheric pressure and one under vacuum. The studies are conducted by flowing the NiCO or CrCO through a reaction chamber and then through two furnaces in series. A dilute mixture of CO in argon gas is used as a carrier gas. The furnaces operate at 300°C and 400°C and decompose the unreacted metal carbonyl. The nickel or chromium deposits on metal coils in the furnaces, and CO and some metal particulates are exhausted to the roof vents. Diborane gas and phosphine gas are used for preparing metal alloys in the two vapor deposition

systems. Approximately 10 pounds of NiCO, 1 pound of CrCO, and 2 pounds of diborane are used annually.

As metal carbonyls are extremely toxic, both hoods are equipped with a chemiluminescent detector which can detect as low as 10 ppb of carbonyl compounds and which alarms at 50 ppb of NiCO. The detector is periodically used to test the roof vent emissions; the most recent test showed on the order of 1 ppb NiCO and 3 ppm CrCO in the exhaust gas. The concentration of metal particulates in the exhaust gas has not been tested, but is expected to be small based on the small amount of metal compounds used.

Lithium Battery Test Facility - Building 919

This facility conducts destructive testing of lithium batteries. Gases from failed batteries, which may contain small quantities of sulfur dioxide, are exhausted to the atmosphere. Small quantities of lithium-containing particulates may also be emitted to the atmosphere. This facility is also used for small-scale (~1 gram) explosive tests.

Gas Gun Shock Test Facility - Building 922

Material studies are conducted in this facility to characterize the physical/mechanical and chemical changes in explosives and propellants. Propellants and explosives studied include aluminum perchlorate, nitromethane, light-sensitive materials, and a wide variety of other reactive materials. Inert materials are also tested. On the order of 100 tests per year are conducted at this facility. Tests generally involve up to 50 grams of reactive material.

Materials tested are subjected to mechanical shock either by explosives or by firing a projectile at the target material. Tests are conducted using a gas gun, which consists of a gun barrel and projectile, a target chamber, and a debris collection chamber. The projectile is fired into the target chamber using compressed helium or nitrogen, and the debris from the target and projectile is collected in the debris chamber. Both the gun barrel and target chamber are evacuated using a vacuum system before each test, and the debris chamber may be evacuated before tests involving more than 50 grams of reactive material. The chambers are vented to the

atmosphere after each test, and debris is disposed of by the Explosive Ordnance Division (EOD). An air filter system can be applied to the debris chamber vent if required for tests of toxic materials, but is not normally used. Small amounts of particulate materials are emitted from the target and debris chamber vents and vacuum system. Shock propagation in the test materials is examined using a dye laser. This laser uses small quantities of HCl diluted in helium. About 1 bottle (400 pounds) of HCl is used annually. Both the laser and HCl storage cabinet are vented to the atmosphere.

Neutron Generator Test Facility - Building 935

This facility conducts destructive and nondestructive testing of tritium-containing neutron generators. No criteria or hazardous air pollutants are emitted from this facility. The facility has the potential to release small quantities of tritium to the atmosphere. Radionuclide emission sources and controls are discussed in Section 4.3.

Technical Area III Air Pollution Sources and Controls

Technical Area III facilities include both development and testing facilities and field explosive test and rocket motor firing areas. Air emission sources and controls associated with development shops are described below. Field test areas are described elsewhere in this section.

Classified-Waste Destructor - Building 6583

The Classified-Waste Destructor, constructed in 1984-5, consists of a shredder and compactor and a stoker-type propane-fired furnace, which are used to destroy classified paper, photographic film, and miscellaneous classified items such as typewriter ribbons, microfiche, etc. City of Albuquerque air quality regulations prohibit the operation of any incinerator within the city. Combustion equipment used for the destruction of classified waste and pathological waste is specifically exempt from these regulations. The emissions from the Classified-Waste Destructor are subject to city visible emission regulations.

In general, classified paper is destroyed in the shredder/compactor, rather than being burned. Paper is shipped to the facility in plastic trash bags. These are cut open and the paper emptied onto the shredder conveyor. Non-shreddable items (fiche, ribbons, plastic) are removed from the conveyor and burned. The shredder has a water spray system, which makes the shredded material easier to compact, and also controls dust emissions from the shredder. The shredder is equipped with a fabric filter, which collects the shredded material. No visible emissions result from the shredder operation. The material is compacted and is then transferred to a dumpster which is periodically emptied. About 150 bags of paper are shredded each week.

Paper from facilities other than SNLA (e.g., ITRI, military facilities, etc.) is burned along with the plastic bags and any non-shreddable material. The material is placed into a ram feeder and charged into the combustion chamber. The primary burner and afterburner are propane-fired. Once sufficient waste is charged into the chamber, the unit burns on an automatic 5-hour cycle and then shuts down. Bottom ash is manually removed from the unit and disposed of in a landfill. Visible emissions from the operation are much lower than the city standard of 20 percent opacity under normal conditions, but may exceed the standard if the combustion chamber is inadvertently overcharged or if the air handling system malfunctions. The facility has been formally inspected by the city, and visible emissions from the baghouse duct were certified to be within city standards (Harley, 1985). The facility has recorded no violations of visible emission limitations since startup.

Burning of plastic bags and other plastic items results in emissions of small quantities of hydrochloric acid and possibly low molecular weight chlorinated organics. There are no controls for HCl emissions from the unit. Nitrogen oxides and carbon monoxide also result from combustion of propane and waste materials.

The unit is also used to recover silver from photographic film. Film is charged into the combustion chamber and pyrolized in one or two 5-hour cycles. Plastic bags, ribbons, etc., are not charged with film. The fim is pyrolized with the air handling system turned off, as the film burns with a much hotter temperature than paper. The ash is manually removed from the unit and manually screened. Fine ash containing silver is drummed for silver recovery. Coarse ash (mostly residue from film clips, frames, etc.) is placed in the dumpster. About 1,000 pounds of film are

processed each month from SNLA. An additional 300 pounds per month are shipped from Los Alamos National Laboratory (LANL). Negligible particulate emissions result from film recovery operations.

Light-Initiated Explosives Facility - Building 6715

Light-initiated explosives are tested at this facility. The explosive, a mixture of silver nitrate and acetonitrile, is mixed in 2-liter batches in a remote-control-operated mixing room and sprayed onto various components using a remote-control-operated sprayer. The sprayed part is then subjected to intense light in the detonation room, which initiates the explosion. Approximately one test per month is done. Up to one test per week can be conducted.

Acetone is used as a rinse solution in the mixing room, and acetylene gas is flowed through the silver nitrate/acetonitrile mixture to react the mixture. A furnace-type filter is used to filter the air exhaust from the mixing room floor vents. The mixing room air is changed every 2 minutes. Small quantities of acetone and acetonitrile are emitted through the mixing room stack. A terrycloth filter is used to filter the floor wash; about 5 gallons of liquid waste are generated per explosive test. Small quantities of methyl ethyl ketone are used to clean components before they are sprayed with the explosive mixture.

The detonation room is also ventilated to a stack. Sandbags are used to contain shrapnel from the tests. Small amounts of particulates may be generated from the detonation and exhausted to the stack.

All explosive and explosive-contaminated materials, including solvents, filters, cardboard, etc., are burned in a remote-controlled Thermal Treatment Facility. This consists of a 4-foot-square steel pan enclosed in a steel cage. Wastes are kept wet to prevent ignition when handled, and are placed in the pan. The unit has two butane-fired burners at the base near the pan and a third burner above the pan. These burners are fired by remote control until the waste is burned to completion. Any rainwater that collects in the pan is filtered and the filters burned.

The Thermal Treatment Facility is included under RCRA interim status for SNLA facilities. Air emissions from the facility have not been tested. Potential emissions

include acetonitrile, methyl ethyl ketone and related incomplete combustion products, and particulates (e.g., silver). Nitrogen oxides and carbon monoxide are emitted from combustion of butane and waste materials. Only wastes generated at Building 6715 are burned in this facility, and emissions are expected to be small based on the small amount of wastes burned.

Melting/Solidification Facility - Building 6630

Various types of steel alloys are prepared in this facility for use in materials studies. A vacuum induction furnace with a 500-pound capacity is used to melt metal mixtures. Metal chips, which include iron and also possibly chromium, nickel, manganese, silicon, and/or copper, are charged into a ceramic crucible outfitted with induction coils. The furnace is evacuated using a series of vacuum pumps and diffusion pumps that vent to the vacuum pump exhaust system. After the furnace is leak-tested overnight, the induction coil is powered to melt the metal. The crucible containing the molten metal at about 2,000°F to 3,000°F is then removed from the furnace and the metal poured into ingot molds. The ingots are then remelted in a vacuum arc furnace, which is also evacuated using diffusion and vacuum pumps. The vacuum system exhausts to a single-stage HEPA filter, fan, and stack located outside the building. This filter is tested and changed on a scheduled basis by an off-site contractor. HEPA filters are generally greater than 99.9 percent efficient and can effectively remove metal fumes from the exhaust.

About 20 percent of the induction furnace melts are investment casting melts done under atmospheric conditions. Investment casting molds are fabricated in Building 845 in Technical Area I. Atmospheric melts involve leaving the vacuum system off and leaving the door to the furnace open during the melt. This causes some fumes from the melt to enter the room, from which they are exhausted through the general building ventilation system rather than through the vacuum exhaust system. Flexible hose is used to exhaust heat and fumes from the melt area. As the vapor pressure of metals is very low at atmospheric pressure, little metal vapor is generated from air melts. Copper and manganese cannot be added to the metal melt under vacuum, as they have a high vapor pressure, and they are therefore added under an argon atmosphere after the vacuum melt is completed. Copper, manganese, and carbon (from the iron) are the constituents that have the greatest potential to vaporize during the melt.

Metal ingots are cut and shaped on various saws located throughout the building. These are cooled by a recirculating glycol/water system and are ventilated by canopy hoods and flexible hoses. Other equipment in the Melting/Solidification Facility includes a 15-pound-capacity vacuum induction furnace used to make aluminum/ceramic composites; vacuum and atmospheric heat treatment furnaces; and an "electroslag" furnace, which purifies molten metal by passing it through slag material. Vacuum systems for these units exhaust to the HEPA filter. A high-vacuum electron beam furnace, which will be used to prepare molybdenum/titanium alloys and refractory composites, was being installed at the time of the Survey. Some acid etching and cold solvent cleaning are done in a hood vented to the roof. Gallon quantities of trichlorethylene, xylene, and 1,1,1-trichloroethane are used.

The vacuum arc furnace used to remelt ingots has been used in the past to melt depleted uranium for special studies. Further studies involving depleted uranium are planned. The SNLA Health Protection group is consulted before such tests are conducted, and the group participates in the design of the experiment. Additional air emission controls may be applied if recommended by the group.

Technical Area IV Air Pollution Sources and Controls

Technical Area IV contains particle beam accelerators and X-ray pulse generators, which are primarily sources of radiological air emissions. Radiological emissions and controls are discussed in Section 4.3. Technical Area IV uses various organic solvents, including chlorofluorocarbons, to clean equipment. A portion of the solvents is evaporated through the building exhaust. A sulfur hexafluoride recovery system, which uses sulfuric acid, is also located in Technical Area IV. Toxic and criteria pollutant emissions from Technical Area IV are included in the toxic air contaminant source registration filed by SNLA with the City of Albuquerque.

Technical Area V Air Pollution Sources and Controls

Technical Area V contains test reactors, which are primarily sources of radiological air emissions. Radiological emissions and controls are discussed in Section 4.3. Technical Area V uses various organic solvents to clean equipment. A portion of the

solvents is evaporated through the building exhaust system. Toxic and criteria pollutant emissions from Technical Area V are included in the toxic air contaminant source registration filed by SNLA with the City of Albuquerque.

Field Test Areas - Technical Area III and Remote Areas - Air Pollution Sources and Controls

Burn Site-9830 Complex

The Burn Site, located in the area of Building 9830 in Lurance Canyon, consists of several enclosed structures and one open-air structure used to test the response of weapons components, transportation containers, etc., to fires. All the facilities use No. 2 fuel oil except the open-air burning tank which has the capability to use jet fuel. The LAARC is an enclosed cylindrical burn facility fabricated from steel, and has insulated walls. Tests are conducted in this facility on casings, reentry vehicles, etc., which contain no radioactive, explosive, or hazardous materials. The test item is suspended above a pool of fuel oil floated on water. Fans are used to blow air into the burn chamber through ducts in the floor. The fuel is ignited and burned, with emissions vented through a chimney in the roof of the chamber. On the order of 50 to 100 gallons of fuel are used per test. The LAARC facility was operated sporadically in 1985 and 1986. Six tests were run in the first half of 1987.

The Tenth-Scale Facility is a second enclosed rectangular burn facility fabricated from steel. The facility does not have insulated walls, and water is sprayed on the outside walls during burn tests to dissipate heat from the facility. Water is used to float fuel for tests. Tests are conducted on articles which do not contain radioactive, explosive, or hazardous materials. Air is blown into the burn chamber through fan ducts in the lower walls. Emissions are vented through a chimney in the roof of the chamber. Generally about 55 gallons of fuel are used per test. Each test lasts about 30 minutes.

The corrugated Chimney Facility, fabricated from corrugated metal, is used to test "live" weapons and weapons components which may contain explosives, depleted uranium, or beryllium. Normally tests of such articles do not release contamination; however, the last test, in 1986, involved a weapon containing depleted uranium and beryllium, and contaminated the Chimney Facility with these materials. The facility

operates with a gravity-fed fuel/water system and with natural draft inlet air (i.e., without fans for blowing air into the unit). Residual water is drummed for disposal or left to evaporate. Potential emissions of depleted uranium or beryllium are not monitored during tests because of the explosion hazard from the tests, and no controls are applied. Swipe tests conducted around the facility after depleted uranium tests have generally shown no contamination significantly above background. Background concentrations of depleted uranium in the area are somewhat higher than normal, possibly because of historical open-air tests involving depleted uranium.

According to the facility operators, beryllium components involved in tests in the corrugated Chimney Facility tend to remain intact, and are generally in the form of beryllium oxide (BeO). Beryllium has a melting point of about 1,280°C, and beryllium oxide a melting point of 2,530°C, both significantly higher than the flame temperature in the unit. The unit also operates with a relatively low airflow. The beryllium is therefore not likely to become entrained in the exhaust gas.

Building 9830 is an enclosed concrete bunker used to test the effects of fires on electrical cable, electronic equipment cabinets, etc. It is a forced air system which uses on the order of 50 gallons of fuel per test. The burning of electrical cable insulation [polyvinyl chloride (PVC)], which may occur during these tests, results in the emission of small quantities of hydrochloric acid, and may also result in emissions of particulate and gases containing chlorinated compounds and other incomplete combustion products. This facility is used sporadically, and its emissions have not been characterized.

The Open-Air or "Swimming Pool" Burn Facility is an in-ground concrete containment structure, which is approximately 50 feet by 20 feet by 3 feet in depth. The structure is filled with several thousand gallons of fuel floated on water which is burned in order to expose transportation containers to the conditions of an open-air fire. The article tested is suspended above the pool during the test. Fuel and water are gravity-fed from tanks, and residual water is stored in a tank and reused. This facility is used approximately once a year, and may be used up to four times a year. The Open-Air Burn Facility, being unenclosed, is not subject to controls of visible or pollutant emissions.

At the Burn Site, burn tests involve hazardous materials such as depleted uranium and beryllium, and also involve combustible materials such as plastics and wood. Tests involving such materials require the preparation of action description memorandums (ADMs). Units tested in 1986-1987 include those listed in Table 3-6. Worst-case analyses are conducted in order to estimate potential emissions of toxic air pollutants based on emission factors and previous test experience, and calculated site-boundary concentrations are compared to applicable TLVs or environmental standards. In general, concentrations of toxic air pollutants have been estimated to be much less than the applicable TLV. One test of a weapons component is believed to have released approximately 15 pounds of depleted uranium oxide, as this quantity remained unaccounted for in post-test analyses (Stanford, 1987). The uranium oxide is believed to have been dispersed in the immediate vicinity of the facility.

ADMs written for burn tests provide estimates of the releases of carbon monoxide, sulfur dioxide, particulates, and other pollutants. Site-boundary carbon monoxide concentrations have been estimated to be on the order of 1 percent of the ambient standard of 9 ppm. Sulfur emissions are very low, as the fuel meets military specifications for sulfur content (~100 ppm). Studies of burn test emissions conducted from aircraft indicate that approximately 5 percent of the carbon in the fuel remains uncombusted. Emissions are roughly the same as those from heavy truck and bus engines. Nitrogen oxides are not generated because of the low flame temperatures.

Burn tests are conducted only when meteorological conditions are favorable. Wind speed, wind direction, humidity, and temperature are measured at the burn site, and meteorological data are obtained from wind speed/direction meters at the burn site and also from Albuquerque Airport. Tests are conducted only when winds are from the west, away from populated areas. The maximum plume rise for enclosed burn tests conducted under favorable conditions is about 500 feet. This plume rise is not great enough to allow the plume to leave the confines of the canyon. The plume rise for tests conducted in the Open-Air Burn Facility is greater than the canyon height, and the plume from these tests can leave the canyon. The City of Albuquerque is notified of all proposed tests, as required by permit conditions, and can postpone a test if any air quality concerns arise (Shankar, 1987).

TABLE 3-6

BURN TESTS CONDUCTED IN 1986 - 1987 AT THE BURN SITE

Material Tested	Test Unit	Hazardous/ Combustible Materials Involved	Fuel Consumed	Toxic Air Pollutant Emissions
Fire-Resistant Shipping Container	LAARC	Wood (Maple, Redwood) KEVLAR Fiber and Resin Various Adhesives	330 Gallons #2 Oil	Kilogram quantities of plastic combustion products
TRUPACT-I Container	Open Burn	Rigid Polyurethane KEVLAR/Vinyl Acetate Various Adhesives Air Bags (Plastic)	9000 Gallons #2 Oil	Kilogram quantities of plastic combustion products
Weapon Component/ Propellant Fire	Chimney Facility	Depleted Uranium Beryllium Oxide Lithium Hydride Propellant (Aluminum Perchlorate)	2,515 Pounds Propellant (Test 2) 1,500 Pounds Propellant (Test 1)	Depleted uranium Lithium Hydride
Plastic Cylinders	Open Burn	Acetyl Urethane	None	Gram to kilogram quantities of plastic combustion products

Source: SNLA Action Description Memorandums (ADMs), 1985-1987

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Air emissions from enclosed and open-air burn tests are subject to visible emission standards included in the City of Albuquerque air quality regulations. Emissions must be less than 20 percent opacity measured as a 6-minute average. Until recently, none of the burn facilites met the opacity limitation, and in 1986 the facilities were operated under a variance granted by the city. SNLA modified the three enclosed burn facilities in 1986 and 1987 in an effort to reduce visible emissions to a level that would comply with the city standard. The LAARC facility was modified by adding baffles to the air pipes, which increases turbulence and promotes air/fuel mixing. This reduced visible emissions, and the LAARC has been operated twice with low smoke emissions. The emissions from the most recent test of the LAARC failed to meet visible emission standards because the air inlet fan failed, which did not allow sufficient combustion air to enter the burn chamber. The fan was replaced and the LAARC reconfigured. It is expected that the LAARC can meet the opacity standards based on previous test results (Stanford, 1987). However, the LAARC has not been retested because no tests are presently scheduled for the facility. Construction of a new burn facility to replace the LAARC is planned.

The Tenth-Scale Facility was modified by adding baffles in the chimney of the burn chamber. The baffles act to create turbulence in the exhaust gas in the chimney, and create the effect of an afterburner. Emissions from the Tenth-Scale Facility averaged about 10 percent over a 30-minute test, and the facility has been certified by the city as in compliance with the visible emission standard (Stanford, 1987). The corrugated Chimney Facility, which has not been operated since 1986, had not been modified at the time of the Survey and had not been tested.

The Open-Air Burn Facility, by its nature, is not subject to application of visible emission control systems. The facility will continue to operate under a variance from the standard. A new smaller open-air facility proposed to be constructed at the burn site to replace the existing facility is also expected to require a variance from the visible emissions standard. A proposed new enclosed burn facility, which will replace the LAARC facility, will require an air emission permit from the city. The new facility will be required to meet the visible emission standard, and also to meet ambient air quality standards for carbon monoxide in order to receive a permit to operate. Stack sampling may be required as a permit condition. Construction of the new facilities is expected to commence in 1988.

Remote Facilities Field Tests

Various types of field tests involving explosive or propellant materials are conducted by SNLA. These include tests using rocket motors conducted at the sled track, flyer plate tests used to test explosive detonators, and explosive firing tests. Field explosive and rocket motor tests result in short-term emissions of toxic and criteria air pollutants, and are in some cases sources of soil contamination. Field tests conducted since late 1985 have been subject to ADM requirements. ADMs serve to provide a description of the test conditions and location, and to provide information concerning potentially hazardous materials involved in the test and any potential emissions to the environment. Tests conducted before late 1985 do not have ADMs; some of these tests involved dispersion of hazardous materials such as depleted uranium and beryllium, and are discussed in Section 4.5. Current testing operations that have the potential to cause soil contamination are discussed in Section 3.2. Future planned field tests are expected to be on a smaller scale than historical tests, with consequently less potential for emissions to the environment.

Rocket Motor Tests

Rocket motors are fired at the Technical Area III sled tracks in conducting impact tests of projectile shapes, weapons components, etc. The test unit is mounted on a sled with one or more rocket motors. The sled either accelerates the tests unit toward a target or provides sufficient acceleration for the test unit to become airborne. A recent series of impact tests for which ADMs have been prepared involves a test unit impacting a concrete target at the Technical Area III 10,000-foot sled track (Lane, 1987). The test units contain kilogram quantities of depleted uranium and lithium hydride. A Gaussian plume dispersion analysis was conducted for lithium hydride, as part of the ADM analysis. Complete aerosolization of all the lithium hydride was assumed, and calculations indicated that the highest lithium hydride concentration at the site boundary would be on the order of 0.004 mg/m^3, or 17 percent of the TLV. The depleted uranium is generally recovered with the debris from the test and not widely dispersed. This analysis indicates that other similar field tests, which have the potential to disperse kilogram quantities of hazardous materials (e.g., lead, beryllium), will result in only small maximum concentrations at the site boundary.

Other recently conducted tests at the 10,000-foot sled track involved use of rocket motors containing a lead-containing propellant mixture (Lane, 1986). Each rocket motor contains 750 pounds of propellant containing 3.73 pounds of lead, and from one to seven rocket motors may be used per test. Dispersion analyses were conducted assuming both favorable and unfavorable meteorological conditions, and both one and seven motor tests. Results of the analyses are included in Table 3-7. As shown in the table, a test involving a single rocket motor results in a modeled maximum lead concentration below the numerical ambient air quality standard of 1.5 $\mu g/m^3$, where a test using seven rocket motors results in modeled concentrations greater than 1.5 $\mu g/m^3$ several miles from the site boundary, even under favorable meteorological conditions. As modeled lead concentrations are significantly higher under unfavorable conditions, tests are conducted only under favorable (unstable) conditions.

Although the modeled lead concentrations exceed the numerical standard of 1.5 $\mu g/m^3$, rocket motor firings are not expected to result in any exceedance of the Federal and city ambient air quality standards for lead, as the Federal standard is calculated as a quarterly average and the city standard is calculated as a 30-day average. The duration of a rocket motor firing test is on the order of minutes, and increased lead concentrations resulting from the tests will not persist for long periods (Smith, 1986). The tests and other lead emission sources at SNLA do, however, contribute to the overall inventory of ambient lead in the Albuquerque area.

Rocket motors are also used in conducting armor penetration tests at the Old and New Cable Sites, at the Drop Tower Facility for projectile simulation, at Building 9927 to simulate terrorist attacks, and in other SNLA areas. Analyses at the Drop Tower Facility at Building 9927 for projectile simulation similar to those previously described for the sled tests may be required if a significant potential for environmental releases exists. SNLA is required to notify the EPA national response center of any releases of regulated substances to the environment in excess of the regulatory reportable quantity (RQ). The RQ for lead is 1 pound, and notification was required for a single rocket motor firing conducted in March 1987. The City of Albuquerque Air Pollution Control Division is also notified of releases. SNLA also notifies EPA and the city of releases of depleted uranium (for which the current RQ is 1 pound) and other regulated substances.

TABLE 3-7

MODELED LEAD CONCENTRATIONS RESULTING FROM ROCKET MOTOR FIRING

Number of Rocket Motors Fired	Assumed Meteorological Conditions	Site Boundary Lead Concentration	Distance from Site Boundary at which the Maximum Concentration may Exceed 1.5 µg/m3 (Ambient Air Quality Standard) *
One	Unfavorable (Neutral)	1.39 µg/m3	Not Exceeded
Seven	Unfavorable (Neutral)	64.8 µg/m3	7.9 Miles
One	Favorable (Unstable)	0.129 µg/m3	Not Exceeded
Seven	Favorable (Unstable)	8.72 µg/m3	2.0 Miles

* The Federal ambient air quality standard for lead is 1.5 µg/m3 as a quarterly average. The City of Albuquerque standard for lead is 3.0 µg/m3 as a 30-day average. A seven-rocket-motor firing will result in only a short-term exceedance of the numerical standards.

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Explosive Aerosol/Shockwave Test Facility-9920/9926 Complex

This facility is used to conduct tests using explosives for shockwave chemistry characterization. Aerosol detonation and air dispersion studies are also conducted at this facility. Shockwave tests are conducted by encapsulating various materials such as titanium, PZT, lead sulfide, etc., in a copper shell, which is then placed between two steel plates. These target capsules are fabricated in Building 808 in Technical Area I. Two explosive material lenses are attached to the capsule, which imparts a shock to the encapsulated material when detonated. Explosive lenses are fabricated from Baritol, a mixture of barium nitrate and TNT, at LANL; additional machining may be done in Building 9960 if required. These tests are conducted in a room-sized explosion chamber in Building 9926, and up to 5 pounds of explosive can be used. The Baritol detonation forms barium oxide, nitrogen oxides, and ammonia. The encapsulated test material is not released during the test. The barium oxide coats the inside walls of the explosion chamber and may be exhausted to the atmosphere through the ventilation system, which does not have a filter. Barium oxide has toxic effects from long-term exposure, and a replacement (possibly RDX or Nitroguanidine) may be used in the future.

Two "Air Buildings," which are positive pressure plastic fabric structures, are located near Building 9926 and are used to conduct dispersion and flame suppressant studies. Nickel oxide and depleted uranium have been used in this facility. Negligible air emissions result from this operation. Several facilities located outside Building 9926 are used to conduct aerosol explosion studies. Various mixtures of fuel (kerosene) and air, ethyl hexyl nitrate and air, and explosive mixtures of hydrogen, carbon dioxide, steam, and air are detonated to simulate explosions in reactors, refineries, etc. Fuel/air studies are conducted by spraying fuel into a large clear plastic-covered chamber with an atomizing nozzle. Five to seven gallons of fuel are used per test. The fuel/air mixture is detonated with a small explosive charge. Visible emissions from these tests are by nature short term. Carbon monoxide, particulate soot, and incomplete combustion products related to fuel combustion may be emitted to the atmosphere as a result of these tests.

A "Sooting Building" is used to coat metal plates with an oil soot. The plates are used to detect the characteristics of explosive detonations. Particles from the detonations form a pattern in the soot, which can then be analyzed. About 2 quarts

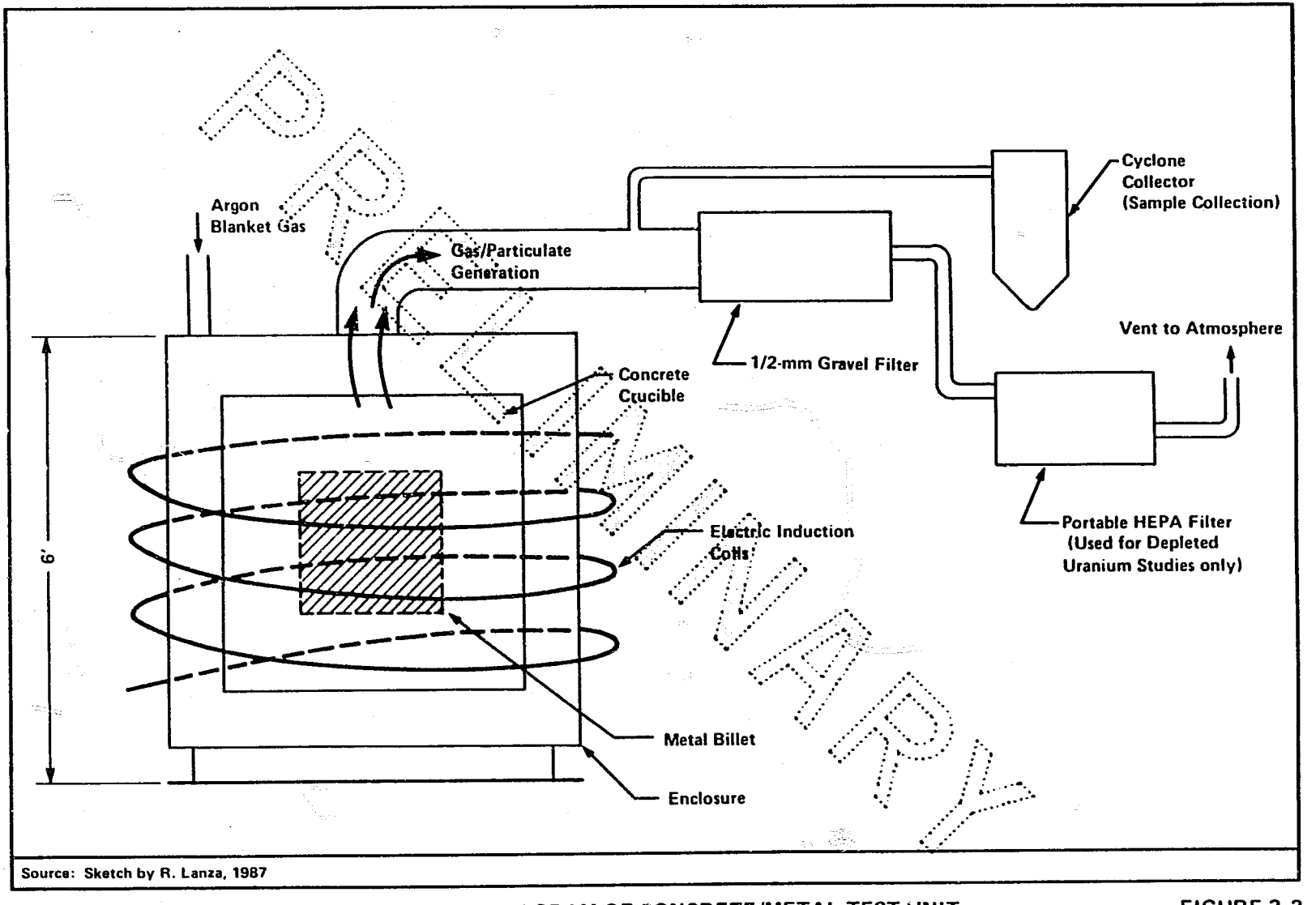
of kerosene are burned in the building for about 1 hour to form the soot. The facility is operated on a sporadic basis, and visible emissions, carbon monoxide, and incomplete combustion products result from the operation. The Sooting Building and the explosive fuel aerosol tests have not been observed by the city for assessment of visible emissions.

Molten Core Facility - 9939/9939A Complex

This area is used to conduct studies of concrete/metal interactions for reactor accident simulation, and the test equipment used is located primarily outside the building. Billets of various metals, which may include depleted uranium, steels, zirconium, and other metals, are placed in large concrete or magnesium oxide crucibles. Tests involving sodium are no longer performed. The metal is heated by external induction coils. The heated metal reacts with the crucible material and generates gases and particulate materials, which are analyzed as part of the study Particulate emissions are controlled by a 1/2-mm gravel filter. A schematic diagram of a concrete/metal test unit is shown in Figure 3-2. There are several units at Building 9939 of various sizes, and tests are conducted about four times a year. The largest enclosure is approximately 10 feet in diameter and 20 feet high. This unit was designed for sodium studies and is no longer used. Smaller scale molten core tests are conducted at the 6922/6924 complex.

Gases generated by concrete/metal tests are primarily hydrogen, carbon dioxide and carbon monoxide, and water. Particulate materials contain metal and metal oxide components of steel/zirconium alloys and concrete, including iron, barium, chromium, manganese, zirconium, molybdenum, etc. Sodium, potassium, chlorine, and sulfur compounds are also generated from the decomposition of concrete. Tests involving depleted uranium may generate aerosols containing 1 to 4 percent uranium. It is expected that particulate emissions will deposit in the immediate vicinity of the complex and result in contamination of surface soil.

Particulate emissions are controlled by a gravel filter. The gravel filter has been estimated to be 90 percent efficient for aerosols, down to 2 microns in diameter, based on modeling, and 99 percent efficient based on bench tests. The actual efficiency of the gravel filter has not been determined. The pressure drop across the gravel filter is measured before each test. A portable HEPA filter is installed



Source: Sketch by R. Lanza, 1987

SCHEMATIC DIAGRAM OF CONCRETE/METAL TEST UNIT

FIGURE 3-2

PRELIMINARY

downstream from the gravel filter for depleted uranium tests. A HEPA filter used without the upstream gravel filter would be blinded by the aerosol. The efficiency of a standard HEPA filter is 99.97 percent for particulate down to 3 micrometers in diameter.

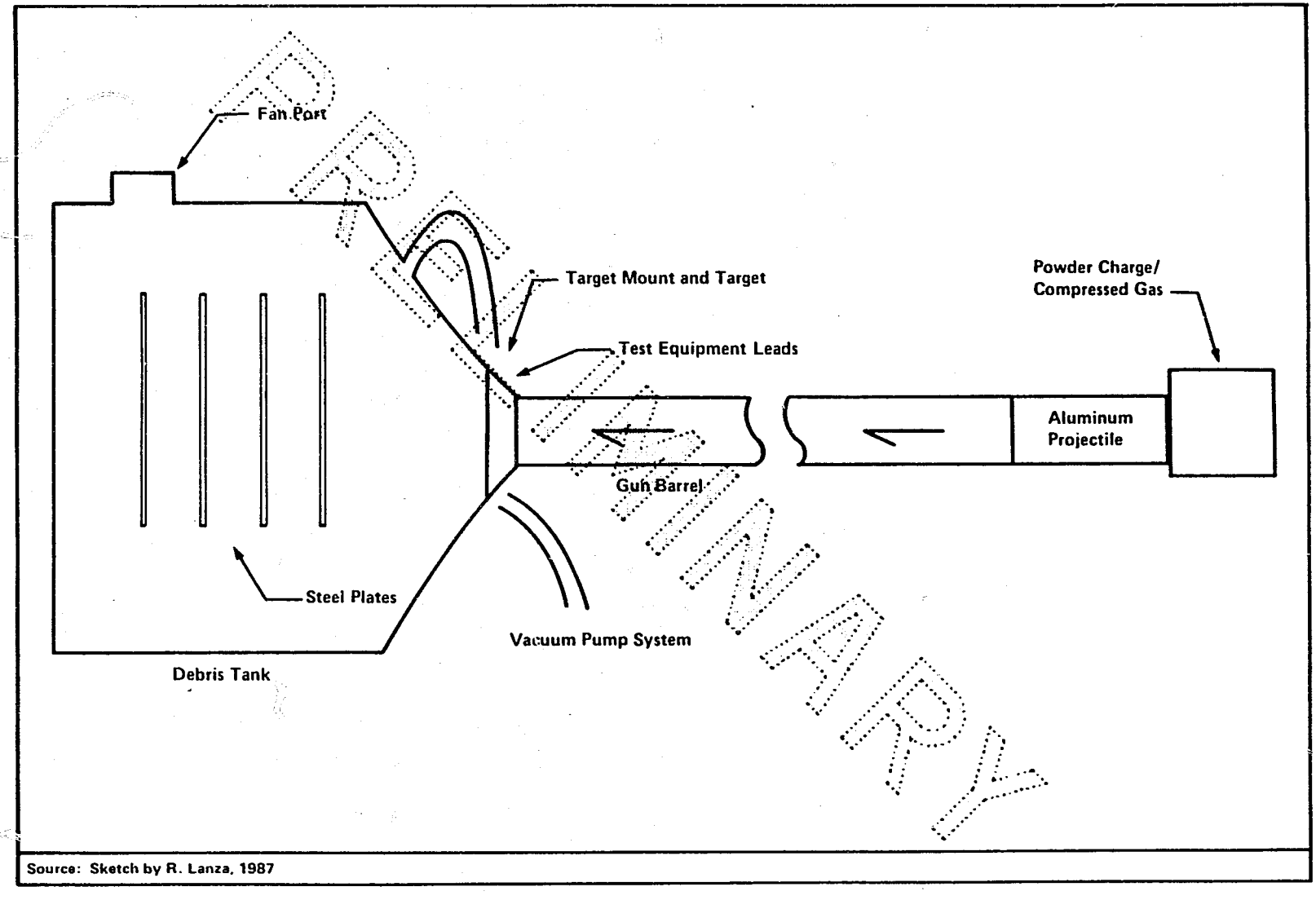
Depleted uranium oxide contamination of surface soil was observed in the vicinity of the Building 9939 test units during the Survey. The contamination is believed to be the result of a combination of deposition of the depleted uranium oxide aerosol from the fugitive emissions and vent emissions from the concrete/metal tests, and improper handling of depleted uranium at the facility.

Hypervelocity Gun Facility - 9950/9956 Complex

The Hypervelocity Gun Facility consists of several compressed gas- and powder-fired guns which are used to fire metal piston projectiles at target materials. Three guns are presently in use, and two others are under development. Tests are conducted to characterize the effects of mechanical shock on various materials, primarily metals. The physical characteristics of the target material (e.g., temperature and velocity profiles) are measured during the tests, using lasers and other electronic equipment.

Each gun consists of a gun barrel and projectile, target chamber, and debris collection chamber (see Figure 3-3). The projectile is fired into the target chamber with either compressed gas (helium, hydrogen, nitrogen) or black powder. The maximum powder charge for the high-velocity gun is 20 pounds; that for the 2-stage gun is 9.2 pounds. The intermediate-velocity gun is fired with compressed gas. The gun barrel, target chamber, and debris chamber are evacuated using a vacuum system before each test. The high-velocity gun and 2-stage gun have a common vacuum system, while the three remaining guns have separate systems. The vacuum system is isolated before the firing of the gun. The projectile is fired by igniting the powder or by breaking a rupture disk by the compressed gas.

The target is usually a metal disk about 2 inches in diameter mounted in an aluminum frame. The target and frame material and projectile are collected in the debris tank.



Source: Sketch by R. Lanza, 1987

SCHEMATIC DIAGRAM OF GUN UNIT

FIGURE 3-3

DRAFT PRELIMINARY

The by-product gas from the powder combustion is a flammable mixture of carbon monoxide, hydrogen sulfide, hydrogen, ammonia, and methane (Hamilton, 1976). The debris tank is opened to the atmosphere after each test, and the gases are diluted with air before being evacuated from the tank with the vacuum system. Insufficient dilution can result in a fire. Debris is removed from the tank and the tank cleaned with soap and water after each test. This minimizes particulate accumulation in the vacuum pump system. A kerosene-based solvent is used to clean the gun barrel after each test.

Gun facility tests have occasionally been done with small quantities of toxic metals such as lead, beryllium, and cadmium. Destruction of the target can result in formation of particulate material and/or metal vapors. The cadmium foil used in some tests vaporizes completely upon impact. Tests involving small quantities (about 5 pounds) of mercury are planned. Tests involving toxic metals are generally conducted by constructing a "greenhouse" around the debris tank. This consists of a wooden frame covered with plastic. The enclosure is kept under negative pressure and exhausted through a HEPA filter. Procedures for the mercury tests were being developed by the Industrial Hygiene group at the time of the Survey, and were not yet finalized. A proposed procedure involves wetting the inside of the debris chamber with a commercially available mercury absorbent to remove the mercury vaporized in the test from the tank gases. The vacuum system is not equipped with a filter, and some potential for contamination of the system with toxic metals exists. Previous tests involving beryllium targets did not result in any contamination of the vacuum pump oil.

A machine shop in Building 9956 is used to prepare metal targets and target frames. No machining of toxic metals occurs in this shop. All such machining is done at the Toxic Machine Shop in Building 869 of Technical Area I. Powder mixing and weighing is done in Building 9957.

SNLA Toxic Air Contaminant Source Registration

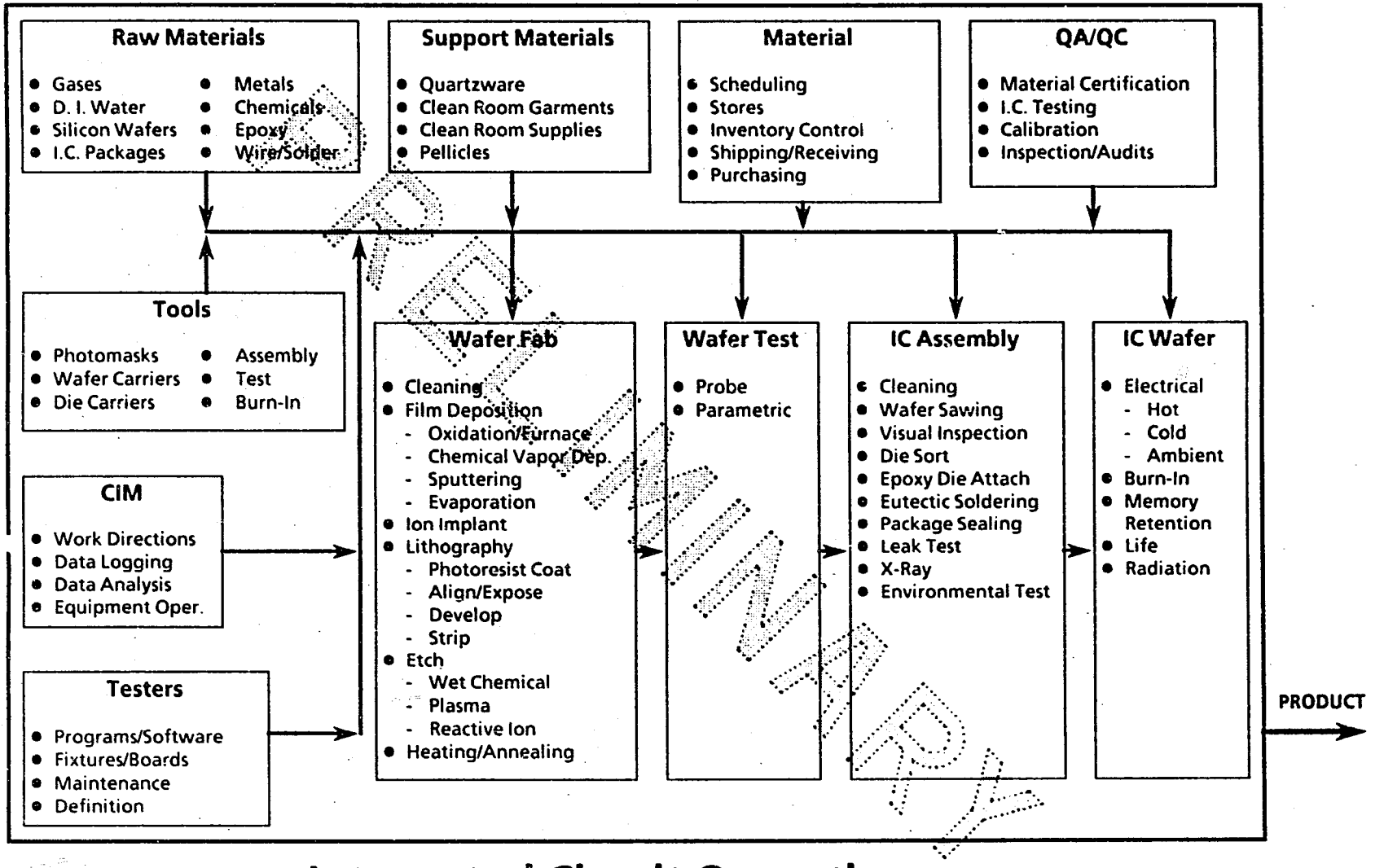
In 1987, the City of Albuquerque for the first time required each facility within the city to complete a toxic air contaminant source registration form, and to provide estimates of the emissions of specific toxic air contaminants from the facility. SNLA filed a registration form and additional information with the city, which included

an estimate of air emissions based on chemical purchases, and also a list of stacks and vents at SNLA, based on a stack inspection conducted in June 1987. The SNLA emissions estimates are based on annual chemical purchases and an assumed evaporation rate, expressed as a fraction of the total inventory of each chemical. The calculated emissions cannot necessarily be considered entirely representative of SNLA operations. Several chemical constituents emitted from SNLA operations, including lead fumes and chlorine gas from the Building 841 Foundry, ferric chloride from the Building 841 Printed Circuits Laboratory and arsine from the Chemical Vapor Deposition Laboratories, have not been estimated. Also, the assumed evaporation rate of some constituents, particularly acid solutions and volatile organics such as trichloroethylene and chlorofluorocarbons, may be underestimated in some cases. However, the chemical purchases inventory, even with more conservative assumptions concerning evaporation rates, indicates that air emissions from SNLA operations are relatively small. A more comprehensive purchasing inventory provided by SNLA also indicates that emissions may be higher than those estimated in the source registration, but nonetheless are relatively small.

3.1.2.2 Bendix Albuquerque Operations

Bendix Albuquerque Operations (BAO) is located in Building 870 of SNLA Technical Area I. The facility produces radiation-hardened, custom-designed integrated circuits. Commercially procured silicon wafers are subjected to a variety of process operations and environmental and quality control tests in the integrated circuit fabrication process. A summary of the integrated circuit process is included in Figure 3-4. A variety of chemicals and commercially available solutions are used in the wafer fabrication process, including acids such as hydrofluoric and sulfuric acids, chlorofluorocarbons and organic solvents, and toxic gases such as arsine and phosphine. Table 3-8 summarizes the inventory of chemicals purchased by BAO in the first 6 months of 1987.

Various acids and commercial etching and stripping solutions are used in "wet bench" baths in clean rooms in processing the silicon wafers. Nine benches are used for etching operations and are equipped with slot exhausts above polypropylene covers. Two benches are used for developing, and they use sulfuric, nitric, and hydrochloric acids. These benches are also equipped with slot exhausts and covers. The exhaust rate for each wet bench is about 100 ft^3/min. The wet benches are active during three daily shifts, and are covered when not in use. The



Integrated Circuit Operations

FIGURE 3-4

TABLE 3-8

INVENTORY OF CHEMICALS PURCHASED BY BAO,
JANUARY 1987 TO JUNE 1987

Organic Solvents	Unit Size*	Total Quantity (gal)
Xylene	5 CS	20
Acetone	98 CS	392
2 Propanol	131 CS	524
Methanol	25 BT	25
Genesolv D/Freon PCA	146 CN	730
Etching/Stripping/Developer Solutions (Acid/Caustic)		
Ammonium Hydroxide	29 CS	116
Mixed Acid Etchant 5:3:3 (MAE)	0 CS	0
Buffered Oxide Etchant 7:1 (BOE)	247 CS	1,482
Sulfuric Acid (95%)	986 CS	3,944
Acetic Acid (99.9%)	7 CS	28
Nitric Acid	16 CS	64
Hydrofluoric Acid	149 CS	894
Hydrogen Peroxide (30%)	394 CS	1,576
Phosphoric Acid (85%)	90 CS	360
Buffered Oxide Etchant 20:1 (BOE)	122 CS	732
Poly Silicon Etchant	29 CS	174
Ammonium Fluoride (40%)	121 CS	484

*CS = Case, CN = Carton, BT = Bottle

TABLE 3-8

INVENTORY OF CHEMICALS PURCHASED BY BAO,
JANUARY 1987 TO JUNE 1987 (Continued)

Etching/Stripping/Developer Solutions	Unit Size**	Total Quantity
Glass Etch	70 CS	70 Gallons
Hydrochloric Acid (38%)	24 CS	96 Gallons
Nophenol -922	125 CS	750 Gallons
Polysilicon Etchant	29 CS	29 Gallons
Photoresist/Developer Solutions (Non-Acid/Caustic)		
Developer Pos Resist AZ351 3.5:1		2,500 Gallons
Thinner Photoresist 1300, AZ		50 Gallons
Kodak 820 Photoresist		64 Gallons
AZ1450J Photoresist		95 Gallons
AZ1470 Photoresist		62 Gallons
R-10 Photoresist Stripper		14 Gallons
Toxic Gases		
15% Phosphine/Hydrogen*	1 Cy G/4 Cy Lecture	5 Pounds PH_3
15% Arsine/Hydrogen*	0 Cy G/0 Cy Lecture	--
Boron Trichloride	1 Cy	100 Pounds BCl_3
Boron Trifluoride	0 Cy	--
Silane Gas	3 Cy	150 Pounds $Si H_4$
Dichlorosilane Gas	4 Cy	400 Pounds $Si Cl_2 H_2$
Hydrogen Chloride Gas	22 Cy	400 Pounds HCl
Chlorine Gas	4 Cy	100 Pounds Cl_2
Ammonia Gas	0 Cy	--

Source: Information provided verbally by BAO, 1987

* Normal use of arsine and phosphine is one 30 ft^3 (G size) cylinder every 3 months

** CS = Case, CY = Cylinder

benches are active during three daily shifts, and are covered when not in use. The etching solutions are changed three times a week, and are collected and neutralized in the elementary neutralization system (ENS) before discharge to the sanitary sewer system.

Several of the baths, including baths containing nophenol (a mixture of naphtha and sulfonic acids), ammonium fluoride, and phosphoric and nitric acids, are heated with electric immersion heaters. The nophenol is heated to 100°C. Other solutions are heated to about 40°C. Use of fiberglass and stainless steel ductwork in some areas, and periodic replacement of ductwork damaged by corrosion indicate that some acid vapors are emitted from the ventilated tanks through the ductwork to the roof vents. No scrubbers are installed on the acid tank exhausts; tanks are covered with polypropylene covers when not in use, which serves to control emissions of acid vapors. No estimate of acid gas emissions from BAO is available.

The total amount of acid solutions collected by the ENS is approximately 50 gpm and the amount of acids included in the BAO purchasing inventory is relatively small. This indicates that the major portion of the acid solutions is collected by the ENS, and that atmospheric emissions of acid vapors are relatively small.

BAO uses small quantities of toxic gases, including arsine, phosphine, boron trichloride, boron trifluoride and silane, and corrosive gases, including chlorine and hydrogen chloride, in treating silicon wafers. Gas cylinders are stored outside Building 870 in ventilated cylinder cabinets in an enclosed storage building. The cabinets are equipped with continuous monitors to detect gas leaks. The areas in Building 870 in which arsine and phosphine are used are equipped with alarmed continuous monitors for arsine and phosphine gas; a system to monitor boron trichloride is scheduled for installation. The arsine/phosphine monitors can detect in the parts-per-billion range.

Normal consumption of arsine and phosphine gases is one 30 ft^3 cylinder every 3 months. These gases are used in dilute (1 percent or 15 percent in hydrogen or argon) mixtures in various processes. Arsine, phosphine, and some boron trichloride and silicon tetrafluoride are used as ionized gases in the ion implant process to dope silicon wafers. Two ion implant machines can use any of the four gases, depending on the process. This process operates at high vacuum, and the vacuum systems exhaust small quantities of the gases to the atmosphere when the machines are purged. The vacuum pump oil absorbs some arsenic, and is disposed of as a

hazardous waste. Dilute (1 percent) phosphine gas and hydrogen chloride gas are used in atmospheric furnaces in which a variety of wafer treatment processes are conducted. The furnaces exhaust through two fans to a stack. Phosphine and silane are also used in vapor deposition machines to deposit phosphorus or silicon vapors onto silicon wafers under vacuum. No emission controls are applied to the ion implant, furnace, or vapor deposition exhausts.

Two reactors are used to form layers of silicon substrate, and use dilute (100 ppm) phosphine in hydrogen and hydrogen chloride gas at atmospheric pressure in doping the silicon wafers. The majority of the phosphine is incorporated into the silicon, according to the machine manufacturer. The exhaust gas is potentially toxic, and nitrogen gas is used to purge the exhaust lines before maintenance. The unit is equipped with a chlorine/phosphine scrubber which uses 30 psi water and removes toxic constituents from the exhaust. The scrubber exhausts to a roof vent. The efficiency of the scrubber has not been measured, but is expected to be high for chlorine based on the high solubility of hydrogen chloride in water. Phosphine is less soluble, and the scrubber efficiency is expected to be lower for phosphine. The scrubber formerly used caustic solution rather than water, but safety concerns about caustic handling caused the use of caustic to be discontinued.

A vapor deposition machine is used at BAO by SNLA researchers to conduct development studies on silicon wafers. The unit operates under vacuum and uses small quantities of tungsten hexafluoride to treat silicon wafers. Tungsten hexafluoride is extremely corrosive, and the machine exhaust is equipped with a water scrubber fabricated of polyvinyl chloride (PVC) and stainless steel. The scrubber is alarmed for low water flow and exhaust gas backpressure, and uses 60 psi water. The efficiency of the scrubber has not been determined.

Organic solvents, including xylene and acetone, are used to clean silicon wafers, Photoresist masks, and other parts at the wet benches. Chlorofluorocarbons are used in two refrigerated degreasers to clean parts. These do not have dedicated exhausts. Photoresists (complex organics) and organic solvents, including chlorofluorocarbons and nophenol (containing naphtha) used at BAO are collected by the solvent capture system (SCS). A summary of the approximate amounts of the various solvents used at BAO that are captured by the SCS is included in Table 3-9. A dedicated chlorofluorocarbon capture system is planned for installation. It is expected that some evaporation of solvents will occur through the exhaust systems

TABLE 3-9

BAO SOLVENT CAPTURE SYSTEM SUMMARY

Chemical	Gallons/Month (Approximate)
Acetone	75
Ammonium Hydroxide	1
Freon	80
Nophenol	35
Photeoresist	40
Pump Oil	25
2-Propanol	43
R-10 Photoresist Stripper	5
Tergitol TX-100 (Surfactant)	<1
DI Water	225
Xylene	12
Total	542

Source: Information provided verbally by BAO, 1987

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and also from the SCS tank vent. No solvent emission controls are applied to the exhaust system. Comparison of the SCS summary and purchasing inventory indicates that atmospheric solvent emissions from BAO are small.

3.1.2.3 Inhalation Toxicology Research Institute

The Inhalation Toxicology Research Institute (ITRI) conducts inhalation exposure studies on mice, beagle dogs, and other test animals using a variety of radioactive and toxic chemical substances. Emissions of these substances to the atmosphere result from preparation of exposure mixtures, ventilation of the inhalation laboratories, and analysis of test samples. Emissions of air pollutants also result from support services at ITRI including waste management and utilities.

Table 3-10 shows the inventory of toxic air contaminants used at ITRI. This inventory represents the estimated quantity of each substance used annually at the facility; the amount actually emitted to the atmosphere is lower, as some of the materials may be incorporated into solid or liquid wastes. A variety of toxic and potentially carcinogenic substances are used for inhalation studies at the facility. ITRI maintains a computerized inventory list of all "controlled materials" at the facility, including known and suspected carcinogens, toxic substances, and radionuclides. The data base includes the name, identification number, and location of each substance, the amount in storage and amount issued to the researcher, and the date received and date issued. A wide variety of substances are stored and handled at the facility, mostly in gram to kilogram quantities. Several kilograms of beryllium compounds are stored at ITRI, and about 250 grams have been issued to researchers since 1986.

The amount of a particular substance issued on an annual basis represents the upper bound of the amount potentially released to the atmosphere. The substance may also be released from the facility as liquid or solid waste or be destroyed/chemically converted as part of laboratory analysis.

A stack and vent inventory provided by ITRI (Thompson, 1987d) shows that the facility has several hundred stacks and vents of various types. As ITRI was designed as a facility to conduct radionuclide studies, stacks and vents in inhalation study areas are equipped with two HEPA filters, including those laboratories not used for radionuclide studies. These filter systems are highly efficient in controlling

TABLE 3-10

ITRI TOXIC AIR CONTAMINANT INVENTORY

Chemical Name	Estimated Maximum Potential Release (lb/yr)
Acetaldehyde	<0.1
Acetic Acid	<10
Acrylonitrile	<200
Ammonia	<10
Benzene	<10
Bromine	<0.1
1,3-Butadiene	<10
Carbon Disulfide	<1
Carbon Tetrachloride	<1
Chloroflurocarbons (CFC113)	<100
Chloroform	<10
Di (2-Ethylhexyl) Phthalate	<0.1
Dioxane	<1
Ethyl Acetate	<30
Ethylene Oxide	<10
Formaldehyde	<100
Hexane	<30
Hydrochloric Acid	<10
Hydrofluoric Acid	<5000-6000
Hydrogen Sulfide	<100
Methylene Chloride	<100
Methyl Ethyl Ketone	<10
Methyl Isobutyl Ketone	<1
Nitric Acid	8000-9000
Phenol	<0.1
Polycyclic Organic Compounds	<10
Sulfuric Acid	<10
Tetrahydrofuran	<100
Toluene	<100
Xylene (all isomers)	<100
CFC 113	<100
Methyl Chloride	<1

Source: McClellan, 1987b

2 OF 8

particulate and non-volatile liquid emissions from the laboratory exhausts. Small quantities of various solvents are used in, or in support of, inhalation studies, and several types of acids, including large amounts of nitric acid and hydrofluoric acid, are used for sample preparation. HEPA filters will not control emissions of acids or VOCs, however, and will be only partially effective in removing semi-volatile constituents from the exhaust gases. Major toxic air contaminant and criteria pollutant emissions from ITRI laboratories and support services are discussed below. Radionuclide air emission sources and controls at ITRI are discussed in Section 4.3.

Steam/Hot Water Plant and Diesel Engines

Steam and hot water are provided to ITRI by six boilers located at the facility. All are dual-fuel boilers, and can be fired with propane or No. 2 fuel oil. Propane has been generally used for the past several years. Fuel oil is burned on a nonroutine basis to dispose of inventory in the fuel storage tanks. The operating characteristics of the boilers are summarized in Table 3-11. Each boiler exhausts to a separate 25-foot stack located on the roof of the building.

Under normal operating conditions, one steam boiler and one or two hot-water units are operated. Peak demand is one steam boiler and 12 mmBtu/hr of hot water. In the summer months, propane consumption in the boilers is about 5,000 gallons/week; fuel consumption increases to 16,000 to 20,000 gallons/week in the winter months. Fuel consumption is monitored by fuel tank inventory and also by daily monitoring of the positive displacement meters. The hot-water system is a closed-loop system, with water returned from usage points to the boilers.

A heat recovery system using ethylene glycol recovers heat from the laboratory stack exhausts. Ethylene glycol is pumped at about 27 psig through copper coils with aluminum fins located in the stacks, which recover heat by heating the ethylene glycol. The ethylene glycol is used in heat exchangers to preheat the boiler inlet water. The ethylene glycol is then recirculated into the stack heat recovery coils.

ITRI also operates two stationary and two portable diesel engines. The two stationary engines are each rated at 800 KW electric output, and are used to provide emergency power in the event of a power outage. The units are tested for one-half

TABLE 3-11

OPERATING CHARACTERISTICS OF DUAL-FUEL-FIRED BOILERS AND STATIONARY DIESEL ENGINES AT ITRI

Unit and Number	Date Installed	Fuel	Heat Input (mmBtu/hr)	Output
Boiler 1	1961	Propane/Fuel Oil	2.5	Steam, 65 psig
Boiler 2	1961	Propane/Fuel Oil	5	Hot Water, 140°F-190°F
Boiler 3	1961	Propane/Fuel Oil	5	Hot Water, 140°F-190°F
Boiler 4	1967	Propane/Fuel Oil	2.5	Steam, 65 psig
Boiler 5	1967	Propane/Fuel Oil	5	Hot Water, 140°F-190°F
Boiler 6	1979	Propane/Fuel Oil	10	Hot Water, 140°F-190°F
Diesel 1	1981	Fuel Oil	--	Electricity, 800 KW
Diesel 2	1981	Fuel Oil	--	Electricity, 800 KW

Source: Information provided verbally by ITRI, 1987.

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hour each week, and may be operated up to three times a week for short periods (~one-half hour) to provide emergency power. The stationary diesel engines exhaust to separate stacks located on the roof of the diesel generator building. The portable diesel generators are each rated at 150 KW electric output, and are used to provide local power for permanent facilities. All diesel engines are operated with the same fuel as is used in the boilers, from the same fuel tank. The fuel contains a nominal 0.5 percent sulfur.

At the time of the Survey, two automotive diesel engines (Oldsmobile) were being used on an as-needed basis to provide diesel exhaust for inhalation studies. The excess exhaust gas not used in the inhalation study exhausts through a 25-foot stack located on the roof of the building.

The City of Albuquerque formerly received annual fuel consumption reports from ITRI. Fuel oil consumption data are now included in the annual environmental reports prepared by ITRI. The city has not conducted inspections of the boilers or diesel engines, and the units do not have air emissions permits. The city has not advised ITRI as to whether the units require air emissions permits. The city has advised SNLA that similar-sized units located in Building 605 of Technical Area I of SNLA do not require permits.

Pathological-Waste Destructor

ITRI operates a Pathological-Waste Destructor located in Building 9221 near the sanitary wastewater lagoons. The unit consists of a ram feeder, fixed hearth combustion chamber, spray dryer, baghouse, and two HEPA filters, and is designed to burn carcasses of radioactive test animals and bedding, organic wastes, solvents, and scintillation vials. Disposal of solvents and scintillation vials in the destructor is now prohibited by RCRA regulations, and only test animals and bedding are burned. City of Albuquerque air quality regulations prohibit the operation of any incinerator within the city. Combustion equipment used for the destruction of pathological waste and classified waste is specifically exempt from these regulations. The pathological destructor was installed in 1981.

The pathological destructor is operated by feeding wastes to the ram feeder and to the primary combustion chamber, which is fired with propane. The primary

combustion chamber is operated at 1,650°F. Combustion gases enter the secondary combustion chamber, maintained at 1,800°F, and then enter the spray dryer. The spray dryer is designed to use low-level radioactive wastewater, lime and flyash in a slurry as a scrubbing medium. Radioactive wastewater can be stored in a tank, and pumped through a particulate filter into a second tank, where lime and flyash can be added. Historically, however, the addition of lime has caused plugging of the slurry atomization nozzles, and the use of low-level radioactive wastewater requires the maintenance crew to wear protective gear. As a result, tap water is presently used instead of lime slurry in the spray dryer.

The exhaust gas flows from the spray dryer to a baghouse and then through two prefilters and two HEPA filters before exiting to a stack. HEPA filters are generally 99.97 percent efficient in collecting particulate down to 3 micrometers in diameter. The filter bags are cleaned automatically by reverse air pulse, and cleaning can be done manually through the system control panel. The bags have not been changed since 1983. Filter cartridges, filter bags, and collected ash are expected to be solidified in drums when a sufficient quantity is generated.

The pathological destructor was not operational at the time of the Survey, as the seal between the spray dryer exhaust gas outlet and baghouse inlet was broken. A new high-temperature-resistant seal is scheduled to be installed, at which time the unit will be reactivated.

The destructor was operated continuously between July 1985 and December 1986, burning nonradioactive test animals, as part of a research effort. It was operated sporadically from December 1986 until failure of the spray dryer seal in 1987. It is expected that, upon reactivation of the unit, test animals, bedding, and low-level radioactive wastewater will be disposed of in the unit. The unit is intended to be tested using nonradioactive test animals before any radioactive test animals are disposed of.

Particulate and visible emissions from the destructor are expected to be minimal, as the particulate control system is highly efficient. Releases of radionuclides from the unit are discussed in Section 4.3. Emissions of nitrogen oxides and carbon monoxide are generated from the combustion of propane and waste materials. Small quantities of hydrochloric acid are expected to be generated from plastic bags used

to contain the wastes fed into the unit. Any such emissions from the unit will not be controlled to a significant extent by the spray dryer, as no alkali is used in the system and no wastewater is generated. Toxic pollutant emissions from the unit have not been determined, but are expected to be small considering that the wastes burned (test animals, bedding) are substantially water and organic material.

Muffle Furnace/Digester

The Alpha Wing contains muffle furnaces and tissue digesters, which are used for test sample preparation. The test samples are heated in the furnace, and then dissolved in nitric acid and hydrofluoric acid. The muffle furnace exhaust is equipped with a HEPA filter system, and the exhaust rate is monitored and alarmed. The digestion takes place in hoods, and all the acid used is eventually driven off by the digestion process. Approximately 5,000 to 6,000 lb/yr of hydrofluoric acid and 8,000 to 9,000 lb/yr of nitric acid are used at ITRI, nearly all of which are used in the tissue digestion process. No acid gas emission controls are applied to the digestion exhausts, and HEPA filters cannot be used on the exhausts, as the acid gases will attack the filters. The fan and exhaust gas plenum of the digester exhaust was visibly corroded at the time of the Survey, and it is expected that the copper and aluminum heat recovery coils inside the stack may also be experiencing corrosion. There are numerous other exhaust systems which exhaust glove boxes, animal handling areas, etc. in the Alpha and Beta/Gamma Wings, and seven fume hoods for sample preparation in the Beta/Gamma Wing. These exhausts are equipped with HEPA filters, and are primarily potential sources of emissions of radionuclides, and sources of small quantities of acid gases and organic solvents.

Cell Toxicology Room

This area, located in a new wing of the ITRI main laboratory, is used in conducting studies with tritium and carbon-14-labeled compounds, including known and suspected carcinogens such as benzo-a-pyrene. Only solid and liquid constituents are handled in this area and generally gram quantities of test compounds are used. The inventory of benzo-a-pyrene at the laboratory is about 1 kilogram; only several grams had been used at the time of the Survey. The room exhausts through two HEPA filters, which will effectively control emissions of particulate and non-volatile liquids from the exhausts.

Perchloric Acid Hoods

Two dedicated hoods located in the analytical chemistry laboratory and main laboratory building are used to dissolve talc samples for analysis. The talc is dissolved in perchloric acid and then analyzed by atomic absorption. Both hoods have exhaust gas washdown systems which use water. The washdown water discharges to the sanitary sewer system. Consumption of perchloric acid is on the order of 2 to 3 gallons per year.

Benzene Studies

Small amounts of tritiated benzene are used for inhalation studies at ITRI. The exhaust from the exposure chambers flows through a charcoal filter. The amount of benzene used at ITRI is estimated to be about 10 lb/yr. Tritium releases from ITRI are discussed in Section 4.3.

3.1.3 Environmental Monitoring Program

3.1.3.1 Sandia National Laboratories - Albuquerque

SNLA does not conduct any on-site or off-site monitoring for toxic or criteria air pollutants. Emissions of both toxic and criteria pollutants are small and have a small effect on air quality. The facility is not required by the City of Albuquerque to conduct air quality monitoring. The State of New Mexico operates a network of ambient air monitoring stations in Bernalillo County. These stations provide data on ambient concentrations of ozone, sulfur dioxide, lead, carbon monoxide, and total particulates. Ambient air quality data are discussed in Section 3.1.1. The toxic air contaminant source registration filed with the City of Albuquerque by SNLA provides an estimate of the toxic air emissions from the facility. The source registration is discussed in Section 3.1.2.1.

3.1.3.2 Bendix Albuquerque Operations

BAO does not conduct any on-site or off-site monitoring for toxic or criteria air pollutants. Emissions of both toxic and criteria pollutants are small and have a small effect on air quality. The facility is not required by the City of Albuquerque to

conduct air quality monitoring. The State of New Mexico operates a network of ambient air monitoring stations in Bernalillo County. These stations provide data on ambient concentrations of ozone, sulfur dioxide, lead, carbon monoxide, and total particulates. Ambient air quality data are discussed in Section 3.1.1.

3.1.3.3 Inhalation Toxicology Research Institute

ITRI does not conduct any on-site or off-site monitoring for toxic or criteria air pollutants. Emissions of both toxic and criteria pollutants are small and have a small effect on air quality. The facility is not required by the City of Albuquerque to conduct air quality monitoring. The State of New Mexico operates a network of ambient air monitoring stations in Bernalillo County. These stations provide data on ambient concentrations of ozone, sulfur dioxide, lead, carbon monoxide, and total particulates. Ambient air quality data are discussed in Section 3.1.1. The toxic air contaminant source registration filed with the City of Albuquerque by ITRI provides an estimate of the toxic air emissions from the facilities. The source registration is discussed in Section 3.1.2.3.

3.1.4 Findings and Observations

3.1.4.1 Category I

None

3.1.4.2 Category II

None

3.1.4.3 Category III

None

3.1.4.4 Category IV

None

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3.2 Soil

3.2.1 Background Environmental Information

3.2.1.1 Surface Soils

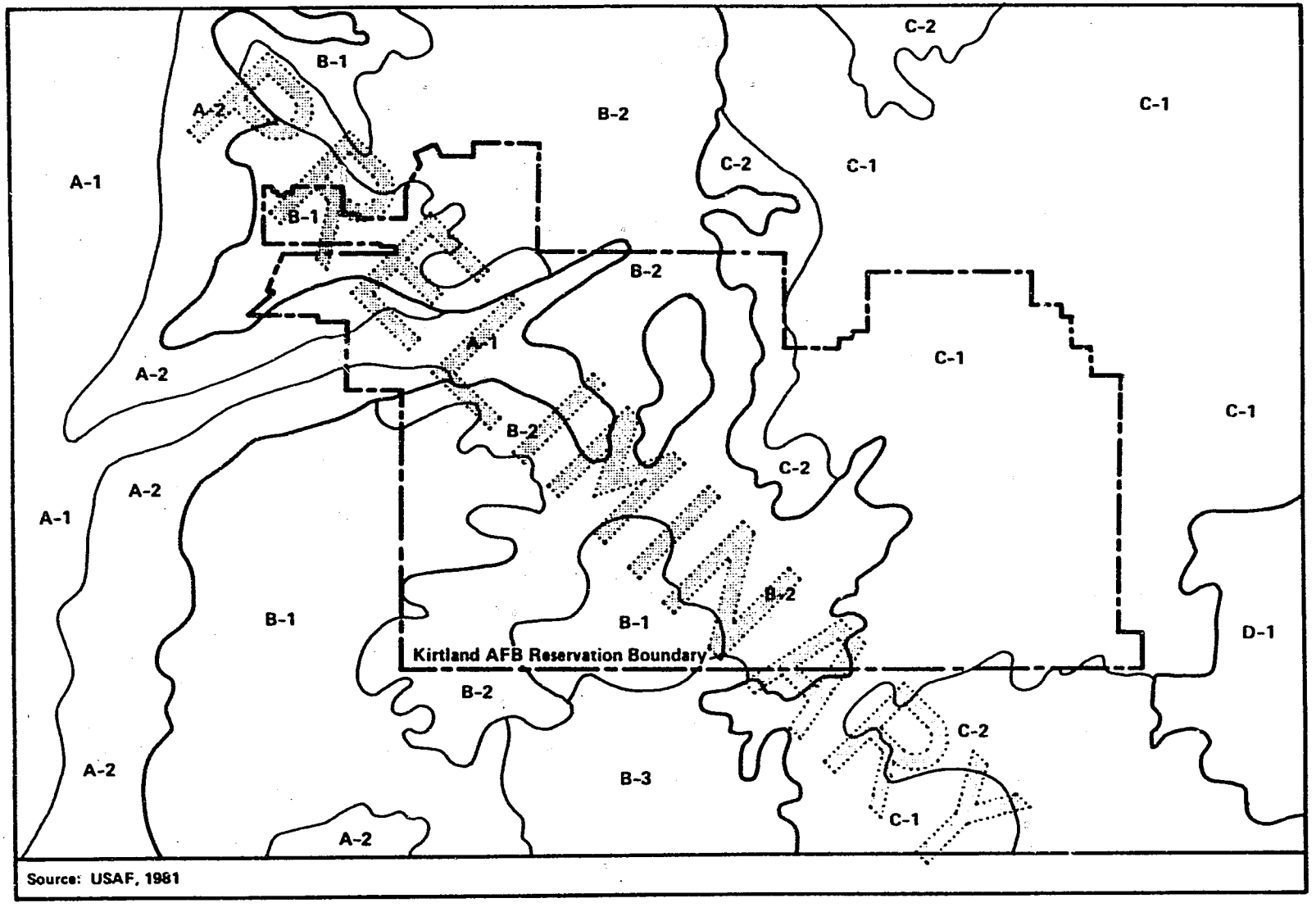
Kirtland Air Force Base (KAFB) soils are primarily alluvium, formed where streams drain from mountains into lowlands. The foothills, slopes, and the level mesa to the west have soils identified as part of the Tijeras-Embudo Association. Typically these have a surface layer of brown gravelly fine sandy loam, underlain by a subsoil of brown sandy clay loam, and a substratum of gravelly sandy loam. Mountain areas are generally of the seis-orthids and rock outcrop associations, indicating generally well-drained, stony, shallow soils.

Surface soils of the installation area have been mapped in studies performed by the U.S. Department of Agriculture (USDA), Soil Conservation Service. Six district soil associations have been mapped within installation boundaries and are depicted on Figure 3-5. The soil associations are described in Table 3-12. Base soils are predominantly well-drained gravelly sands containing varying amounts of silts and clays.

3.2.1.2 Adjacent Land Uses

KAFB, within which Sandia National Laboratories-Albuquerque (SNLA) is located, is bounded on the east by the Cibola National Forest, on the south by Isleta Indian Reservation, and on the west by vacant land owned by the State of New Mexico and held in trust for the University of New Mexico. The state's 11,000-acre tract, called Mesa del Sol, is being master-planned for development and may someday become a new town with industrial, commercial, residential, and recreational areas.

KAFB is bounded on the north by the city, with primarily multifamily residential, light industrial, and commercial uses.



KIRTLAND AIR FORCE BASE SOIL ASSOCIATIONS

FIGURE 3-5

TABLE 3-12

KIRTLAND AFB SOIL ASSOCIATIONS MAP LEGEND
(see Figure 3-5)

Group	Subunit	Associations and Descriptions
A		**DEEP SOILS ON FLOODPLAINS & DISSECTED TERRACES**
	1	Gila-Vinton-Brazito assoc: well drained loamy soils.
	2	Bluepoint-Kokan assoc: sandy, gravelly soils.
	3	Hautz-Gila assoc: well drained, loamy soils.
B		**DEEP SOILS ON ALLUVIAL FANS, MESAS & PIEDMONTS**
	1	Madurez-Wink assoc: well drained loamy soils.
	2	Tijeras-Embudo assoc: well drained loamy, gravelly soils.
	3	Latene-Nickel assoc: well drained loamy, gravelly soils.
C		**SHALLOW TO DEEP SOILS ON MOUNTAINS & FOOT SLOPES**
	1	Seis-Orthids assoc: loamy, stony, cobbly soils.
	2	Kolob-Rock outcrop assoc: loamy, stony soils and rock.
D		**VERY SHALLOW TO DEEP SOILS ON UPLANDS**
	1	Silver-Witt-Laporte assoc: loamy soils underlain by limestone.

Source: ES, 1981

Note: Data represent upper 60" of soil profile.

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Technical Area I is bounded on the north by an Air Force residential area and on the west and south by Air Force offices and test areas. To the east, where there is a large vacant tract with high development potential, a developer has recently proposed a recreation area, plus commercial and residential development.

3.2.1.3 Land Use and Ownership Within KAFB

KAFB covers approximately 52,000 acres. Within its boundaries, SNLA, through the U.S. Department of Energy (DOE), owns 2,917 acres: 908 acres in Technical Areas I, II, and IV, and 1,920 acres in Technical Areas III and V. DOE also owns 86 acres along Eubank, north of Sandia, intended as a future site for its headquarters building. Another 5,288 acres, scattered throughout the Coyote Test Field (CTF), are used primarily for testing, and are on 1- to 5-year use permits from the KAFB. ITRI occupies a 144-acre site in the southcentral portion of KAFB. BAO is located in Building 870 in Technical Area I. DOE also has a use permit for 4,595 acres of land withdrawn from the U.S. Forest Service (USFS), and KAFB controls 20,702 acres also withdrawn from the USFS. This land is primarily used for testing and for buffers.

KAFB is also used by other organizations, including the Civil Engineering Research Facility of the University of New Mexico, and the Inhalation Toxicology Research Institute (ITRI).

Technical Areas I, II, and IV are bounded on the south by Tijeras Arroyo. North of Technical Area I is a KAFB housing project. To the east, Technical Area I fronts on Eubank, a city street, and vacant developable land, with KAFB property fronting the eastern boundary of Technical Areas II and IV.

3.2.1.4 Wildlife and Vegetation

Most wildlife on SNLA feeds on grasses and other range plants. Faunas of the open mesa consist of reptiles, rodents, rabbits, coyotes, and a variety of birds. Deer, bobcats, black bears, and an occasional cougar have been sighted in the wetter mountain areas.

Two major plant groups comprise the existing natural vegetation at SNLA: Grassland Association, found on the mesa, and Pinyon-Juniper Association, found at

higher altitudes in the Manzano Mountain area. The Grassland Association includes sage, cactus, and native grasses, with shrubs and small trees along the arroyos. As elevation increases to 5,800 feet, juniper, scrub oak, pinyon, and ponderosa pines appear.

3.2.2 General Description of Pollution Sources and Controls

3.2.2.1 Sandia National Laboratories-Albuquerque

SNLA's mission is the development of nuclear explosives and includes designing the arming, fusing, and firing systems used in nuclear bombs and warheads. Safety, reliability, and survivability of weapon systems receive primary emphasis.

Sources of soil pollution resulting from the above activities can be grouped into two categories, leaks and spills of chemicals, and destructive or active weapons systems testing. The latter of these categories involves explosive and impact testing that is performed in Technical Areas II and III and in environmental test areas outside the five SNLA Technical Areas. These test areas are located south and east of Technical Area III in CTF and in canyons on the west side of the Manzano Mountains. Coyote and Lurance Canyons are such areas. Depleted uranium and associated explosive materials are occasionally spread over limited areas during this explosive testing. The test areas are inspected following each test and radioactively contaminated materials are collected and disposed of. A detailed discussion of spills and leaks, historical explosive and impact tests, and areas of soil contamination is contained in Section 4.5. Areas of radiological soil contamination are also discussed in Section 4.3. A description of typical current explosive and impact tests is included in this section.

Rocket Motor Impact Tests - Technical Area III Sled Tracks

Rocket motors are fired at the Technical Area III Sled Tracks in conducting impact tests of projectile shapes, weapons components, etc. The test unit is mounted on a sled with one or more rocket motors. The sled accelerates the test unit toward a target. A recent series of impact tests involves a test unit impacting a concrete target at the 10,000-foot sled track. The test units contain kilogram quantities of depleted uranium and lithium hydride. A steel "catcher box" at the impact area is

used to contain the depleted uranium and other debris dispersed by the test. The debris is collected and analyzed as part of the test results. Generally the major portion of the depleted uranium is recovered with the debris. It is expected that the depleted uranium not collected will contaminate surface soil in the vicinity of the target area and not be widely dispersed. Complete aerosolization of all the lithium hydride is conservatively assumed. It is expected that some of the lithium, as lithium oxide, will contaminate surface soil in the vicinity of the target area and not be widely dispersed.

Flyer Plate Tests - Thunder Range Flyer Plate Test Facility

Flyer plate tests are conducted in an area of the Thunder Range west of Bunker 9966. These tests involve firing an aluminum flyer plate at a contact fuse using a C-4 explosive charge. Up to 1,000 pounds of explosive may be used for a flyer plate test. The C-4 explosive is contained in a lead/steel casing. The assembly is buried in a trench and covered with an earth/sand barrier. Approximately 1,000 pounds of explosive and 12,000 pounds of lead were involved in a test conducted in 1986. The detonation of the explosive fragments the casing and throws the flyer plate out of the trench toward the contact fuse. The majority of the fragments are contained by the trench and barrier. Some lead fragments escape the trench with the explosive detonation products and the flyer plate. It is expected that lead particulate escaping the trench will be coarse fragments, which will contaminate surface soil in the vicinity of the test area, but will not be widely dispersed. The explosive detonation is not expected to result in significant vaporization of lead, as sufficiently high temperatures are not generated in the casing. The C-4 explosive used in the flyer plate tests is an organonitrate compound. The gaseous detonation products from the C-4 explosive include low-molecular-weight hydrocarbons, carbon monoxide, and nitrogen oxides. These gases are dissipated by the force of the explosion and by wind, and are not expected to result in significant off-site concentrations. Small quantities of undetonated explosive or solid explosive by-products may also contaminate soil in the test area.

Action Description Memorandums (ADMs) are required for flyer plate tests, and SNLA is required to notify the U.S. Environmental Protection Agency (EPA) emergency response center of lead releases from the flyer plate tests. Although the exact quantity of lead released cannot be measured accurately, SNLA estimated that

a test conducted in September 1987 released 100 pounds of lead to the environment. The EPA national response center and the City of Albuquerque were notified of the release.

Large-Scale Explosive Field Tests - Thunder Range and Remote Explosive Test Areas

Explosive tests have been conducted at the Thunder Range to determine the effects of explosive blasts on shipping containers, and also to test weapons components. Shipping casks are tested using depleted uranium oxide mockups of fuel elements; weapons components can contain depleted uranium and/or beryllium elements. A shipping cask test conducted in October 1986 near Building 9964 involved a segmented lead container with approximately 1,000 pounds of depleted uranium oxide. The test was conducted by placing the cask in a steel "bang box" and firing a projectile into the cask. The box acts as a blast shield and minimizes the dispersion of debris. Aerosol monitoring of uranium dispersion in and around the box is conducted during the test.

Previous test results indicate that tests of this type under normal conditions may release on the order of 5 kilograms of depleted uranium oxide in the form of coarse, recoverable fragments, and on the order of 10 grams of dispersed, nonrecoverable aerosol. Increased releases of uranium oxide may occur if the projectile breaches the cask, which would result in dispersion of uranium oxide fragments and aerosol in the vicinity of the test area. Tests are conducted only under favorable meteorological conditions (i.e., low wind speed and stable dry air). Releases of nonrecoverable uranium oxide in excess of the reportable quantity (1 pound) are reported to the EPA national response center. Lead released by the fragmentation of the cask is primarily in the form of coarse, recoverable particles.

Future explosive field testing is expected to be conducted in the area of Building 9927. Tests may involve on the order of 25 to 100 pounds of explosives, and may involve tests of depleted uranium/beryllium components and fragmentation of lead casings. Results of air sampling and fixture swipes after previous tests conducted in the area of Building 9964 indicate that depleted uranium and beryllium compounds break into recoverable pieces and are not significantly dispersed to the atmosphere. There is the potential for surface soil contamination in the area of the test from dispersion of non-recoverable particulate metal.

Large-scale field explosive tests are conducted outside the 9920/9926 complex. Approximately 50 to 100 pounds of Baritol, which contains barium nitrate, are used in this area. Barium oxide produced by the explosion will disperse into the air and contaminate soil in the vicinity of the test area. The explosive by-products are not recovered after the test.

Small-Scale Explosive Testing - Detonator Laboratory-Building 907-Technical Area II

Testing is performed in this facility to determine the characteristics of explosives, explosive actuators, and detonators. Explosives and explosive devices may be exposed to lasers or X-rays during tests, and electronic test equipment is used to monitor test conditions. The actuators and detonators, which generally contain on the order of several grams of explosives, are exploded in several test chambers or "boom boxes" located inside and outside the building.

The outdoor explosive test chambers are designed to handle larger scale explosive tests than the indoor chambers. The detonator table and catcher box are fabricated of steel plate. Each chamber is approximately a 6-foot cube, and up to 1 pound of explosive can be tested. PETN and HXN are the main types of explosives tested (chemical characteristics of explosives are discussed in Appendix K). The catcher box is used for tests involving greater than 20 grams of explosive, to collect shrapnel which would otherwise be dispersed over a wide area. Debris is cleaned up by the facility operators. Explosive tests are performed approximately once or twice a week in the outdoor chambers. Tests involving more than 1/2 pound of explosive may be performed twice per year. The emissions from these tests are small, as the total amount of explosives tested is small, and the major portion of the debris from larger scale tests is contained in the catcher box.

Explosive Test Facility - Building 9930 - Remote Area

Characterization studies of explosive detonators are conducted at this facility. Explosive tests involving up to 7 pounds of cased explosive and up to 50 pounds of uncased (raw) explosive can be conducted at Building 9930. Outdoor tests are

conducted in an open explosive test chamber, or boom box. Explosives are detonated and photographed by high-speed X-ray cameras. Film is developed in a darkroom at the facility.

Casings used with explosives are generally steel, copper, or aluminum, and debris is generated by the tests. Dispersion of the debris is limited by the earthen berm that surrounds the test area, and debris is not usually collected. Some tests involve incomplete detonation of the explosive. Large explosive fragments are collected and disposed of by the Explosive Ordnance Division (EOD), and smaller fragments are burned in place. Soil contamination resulting from dispersed metal fragments and explosives is confined to the bermed test area.

A Davis gun, used to conduct black powder ignition tests, is located on the roof of Building 9930. The gun was not yet operational at the time of the Survey. Each test involves about 30 pounds of black powder, a mixture of nitrocellulose and nitrostyphenate, and it is estimated that 60 percent of the powder may be thrown from the gun uncombusted. The powder disperses in the immediate vicinity of the gun and is either collected or burned in place. Dispersion of the explosive outside the vicinity of the test area is expected to be minimal.

Other Sources of Soil Contamination

Other sources of soil contamination at SNLA include weapons component tests at the Burn Site involving depleted uranium and beryllium. A weapons component test conducted in 1986 is believed to have released approximately 15 pounds of depleted uranium to the soil in the immediate vicinity of the facility. Localized soil contamination by depleted uranium was found at the Molten Core Facility (9939/9939A Complex) during the Survey. Emissions from these facilities are discussed in Section 3.1.

3.2.2.2 Bendix Albuquerque Operations

Bendix Albuquerque Operations (BAO) has no potential sources of soil contamination.

3.2.2.3 Inhalation Toxicology Research Institute

Potential sources of soil contamination at ITRI are discussed in Sections 3.3, 4.1, and 4.3.

3.2.3 Environmental Monitoring Program

3.2.3.1 Sandia National Laboratories-Albuquerque

SNLA has maintained an environmental monitoring program for radionuclides since February 1959. As stated in the Environmental Monitoring Report, "The objectives of this surveillance program are to detect the release and/or migration of radioactive material from SNLA operations and to determine the resulting population exposures above normal background radiation levels." This monitoring program includes an on-site and off-site monitoring program for soils. This soil sampling and analysis includes only investigation of radiological contaminants and is discussed in detail in Section 4.3 on Radiation. SNLA has done some nonroutine sampling of beryllium in soil at explosive field test areas (e.g., 9964). No routine soil monitoring program for nonradiological contaminants exists.

3.2.3.2 Bendix Albuquerque Operations

BAO conducts no soil monitoring.

3.2.3.3 Inhalation Toxicology Research Institute

Soil samples are collected annually from six locations around the perimeter of ITRI and are analyzed for radiological contamination. The results of this sampling and analysis for 1986 are described in Section 4.3.3.3.

3.2.4 Findings and Observations

3.2.4.1 Category I

None

3.2.4.2 Category II

None

3.2.4.3 Category III

None

3.2.4.4 Category IV

None

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3.3 Surface Water

This section provides a characterization of surface water and the factors that influence it in the vicinity of the Sandia National Laboratories-Albuquerque (SNLA). Basic water source and water usage information is presented, area patterns of surface-water drainage are explained, and resultant areas of runoff are indicated.

3.3.1 Background Environmental Information

3.3.1.1 Hydrologic Setting

The Albuquerque area is located on the east mesa of the Rio Grande Valley, which is a depressed linear geologic feature extending from Colorado to Mexico. The east mesa is a high, arid table that forms the foothills of the Manzano Mountains to the east of the Kirtland Air Force Base (KAFB). The mesa is high mountain desert, covered with grass, sage, cactus, and associated vegetation. This vegetation grades into juniper, pinyon, and ponderosa pine ascending into the mountains to the east. The Manzano Mountains to the east rise to 8,000 feet above mean sea level (AMSL), 2,650 feet higher than the mesa, which has an average elevation of 5,400 feet AMSL.

SNLA is bounded on the north by the City of Albuquerque, with primarily multifamily residential, light industrial, and commercial uses. To the east of SNLA lies the Cibola National Forest and to the south Isleta Indian Reservation. The western side of SNLA is adjacent to an 11,000-acre tract of land called Mesa del Sol owned by the State of New Mexico and held in trust for the University of New Mexico for potential future development with a new town and light industrial, commercial, and residential associated areas.

The major hydrologic surface-water feature in central New Mexico is the Rio Grande, which runs north-south through Albuquerque and is approximately 5 miles west of KAFB (see Figure 2-1). The water of the Rio Grande is used primarily for irrigation of agricultural crops. The municipal and domestic water needs of the Albuquerque vicinity are met by deep groundwater wells which generally range in depth from 450 feet to 1,100 feet.

3.3.1.2 Climate

In general the climate in Albuquerque is mild and dry with large diurnal and seasonal variation in temperature; typical days are clear and sunny with light winds. From July through September, brief heavy thunderstorms deliver most of the annual rainfall of 8 inches on the mesa and 20 inches on the mountains.

Temperature, wind, and precipitation data in rainfall and snowfall as recorded by the KAFB are shown in Table 3-13. The summarized data indicate that the mean annual precipitation is 8.4 inches and that mean annual snowfall is 10 inches. Potential evapotranspiration (evaporation occurring when no soil-water deficit exists) for the Albuquerque area is 30.9 inches total (see Figure 3-6). Actual evapotranspiration has been determined to be about 95 percent of precipitation in this climatic regime, while the remaining 5 percent is divided equally between runoff and recharge (COE, 1979).

3.3.1.3 Rio Grande

The middle Rio Grande Basin is the sub-basin of the Rio Grande extending from Otowi Bridge to Elephant Butte Dam. The Albuquerque Greater Urban Area (AGUA), which is shown in Figure 3-7, extends from Cochiti Dam on the north to the confluence of the Rio Puerco, just south of Bernardo. The AGUA is within the central portion of the middle Rio Grande Basin. The major population center within the AGUA is Albuquerque, which comprises roughly 70 percent of the people in the AGUA, with about 10 percent being north of Albuquerque and 20 percent south. The smaller communities in the area include Bernalillo, Los Lunas, Belen, and the five Indian Reservations in the AGUA area - Cochiti, Santo Domingo, San Felipe, Sandia, and Isleta.

The Rio Grande flows along a rift valley, a long and narrow structural depression bordered on either side by uplifted fault blocks. That part of the depression in which the river flows or which is underlain by recent alluvium is termed the inner valley. It slopes gently downstream at 6 or 7 ft/mile and ranges in width from 1 to 6 miles. The Rio Grande Valley is bounded on the east by the Sandia and Manzano Mountains. From the river the surface of the valley fill, locally termed the "East

TABLE 3-13

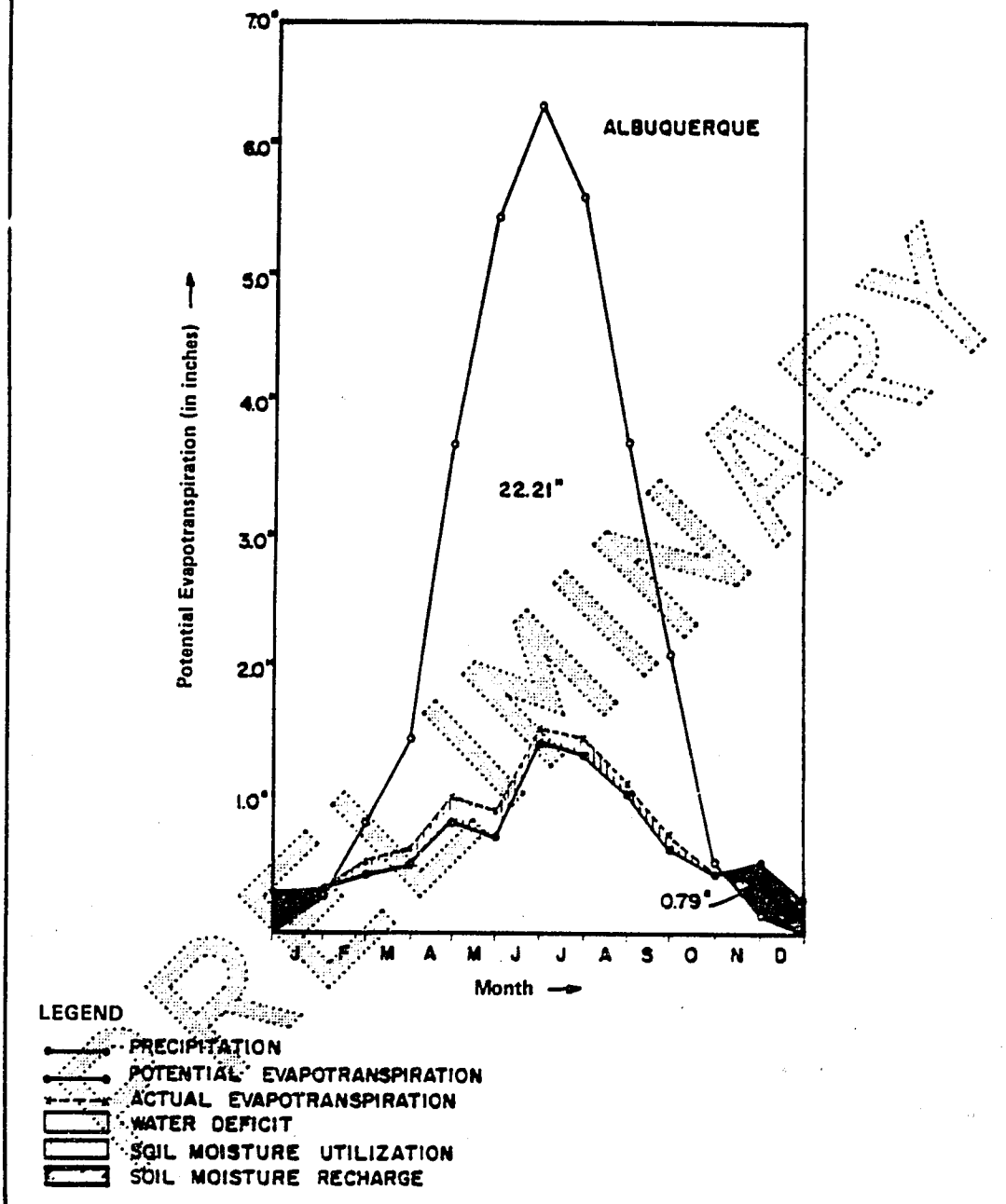
WEATHER CONDITIONS AT KIRTLAND AFB, NM

Month	Temperature		Precipitation		Wind	
	Mean Max (oF)	Mean Min (oF)	Mean (in.)	Max (in.)	Mean Speed (kts.)	Pre-vailing Direction
January	46	24	0.4*/2.0**	0.9*/5.0**	7	N
February	52	28	0.4/2.0	0.5/4.0	8	N
March	59	33	0.5/2.0	0.8/7.0	9	NNW
April	69	42	0.5/neg	1.7/3.0	9	NNW
May	78	52	0.5/neg	1.1/0	9	S
June	89	61	0.6/0	1.6/0	9	S
July	91	66	1.2/0	1.8/0	8	SE
August	88	64	1.3/0	1.2/0	7	SSE
September	82	58	1.0/neg	1.9/neg	7	SSE
October	71	45	0.8/neg	1.8/1.0	7	SSE
November	56	31	0.4/1.0	0.8/6	7	NNW
December	48	26	0.5/3.0	1.4/14	6	N
Annual	69	44	8.4*/10.0**	1.9/14**	8	SSE

Source: ES, 1981
* Rainfall
** Snowfall
Elevation 5,362 Ft. MSL

Period of Record is 31 years.

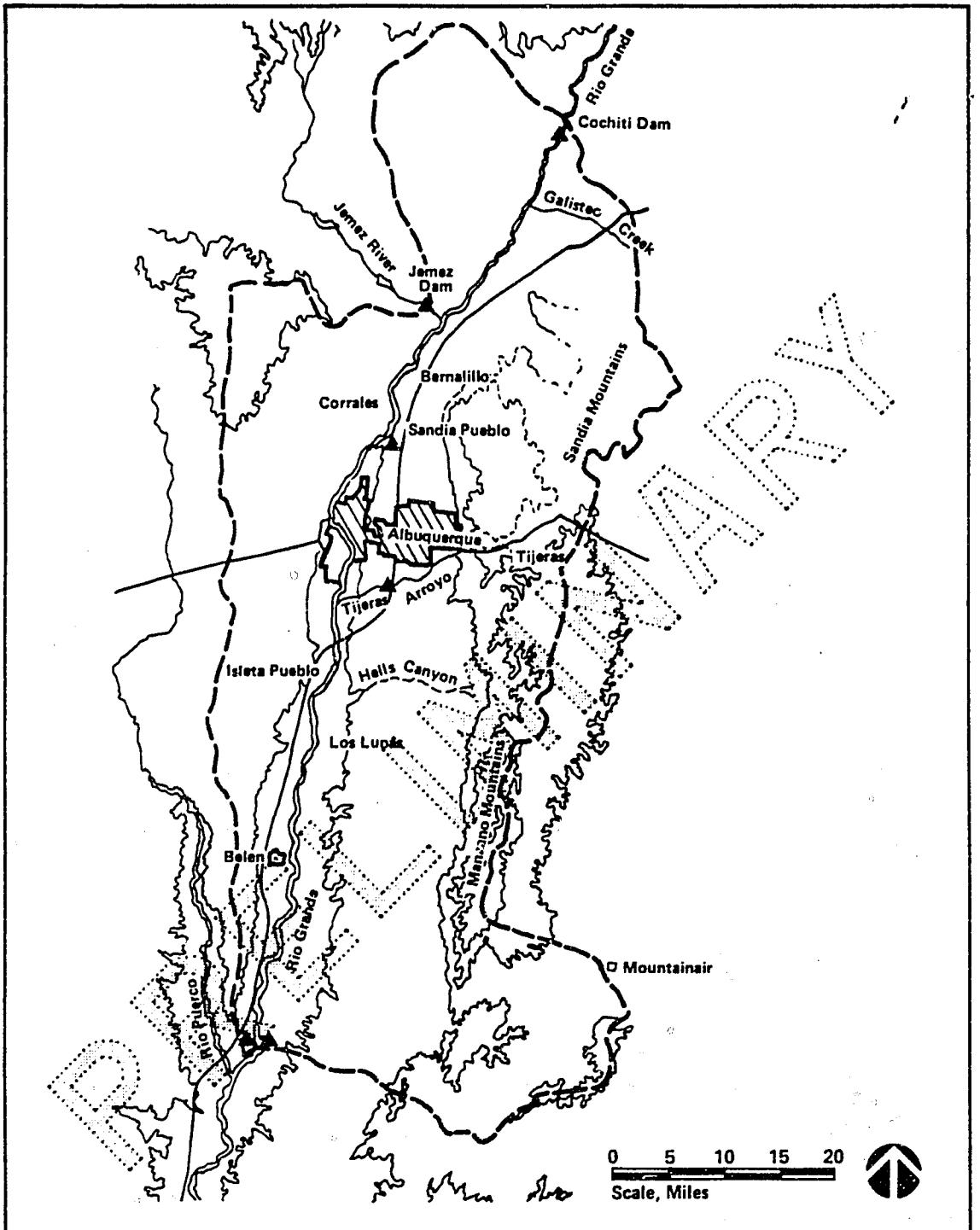
PRELIMINARY DRAFT



Source: COE, 1979

POTENTIAL EVAPOTRANSPIRATION FIGURE 3-6

PRELIMINARY



Source: ES, 1981

RIO GRANDE VALLEY IN THE ALBUQUERQUE GREATER URBAN AREA (AGUA)

FIGURE 3-7

Mesa," rises abruptly to a height several hundred feet above the inner valley floor and then slopes gently upward to the foot of the mountains. The mesa edge forms a distinct rim along the inner valley, although eroded, and in some areas completely cut through by broad arroyos carrying sediments down from the mountains to be deposited as alluvial fans on the inner valley floor. Few arroyos draining the East Mesa discharge directly into the river. Most either lose their flow by infiltration into the alluvial fans or empty into the numerous canals and drains paralleling the river. The only major tributary draining AGUA from the east is Galisteo Creek, about 30 miles north of Albuquerque. The larger arroyos such as Tijeras and Hells Canyon carry flows during spring melt or following individual storms. In addition, the City of Albuquerque has two concrete-lined flood control channels which collect and redirect storm runoff to the river.

3.3.1.4 Surface Drainage

On the west side of the Rio Grande, the Llano de Albuquerque, a series of cut terraces rising to a broad upland 600 feet above and parallel to the river, is referred to as the "West Mesa" in the Albuquerque area. The Llano is 70 miles long and 8-12 miles wide. The Jemez River, flowing southeastward from the Jemez Mountains, is the largest tributary in the AGUA area. Of the numerous arroyos draining the West Mesa, Arroyo de la Barranca and those further north discharge directly to the river whereas those to the south discharge into drains and canals (COE, 1979).

The East Mesa, on which SNLA operations are located, has a generally west-southwesterly ground surface slope ranging from about 250 feet per mile (47 m/km) near the mountains to 20 feet per mile (3.8 m/km) near the river. The distance from the foot of the mountains to the river varies from 3 miles in the northern part of the mesa to 9 miles in the southern part of the mesa.

The topography of KAFB is dominated by Tijeras Canyon, which cuts across it from east to west between Technical Areas I and II on the one hand and Technical Areas III and V and the Coyote Test Field (CTF) on the other. In addition, numerous small drainages emerge from the mountains onto the Mesa. Important among these is Arroyo del Coyote, on or near which lie a number of the facilities of the CTF (see Figure 3-8). Tijeras Arroyo and its tributaries, including Arroyo del Coyote, drain the northeastern quadrant of KAFB, a drainage area of about 133 square miles. The

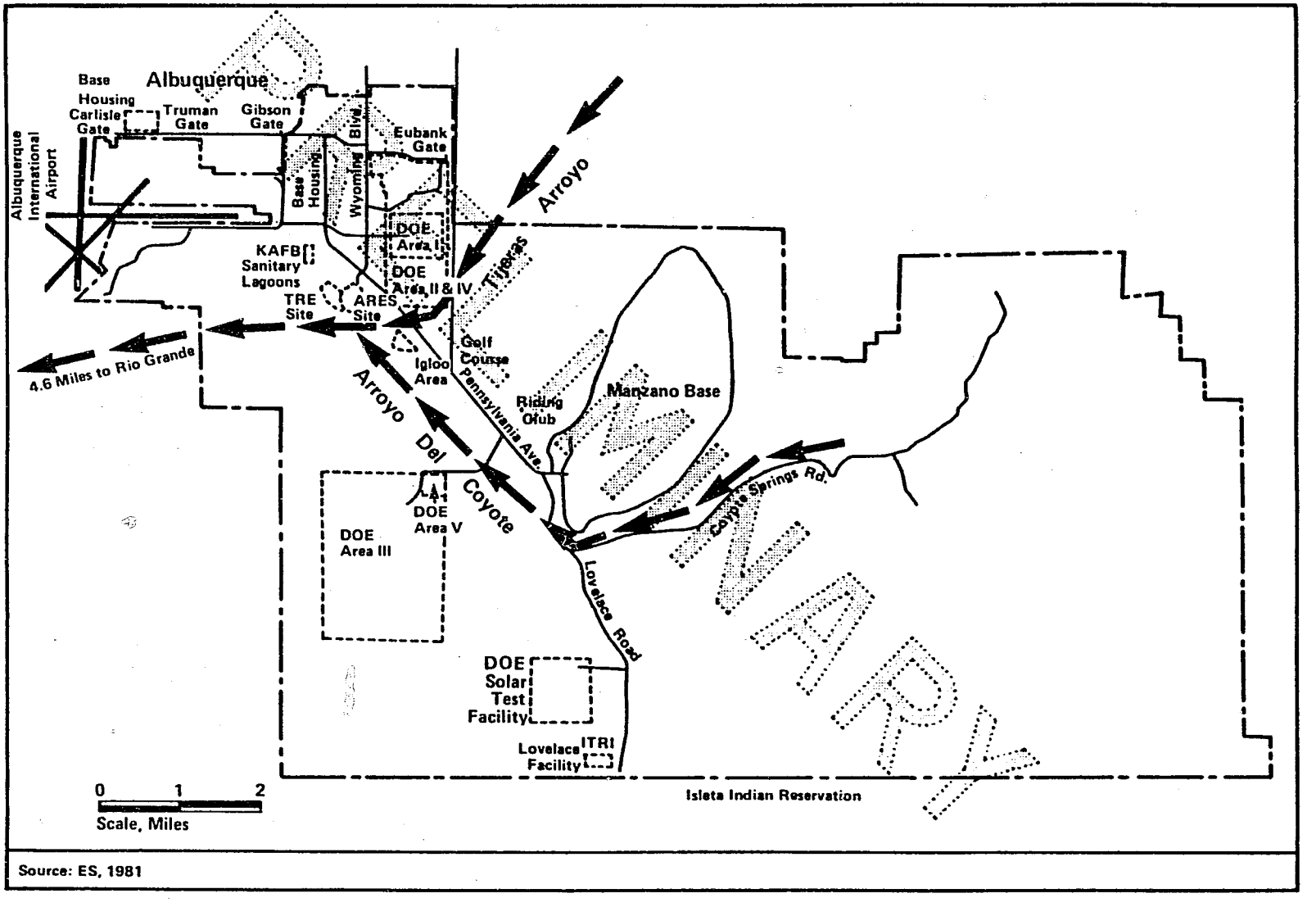
southern half drains southward into arroyos on Isleta Indian Reservation land. During heavy precipitation, the higher interfluvial regions drain by sheet flow into small gullies and rivulets; this water is carried by natural or artificial flow paths into Tijeras Arroyo, whence it eventually reaches the river to the west. Springs discharging in the mountains and Tijeras Canyon provide a perennial flow in the upper part of the canyon; however, the arroyo crossing the valley is dry most of the time. With the exception of occasional flows which reach the Rio Grande, most of the surface water reaching the valley fill from the canyon is lost by evapotranspiration and to the underlying aquifer.

3.3.1.5 Surface and Subsurface Water Use

The Rio Grande has an average flow of 730,000 acre-feet per year. In recent years total annual pumpage in the Albuquerque area has been around 125,000 acre-feet ($1.5 \times 10^8 m^3$) from about 300 large-discharge municipal, industrial, and irrigation wells and a considerably greater number of small-discharge wells. Pumpage from these area water sources is expected to increase to over 220,000 acre-feet per year by the end of the century. At present about 20 percent of this water is derived from deep wells, and this fraction is expected to increase to 27 percent by the end of the century (COE, 1979).

KAFB lies within the limits of the Rio Grande underground water basin, a natural resource area defined by the State of New Mexico as a "declared underground water basin," regulated as a sole source of potable water. The principal aquifer of the Rio Grande Basin and KAFB has been termed the "valley fill." The valley fill is comprised of unconsolidated and semi-consolidated sands, gravels, silts and clays, alluvial fan deposits, and valley alluvium associated with stream development. The valley fill varies in thickness from a few feet adjacent to the mountain ranges east of KAFB to over 21,000 feet at a point 5 miles southwest of the KAFB.

Groundwater exists in the valley fill under water table (unconfined) conditions, although locally, artesian (confined) conditions may exist. In almost all areas



Source: ES, 1981

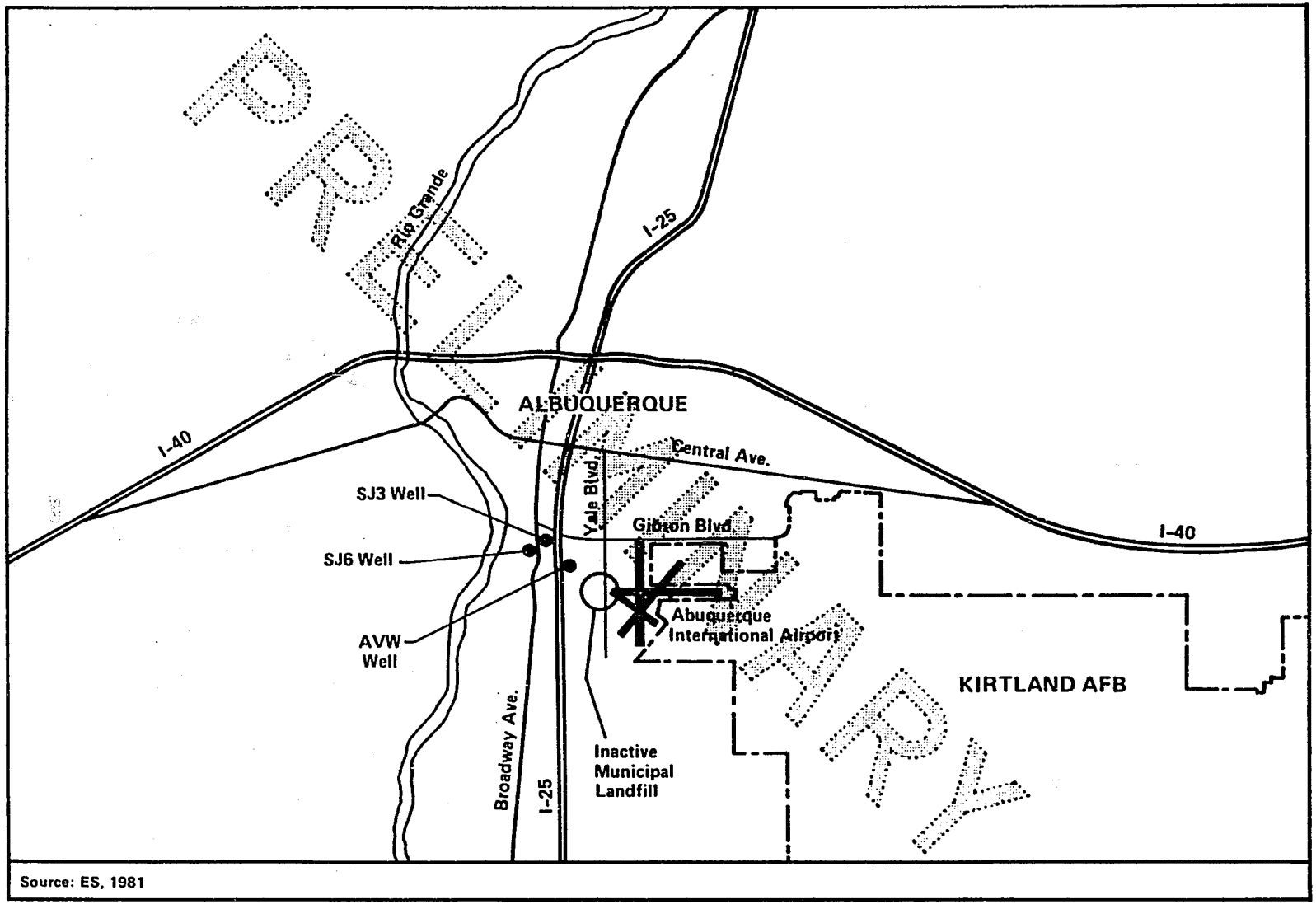
SURFICIAL DRAINAGE AT KIRTLAND AFB

FIGURE 3-8

underlain by thick accumulations of the valley fill, groundwater may be obtained in large quantities. In areas where the fill thins, such as at the base of mountains, supplies may be limited. The water table of the Albuquerque area is known to be an irregular, sloping surface. Irregularities in this surface are thought to be due to changes in local permeability, variations in saturated thickness, and local additions or withdrawals of groundwater. The impact of local faulting on KAFB groundwater flow is not known; however, well data suggest that the area east of the Hubbell Springs Fault may have significantly shallower groundwater levels than that portion of the installation west of the fault (see Section 3.4).

Kirtland Air Force Base presently obtains water supplies from a system of 12 wells screened into valley fill deposits and by purchasing additional supplies from the City of Albuquerque. These wells have been constructed individually and are not installed in well fields as are the city wells. The locations of KAFB supply wells are shown and described in Section 3.4. The quality of water derived from base wells is generally good and complies with drinking water standards (see Section 3.4). Most water used by SNLA is through the KAFB system, with 15 percent being purchased from the City of Albuquerque through connections to the city distribution system.

State of New Mexico EID test data indicate that two city wells (SJ3 and SJ6) located in the city's San Jose well field west of KAFB have become contaminated with industrial chemicals (Figure 3-9) (ES, 1981). In addition, a privately owned industrial process well (AVW), located just south of the San Jose well field, has also been contaminated by organic materials including industrial chemicals and solvents. It has been reported (USAF, 1981) that this may be due to a combination of factors including a relatively high local water table (which does not typically exist on KAFB), highly permeable soils of the unsaturated zone, high-volume municipal well field pumpage, and liquid industrial waste disposal by area industries. KAFB with its appurtenant activities does not believe itself to be associated in any way with these incidents of well contamination.



Source: ES, 1981

CONTAMINATED WELLS NEAR THE KAFB INSTALLATION FIGURE 3-9

3.3.2 General Description of Pollution Sources and Controls

3.3.2.1 Sandia National Laboratories - Albuquerque

Sanitary and Industrial Wastewater Handling, Treatment, and Disposal

As indicated in Section 3.3.1, there are very few sources of naturally occurring surface waters within the boundaries of the SNLA. Generally these are the naturally occurring springs and seeps such as Coyote, Sol se Mete, and Lurance Canyon Springs, which are thoroughly discussed in Section 3.4. There are several man-made surface impoundments containing significant quantities of water, such as the treatment lagoons at ITRI, the KAFB sewage lagoons, and test ponds such as the pond named Lake Christian, which is used for explosive shockwave testing at the Los Alamos National Laboratory LS-1 site, and the drop tower ponds in Technical Area III.

The facilities in SNLA Technical Areas II, III, and V, Coyote Canyon test complex and Thunder Range areas, ITRI, the Central Training Academy (CTA), Manzano Base, and LS-1 site are all on septic tanks for disposal of sanitary wastewater. In some cases discharges of industrial wastewater and process wastes are mixed with the sanitary wastes going to these septic tanks. These sanitary as well as industrial and process sources are significant in terms of potential environmental problems, as they provide a continuing downward-driving hydraulic head for pollutants that are currently being disposed of to the soil column, and/or those pollutants that have been previously disposed of to the soil column. A listing of the major septic systems in Technical Areas I, II, and III and CTA is included in Table 3-14.

The facilities in Technical Areas I and IV are served by sanitary sewers and separate storm sewers. With a few small exceptions, all sanitary and industrial wastewater is discharged jointly into the sanitary sewer system. The total sanitary and industrial wastewater flow generated by SNLA facilities in these two Technical Areas has been estimated by SNLA to be 750,000 gpd average flow and 1,052,000 gpd maximum flow. Of this amount, all of the wastewater from Technical Area IV from Buildings 981 and 981 and the wastewater from Buildings 823, 870, and other buildings along M Street in Technical Area I flow directly to the City of Albuquerque sewer

TABLE 3-14

SNLA
LIST OF SEPTIC TANKS

Bldg. No.	TECHNICAL AREA I	Size (gal)
885		(2) 800
889		500
898		900
	TECHNICAL AREA II	
901		1200
904		900
907		450
913		380
915		900
919		1250
935		400
940		900
	TECHNICAL AREA III	
6500		750
6501 #1		1000
6501 #2		1000
6505		450
6523		750
6530		500
6536		1000
6542 #1		900
6542 #2		500
6560		750
6570		750
6584		3500
6587		1450
6588 #1		5000

TABLE 3-14

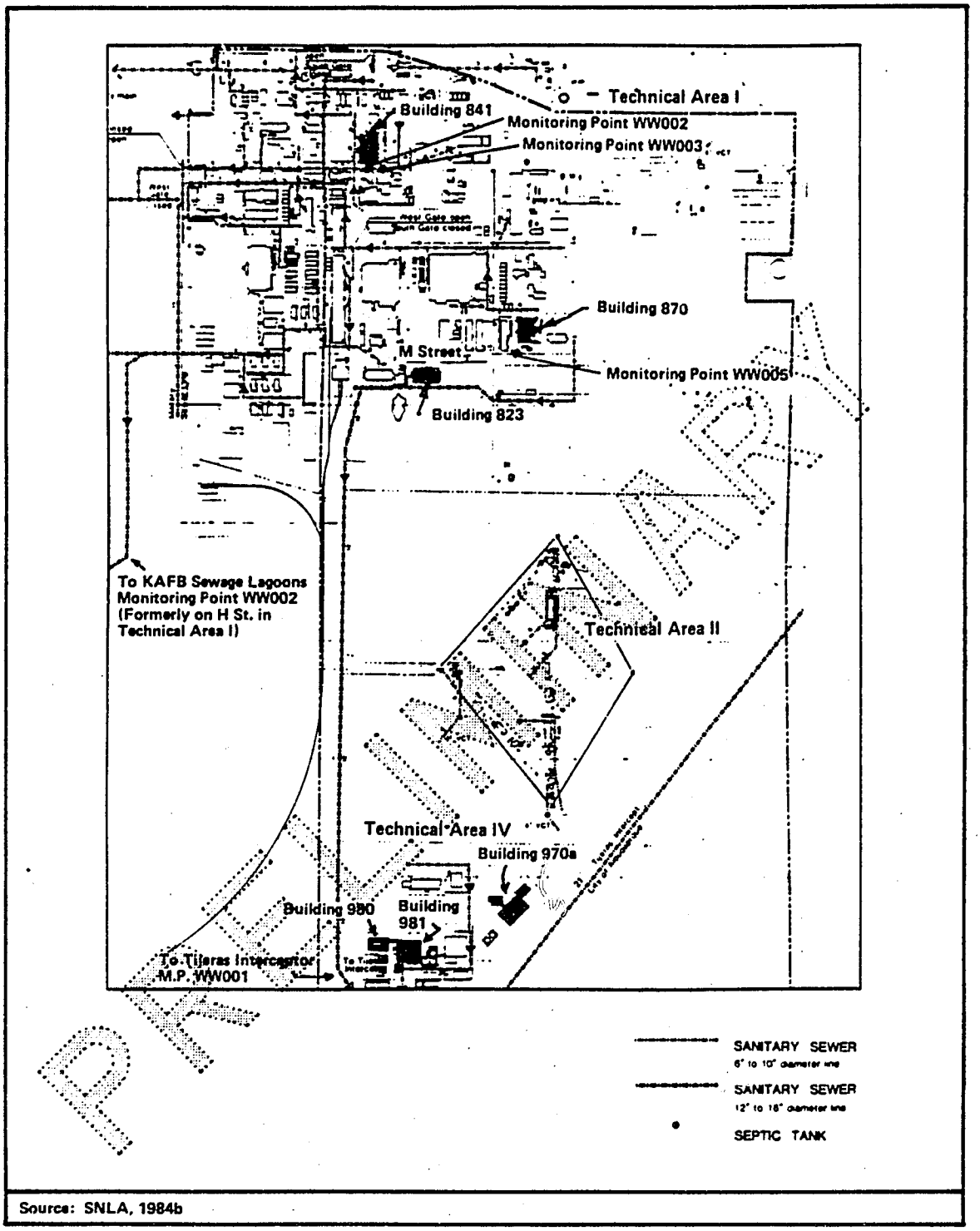
SNLA
LIST OF SEPTIC TANKS (Continued)

Bldg. No.	TECHNICAL AREA III	Size (gal)
6588 #2		4200
6589-6600		3500
6610		550
6620		500
6630		600
6631		600
6635-6636		750
6640		550
6650		2500
6710		750
6715		750
6721		1000
6730		1000
6741		750
6750		1000
	6000 IGLOO AREA	
6020		1000
	CTA	
9925 #1		750 (Abandoned)
9925 #2		1500
9926		875
9927		750
9930		750
9940		1000
9950		750
9960		900
9965		750
9970		800
9990		750

Source: SNLA, 1971

system by discharges into the Tijeras interceptor just south of Technical Area IV (see Figure 3-10). The flow has been estimated by SNLA to be approximately 288,000 gpd average flow. The remainder of SNLA's estimated average sanitary and industrial wastewater flow of 462,000 gpd is discharged into the KAFB sewer system. Sewers that flow into Technical Area I from the KAFB sewer system carry sanitary and industrial wastewater from Air Force housing and industrial areas north of the SNLA area. These sources of an estimated 258,000 gpd average flow combined with the 462,000 gpd from SNLA are jointly discharged to two KAFB sewage lagoons (see Figure 3-8).

These lagoons were constructed in approximately 1962 by the Air Force to create a source of treated wastewater for irrigation of the on-base Tijeras golf course. The two lagoons are facultative, with no aeration, and are approximately 6 feet deep and are 7 acres each in surface area. They are connected in series and the discharge is from the surface of the southern lagoon. Influent is directed by a splitter valve box into either north or south lagoons. However, because of partial blockage of the cross-connection between the two lagoons, the influent flow is all directed to the north lagoon for several days, and then to the south lagoon, and back and forth manually to keep the water levels even. Detention time therefore at estimated average daily flow influent of 720,000 gpd varies from 19 days for one lagoon to 38 for both in series. In the past a portion of the influent (reported to be as high as 60 percent) during the summer and 100 percent in the winter was bypassed directly to the city sewer system by use of a splitter box depending on the irrigation needs of the golf course. Currently, from April to October, 100 percent of the influent is routed to the lagoon and subsequently discharged through a pipe across Tijeras Arroyo to the Tijeras golf course. There it flows into an approximately 1-acre pond where it is diluted with potable fresh water from the KAFB water distribution system in a ratio of approximately 1/3 wastewater 2/3 fresh water. During the winter months the lagoons lie idle and all influent is diverted to the City of Albuquerque publicly owned treatment works (POTW). The city POTW was upgraded in the mid-1970s to an activated sludge secondary treatment system with a design flow of 23 million gpd. Actual average flow is approximately 20 million gpd. The KAFB sewage lagoons have been in continuous use since 1962 and since constructed they have never been dredged, nor has the sludge ever been depth-surveyed or chemically analyzed. The lagoon effluent has never been disinfected.



Source: SNLA, 1984b

TECHNICAL AREAS I, II & IV SANITARY SEWER SYSTEM FIGURE 3-10

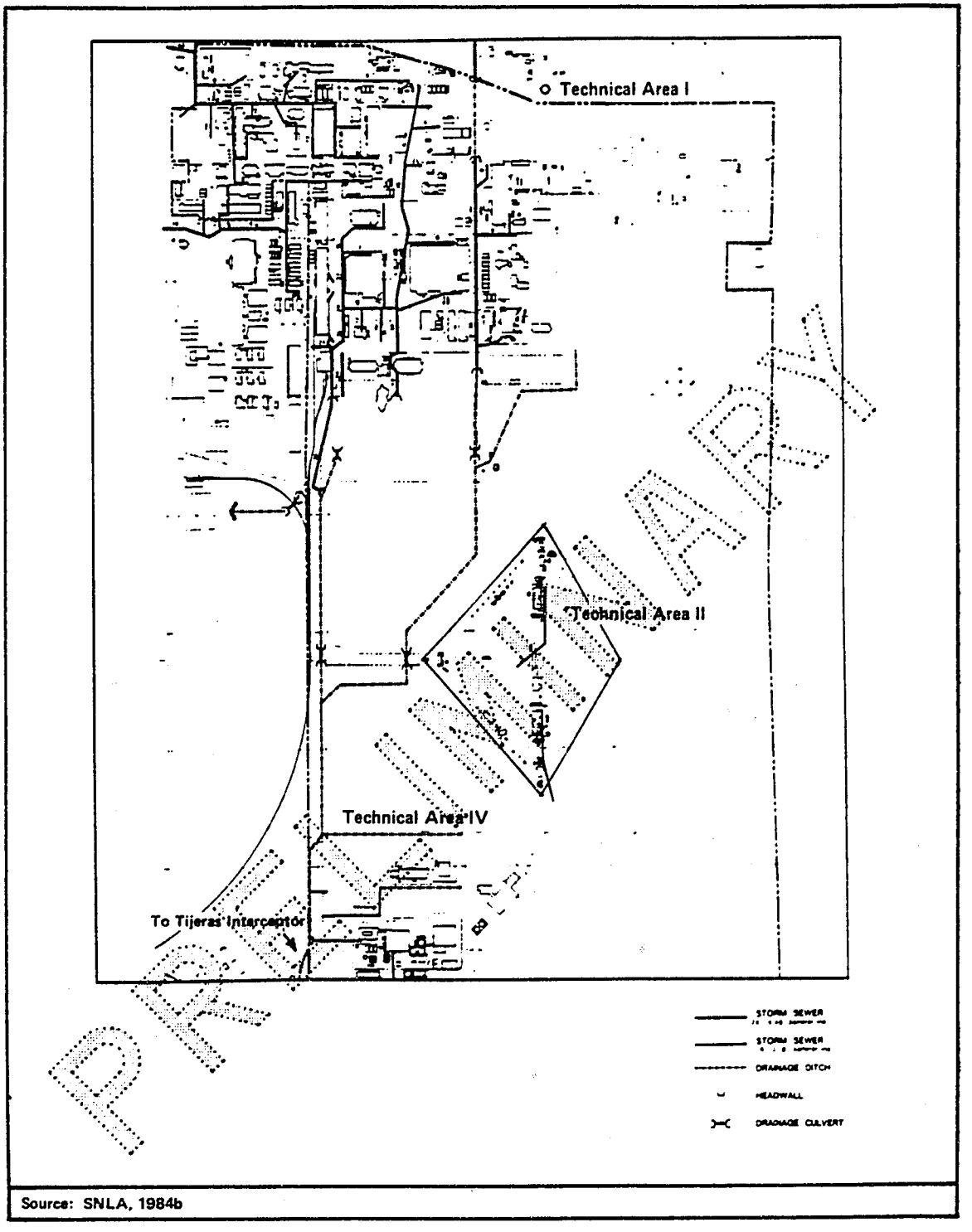
It should be noted for thoroughness that the lagoons receive the flow from the area known as "Kirtland East" which includes SNLA. The "Kirtland West" area of KAFB is discharged directly to the POTW sewer system.

The City of Albuquerque adopted its new sewer use and wastewater control ordinance on 4/3/85. At the request of the POTW, SNLA applied for and received in early 1987 wastewater discharge permits which required monitoring at five locations WW001-WW005 (see Figure 3-10). Five permits were therefore issued by the City of Albuquerque, #2096 A through E. The limits in these permits are for various metals, inorganics, phenolic compounds, and oil and grease and have been based upon the National Pollutant Discharge Elimination System (NPDES) pretreatment requirements for the metal finishing and the semiconductor subcategories. It should be noted that although SNLA reported in its permit application package the substantial photoprocessing in Technical Area I, this subcategory was evidently not the basis for any permit limitations.

Stormwater Collection and Disposal

Technical Areas I and IV have a separate, piped storm sewer system which outside of Technical Area I becomes a series of open drainage ditches (see Figure 3-11). These ditches all collect into one large channel which discharges over a damlike erosion control structure with energy dissipaters into Tijeras Arroyo. This ditch system is generally dry except during and immediately after a rainfall event. Most stormwater in Technical Area I is generated by on-site runoff. About 300 acres north of Technical Area I also drain into this system. This area is mostly occupied by Air Force housing. Technical Area II runoff flows directly east and into Tijeras Arroyo by overland flow, as do some portions of Technical Area IV with some going to the open channel previously described.

Currently, the only known industrial connections to the stormwater sewers are cooling water blowdown from Building 860 and wastewater for 2 carwashes at the base motor pool. Prior to 1985, several sources of industrial wastewater were connected to the stormwater sewer. These involved wastewaters from an incinerator in Building 870, from the now-demolished filter cleaning Building 878, and from several sources of cooling tower blowdown. A joint SNLA/KAFB program between 1982 and 1985 has repiped these discharges to the sanitary sewer system.



Source: SNLA, 1984b

STORM SEWER, SURFACE DRAINAGE IN TECHNICAL AREAS I, II, & IV

FIGURE 3-11

Stormwaters from the remote areas of the site are handled by short reaches of culverts under roads and ditches into the system of arroyos described in Section 3.3.1.

Specific Sources of Industrial Wastewater

There are a large number of facilities at SNLA that discharge sanitary and process wastewaters to septic tanks, as discussed in the previous section. This is dictated by the fact that only Technical Areas I and IV are served by sewer systems, and the remaining Technical Areas and remote areas are served by septic tanks. The State of New Mexico Water Quality Act requires that all industrial wastewater discharges to the soil column be permitted. Domestic liquid wastewater discharges of 2,000 gpd or more also require a permit. Under the State Act, discharges of effluent or leachate into the ground must conform with standards of quality (see Table 3-15) and not contain any toxic pollutants (see Table 3-16). Additionally, a Bernalillo County ordinance requires a permit for all liquid discharges to the ground less than 2,000 gpd. Compliance with laws is a concern that Waste Management staff have been unable to resolve to date since no characterization of septic tank wastewaters and no permit applications have been made by SNLA.

Technical Area I

Recent changes (see Section 4.1) in waste handling operations of the test facilities and chemical and support laboratories have tended to reduce the quantity of hazardous chemicals disposed of to the sanitary sewer system. Quantities of chemicals larger than 100 ml are to be collected for disposal, subject to a recent 1986 guideline by SNLA which is shown in Table 3-17. Adherence to this policy seems to be generally practiced with some notable exceptions which are discussed in the following sections. However, prior to this new policy many of the chemicals from the test facilities and laboratories were disposed of directly to the sanitary sewer, and in some cases directly to the storm sewer.

An examination of the KAFB sanitary sewer system was performed recently in 1987 by Bohannan-Huston. System-wide inflow and infiltration rates were estimated, and the major flow contributions of the plating shop and integrated circuit fabrication process were clearly identified. Infiltration is estimated to be on the

TABLE 3-15

GROUNDWATER STANDARDS * FOR NEW MEXICO

A. General Groundwater Standards	Concentration
Arsenic (As)	0.1 mg/L
Barium (Ba)	1.0 mg/L
Cadmium (Cd)	0.01 mg/L
Chromium (Cr)	0.05 mg/L
Cyanide (CN)	0.2 mg/L
Fluoride (F)	1.6 mg/L
Lead (Pb)	0.05 mg/L
Total Mercury (Hg)	0.002 mg/L
Nitrate (NO_3, as N)	10.0 mg/L
Selenium (Se)	0.05 mg/L
Silver (Ag)	0.05 mg/L
Uranium (U)	5.0 mg/L
Radioactivity: Combined Radium-226 and Radium-228	30.0 pCi/L
Benzene	0.01 mg/L
Polychlorinated biphenyls (PCBs)	0.001 mg/L
Toluene	0.75 mg/L
Carbon Tetrachloride	0.01 mg/L
1,2-dichloroethane (DCE)	0.01 mg/L
1,1-dichloroethylene -(1, 1-DCE)	0.005 mg/L
1,1,2,2-tetrachloroethylene (PCE)	0.02 mg/L
1,1,2-trichloroethylene (TCE)	0.1 mg/L
ethylbenzene	0.75 mg/L
total xylenes	0.62 mg/L
methylene chloride	0.1 mg/L
chloroform	0.1 mg/L
1,1-dichloroethane	0.025 mg/L
ethylene dibromide (EDB)	0.0001 mg/L
1,1,1-trichloroethane	0.06 mg/L
1,1,2-trichloroethane	0.01 mg/L

TABLE 3-15

GROUNDWATER STANDARDS * FOR NEW MEXICO (Continued)

A. (continued)	Concentration
1,1,2,2-tetrachloroethane	0.01 mg/L
vinyl chloride	0.001 mg/L
PAHs: total naphthalene plus monomethylnaphthalenes	0.03 mg/L
benzo-a-pyrene	0.0007 mg/L
B. Other Standards for Domestic Water Supply	
Chloride (Cl)	250 mg/L
Copper (Cu)	1.0 mg/L
Iron (Fe)	1.0 mg/L
Manganese (Mn)	0.2 mg/L
Phenols	0.005 mg/L
Sulfate (SO_4)	600 mg/L
Total Dissolved Solids (TDS)	1000 mg/L
Zinc (Zn)	10.0 mg/L
pH	between 6 and 9
C. Standards for Irrigation Use -- Groundwater shall meet the standards of subsections A, B and C unless otherwise provided	
Aluminum (Al)	5.0 mg/L
Boron (B)	0.75 mg/L
Cobalt (Co)	0.05 mg/L
Molybdenum (Mo)	1.0 mg/L
Nickel (Ni)	0.2 mg/L

Source: BNA - Environment Reporter, 1986

* Note: Groundwater shall meet the standards of Sections A and B.

TABLE 3-16

TOXIC POLLUTANTS * UNDER NEW MEXICO WATER QUALITY REGULATIONS FOR DISCHARGES TO THE GROUND

Acrolein	1,1-dichloroethylene
Acrylonitrile	Dichloropropenes
Aldrin	Dieldrin
Benzene	2,4-dinitrotoluene
Benzidine	Diphenylhydrazine
Carbon tetrachloride	Endosulfan
Chlordane	Endrin
Chlorinated benzenes	Ethylbenzene
Monochlorobenzene	Halomethanes
Hexachlorobenzene	Bromodichloromethane
Pentachlorobenzene	Bromomethane
1,2,4,5-tetrachlorobenzene	Chloromethane
Chlorinated ethanes	Dichlorodifluoromethane
1,2-dichloroethane	Dichloromethane
Hexachloroethane	Tribromomethane
1,1,2,2-tetrachloroethane	Trichlorofluoromethane
1,1,1-trichloroethane	Heptachlor
1,1,2-trichloroethane	Hexachlorobutadiene
Chlorinated phenols	Hexachlorocyclohexane (HCH)
2,4-dichlorophenol	Alpha-HCH
2,4,5-trichlorophenol	Beta-HCH
2,4,6-trichlorophenol	Gamma-HCH
Chloroalkyl ethers	Technical HCH
Bis (2-chloroethyl) ether	Hexachlorocyclopentadiene
Bis (2-chloroisopropyl) ether	Isophorone
Bis (chloromethyl) ether	
Chloroform	Nitrobenzene
DDT	Nitrophenols

TABLE 3-16

TOXIC POLLUTANTS * UNDER NEW MEXICO WATER QUALITY REGULATIONS FOR DISCHARGES TO THE GROUND (Continued)

Dichlorobenzene	2,4-dinitro-o-cresol
Dichlorobenzidine	Dinitrophenols
Nitrosamines	Phenanthrene
N-nitrosodiethylamine	Pyrene
N-nitrosodimethylamine	Tetrachloroethylene
N-nitrosodibutylamine	Toluene
N-nitrosodiphenylamine	Toxaphene
N-nitrosopyrrolidine	Trichloroethylene
Pentachlorophenol	Vinyl chloride
Phenol	Xylenes
Phthalate esters	o-xylene
Dibutyl phthalate	m-xylene
Di-2-ethylhexyl phthalate	p-xylene
Diethyl phthalate	1,1-dichloroethane
Dimethyl phthalate	Ethylene dibromide (EDB)
Polychlorinated biphenyls (PCBs)	cis-1,2-dichloroethylene
Polynuclear aromatic hydrocarbons (PAH)	trans-1,2-dichloroethylene
Anthracene	Naphthalene
3,4-benzofluoranthene	1-methylnaphthalene
Benzo(k)fluoranthene	2-methylnaphthalene
Fluoranthene	Benzo-a-pyrene
Fluorene	

Source: BNA, 1986

*NOTE: a toxic pollutant is defined by New Mexico to be "any water contaminant or combination of water contaminants in the list below creating a lifetime risk of more than one cancer per 100,000 exposed persons."

TABLE 3-17
SNLA GUIDELINES FOR DISPOSAL OF CHEMICALS IN THE SANITARY SEWER SYSTEM

The following lists comprise compounds that are suitable for disposal down the drain with excess water in quantities up to about 100 g at a time. However, compounds with disagreeable odors should not be sent down drains. Division 3314 should be contacted (4-4966) to arrange for disposal of compounds not found on either list, in amounts greater than 100 g or that have disagreeable odors. Compounds on both lists are water soluble to at least 3% and present low toxicity hazard. Those on the organic list are readily biodegradable. Chemicals not on the lists should not be sent down the drain.

I. ORGANIC CHEMICALS

Alcohols
- Alcohols with less than 5 carbon atoms
- t-Amyl alcohol
- Alkanediols with less than 8 carbon atoms
- Glycerol
- Sugars and sugar alcohols
- Alkoxyalkanols with less than 7 carbon atoms
- $n\text{-}C_4H_9OCH_2CH_2OCH_2CH_2OH$
- 2-Chloroethanol

Aldehydes
- Aliphatic aldehydes with less than 5 carbon atoms

Amides
- $RCONH_2$ and RCONHR with less than 5 carbon atoms
- $RCONR_2$ with less than 11 carbon atoms

Amines
- Aliphatic amines with less than 7 carbon atoms
- Aliphatic diamines with less than 7 carbon atoms
- Benzylamine
- Pyridine

Carboxylic Acids
- Alkanoic acids with less than 6 carbon atoms
- Alkanedioic acids with less than 6 carbon atoms

PRELIMINARY

TABLE 3-17
SNLA GUIDELINES FOR DISPOSAL OF CHEMICALS IN THE SANITARY SEWER SYSTEM (Continued)

Hydroxyalkanoic acids with less than 6 carbon atoms

Aminoalkanoic acids with less than 7 carbon atoms

Ammonium, sodium, and potassium salts of the above acid classes with less than 21 carbon atoms

Chloroalkanedioic acids with less than 4 carbon atoms

Ketones

Ketones with less than 6 carbon atoms

Esters

Esters with less than 5 carbon atoms

Isopropyl acetate

Ethers

Tetrahydrofuran

Dioxolane

Dioxane

Nitriles

Acetonitrile

Propionitrile

Sulfonic Acids

Sodium or potassium salts of most are acceptable

II. INORGANIC CHEMICALS

This list comprises water-soluble compounds of low-toxic-hazard cations and low-toxic-hazard anions. Compounds of any of these ions that are strongly acidic or basic ($2 \geq pH \geq 12$) should either be neutralized to a pH between 2 and 12 or mixed with a 100-fold excess of water as they are sent down the drain.

Cations	Anions
Al^{3+}	BO_3^{3-}, $B_4O_7^{2-}$
Ca^{2+}	Br^-
Cu^{2+}	CO_3^{2-}

PRELIMINARY

TABLE 3-17
SNLA GUIDELINES FOR DISPOSAL OF CHEMICALS IN THE SANITARY SEWER SYSTEM (Continued)

$FE^{2+,3+}$	$C1^-$
H^+	HSO_3^-
K^+	OCN^-
Li^+	OH^-
Mg^{2+}	I^-
Na^+	NO_3^-
NH_4	PO_4^{3-}
Sn^{2+}	SO_4^{2-}
Sr^{2+}	SCN^-
$Ti^{3+,4+}$	
Zn^{2+}	
Zr^{2+}	

Source: National Research Council, 1983.

PRELIMINARY

order of 2 percent. Major sources of wastewater are directly from the laboratories (19 percent), cooling towers (12 percent), and process water (60 percent). The housing for KAFB contributes about 7 percent. The average flow for the total KAFB system is estimated to be approximately 5.5 mgpd or 3,800 gpm. The division of sanitary sewer effluents that go directly to the City of Albuquerque treatment facility and those discharges that go to the KAFB sewage lagoons has been previously described. The majority (approximately 66 percent) of any potential significant discharges from SNLA facilities go to the KAFB sewage lagoons prior to going to the golf course.

Although chemical concentrations might be low, the potential to accumulate hazardous chemicals in the KAFB sewage lagoons is high due to the nature of a facultative lagoon. This concern is further compounded when it is considered how these chemicals might be changed in an anaerobic facultative environment, and what by-products are produced. Recent data in the literature express concern that a large fraction of biological processes result in the production of by-products that are more hazardous than the material that has been treated. Also it is important to remember that microbes are highly selective. Bacteria which will degrade a specific chemical will not attack other chemicals even in the same family. For example, a microorganism which destroyed meta and ortho isomers of chlorotoluene would not attack the para isomer. Therefore, without clear data on specific contaminants, it is not prudent to assume that the treatment lagoons at KAFB are destroying potentially hazardous chemicals prior to the release to either the golf course or the City of Albuquerque treatment facilities.

The laboratory complex, Buildings 805, 806 and 807, may have been significant contributors in the years prior to institution of the present guidelines for disposal of chemicals in the sanitary sewer system (Table 3-17). Quantities of chemicals used are not available from prior years. However, all of the laboratory sinks are connected to the sanitary sewer. Disposed chemicals are assumed to be mainly organics, such as acetone, methyl ethyl ketone (MEK), benzene, etc.

Tables 3-18 and 3-19 show chemical usage for some of the major buildings in Technical Area I. They have been compiled from chemical purchasing records for

TABLE 3-18

CHEMICAL USAGE QUANTITIES BY BUILDING

Chemical Name	Building No.								Total Quantities
	805	823	834	840	841	864	880	894	
Acetone	242	51	1,522	232	65	66	56	28	2,262
Methylene Chloride	33	13	4	13	1,400	8	38	-	1,509
Toluene	49	16	106	3	14	-	93	7	288
Benzene	3	-	-	-	-	-	-	-	3
Xylene (No. 841 only)	-	-	-	-	45	-	-	-	45
Trichloroethylene	35	2	-	22	2	52	3	6	122
Trichloroethane	-	-	171	18	-	36	17	-	242
1,1,1-Trichloroethane	-	-	-	151	-	8	-	-	159

- all quantities expressed in gallons
- inventory period covers 16 months

TABLE 3-19

PHOTOGRAPH PROCESSING CHEMICAL USAGE BY BUILDING[1]

Chemical Name	Building No.					Total Quantities[2]
	802	863	880	892	894	
Activator	111	-	-	65	-	176(gal.)
Conditioner/Replenisher Bath	1375	-	10	-	-	1,385(gal.)
Clearing Bath	-	-	105	-	-	
Developer	3340	300(lbs.)	1298	690	90	5,418(gal); 300(lbs.)
Developer Starter	481	-	25	-	-	506(gal.)
Fixer	1285	-	190	715	120	2,310(gal.)
Formaldehyde	-	20	-	-	-	20(gal.)
Kodak Anti Calcumin	-	51.25	-	-	-	51.25(gal.)
Stabilizer	75	-	5	-	-	80(gal.)
Stop Bath	116	-	-	337	-	453(gal.)
Redeveloper	-	-	573	-	-	573(gal.)
Reversal/Replenisher	1200	-	-	-	-	1,200(gal.)

1 Inventory period covers a 16 month period in 1985-1986.
2 Total quantities indicated contain one or more types of the identified solution. All quantities are expressed in gallons unless otherwise indicated.

1985 and 1986. Buildings 840 and 841, which contain complex process development and support activities, have been major contributors to the wastewater flow in the past (DOE-AL, 1987). Estimates by Bohannan-Huston in the sewer assessment indicated this complex was a major contributor of chemicals to the sanitary sewer. Current operations appear to be within compliance (see Section 3.3.3). Some of the early discharges have gone directly to an exterior storm sewer. Visual inspection indicated that a line from the etchant operations area in Building 841 went directly to the storm sewer. The concrete around the storm sewer catch basin was deteriorated to the same extent as the floor in the etchant room from exposure to the ferric chloride and other etchant chemicals. Interviews with employees tend to confirm these concerns (DOE-AL, 1987). Development activities within Technical Area I include foundry operations, paint shops, printed circuit fabrication development, plating development, etc. Employee interviews confirmed that proper hazardous waste disposal policies are currently being followed. Gross quantities of acids and etchant solutions are therefore not currently being disposed of directly to the sewer system. However, there is reason to suspect that large discharges have occurred in the past.

Discharges from the plating area in the printed circuit fabrication and development area still are periodically discharged to the sanitary sewer. The criteria for when to discharge to the sewer, and when to drum the waste did not seem clear to facility employees nor consistent with the aforementioned directive on discharges over 100 mL. Table 3-20 lists Building 841 tanks and contents and their frequency of change.

Building 863, the Motion Picture Laboratory, is apparently the only classified photography laboratory for motion-picture film west of the Mississippi, and all classified film is sent here for development. This represents many millions of feet each year. Chemicals such as acids, bases, vigorous oxidizers and organics were stored on the same tables, benches, and shelves. All spent chemicals are discharged directly to the sanitary sewer system.

In Building 802, the Black and White Photo Lab, similar practices of disposal exist. All developer chemicals and fixer chemicals are discharged directly to the sewer. This is and has been the disposal practice since the laboratory was installed. About

TABLE 3-20

BUILDING 841 PLATING AND COATING SHOP TANKS

Tank Number	Generic Name	Original Components	Tank Size	Major Contaminants	Minor Contaminants	pH	Change Frequency
1	Degreaser	1,1,1-Trichloroethane					3-6 mos.
2	Alkaline Cleaner	hydroxide emulsifiers					
3		HCl (50%)	175 gal	Fe Cu Cd Zn			2-4 mo.
4	Cadmium Plate	NaCN	175 gal	Cd			5-10 yrs.
5	Type II	Sodium Dichromate ($Na_2Cr_2O_7.2H_2O$) HNO_3 (2-5%)	175 gal			1.5-2	5-10 yrs.
6	Copper Bright Dip	HNO_3 (50%) H_2SO_4 (50%)	175 gal	Cu Zn	Fe		12-24 mos.
7		CuCN NaCN Rochelle Salts (K&Na Tartrate)	175 gal		Fe		24-36 mos.
8	Nickel Bath	NiCl $NiSO_4$ Boric Acid (H_3BO_3) numerous proprietary organic additives	175 gal			4.5	24-36 mos.

TABLE 3-20

BUILDING 841 PLATING AND COATING SHOP TANKS (Continued)

Tank Number	Generic Name	Original Comonents	Tank Size	Major Contaminants	Minor Contaminants	pH	Change Frequency
9	Copper Plating	$CuSO_4$ H_2SO_4	175 gal			1-2	24-36 mos.
10a b c d e f	Color Anodizing	Aniline dyes Acetic acid	30 gal 175 gal			3-7 3-7	
11	Aluminum Etch	NaOH (10% w/w)	175 gal	Al Mg Si Mn Fe	Cu	14	18-24 mos.
12	Acid Bath	HNO_3 (50% v/v)	175 gal	Al Mg Si Mn Fe	Cu		6-12 mos.
13	Aluminum Anodizing	H_2SO4 (15-18%)	175 gal	Al	Cu Mg Si Mn Fe		12-24 mos.
14	Dye Sealant	$NiCH_3COO$ (7#/gal) H_3BO_3 (7#/gal)	175 gal		aniline dyes		6-12 mos.

TABLE 3-20

BLDG. 841 PLATING AND COATING SHOP TANKS (Continued)

Tank Number	Generic Name	Original Components	Tank Size	Major Contaminants	Minor Contaminants	pH	Change Frequency
15		$Na_2Cr_2O_7.2H_2O$ (2-4 oz/gal) HNO_3 (20-25%)	175 gal	Al	Cu Mg Si Mn Fe		12-24 mos.
16	Aluminum Anodizing	H_2SO_4 (15-18%) (higher temp. than 13)	175 gal	Al	Cu Mg Si Mn Fe		12-24 mos.
17	Aluminum	H_3PO_4 (70%)	175 gal	Al	Cu Mg Si Mn Fe		12-24 mos.
18a b c	Brown Oxide Line	Amonium persulfate $(NH_4)_2S_2O_8$ (1H/gal) Proprietary bath #1 Proprietary bath #2	10 gal 10 gal 10 gal	Cu		high	6 mos.
19	Ebonl S	Proprietary bath (hydroxide) (Na Nitrate/Nitrite)	30 gal	Fe		14	18-24 mos.
20		Nickel Sulfamate $(NiSO_3NH_2)$ H_3BO_3 Organic additives	60 gal	Ni		4.5	18-24 mos.

every 3 months a bath of sulfuric acid and potassium dichromate (about 60 gallons) is drained directly to the sanitary sewer.

In Building 605, the Steam Plant, makeup rates for the boilers average about 60,000 gpd. Use of chromates for corrosion control was discontinued about 12 years ago. The composition of the current additive chemicals is unknown to the plant operations staff The blowdown has an average pH of 8.2, and a dissolved solids level of 3,200 ppm. Attempts at using blowdown as heat makeup have been discontinued because of scaling problems in the heat exchangers. Periodically the dissolved solids level increases. This is usually found to be caused by some other operation in Technical Area I inadvertently hooking process discharges into steam condensate return lines. The blowdown goes to the sanitary sewer system, and to the KAFB lagoons. Regeneration streams from the boiler water deionizers also go directly to the sanitary sewer, without measurement.

The Plastics Shop is contained in Building 834. Several dozen 1- to 5-gallon containers of solvents and strippers are stored in a room off the Plastics Shop. This room has a floor drain connected to the sanitary sewer close to the storage racks. These chemicals included dissolvers, solvents, and strippers containing phenols, methylene chloride, toluene, benzene, petroleum solvents, and chlorinated hydrocarbons. Solvent chemical usage was estimated by shop staff to be approximately 300 gallons/month of toluene and acetone and approximately 5 gallons/month of 1,1,1-trichloroethane for use in a vapor degreaser. A spray booth with a 1,000-gallon water bath is used for vapor control of strippers and solvents. The water bath is dumped to the sanitary sewer system approximately 3-4 times per month.

The Glass Shop is housed in Building 864. The only significant process wastewater discharge in this building is hydrofluoric acid bath washwater which is discharged in the amount of approximately 20-50 gpd when the Glass Shop is operating, which is intermittently a few days per month. The washwater is contaminated by HF by carryout and is passed through a sump containing limestone prior to discharge to the sanitary sewer. The efficiency of this treatment system has never been determined.

Technical Area II

Technical Area II is still served by septic tanks, even though it is bounded on the east and west by the sanitary sewer lines that service Technical Areas I and IV. Most of the experiments conducted within this Technical Area are quite small, and result in relatively small discharges, per current practices. All facilities utilize a wide variety of solvents, which were previously disposed of to the septic system. There is evidence (DOE-AL, 1987) that some of the facility drains are contaminated with explosive debris or chemicals. Darkroom facilities appear to be no longer used, but past practice was to dispose of the developer chemicals to the septic system. Chemical storage practices are mixed. A chemical storage cabinet at Building 915 contained both phosphoric acid and organics. Old chemicals that were not needed for programmatic support were also improperly stored. Case quantities of titanium tetrachloride and ammonium hydroxide were stored in proximity.

Building 907, up until 4 to 5 years ago, apparently contained a large chemical synthesis program that utilized large quantities of chemicals as indicated by interviews with other employees in the building. No one in the facility knows the details of the program, but recent cleanup activities removed a semi-trailer full of old chemicals from the laboratories. There is a potential that significant quantities were released to the septic system.

Building 906 contains a Chemical Laboratory. This facility appeared to be abandoned except for the improperly stored chemicals. Old signs indicated that the facility was used for decontamination of radioactively contaminated materials. The sinks in the decontamination area went directly to the building septic tanks. There is a concern for radioactive and explosive materials within the drain field and septic system. Because of the rather small size of the facility, these discharges were most likely quite small in volume. While current practices are of only nominal concern, the continuing hydraulic head that can move previously disposed hazardous materials within the soil column is of concern.

Stormwater control within Technical Area II is dictated by the natural contours of the land. Areas within the central section, near the old chemical laboratory, Building 906, and the southern areas in the vicinity of the 935 and 940 Buildings are natural collection spots. Standing stormwater covered several thousand square feet

in each of the areas. About 50 unlabeled drums sitting in the stormwater collection area north of Building 906 appeared to be empty, but the prior contents were unknown.

Technical Area III

Technical Area III contains a wide variety of test facilities, which are all serviced by septic tanks. Current programs bear varying resemblances to past activities. New programs have changed the operations and discharge characteristics of chemicals to the soil column. Between the CEARP and employee interviews during the Survey, there is little doubt that hazardous wastes have been discharged to the soil column. In this area experimenters from several different divisions share the facilities, but each uses a different portion of the facility, independent of other activities that may affect total building discharges to the septic system, and there appear to be few methods of administrative controls. Compliance with the order to capture and collect hazardous organics, for quantities larger than 100 mL, is less widely practiced than in Technical Areas I and II.

Building 6540/6542 contains a Photography Laboratory, which provides a wide variety of services for test facilities in the areas, from camera support systems for special tests to quick turnaround photographs from test shots. Photochemical developing solutions are discharged to the septic tanks. Motion-picture films are sent to Technical Area I for development. Chemical discharges vary with the current test load in Technical Area III.

Building 6520-27 contains an aboveground centrifuge. The use of hazardous chemicals is limited; however, the spill prevention and control features for the large oil storage and handling system are minimal, and there are very few provisions for preventing a major spill of hydraulic fluid from seeping into the soil column. The environmental hazard is small because the hydraulic oil is composed of mineral oil and does not contain any hazardous constituents.

In Building 6536, the Plasma Arc Facility, the experimental activities are quite limited at the present time. Previous activities include testing of materials for the Space Nuclear Atomic Propulsion (SNAP) systems and testing of materials under plasma arc conditions for ablation. Prior discharges are unknown by the present

staff, but judging from the size, variety, and complexity of the old test equipment that was abandoned in place, such as the solar test equipment, the potential for large prior discharges is quite high.

Building 6510 contains a water drop tower. Makeup rates for the pond are substantial, indicating that both solar evaporation and leakage are viable mechanisms. The continuing hydraulic head from leakage from this facility is a major concern, as it could also affect contaminants discharged from nearby facilities. Depending on the results from some of the previous testing, there is a potential for radioactive and explosive debris in the pond, and in the soil column below the test pond.

In Building 6502, a local contractor, McDade and Woodcock, was performing maintenance on old electrical pot heads. One of the steps was to remove the old dielectric material. This was being performed outside, and the solvent and dielectrics were being spilled all over the work area, and were soaking into the soil. No SNLA supervision was present.

Building 6630 performs a variety of functions ranging from environmental testing of large components at very low temperatures to evaluating new steel casting techniques. It also contains a large (~ 10 feet x 10 feet x 30 feet) salt spray test chamber that was used several times per year in the past for corrosion testing of large components. Discharges from the chamber go to a separate septic tank. There is a potential for hazardous heavy-metal collection in this system. Water treatment for the facility is modest, but all deionization backwash solutions go directly to the septic system. Regeneration is several hundred gallons/month. Laboratories supporting the metallurgy operations discharge an estimated 2 gallons/month of hazardous organics, with a similar amount of acids going to the septic system.

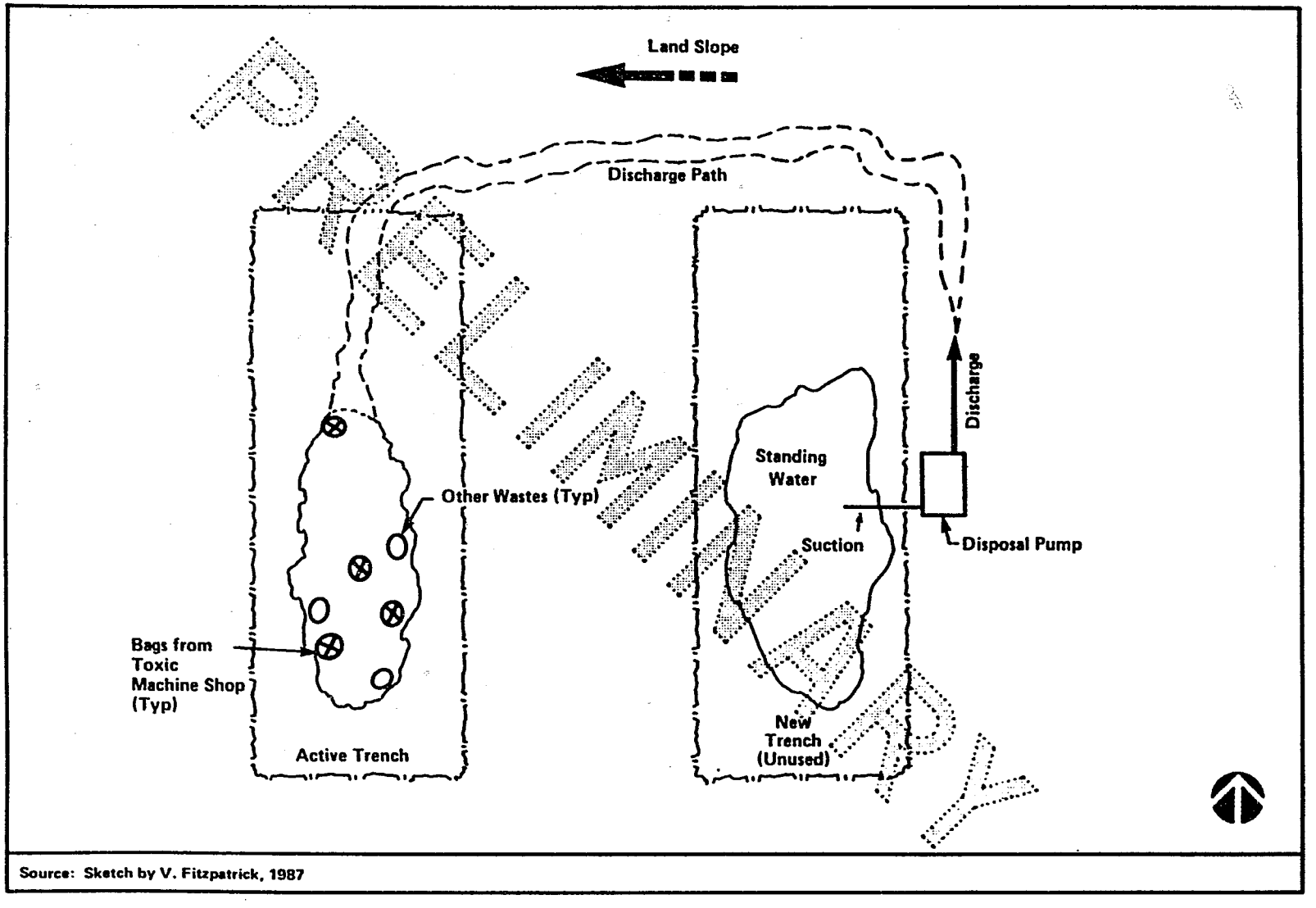
The Classified Landfill has serious subsidence problems in the southern half. Several subsidence pits over 2 feet in depth were observed, caused by the collapse of buried waste. Stormwater collects in these pits, increasing the hydraulic head and the potential for migration. Some subsidence areas were approaching the depth where there were direct pathways to the buried waste. Evidence of animal burrows and the lack of vegetation control could provide alternate pathways for the release of

buried materials. Tumbleweeds and other deep-rooting plants were observed growing over the burial areas. One of the "protective" cement pads over a burial area was completely undercut by surface runoff, indicating lack of surface-water management, along with the lack of vegetation control.

In the Unclassified Radioactive Landfill, rains occurred the evening before the visit, and an estimated several hundred gallons of stormwater were evident in both a new (yet unused) trench and an active trench. Water was being pumped from the new trench by a diesel pump at a rate estimated to be about 10 gpm. The water was being discharged on the ground next to the new trench and was flowing downhill into the active burial ground. A bag from the Toxic Machine Shop was observed floating in the water in the bottom of the trench. Other bags were being exposed by the inflow of water as were other previously disposed wastes. The lack of a surface/stormwater control program appears to compound the problems of proper operation. Standing water, much of which drains into the trenches, makes the bottom too wet to ensure the proper placement of waste, and in some cases precludes covering operations, leading to either unsafe practices or inefficient use of the space. The physical arrangements and the flow of water are shown in Figure 3-12. The maintenance staff was not on site, and there was no place to post operating procedures for temporary staff assigned to do periodic work at the facility.

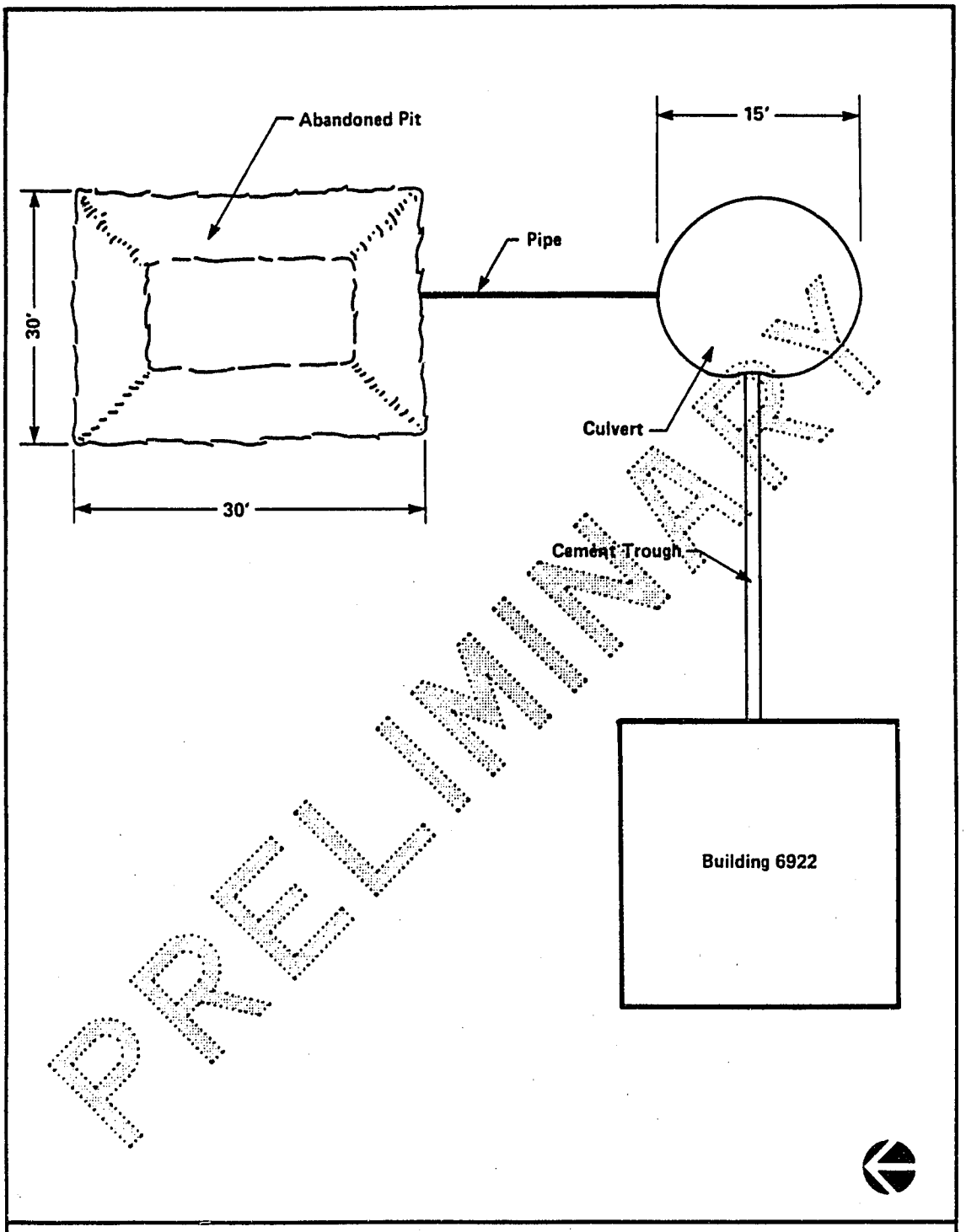
Building 6922 contains a Hydrazine Facility that is abandoned, and on-site staff were unfamiliar with the facility programs. Inspection showed that there was a cement channel which drained from the facility to a partially buried culvert, which overflowed into a pit. The culvert is about 15 feet in diameter, and the square pit was about 30 feet on a side. The layout is shown in Figure 3-13. If hazardous material was disposed of here, the lack of surface-water management provides a periodic hydraulic head. This area is near enough to the Hubble Springs Fault that there could be concerns on the distance to groundwater.

The Old Burn Pit has been used for a variety of disposal activities, including the disposal of old gas cylinders that contained hazardous gases. The pit has no surface-water or stormwater management. This area is near enough to the Hubble Springs Fault that there could be concerns on the distance to groundwater.



Source: Sketch by V. Fitzpatrick, 1987

SKETCH OF WATER INCIDENT AT THE UNCLASSIFIED BURIAL GROUND FIGURE 3-12



Source: Sketch by V. Fitzpatrick, 1987

LAYOUT OF BUILDING 6922 AND SURROUNDING AREA FIGURE 3-13

Building 6720 is the diesel storage and maintenance area. Current operations show large numbers of spills and leaks from repair of the numerous vehicles in the area west of the building shop. There is a concern about disposal of the fluids drained during maintenance operations.

At Building 6730, the laydown area behind the building contained many old test assemblies on skids. Numerous leaks were evident. This is apparently one of those situations where several divisions share a building and no one is in charge, thus abandoned test equipment lies out on the back lot for years. There were tanks of caustic, with brass valves that were leaking, and diesel tanks showing evidence of small leaks. There was also a burn test apparatus with lines coming out of the ground adjacent to the pad where the apparatus was located, labeled "JP-4 and Oxygen". It was impossible to trace the lines to their sources.

Stormwater control in Technical Area III is largely dictated by natural contours, and few if any attempts are made to route stormwater to a disposal area. In the vicinity of old test pits and various burial grounds, this is a major concern.

Technical Area IV

Technical Area IV is relatively new, and has very nominal sanitary water discharges and no identifiable process wastewater discharges. Facility regeneration systems for deionized water have been taken out of service and handled by commercial contract, with regeneration activities performed off-site. Large quantities of mineral oils are used in the accelerators; however, spill prevention and control facilities are adequate, and all oil tanks are double-lined with adequate catchment containment. The only two concerns in the entire Technical Area are the unlined overflow pond along the southern border (a second lined pond has been refurbished with a new liner and is not a current concern) and the fact that Building 970 will discharge directly to the Tijeras interceptor sewer, without being monitored during the facility startup stage. This is the most likely time for process upset conditions to occur and result in accidental discharges of oil to the sanitary sewer system.

Technical Area V

Past problems with Technical Area V reactor cooling systems have been documented in the CEARP. Sampling under the auspices of the CEARP program will adequately document any problems in the lagoons. Current operations with respect to potential water discharges are relatively benign, as demineralization beds associated with reactor operations and tests are handled by commercial contracts, with regeneration operations off-site. Some of the laboratories may discharge hazardous chemicals, but the quantity is quite small (e.g., few quarts/yr). The major concerns with Technical Area V are the actual status of the facility oil tank farms and the integrity of the associated aboveground and underground storage tanks. While the contents are mineral oil, the quantities are sufficient to cause concern.

Remote Areas

Concerns associated with the remote areas center on two areas: (1) current and past discharges from fixed facilities that are on septic systems and (2) test operations where test pits have not been remediated and provide a collection point for surface water and stormwater. These concerns are enhanced by evidence that several of the remote facilities are in locations where the groundwater is known or believed to be less than 100 feet deep. In older site documentation there is a general belief that the groundwater table was at least 500 feet deep everywhere on the site. There is strong evidence that this is not true (see Section 3.4). The well at the Yates homestead, located near the northeast corner of the Manzano Base, is only about 50 to 60 feet deep. It is also believed that depths to groundwater along the southern boundary of the Laboratory and east of the Hubble Springs Fault are less than 100 feet. The old wells in the Coyote Canyon area appear to have been powered by windmills, indicating groundwater depths much less than 500 feet. The belief that groundwater is 500 feet deep throughout SNLA was a prevalent factor in employee interviews at the remote areas. This erroneous belief fosters a further belief that transport to groundwater is not a concern, and further that discharges to the soil column are not a concern.

The Thunder Range test area contains a large number of man-made pits and depressions from prior explosive tests. Some pits north and west of the shock tube facilities have cattails growing in the bottom, indicating significant and sustained water retention. In one series of tests, 3,000 to 4,000 kgs of lead were used to encase each high-energy explosive and there were more than 10 such explosions in

the series (DOE-AL, 1987). In general only large pieces and fragments were retrieved from tests. Tests at the beryllium site are of equal concern, even though much smaller quantities were used in the tests.

Entrance to Building 9820 was not possible at the time of the on-site visit, so current activities are unknown. Immediately south of the building in a small arroyo, the growth of weeds and cattails indicates a sustained water discharge from a pipe that probably comes directly from the building. This bears further investigation because of the lack of information, and the potential that the facility could have contained radioactive materials at one time as stated in the CEARP Phase I Report.

At the burn site, a large variety of burn tests have been conducted in surface test areas and igloos. Concerns center in two areas: (1) surface test pits and burn igloos where contaminated materials were exposed, and the container being tested may have failed, and (2) current surface-water and stormwater management practices. The area at the burn site used for depleted uranium testing has been cleaned up and partially restored. However, remaining stormwater drains indicate a significant potential for having washed contaminated materials into either a small surface impoundment to the west or the arroyo south of the road. One of the old, but not yet retired test igloos is labeled "Caution Beryllium Contamination." The storm drains from this area are suspect also. The water from the large burn tank drains directly into an adjacent surface impoundment for infiltration. Any contaminated soil that may be in the surface impoundment is also of concern.

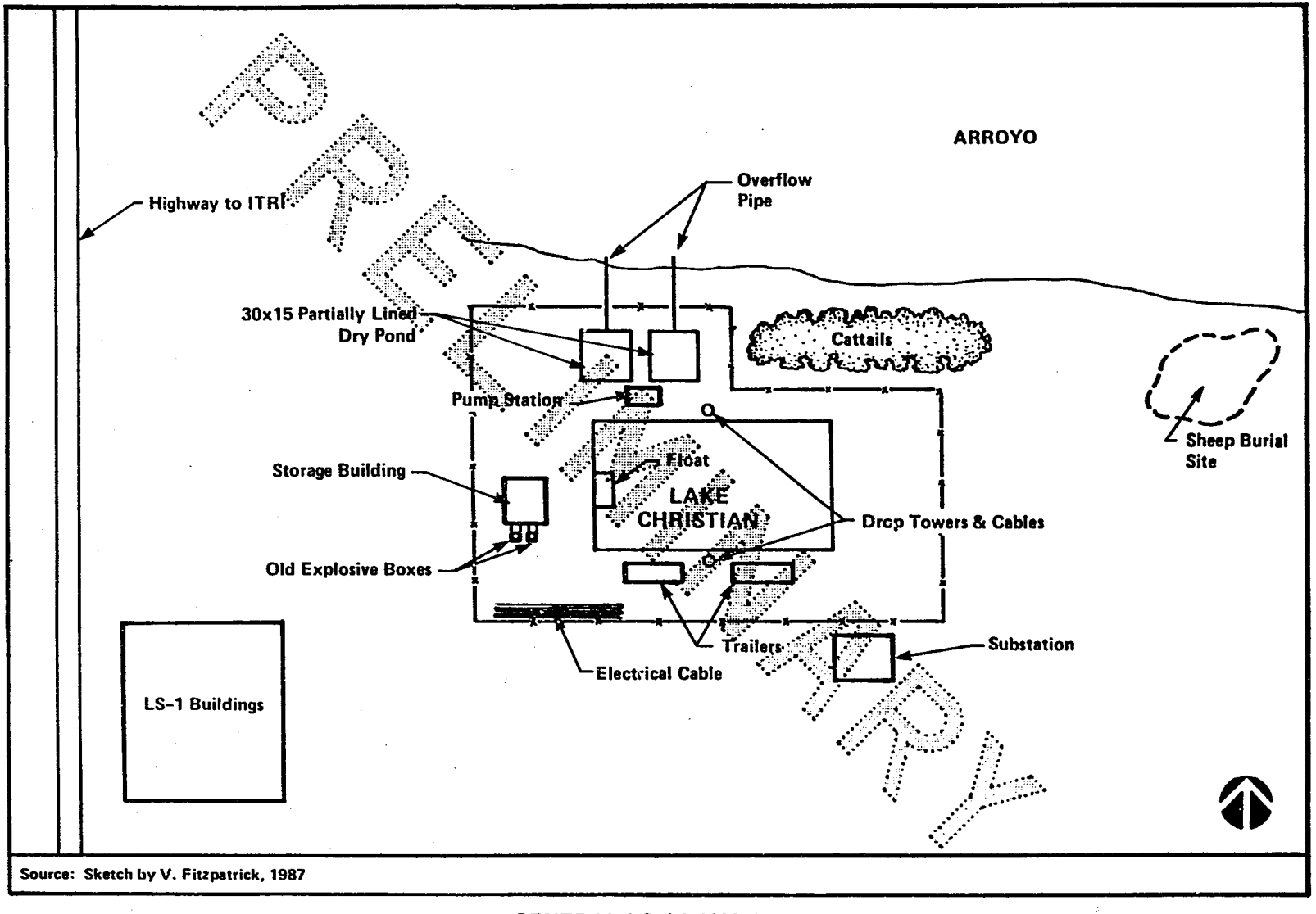
The remainder of the remote test facilities to be discussed are in the 99XX series designation. Each of these facilities provides a specialized test capability, except 9960, which has been used exclusively for custom machinery of explosives. All the facilities are served by septic tanks, and all have about a 20-year history of nominal discharges of photochemicals and small quantities of explosives and organic solvents to the septic system. Most facilities have a continuing potential for additional nominal discharges of a few gallons/month. The facilities identified below are those that have a greater than nominal potential for past or current discharges; the facilities with a nominal history of discharges will not be discussed individually. At Building 9927, employee interviews indicated a significant potential for copper contamination in terms of kilogram quantities in the

surrounding soil from prior testing. This is a concern over and above those mentioned in the CEARP.

At Building 9939, current feasibility testing associated with uranium/zirconium/concrete interaction could result in the release of uranium to the surrounding soil. Larger experiments have adequate containment, but feasibility tests are uncontained. Handling procedures for uranium and other chemicals are not up to industry-accepted standards, increasing the possibility of inadvertent discharges to the septic system. There is no active spill prevention, control, and countermeasures (SPCC) program for the ethylene glycol system, which has a nominal inventory of ~3,000 gallons. General housekeeping practices are lacking. In Building 9940, prior experiments with corium thermite (DOE-AL, 1987) resulted in kilogram quantities of hazardous metal being washed into the soil column adjacent to the test pad. At Building 9960, prior to about 1980 the cotton bags used to catch explosive debris in wastewater from the machinery operations often failed, resulting in the explosives being released to the soil column via seepage pits. The new polyester bags do not have this problem, but the hydraulic head is still present by virtue of current operations.

At Building 9990, continued large use of the facility darkroom facilities is a concern. The proximity of large polychlorinated biphenyl (PCB)-contaminated capacitor banks to an unprotected floor drain that leads to the septic tank is also a concern.

The LS-1 site consists of several small buildings, and the "Lake Christian" test pond operated by the Los Alamos National Laboratory (LANL). The laboratory and office facilities are served by septic tanks for liquid disposal. There is limited development of black and white pictures, with the developer solutions being disposed of to the septic system. There is evidence of other chemical use, and comments from employees indicate that the chemicals are periodically disposed of to the facility sinks, which discharge to the septic tanks also. The general site layout is shown in Figure 3-14. Interviews with the facility director indicated that prior testing was centered on tests of sheep in Lake Christian, to determine the effects of shock waves generated by underwater explosives. Autopsies and pathology tests are performed on the test animals on the site. The carcasses are disposed of in a burial area east of



Source: Sketch by V. Fitzpatrick, 1987

GENERAL LS-1 LAYOUT

FIGURE 3-14

Lake Christian, and chemicals and fluids from the necropsy laboratory are disposed of to the septic system. Interviews with other employees indicated that radioactive materials may have been used in some of the tests. These interviews indicated that a variety of fish were also used as test species.

Observations of large electrical cables at Lake Christian indicated that electrical shocking may have also been performed. The transformer station south of Lake Christian was equipped with fused cutouts on the power pole, indicating the potential for a large dead short, thus reinforcing the supposition of shock testing.

Lake Christian appeared to have a liner, as evidenced by liner materials around the edge of the pond. It is not known how long the liner had been in place.

From the interviews it is not at all clear what tests have been conducted in Lake Christian over the past 10 to 15 years, and sampling for determination of any potential environmental problem is warranted. There are at least three varieties of fish in Lake Christian--large catfish, large carp, and bluegills.

3.3.2.2 Bendix Albuquerque Operations

In 1980 printed circuit development and fabrication activities conducted by SNLA in Building 841 were segregated. The development activities remained in Building 841 and the fabrication activities were moved to Building 870 (which was a warehouse prior to that time). In 1985, Bendix took partial responsibility for fabrication operations in Building 870, hereafter referred to as the Printed Circuits (PC) Shop. Up until the time of the contractor change, all effluents from the PC Shop went directly to the sanitary sewer system.

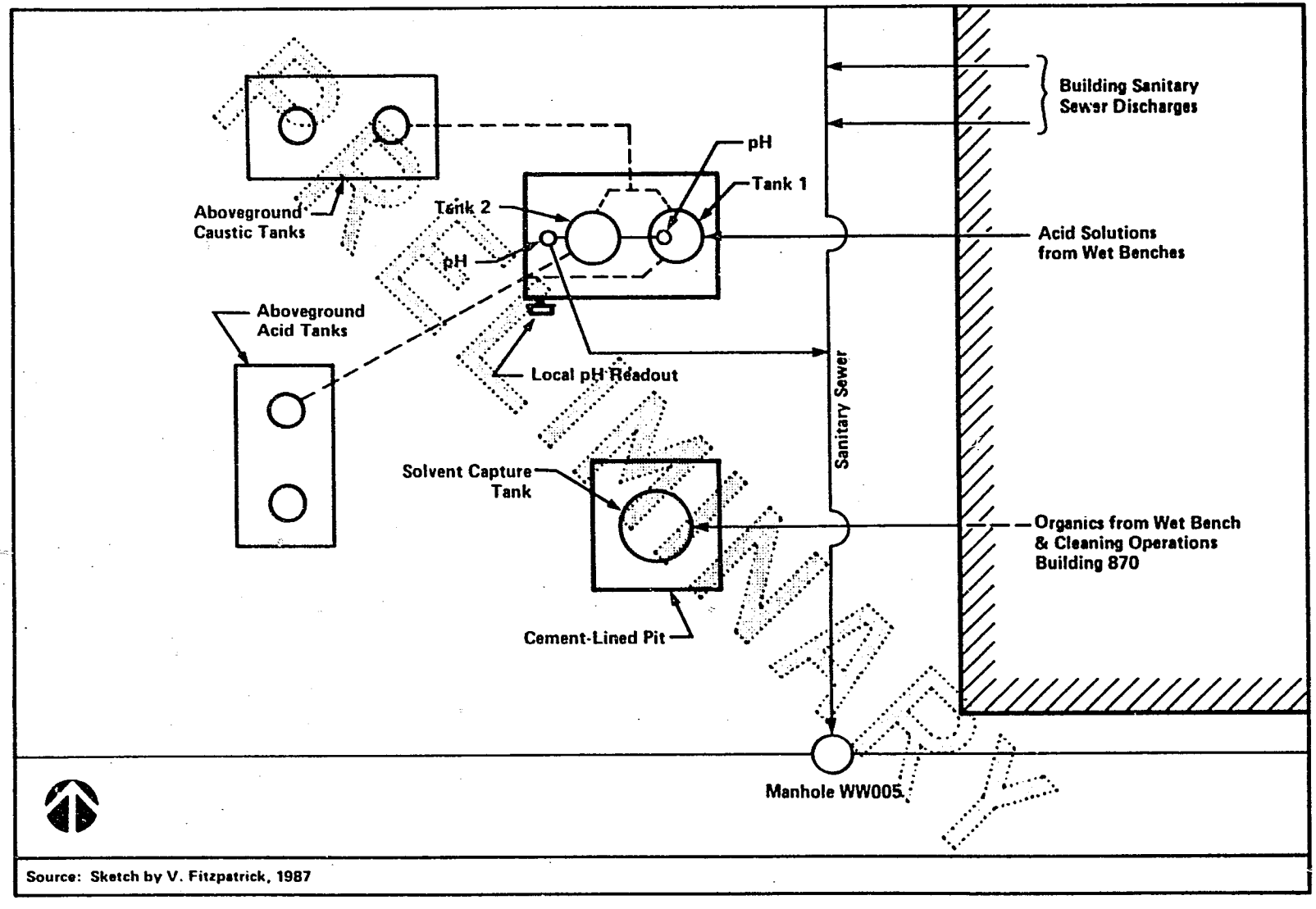
Activities in the PC Shop require the use of large quantities of acids and organics as part of the photoresist template fabrication and subsequent etching operations. Interim and final cleaning steps also require the use of organic solvents.

Recent changes in the discharge system from Building 870 provide for capturing the solvents, recycling organics, and neutralizing the acid discharges from the facility prior to sewer disposal. These modifications became operational in October 1986, when Bendix assumed full control of operations. Prior to that date, all discharges

went directly to the sanitary sewer which connects with the Tijeras interceptor, and goes to the city treatment plant. Prior discharges have resulted in some unknown level of contamination of the city treatment plant, and the sludges discharged from the plant. Current operations data indicate that discharges are about 550 gallons/month of organics to the solvent capture system, and several thousand gallons per month of acidic solutions and fluoride solutions to the elementary neutralization unit (ENU) (see Figure 3-15). Typical organic chemicals discharged to the solvent capture system are acetone, Nophenol, xylene, and photoresist and stripping solutions. Typical acidic solutions discharged to the ENU are hydrofluoric and hydrochloric acid and ammonium fluoride. Current discharges are estimated to be smaller (to an unknown degree as there are no records available for when SNLA was operating the facility) than past operations from 1980 through 1986.

Effluents from Building 870 are monitored in accordance with the provisions of NPDES Permit 2096 E from the City of Albuquerque at Manhole WW005. The permit specifies that the discharges are to be monitored once per month with a daily flow weighted composite sample, with 4-day average samples and a grab sample. However, the flows of another building upstream in the sanitary sewer system are unknown, and the effluent from Building 870 is mixed prior to sampling at the manhole.

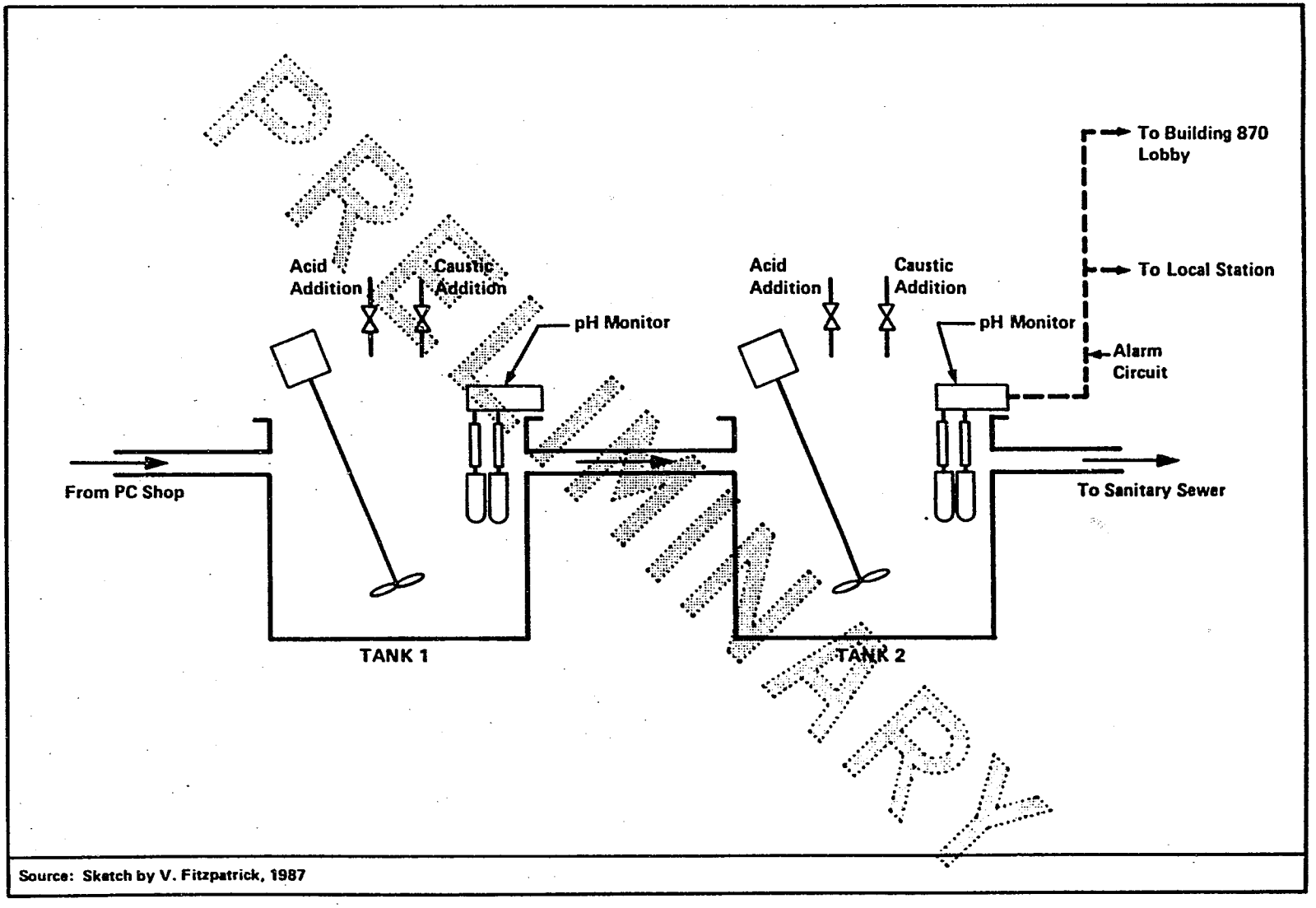
The ENU is monitored for pH in both the initial and final neutralization tank as shown in Figure 3-16. The alarm for deviation from the pH limits indicates at the tanks outside the building and in the reception area at the entrance. When the facility is making production runs, operations are on a 24-hour/day basis. Neither of these locations is likely to be observed during off-shift operations, and the pH is not recorded. The permit specifies that pH and total flow will be monitored continuously; these conditions are not met and there are no records to demonstrate compliance. Periodic readings of the pH, read at the local station by the day shift operations staff indicate that the effluent from the ENU may vary over 5 pH units in the span of 3 to 4 hours, depending on operations and discharges from the wet benches in the building. These data indicate marginal control and that the ENU might be under-designed.



Source: Sketch by V. Fitzpatrick, 1987

SOLVENT CAPTURE AND ENU SYSTEMS FOR PC SHOP AT BENDIX ALBUQUERQUE OPERATIONS

FIGURE 3-15



Source: Sketch by V. Fitzpatrick, 1987

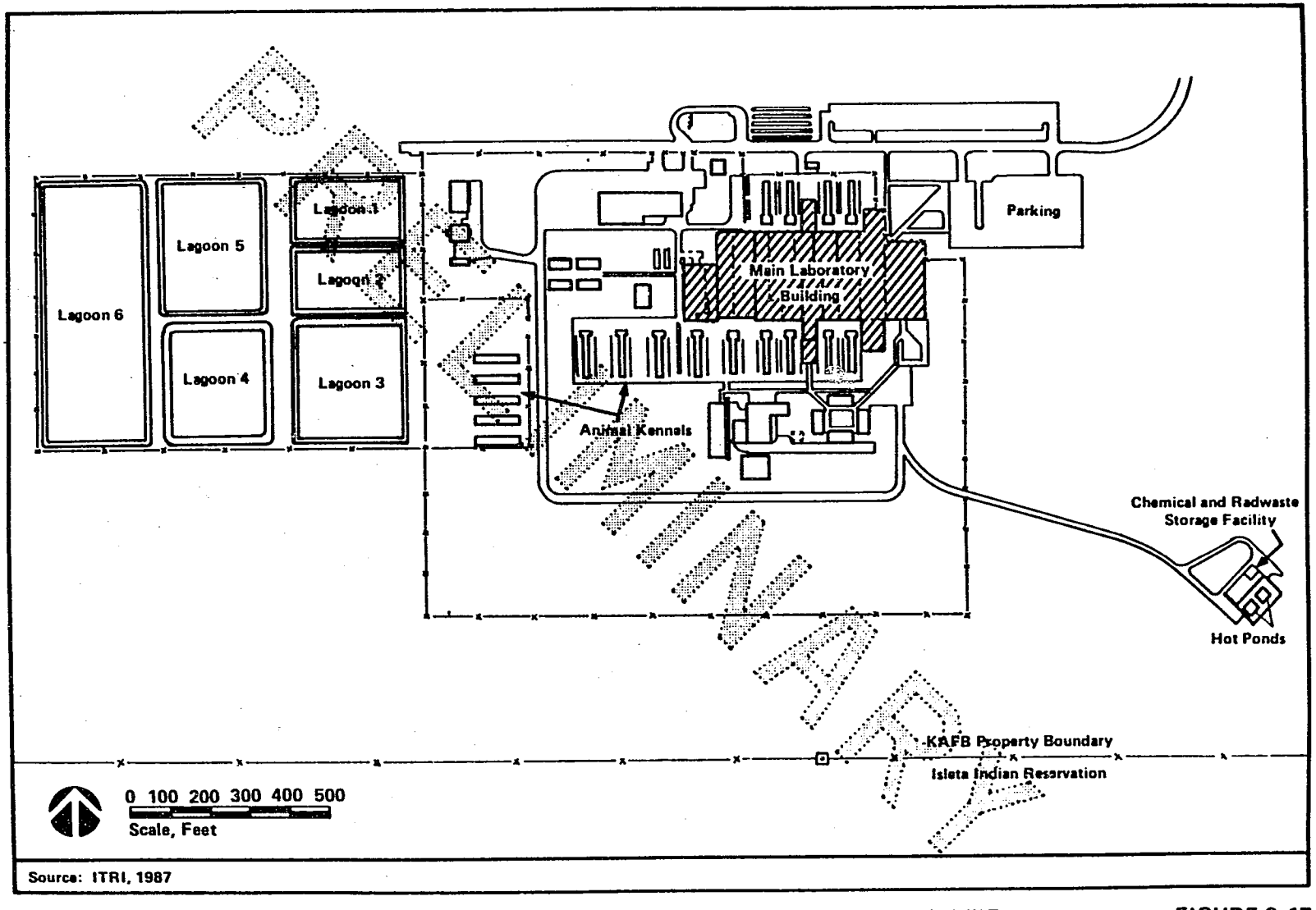
pH MONITOR SYSTEM FOR ENU AT BENDIX ALBUQUERQUE OPERATIONS FIGURE 3-16

The NPDES Permit specifies that the average fluoride concentration should average 32 ppm. Data from one sewer sample taken in March 1986 (which was the only compliance data available; the other samples were taken but the analysis had not been received) indicated fluoride concentrations of 856 ppm and chloride concentrations of 1,771 ppm. Review of all the data sheets available at the facility indicates that the effluent monitoring and control system was inadequate to maintain proper control over operations, and that there were not sufficient data, even if they were current, to demonstrate compliance with the permit requirements.

3.3.2.3 Inhalation Toxicology Research Institute

The Inhalation Toxicology Research Institute (ITRI) was established as a laboratory on the SNLA site in 1962. Since that time the facility has increased in size to nearly double its original floor area. The overall site as it presently exists is shown in Figure 3-17.

All water used on-site goes to the sanitary sewer system and then to the lagoons. The lagoons serve the dual purpose of evaporation and facultative treatment. Wastewater sources included process water from the central engineering facilities, cage washings, effluents from laboratory sinks and washdowns from pathological examinations. Central engineering provides all of the heating and cooling for the offices and laboratories, hot water for sanitary water and laboratory requirements, and deionized water for the laboratories. Hot water and steam are provided by 6 boilers. Boiler makeup water is preheated by solar panels adjacent to the building. Makeup rates for boiler feedwater average approximately 5,000 gpd. Makeup water is softened with zeolite ion exchange equipment. Blowdown from the boilers and regeneration solutions from the zeolite columns go to the sanitary sewer system. Blowdown contains corrosion products from the facility piping, plus chemicals used for corrosion control, fungicide control, and chemical makeup. The use of chromates for corrosion control was discontinued about 11-12 years ago. A wide variety of hazardous and carcinogenic chemicals are used in the inhalation tests; however, the quantity of test chemicals is relatively low. Some of these chemicals may go to the lagoon as spills, in animal excrement, and with cage washings and pathological tissue remnants. Other chemicals used in extraction

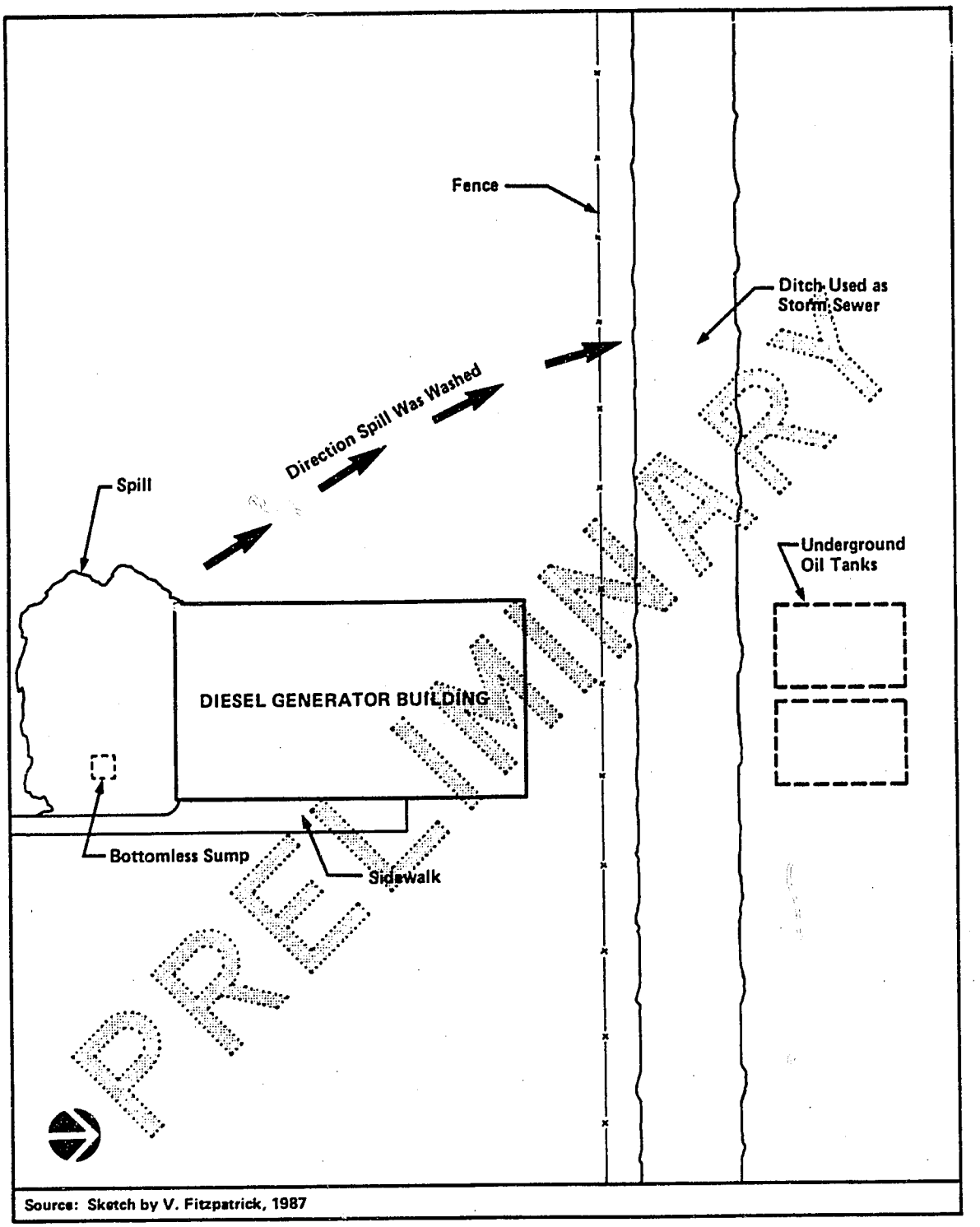


SITE MAP OF INHALATION TOXICOLOGY RESEARCH INSTITUTE FIGURE 3-17

procedures, chemical makeup, glassware cleaning, and general chemical laboratory support represent a much larger source of contamination than the test chemicals. Until 1986 when some of the laboratories were equipped with containers for collecting hazardous chemicals such as xylene, toluene, and methyl ethyl ketone, all these chemicals may potentially have been disposed of down laboratory sinks, which are connected to the sanitary sewer system. ITRI has reported that the solvents xylene, toluene, and ethanol "have been collected in quantity from the histopathology laboratory since the mid-1970's and were never disposed of down the drain." ITRI has had a policy of prohibition of disposal of water-immiscible flammable solvents down sink drains since 1975 and has controlled the disposal of other hazardous chemicals since 1982 (see Section 4.1.1.3).

The first three lagoons were built in 1962, and the others were added to meet the evaporative demands for increased sanitary and process water as the facility increased in size. Lagoons 1, 2, and 3 were lined with commercial materials available at the time they were installed. No tests have been conducted to determine the effectiveness of the liners over time. Use of the first lagoon was discontinued in 1965 when it became contaminated with radionuclides. The lagoon was subsequently backfilled with 1-2 feet of soil, but it still acts as a collection point for stormwater. The bottom of Lagoon 6 has probably been perforated. This lagoon is used only in the winter months when evaporation rates are lower and more surface area is required. Weed growth on the bottom of the lagoon in the summer months is quite dense; some of the plants are deep-rooting types like tumbleweeds, and have probably grown through the bottom material.

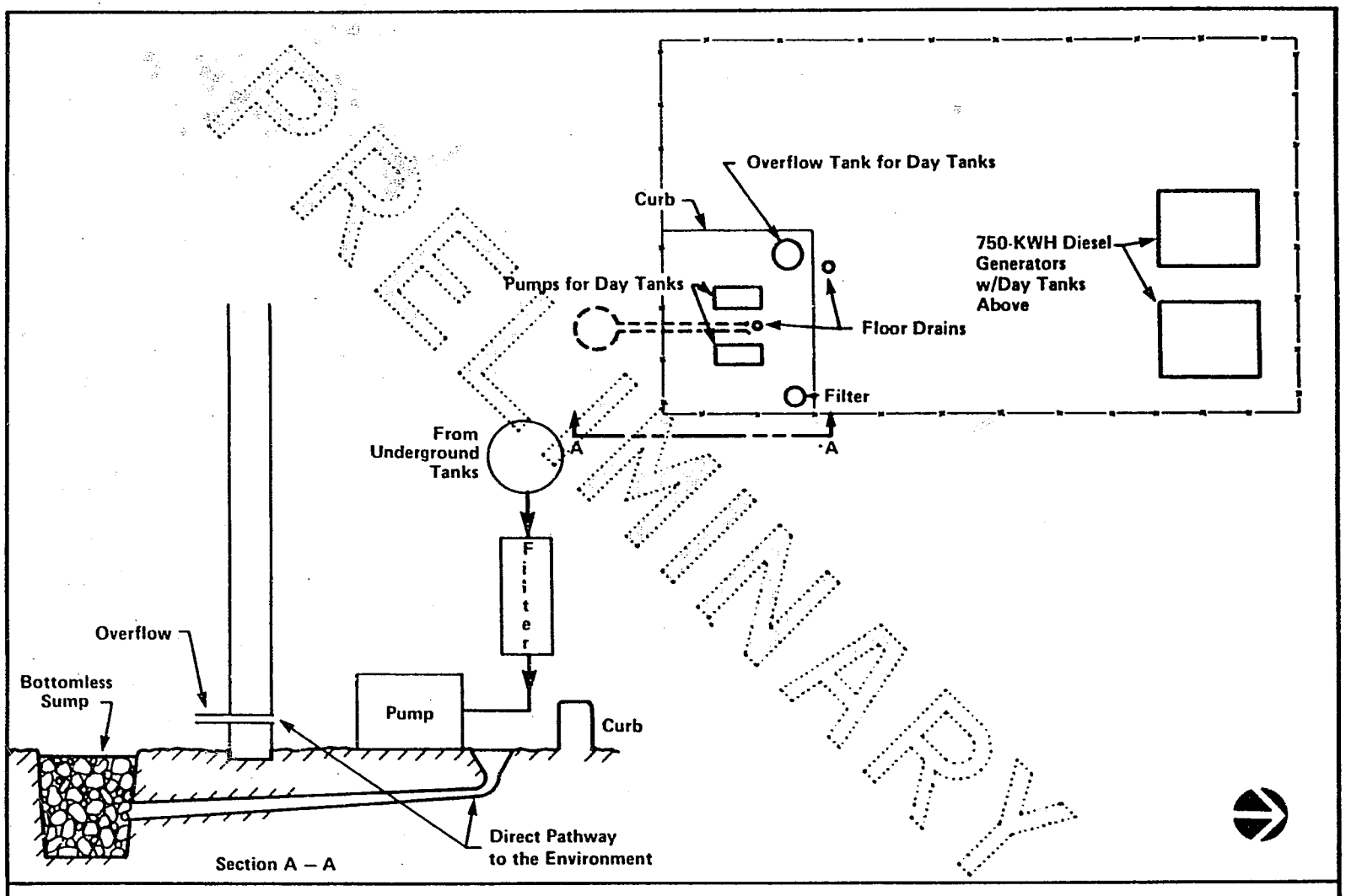
ITRI has an SPCC plan at the facility, and staff are trained in implementation. However the 82,000-gallon storage tanks for No. 2 diesel fuel are belowground with no provisions for inspection of the tanks. Weekly readings with dipsticks are not sufficiently accurate to determine whether leaks are occurring. Procedures for controlling spills during periodic filling and transfer operations were not evident, even after the spill of some 2,000 gallons of fuel during a tank-filling operation. At the time of this spill there was no SPCC program, and the base fire department washed the fuel material into the storm sewer (see Figure 3-18). Further, there are several fundamental design deficiencies in the spill prevention system associated with the fuel handling system. These deficiencies provide direct pathways to the soil column in the event of a single system failure. There is no apparent action to



AREA IMMEDIATELY AROUND
THE ITRI DIESEL GENERATOR BUILDING

FIGURE 3-18

PRELIMINARY



Source: Sketch by V. Fitzpatrick, 1987

ITRI DIESEL GENERATOR BUILDING GENERAL LAYOUT

FIGURE 3-19

correct the direct pathway problems that led to some 250 gallons being released to the environment when a fuel filter failed within the building. (See Figure 3-19.) The penetration in the building wall and the floor drain within the spill control (curbed) area negate any intended effectiveness of the curb in terms of controlling environmental releases. Indication of a spill is by visual observation of the soil above the bottomless sump (French drain). On off-shift or on weekends a major leak can go undetected for several hours.

The hot ponds are the evaporative holding ponds, located in the southeast corner of the ITRI site, as shown in Figure 3-17, where radioactive fluids and associated test and waste materials were deposited to allow evaporation of the water. The storage area also contains a decontamination station for cleaning up small pieces of equipment and test articles. Effluent from the decontamination facility drains directly into the hot ponds. These ponds were originally constructed in 1966, with plastic liners underlain by cement sides and bottoms. The original liners have deteriorated above the water-line significantly, so their integrity on the bottom is doubtful. A small quantity of water is kept in the ponds to prevent resuspension of any radioactive materials, so there is a continuing, though small hydraulic head for further transport of materials that may have leaked out of the ponds.

Approximately 200 rusted drums that contain old scintillation vials are stored on the pad surrounding the hot ponds. The vials contain small quantities of radioactive material and xylene. There is reason to suspect that over time, some of the vials have been crushed, and may have leaked out of the drums and onto the pad. The pad is sloped such that the containment curb is not effective, and there is clear visual evidence that stormwater has flowed across it, over the containment curb, and onto the surrounding soil.

There is reason to believe that groundwater in the area of the ITRI facility may be less than 100 feet below the surface (see Section 3.4). This would provide a relatively short path from the ponds to groundwater for contaminant migration. As can be seen in Figure 3-17, the ITRI facility is located on the boundary of the site. Cattle belonging to the Indians can graze right up to the boundary fence. The proximity of the site boundary, the potential for groundwater being close to the surface, and the continuous hydraulic head available for increasing the potential

migration of previously disposed contaminants is a serious potential concern for off-site transport of hazardous and radioactive materials.

3.3.3 Environmental Monitoring Program

3.3.3.1 Sandia National Laboratories - Albuquerque

Wastewater Discharge Permits

As discussed in Section 3.3.2, in early 1987 SNLA was issued five wastewater discharge permits (City of Albuquerque #2096 A through E). These permits require monthly monitoring at four separate locations in the Technical Area I sanitary sewer system and at one location south of Technical Area IV where wastewater is discharged into the Tijeras interceptor sewer of the POTW. The locations of these monitoring points are shown on Figure 3-10. A brief description of each location's monitoring requirements and limits is provided in the following paragraphs.

Manhole WW001, located just before the point of discharge into the Tijeras interceptor, is governed by Permit #2069A. Limits are contained for various metals, oil and grease, phenolic compounds, pH, temperature, and total toxic organics. Monitoring is required for 4 consecutive workdays per month with daily composite samples, although analysis is not required for all the limited parameters, rather only for total cyanide, copper, cadmium, lead, zinc, and pH. The city's pretreatment staff section is required to sample WW001 once per year to determine compliance with all permit limit parameters. SNLA has installed a permanent flow monitoring and sampling manhole with a parshall flume and sonic level detector integrated sampler. At the time of the Survey, however, timed composite samples were being taken with a portable sampler since the permanently installed sonic level detector was not operating properly.

Permit 2069B governs discharge at Outfall WW002 which was meant to control discharges to the city POTW through the west gate sewer (see Figure 3-10). Since this discharge point has been closed by KAFB, and all flow goes to the KAFB sewage lagoon, SNLA is monitoring the influent to the lagoons in place of Outfall WW002. Monitoring requirements and limits are the same as those for WW001.

Outfalls WW003 and W004, governed by permits 2096 C&D, regulate discharge from the Building 841 Plating Shop in Technical Area I. The flow in Manhole WW004 (to the southeast of Building 841) is metal finishing wastewater plus sanitary wastewater from Building 841. The flow in Manhole WW003 (to the SW of Building 841) receives influent from three directions, only one of which is from Building 841. In order to sample this manhole, the sample withdrawal probe is pushed upstream in the proper influent pipe to the manhole; however, there may be admixture of other wastewaters in these samples. Like sampling locations WW001 and WW002, monitoring is required for 4 consecutive 8-hour production days for the same parameter.

Monitoring and reporting under these permits did not commence until March 1987. Since that time, no significant excursions of permit limits have occurred.

Contamination of the KAFB Sewage Lagoons

Recent sampling and analyses have indicated that solvents and organic chemical contaminants are contained in the wastewater from Technical Area I that is discharged into the KAFB sewage lagoons approximately 8 months per year and directly to the City of Albuquerque POTW for the remainder of the year.

Analyses performed by SNLA for priority pollutants on a sample obtained from Manhole WW002 on March 20, 1986 were used as a part of the August 1986 permit application to the POTW. This sample showed 18 ppb 1,2-dichloroethane, 54 ppb of methylene chloride, and 220 ppb 1,1,1-trichloroethane. A similar analysis of the discharge at WW001 into the Tijeras interceptor showed no detectable organic chemicals and only those priority pollutants associated with domestic sewage.

Samples were obtained on April 28, 1987, by the New Mexico Environmental Improvement Division (EID) of the KAFB sewage lagoons which were analyzed for priority pollutants. In the northernmost lagoon, 1,1,1-trichloroethane was found at a concentration of 80 ppb. Also dichloromethane was detected at a concentration of 30 ppb. Pursuant to these data, SNLA sampled the lagoon influent splitter box, surface outflow area of the southern lagoon, and Tijeras golf course pond on June 25, 1987. All samples were analyzed for volatile priority pollutants, metals, and

inorganics using EPA methods 624 and 625. The lagoon influent was determined to contain 2,200 ppb acetone. According to the lab report, this "resulted in a lower limit of detection for other volatile compounds," in that sample, of approximately 250 ppb. This may have hidden several other volatile organics present in lesser concentrations. The lagoon effluent was determined to contain 19 ppb acetone and 13 ppb methylene chloride (surface sample).

Additionally, unofficial SNLA data not required to be submitted to the POTW for April 1987 revealed the following 1,1,1-trichloroethane results:

	Location	1,1,1-Trichloroethane Concentration
WW003	Bldg 841 SW	630 µg/L (ppb)
WW002	Bldg 803 SW	310 µg/L (ppb)
KAFB	Sewage Lagoon Influent	91 µg/L (ppb)
WW001	Tijeras Interceptor	<5 µg/L (ppb)

Because of the New Mexico EID data obtained from the April 1987 samples, the New Mexico Health and Environment Department issued a Notice of Violation (NOV) of the New Mexico Hazardous Waste Act by letter to the KAFB Commander on August 6, 1987. The NOV ordered that within 30 days the recipient was to

1. Identify all processes and/or operations conducted since November 1980, that may have generated a waste stream containing trichloroethane. At present, this information is only requested for the waste streams that reached the on-site lagoons.

2. "Provide a list of the processes identified for each organization on KAFB."

It is believed that SNLA, in conjunction with the Air Force, requested and was granted a 60-day extension to this requirement.

Stormwater Monitoring

No regular program or historic data base of stormwater sampling and analysis exists for SNLA Technical Areas served by a formal storm sewer system. In preparation for the upcoming potential permit regulation of stormwater discharges, SNLA sampled the Technical Area I, II, and IV storm sewer outfall into Tijeras Arroyo on June 25, 1987. The sample was analyzed for volatile priority pollutants and found to contain 36 µg/L of trichloroethylene. No explanation for the presence of this contaminant was available from SNLA.

Area Surface-Water Monitoring

As a part of the annual monitoring program, samples are obtained once per year from upstream and downstream in the Rio Grande and from Coyote Springs. The Rio Grande upstream station is at Corrales Bridge (location #8) and downstream at Isleta Indian Reservation (Station #11). Significant to the utility of these data is the fact that Station #11 is considerably downstream of the influent point of Tijeras Arroyo to the river. Stormwater flows in Tijeras Arroyo are the only significant surface-water input to the Rio Grande from the site. Additionally, no effort is made to coordinate the sampling of the river with a storm event, the samples are not flow-proportional; rather a single grab from the edge of the river is obtained; in the case of #11 from an irrigation feeder canal that draws from the side banks of the river at an irrigation dam.

These water samples, unfiltered as well as filtered, are analyzed for gross alpha, for gross beta, total uranium, cesium-137, and tritium. Results for 1985 indicate some increases in Rio Grande downstream values versus upstream for gross alpha, gross beta, and uranium (Millard, 1986). These data are shown in Table 3-21.

3.3.3.2 Bendix Albuquerque Operations

Discharge permit 2069E governs discharge at Station WW005 by BAO at Building 870. Permit limits are the same as in all other permits with the exception that monthly analysis of a single day's flow-proportional sample is required for arsenic, cadmium, chromium, copper, fluoride, lead, nickel, zinc, total metals, and total toxic

TABLE 3-21

CONCENTRATIONS OF GROSS ALPHA, GROSS BETA, URANIUM, CESIUM-137, AND TRITIUM IN SURFACE WATER

Sample Type	Location No.	Location	Gross α 10^{-9} µCi/mL	Gross β 10^{-9} µCi/mL	Uranium 10^{-3} µg/mL	^{137}Cs 10^{-9} µCi/mL	^{3}H µCi/mL
Total	8	Corrales (Rio Grande)	4.37 ± 2.44	2.74 ± 1.41	1.0 ± 0.1	<6.69	<MDL
Filtered			2.47 ± 2.08	3.28 ± 1.40	1.0 ± 0.1	<5.95	<MDL
Suspended			<MDL	<MDL	---	---	---
Solids							
Total	11	Isleta (Rio Grande)	9.77 ± 3.07	1.54 ± 1.34	4.7 ± 0.2	<6.49	<MDL
Filtered			4.59 ± 2.49	4.12 ± 1.47	4.7 ± 0.2	<5.80	<MDL
Suspended			<MDL	<MDL	---	---	---
Solids							
Total	33	Coyote Springs	9.37 ± 2.65	13.85 ± 1.73	5.2 ± 0.2	<7.02	<MDL
Filtered			4.36 ± 2.49	12.76 ± 1.72	5.2 ± 0.2	9.12 ± 2.35	<MDL
			<MDL	<MDL	---	---	---

Source: Millard, 1986

PRELIMINARY

organics. In addition, SNLA is required to analyze one of its final discharge samples during the second quarter of each year for all the permit parameters including total toxic organics.

3.3.3.3 Inhalation Toxicology Research Institute

ITRI does not conduct any regular continuous monitoring of its wastewater discharges as they occur. On an annual basis however, water in Lagoons 2 through 6 has been sampled for 6 radionuclides since 1973, and for a Suite of 14 metals since 1983. Thompson (1987a) contains the results of this sampling and analysis for 1986, which show concentrations two to three orders of magnitude less than derived concentration guides for radiological parameters, and below Federal drinking water standards for metals. Because of daily changes in discharges to the lagoons and a lack of knowledge of the degree of coagulation and precipitation of contaminants within the lagoon, annual sampling is not believed to be representative of discharges to the vadose zone or ultimately to groundwater. Annual sampling of sediment in Lagoons 2 through 6 is also performed for radionuclides. No sampling of either water or sediment is performed for any organics, however.

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

1. Toxic chemical discharges to sanitary sewers in SNLA Technical Area I. Toxic chemicals from current and past discharges at several locations in Technical Area I to sanitary sewers may potentially contaminate the liquid effluents and sediments in the KAFB sewage lagoons and golf course pond. Some discharges are also directed to the City of Albuquerque POTW and may contaminate the POTW sludge or pass through untreated and contaminate surface waters.

PRELIMINARY

About two-thirds of the sanitary sewer flow in Technical Area I goes to the KAFB sewage lagoons. The balance goes directly to the city POTW. Large quantities of hazardous chemicals and organic solvents have been discharged to the sanitary sewer in the past. Discharges from Buildings 840, 841, and 863 in addition to the Chemistry Laboratory were large sources. These large contributors are located in the portion of Technical Area I that discharges to the KAFB sewage lagoons. Use and disposal into the sanitary sewer of organic solvents such as acetone, xylene, toluene, benzene, methylene chloride, and TCE/TCA are estimated to be in excess of several thousand gallons/year; in fact the number could have been larger than 10,000 gallons in some previous years. In addition to solvents, plating solutions, acid etching solutions, and large quantities of photochemicals were disposed of to the sanitary sewer. Although this disposal has been largely curtailed, facilities like the motion picture and still picture laboratories are still contributors.

The lagoons can act as concentration areas for heavy metals, so that even large dilute streams are potential concerns. The fate of organic solvents in an anaerobic facultative environment is unknown, so some solvents could be concentrating in the lagoons in addition to the heavy metals.

The two KAFB lagoons are about 25 years old, unlined, and each is about 7 acres in size. The lagoons have never been dredged or sounded for depth of sludge. This situation provides a constant hydraulic head for transport of chemicals, which concentrate in the lagoons, to the vadose zone and potentially provide a path to groundwater.

Water flows from the lagoons to an approximately 1-acre pond at the Tijeras golf course. There it is mixed with fresh potable (chlorinated) water in the ratio of 70 percent potable to 30 percent sewage effluent and used for irrigation of the golf course. All irrigation is done at night to minimize human inhalation of aerosols from the spraying. This practice, however, presents the possibility of contamination of groundwater beneath the golf course and contamination of surface-water runoff into Tijeras Arroyo. Although initial sampling and analyses data have indicated no contamination of the golf course pond with organics (see Section 3.3.3), several unexplained fish kills have occurred at the pond with the latest being in the spring of 1987.

Dissolved oxygen levels in the pond have been surveyed by SNLA and do not appear to be the cause of these fish kills.

Sampling and analysis of the sewage lagoons and Golf Course pond is planned.

2. Leaking drums of scintillation wastes at ITRI. Over 200 fifty-five gallon drums of scintillation wastes containing actinides, which are potentially mixed wastes, are stored outside and some are rusting and leaking. Contamination of area soil and surface-water runoff may potentially result.

There is evidence of erosion channels at the southern corner of the hot ponds concrete area pad. There are mud stains on the pad showing overflows. This leaking has been likely continuing since drum accumulation started in 1975. Quantities leaked from the broken scintillation vials inside the drums are small but may be causing significant long-term accumulation. Soil in the runoff path and surface-water runoff may potentially be contaminated with toluene, radionuclides, and other solvents.

Sampling and analysis of the soil in the runoff path is planned.

3. Subsurface and surface soil contamination at SNLA in Coyote Test Field and Technical Areas II, III, and V. Past and current discharges of photochemicals, solvents, and potentially radioactive substances to the soil columns at Technical Areas II, III, V and 99XX facilities have occurred through the septic tank systems. Some 99XX facilities discharge liquid effluents directly to the ground surface. Soil and potential groundwater contamination may result.

All the facilities in Technical Areas II, III, V and 99XX or remote facilities are served by septic tanks, for sanitary and process sewer requirements. Until 1987 there were no administrative directives regarding collection of hazardous solvents, so most solvents have been disposed of in laboratory sinks. Typical solvents include acetone, methylene chloride, methyl ethyl keytone, toluene, xylene, hexane, and alcohols. Average use is estimated to be several gallons/year in the smaller facilities.

Many of the 99XX facilities have photographic development capabilities in addition to the satellite photography laboratory in Technical Area III, Building 6640/42. High-speed still and movie pictures are used routinely to support high-energy experiments. Movie films are typically developed in Technical Area I and the stills at the test site for quick turnaround. Silver recovery is not usually practiced in the dedicated facility darkrooms.

In addition, the high-energy tests often involve the use of hazardous materials such as lead, copper, beryllium, depleted uranium, etc. Small quantities of high explosive or metal powder may become mixed with liquid wastes during test preparation and assembly activities. Many of the explosive test chambers are equipped with floor drains, to facilitate periodic cleaning. Baritol, an explosive containing barium, has been used in many of the tests, so this is a likely contaminant in the septic tanks also.

The depth to groundwater is generally believed to be 500 feet or greater. This belief tends to foster the feeling among the test and operations staff that groundwater contamination is not a serious concern. This combined with the commonness of septic tanks tends to make staff less conscious of environmental concerns. The division of responsibilities within test facilities tends to enhance this situation. Strong evidence exists, via old wells, that the distance to groundwater may be less than 100 feet under some of the remote test facilities, increasing the potential for groundwater contamination. Further, the constant hydraulic head from sanitary and process discharges provides a continuing source to transport contaminants in the vadose zone. Buildings of particular concern because of the potential for shallow groundwater are 9939, 9940, 9960, 9967, and 9990, as well as facilities in Coyote and Lurance Canyons.

Sampling and analysis is planned as part of the Survey.

4. Discharge of toxics to sewer at BAO. Prior discharges of solvents and acids, as well as current releases of high levels of fluorides, chlorides, and sulfates from BAO Building 870 may have resulted in pollutants concentrating in the Albuquerque POTW. Disruption of the POTW and contamination of its sludge may result.

The solvent capture system (SCS) installed in October 1986 serves as a collection tank for solvents from the printed circuit fabrication and wet benches. The system captures about 550 gallons/month. Earlier operations, which began in 1980, used large quantities of solvents per month. Until installation of the SCS, discharges went to the sanitary sewer, which in that portion of Technical Area I discharges to the Tijeras interceptor, and subsequently to the City of Albuquerque POTW. Minimum estimate of the total quantity discharged between 1980 and 1986 is 50,000 gallons.

Discharges from this facility are regulated under an NPDES Permit (#6096E) from the City of Albuquerque with requirements for sampling at Manhole WW005 to demonstrate compliance. However, there were no data from April 1987 to September 1987 to show compliance with the limits established in the NPDES Permit. Data from March 1987 indicated that fluoride concentration was a factor of 26 greater than the limit in the permit and the fluoride concentration was twice the permitted limit. These concentrations are diluted by an unknown level of flow from other facilities upstream of Building 870.

An ENU was also installed in October 1986 to neutralize acidic discharges from the wet benches. Typically these discharges contain large quantities of fluorides and chlorides, as well as sulfates. These discharges are not metered, but are batch releases of materials on the order of several thousand gallons per month.

The pH data from periodic day-shift readings from the ENU indicated wide variations (5 units) over the period of a few hours, indicating marginal performance, and the potential of significant underdesign of the ENU. Local and remote pH alarms are located in areas where off-shift operations staff would be unlikely to notice them, and the data are not printed on continuous recorders (which in itself is a violation of the terms of the permit). Fluoride levels are a concern to the City of Albuquerque because of the city's limit on discharge of fluorides to the Rio Grande.

In summary, the limited data from the ENU indicate that operations staff do not have enough real-time information to effectively manage or control discharges from the facility.

3.3.4.3 Category III

1. Potential contamination of Lake Christian at LS-1 Site on SNLA. Water and sediments in Lake Christian at the Los Alamos LS-1 site, on SNLA property, may be contaminated with toxic substances from past explosive tests. Groundwater may also be contaminated.

   The lake has been utilized for 30 years for testing of water shockwave blast effects on animals and other unknown tests which may have included radiological tests and/or chemical toxicant tests that potentially involved the lake.

   The lake has never been sampled; however, sampling and analysis is planned as a part of the Survey.

3.3.4.4 Category IV

1. Improper disposal of potentially contaminated surface water at SNLA. On 8/27/87, water pumped from a new radioactive disposal trench was observed flowing into an active burial trench in Technical Area III.

   Accumulated storm and surface water, estimated to be several hundred gallons, was being pumped from a new (not yet used) radioactive burial trench with a diesel pump. Discharge from the pump was flowing into an active burial trench and uncovering previously disposed waste. The wastes observed were five bags of turnings and shape debris from the Toxic Metal Machine Shop. Some of these may have contained either beryllium and/or depleted uranium.

   No workers were on the site at the time, nor were operational procedures posted. Neither trench had protective berms or any other evidence of normal surface-water management practices.

   Allowing the bottoms of these trenches to get wet precludes proper placement of waste, and results in waste either being exposed or inefficient utilization of burial ground space.

2. Inadequate spill prevention, control, and countermeasures at ITRI. Provisions for spill prevention, control, and countermeasures are inadequate to prevent diesel fuel spills from entering the soil column at ITRI.

The filters and pumps for filling the day tanks for the ITRI emergency diesel generators are located in a curbed corner of the building, along with the overflow tank from the day tanks. However, this curbed area has two direct paths to the environment. One is a 3/4-inch pipe penetrating the building wall below the level of the curb. The second is a floor drain within the curbed area that is connected to a seepage pit located immediately south of the building.

Two known releases of No. 2 diesel fuel to the environment have occurred as a result of operational mistakes, combined with the aforementioned design features. One release was about 2,000 gallons and the second was about 250 gallons. Less than 100 gallons was recovered from both spills.

3. Inadequate spill prevention, control, and countermeasure procedures at SNLA Technical Area I. Provisions for spill prevention, control, and countermeasures are inadequate to prevent spills of hazardous substances from entering sanitary or storm sewers or flowing to natural drainage channels at SNLA. In the event of a leak or spill, possible contamination of soil, surface-water runoff, or, if the substance entered a sanitary sewer, of contamination of the KAFB sewage lagoons and KAFB golf course irrigation pond or the Albuquerque POTW could result.

Specific examples include:

A) Improper indoor storage of chemicals in Technical Area I - the chemical storage area at the Plastics Shop in Building 834 has floor drains which are close to containers of compounds containing methylene chloride; toluene; benzene; phenols; or toluene diisocyanate. Open pails of these compounds are also stored in a spray booth in the shop.

B) Lack of diking or protection around PCB capacitors/transformers - potential PCB release to a septic tank system could occur at Building 9990 in Coyote Test Field if capacitor bank failure occurred. Several thousand gallons of PCB-contaminated oil are contained in these 2 capacitors which are located close to a floor drain.

C) Improper outside storage of waste containers - radioactively contaminated waste resins (which were used for water treatment) are being stored in an open-top tank behind Building 6580 in Technical Area V. The tank had filled to overflowing with rainwater which had run on the ground indicating the possibility of contamination of soil and surface runoff. The radioactive contaminant is cobalt-60.

D) Lack of diking or protection around large tanks of flammables - a 25,000-gallon tank of JP-4 jet aviation fuel and also 5 smaller tanks with similar contents, varying in size from 250 to 2,000 gallons, are located at the burn site in Lurance Canyon. The 25,000-gallon tank is on top of a hill above the area where enclosed and open burning is conducted and personnel are often working.

4. Potential leaks of ethylene glycol at ITRI. Potential failure of the ITRI ethylene glycol stack heat recovery system would result in a release to the wastewater system via floor drains.

Ethylene glycol heat recovery units are located in building exhaust stacks that serve hoods with high acid releases. There is visible evidence of corrosion on the heat recovery units. The ethylene glycol system does not have a dump tank or automatic pressure controls. In the event of a failure in the heat recovery unit, the system contents, several hundred gallons, would be pumped on to the laboratory floor: floor drains are connected to the sanitary sewer, which goes directly to the ITRI ponds.

5. Contaminated process wastewater discharges to storm sewer at SNLA. Contaminated wastewater is being discharged to Tijeras Arroyo via a portion of the Technical Area I stormwater system, which may result in soil contamination.

Although several sources of contaminated wastewater have been rerouted during the last 5 years from the storm sewer system to the sanitary sewers (including Building 841 acid sewer, several cooling tower blowdowns, Building 878 filter cleaning lab, the Building 870 incinerator, etc.), a few contaminated discharges still are connected, including two carwashes at the SNLA motor pool (Building 876) and cooling tower blowdown from Building 860.

3.4 Hydrogeology

This section presents a description of the regional geology and groundwater regimes in the vicinity of Kirtland Air Force Base (KAFB), Albuquerque, New Mexico. Topics discussed include geology, stratigraphy, geologic structures, seismicity, hydrogeologic characterization, and regional groundwater use and quality.

After the presentation of background information, a discussion of groundwater pollution sources and controls at the U.S. Department of Energy-Albuquerque Operations (DOE-AL) facilities on KAFB is presented. These facilities include the Sandia National Laboratories-Albuquerque (SNLA), the Central Training Academy (CTA), Transportation Safeguards Division (TSD), Life Sciences 1 (LS-1), Bendix Albuquerque Operations (BAO), Lovelace's Inhalation Toxicology Research Institute (ITRI), and applicable portions of Manzano Base and KAFB facilities. Waste disposal sites with low, moderate, and high potentials for contaminating the groundwater are identified principally on the basis of observations, interviews, and geophysical measurements made during the Survey, with additional information obtained from ES (1981), DOE-AL (1987), and Kearney and Lawson (1987).

The groundwater monitoring program is described. This program includes radiological monitoring at KAFB drinking water wells, as well as chemical monitoring at the SNLA chemical landfill for hazardous constituents. The latter program is evaluated with respect to regulatory requirements and guidance.

Hydrogeologic findings and observations resulting from Survey activities are presented and discussed.

3.4.1 Background Environmental Information

This section presents background information on the general aspects of the groundwater regime at the DOE-AL facilities on the KAFB. The following subsections discuss the regional geology and hydrogeology as they are related to these AL facilities.

3.4.1.1 Geology

The geology of the Albuquerque area has been reported by Bjorklund and Maxwell (1961), Titus (1963), Dale and Bachman (1965), Kelly (1974 and 1977), Hunt (1978), and Grant (1981), among others, as noted in ES (1981). A brief review of their work is summarized below.

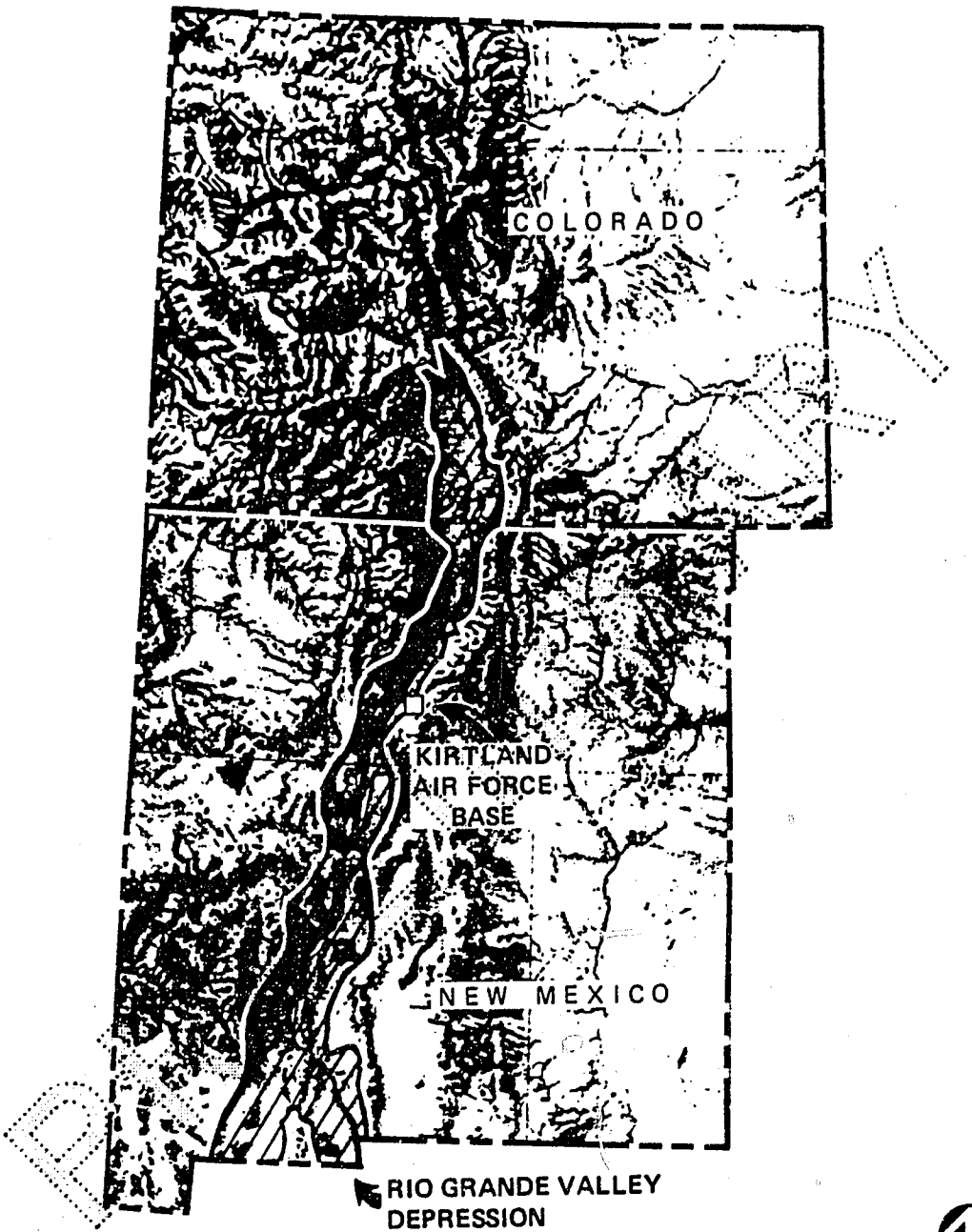
The Albuquerque area is located in the Rio Grande Valley of the Mexican Highland Subdivision of the Basin and Range Physiographic Province. The Rio Grande Valley is a depressed linear feature extending from Colorado to Mexico (Figure 3-20). Kirtland Air Force Base is located on the East Mesa of the Rio Grande Valley, directly west of the Sandia and Manzano Mountains. The mesa is a prominent physiographic feature, appearing as a level-to-gently-sloping shelf extending from the inner valley of the Rio Grande on the west to the Manzano Mountains to the east.

The Inner Valley of the Rio Grande is the lowest point in terms of surface elevation: 4,900 feet NGVD,* approximately 5 miles west of the KAFB. The mesa on which KAFB is located averages 5,400 feet in elevation. The Sandia and Manzano Mountains which form the east valley border are nearly vertical in some areas and reach a maximum elevation of 10,682 feet at Sandia Peak.

Stratigraphy

Geologic units ranging in age from Precambrian to Quaternary have been identified in the Albuquerque area and are described in Table 3-22. The lithologies of these units include unconsolidated materials as well as sedimentary, metamorphic, and igneous rocks.

*NGVD = National Geodetic Vertical Datum of 1929, commonly referred to as mean sea level.



Source: ES, 1981

LOCATION OF KIRTLAND AIR FORCE BASE WITHIN THE RIO GRANDE VALLEY OF MEXICAN HIGHLAND SUBDIVISION OF THE BASIN AND RANGE PHYSIOGRAPHIC PROVINCE

FIGURE 3-20

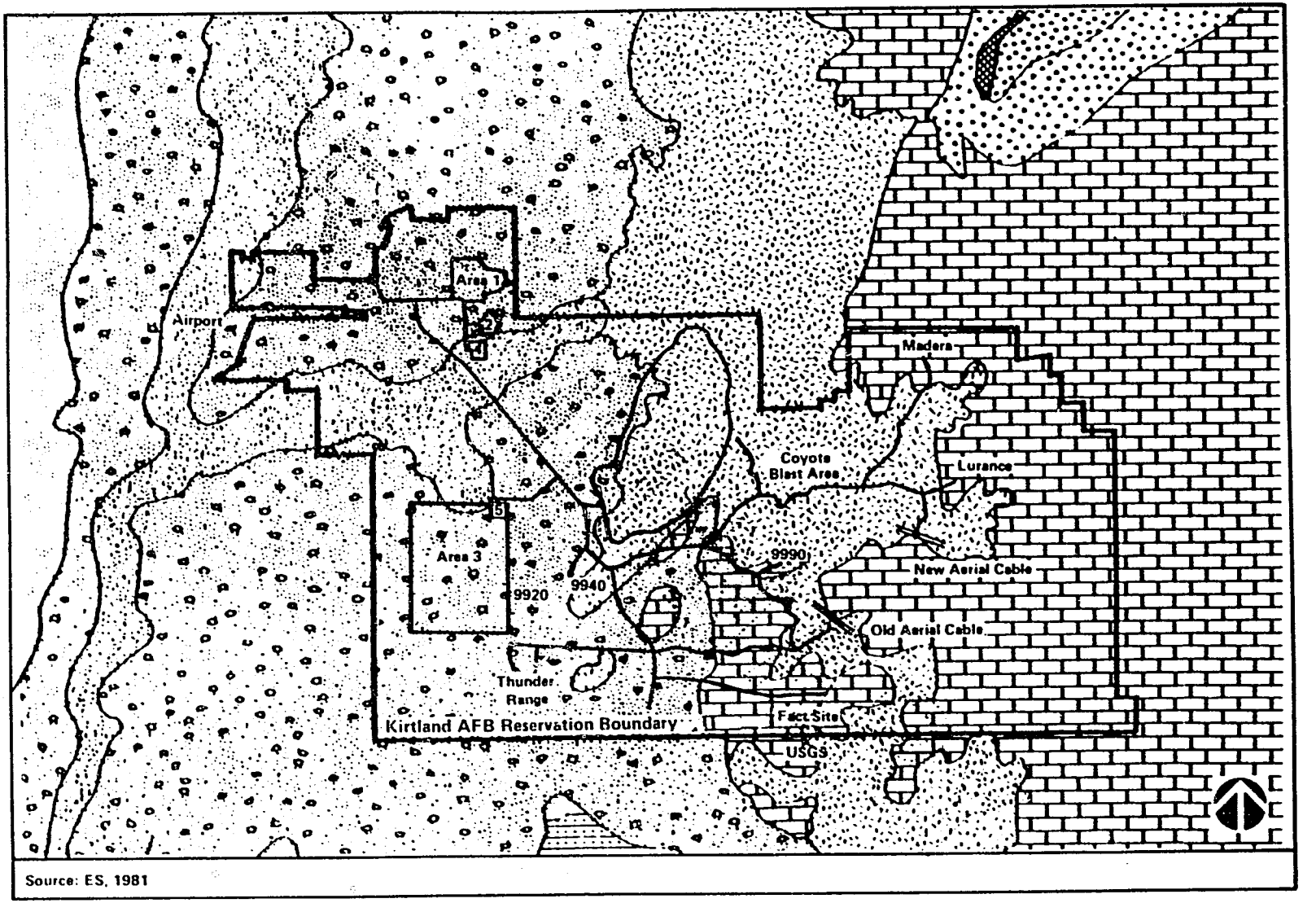
TABLE 3-22

GEOLOGIC FORMATIONS IN THE ALBUQUERQUE-KIRTLAND AFB AREA

System	Series	Age (M.Y.)*	Formations	Thickness
Quaternary	Holocene	0.01-1.5	Gravel, sand, and mud in lowlands, arroyos, low terraces, and alluvial fans	5-100
	Pleistocene	1.5-2	Gravel, sand, caliche; lava flows	10-50
Tertiary	Miocene-Pliocene	7-20	Sante Fe Formation: sand, clay, and gravel	0-21, 000-
	Eocene	53-54	Galisteo Formation: red and buff sandstone and mudstone	1,000-
Cretaceous	Upper	100	Mesaverde Formation: shale, sandstone, and coal	1,500
	Lower	136	Mancos Shale: shale with thin limestone and sandstone beds Dakota Formation: sandstone, conglomerate, shale	
Jurassic	Upper	154	Morrison Formation: variegated mudstone and sandstone	400-800
			Summerville Formation: red and buff mudstone and sandstone	200
			Todilto Formation: gypsum and limestone	
			Estrada Sandstone: red and buff sandstone	150-200
Triassic	Upper	200	Chinle Formation: red and tan mudstone and claystone	1,500
			Santa Rosa Formation: sandstone and conglomerate	200-400
Permian	Upper	235	Bernal Formation: sandstone, siltstone and limestone	100
			San Andres Formation: limestone	30-100
	Middle	250	Glorieta Sandstone	50-100
			Yeso Formation: red and tan sandstone, limestone, and gypsum	600-800
	Lower	280	Abo Formation: red sandstone and mudstone	600-900
Pennsylvanian		300	Madera Formation: limestone, shale, and sandstone	1,000 ±
			Sandia Formation: sandstone, shale, and limestone	100-200
Mississippian		340	Arroyo Penasco Formation	0-100
Precambrian		530 + 2,500 +	Sandia Granite, gneiss, quartzite, greenstone, and schist	

Source: ES, 1981

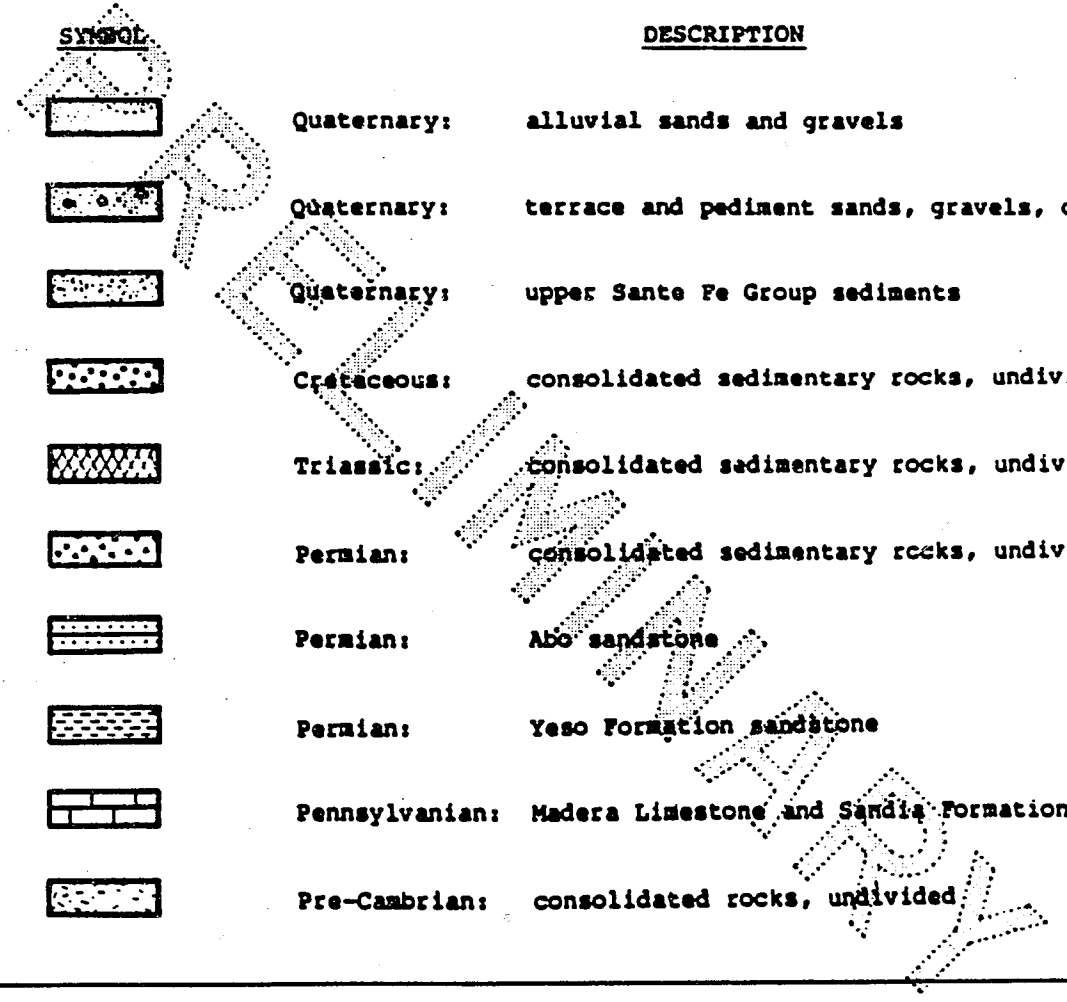
*M.Y. = millions of years from the beginning of the system or series.



Source: ES, 1981

KIRTLAND AIR FORCE BASE GEOLOGY

FIGURE 3-21



Source: ES, 1981

KIRTLAND AIR FORCE BASE GEOLOGY LEGEND FIGURE 3-21 (continued)

The areal distribution of significant geologic units is mapped on Figure 3-21. Generally, the geology of the northern and western portions of KAFB is dominated by the unconsolidated units, while consolidated geologic units predominate in the eastern half of the installation.

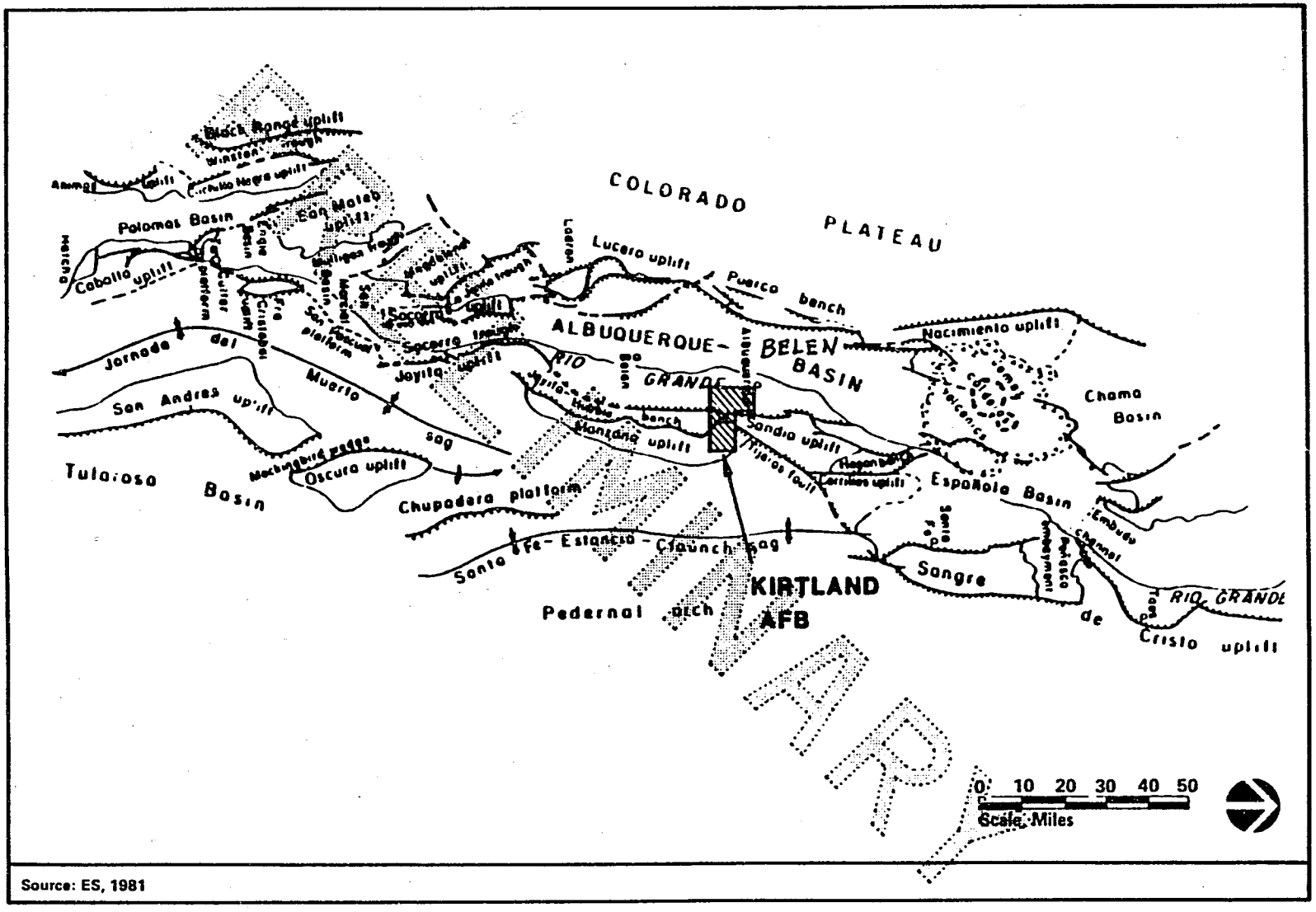
The surficial geologic unit at each of the major areas of interest is listed below.

Area	Predominant Surficial Geologic Unit
Sandia	
• Technical Area I	Quaternary, Terrace/Pediment Clastics
• Technical Area II	Quaternary, Terrace/Pediment Clastics
• Technical Area III	Quaternary, Terrace/Pediment Clastics
• Technical Area IV	Quaternary, Upper Santa Fe Group Sediments
• Technical Area V	Quaternary, Terrace/Pediment Clastics
• Canyon Test Areas	Precambrian, Crystalline Rock
• Coyote Test Area	Precambrian, Crystalline Rock
ITRI	Quaternary, Terrace/Pediment Clastics
LS-1	Quaternary, Terrace/Pediment Clastics

Structure

Kirtland Air Force Base occupies a position straddling a complex geologic setting. The northern and western sections of the KAFB are located within the Albuquerque-Belen structural basin, while the eastern section of the base is located within an area dominated by block-faulted mountains. The Albuquerque-Belen Basin is a large (2,700-square-mile area) complex tectonic element of the Rio Grande Rift, a connected series of structural basins (grabens) bordered by a series of uplifted en echelon fault blocks extending along a north-south alignment from central Colorado to Mexico (Figure 3-22). The western margin of the Basin is defined by the Rio Puerco fault zone and the Rio Puerco highlands. The eastern boundary of the Basin is defined by a complex fault system and the Manzano-Sandia Mountain chain. The highland and mountainous areas have been formed by upfaulted blocks.

Sediments derived from the upfaulted blocks accumulated on the graben floor, filling the basin. Sediment thickness varies from a few feet adjacent to the Sandia



Source: ES, 1981

REGIONAL TECTONIC DIVISIONS

FIGURE 3-22

Mountains to 21,000 feet near the Rio Grande. The maximum stratigraphic displacement along the fault is on the order of 31,000 feet, based on deep exploratory well data and the elevation of Sandia Peak. Indicative of the complex nature of the local geology are numerous structural benches and steps within the basin, depicted on Figure 3-23.

There are four major fault systems within the limits of KAFB (Figure 3-24). These systems are:

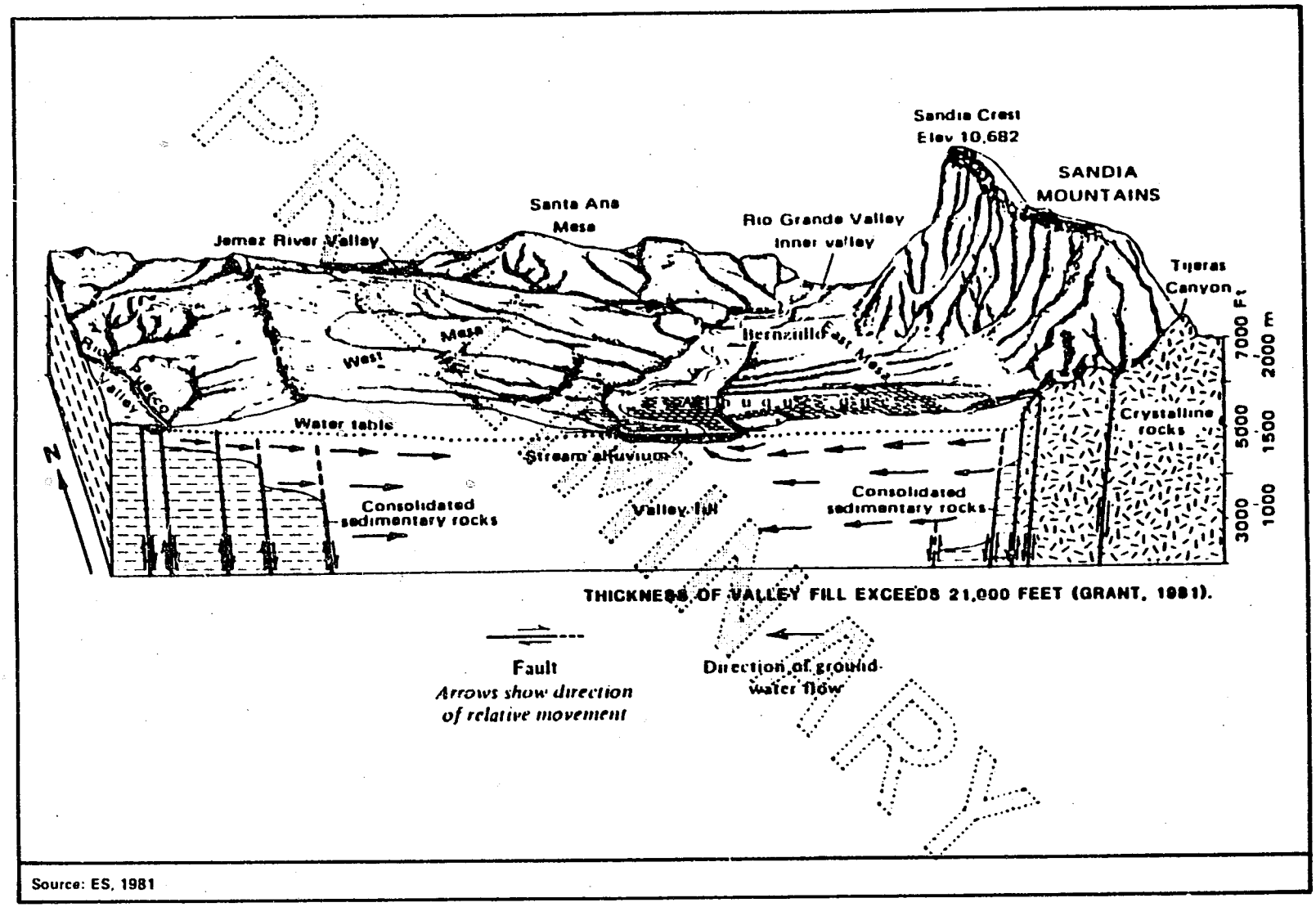
- Manzano-Coyote Fault System
- Sandia Fault
- Tijeras Fault
- Hubbell Springs Fault

The Manzano-Coyote Fault System is believed to be the significant structural feature responsible for raising the Manzanita and Manzano Mountains to their present position of topographic prominence. The Sandia Fault may be a northward extension of the Hubbell Springs Fault and is suspected of being the point where the massive, east-tilting Sandia Mountains separated from rocks underlying the Rio Grande Rift (ES, 1981).

The Tijeras Fault and the Hubbell Springs Fault intersect on KAFB and are considered to be active at the present time. The Hubbell Springs Fault is significant due to its control over groundwater movement. East of the fault, according to a study of Valencia County (Titus, 1963), depths to groundwater are generally less than 100 feet. Springs, indicative of surface or near-surface water levels, have been observed along the fault alignment at and near KAFB. West of the Hubbell Springs Fault and Sandia Fault, depths to groundwater abruptly extend to 450 feet or more (DOE-AL, 1987).

Seismicity

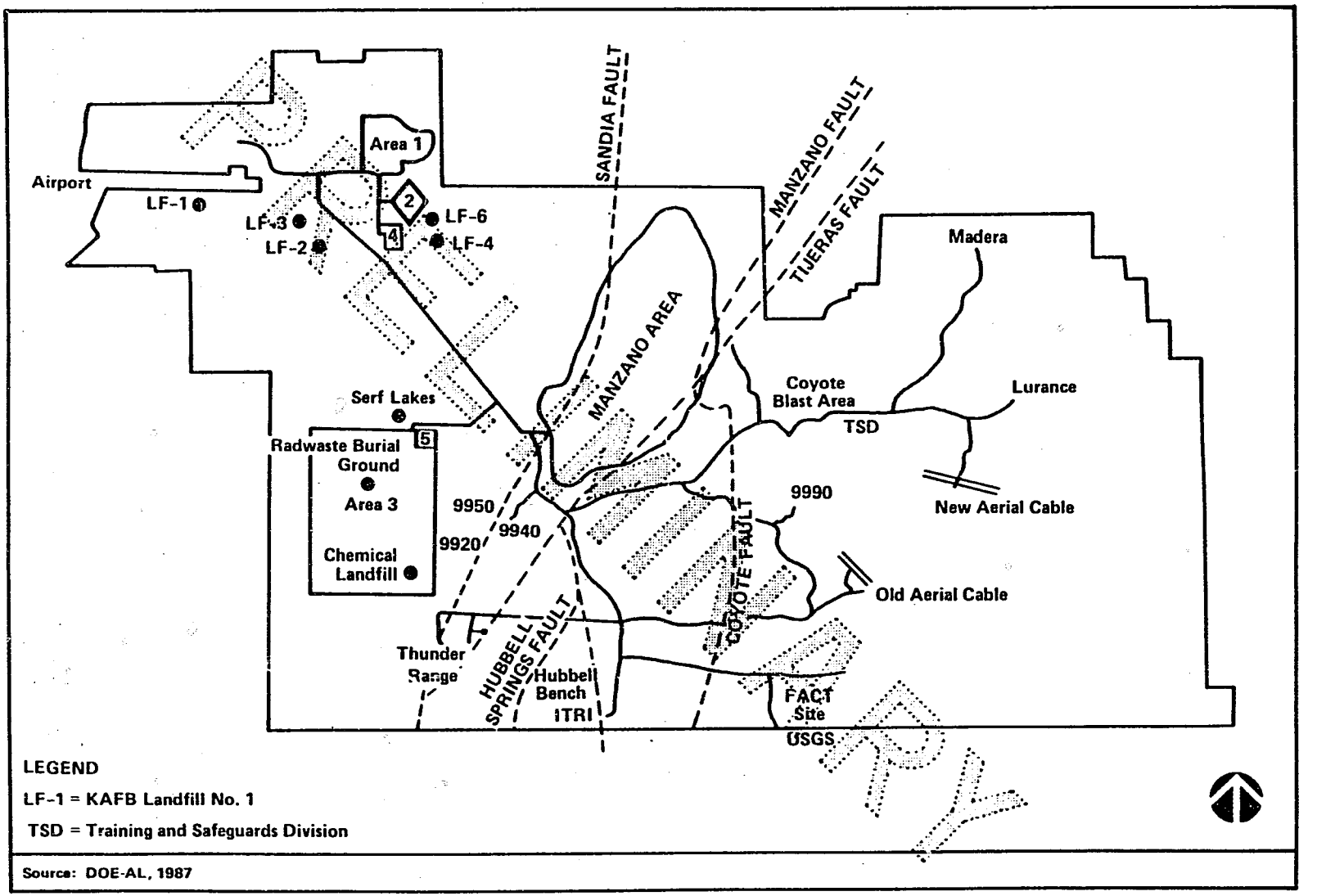
The Rio Grande Rift region is known to be tectonically active. Available records indicate that over 1,100 earthquakes have occurred during a 127-year period. Many of the recorded earthquakes have occurred in the 75-mile zone between Socorro



Source: ES, 1981

BLOCK DIAGRAM OF AREA HYDROLOGIC SYSTEM

FIGURE 3-23



Source: DOE-AL, 1987

MAJOR FAULT SYSTEMS AT KIRTLAND AIR FORCE BASE

FIGURE 3-24

3 OF 8

and Albuquerque. Statistical analysis of the historic earthquake record indicates that a nondamaging earthquake may be expected every 3 years in the Socorro-Albuquerque area, while a damaging event may be expected once every 100 years (ES, 1981).

Albuquerque is located in an area classified as Seismic Zone 2 (Southern Building Code, 1982), which is subject to frequent earthquakes, some of which may cause moderate structural damage. Ground acceleration for Seismic Zone 2 ranges from about 0.07g to 0.22g (DOE-AL, 1987). Movement was recorded on the Hubbell Springs Fault from 1931 to 1935. Hence, it meets the NRC (10 CFR 100, Appendix A) definition of a capable fault.

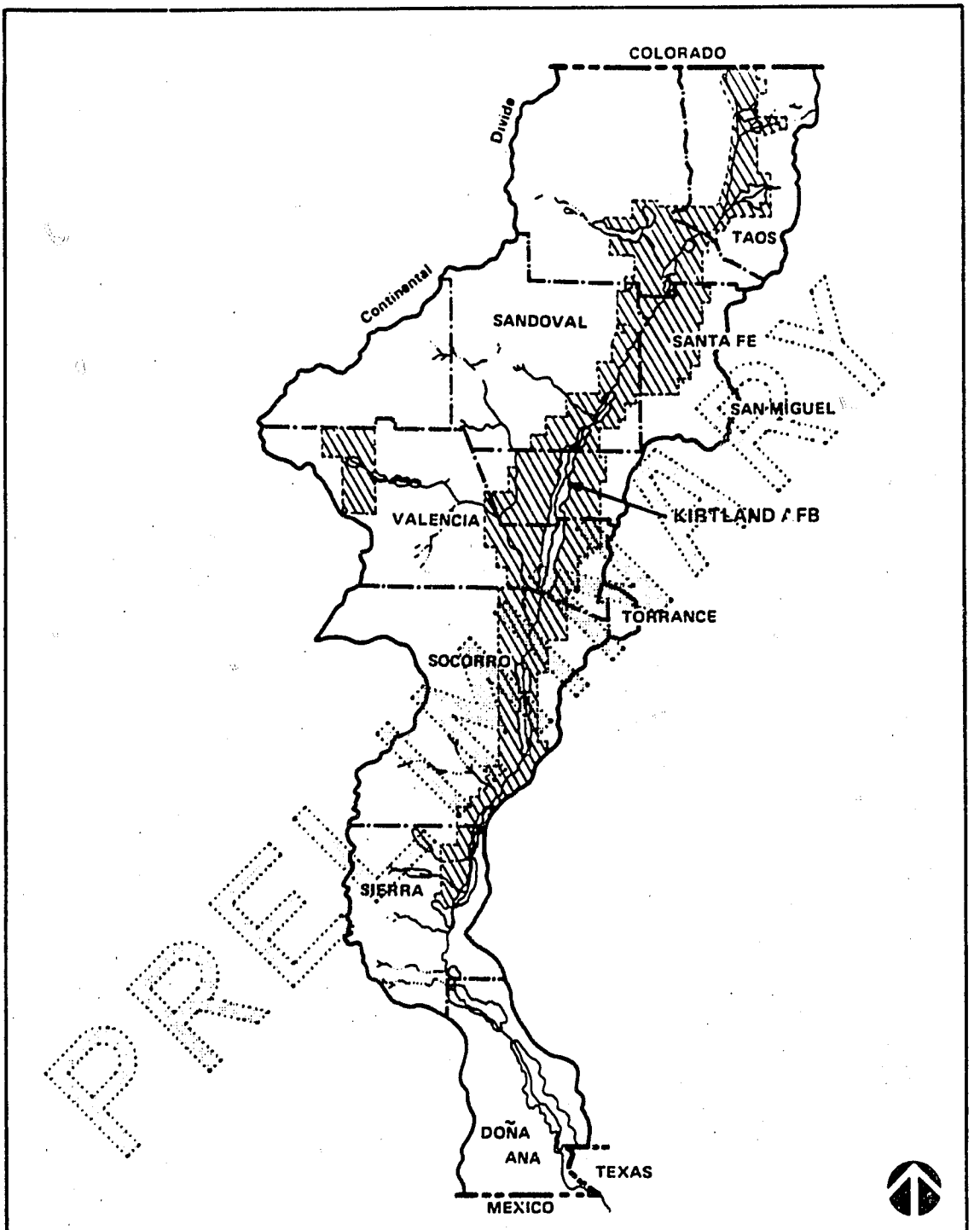
3.4.1.2 Hydrogeology

Groundwater hydrology of the Albuquerque-Kirtland Air Force Base area has been the subject of a number of papers and reports by Bjorklund and Maxwell (1961), Titus (1963), Reeder, Bjorklund and Dinwiddie (1967), New Mexico State Engineer (1967 and 1974), the Albuquerque District, U.S. Army Corps of Engineers (COE, 1979), and Grant (1981). The discussion which follows is, in large part, excerpted from the literature prepared by ES (1981).

Characterization

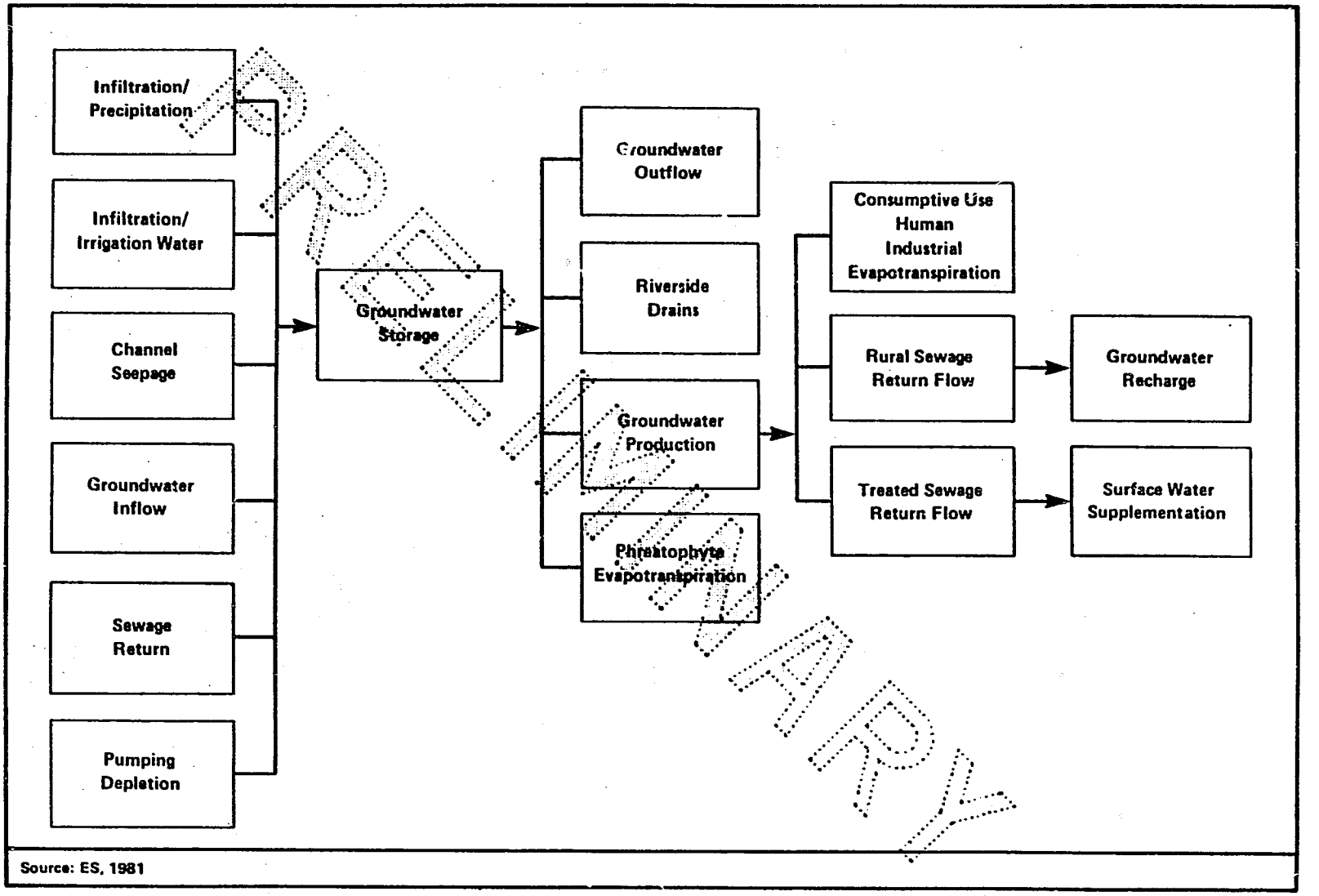
Kirtland Air Force Base lies within the limits of the Rio Grande underground water basin, a natural resource area defined by the State of New Mexico as a "declared underground water basin" (Figure 3-25), regulated as a sole source of potable water (ES, 1981). The Rio Grande Basin is a complex system whose major functional components are identified on Figure 3-26.

The principal aquifer of the Rio Grande Basin and KAFB has been termed the "valley fill." The valley fill is comprised of unconsolidated and semi-consolidated sands, gravels, silts, and clays of the Pliocene-age Santa Fe Formation, as well as more recent alluvial fan deposits associated with upland area erosion and valley alluvium associated with stream development. The valley fill varies in thickness from a few feet adjacent to the mountain ranges on KAFB to over 21,000 feet at a point 5 miles



Source: NMSE, 1974, as cited in ES, 1981

RIO GRANDE BASIN, NEW MEXICO FIGURE 3-25



GROUNDWATER SYSTEM COMPONENTS

FIGURE 3-26

southwest of the airfield. The valley fill is bounded on the west and east by the upfaulted block mountains, and the basin floor is formed by the consolidated rocks of the graben (Figures 3-22 and 3-23). The valley fill in the study area contains groundwater along the entire extent of the Rio Grande (Figure 3-25).

The Santa Fe Formation is relatively permeable in the Albuquerque area. Coefficients of transmissivity range from 100,000 to 600,000 gpd/ft in wells on the east side of the Rio Grande. Wells tested at SNLA and on KAFB had transmissivities ranging between 100,000 and 450,000 gpd/ft. The groundwater flow velocity within the Santa Fe Formation has been estimated at about 20 ft/yr (DOE-AL, 1987).

Groundwater exists in the valley fill under water table (unconfined) conditions, although locally, artesian (confined) conditions may exist. In almost all areas underlain by thick accumulations of the valley fill, groundwater may be obtained in large quantities. In areas where the fill thins, such as at the base of mountains, supplies may be limited. Where the valley fill is very thin, groundwater is obtained at low pumping rates from the underlying fractured crystalline rocks.

The water table in the Albuquerque area is known to be an irregular, sloping surface. Irregularities in this surface are thought to be due to changes in local permeability, variations in saturated thickness, and local additions or withdrawals of groundwater. Generally, the regional water table slopes gently (at a low gradient) from the upland areas diagonally downvalley southwestward toward the Rio Grande. The regional direction of groundwater flow on the KAFB is to the west away from the Manzano Mountains and to the south, following the gradient of the Rio Grande.

The impact of local faulting on groundwater flow at KAFB is not really known (ES, 1981). However, it is generally believed that the en echelon faults along the eastern portion of KAFB control groundwater movement. It has been postulated that travertine deposition (precipitation of calcium carbonate from solution in groundwater) within fault fractures may have sufficiently reduced permeabilities to the point where the faults act as barriers to the western migration of groundwater. Springs have been observed along the fault alignments, particularly the Hubbell Springs Fault, and there is a shallow water table east of the faults which may be perched. The primary regional aquifer, the valley fill, underlies KAFB at a depth of

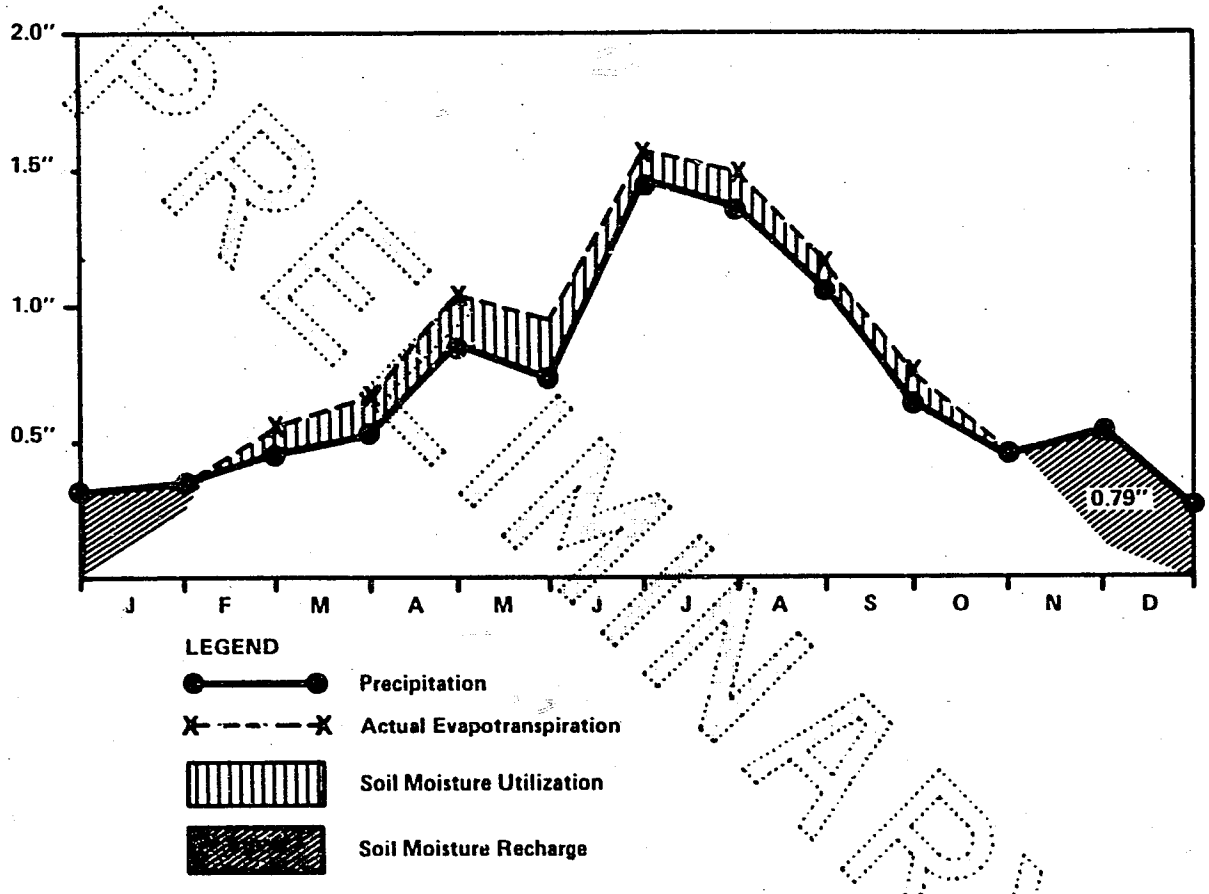
400 to 600 feet west of the Hubbell Springs Fault, and at a depth of 50 to 150 feet east of the fault (DOE-AL, 1987). Groundwater in wells at the LS-1 facility, east of the fault, has been measured at a depth of 54 feet (ES, 1981).

Water levels within the valley fill fluctuate with use, evapotranspiration, or additions to the hydrogeologic system (Figure 3-26). Water level fluctuations may be brief, seasonal, or long term within the area of interest. Recharge to the system occurs from precipitation, underflow of groundwater from adjacent areas, and seepage from streams, canals, drains, and septic systems, surface reservoirs, and applied crop irrigation water. On KAFB, recharge is most likely to occur at the base of the mountains and in canyon areas where coarse-grained deposits of pediment materials favor the rapid infiltration of precipitation. Evapotranspiration for the area, graphically summarized in Figure 3-27, is high during February through October. Soil moisture recharge occurs during November through January.

Regional Groundwater Use

In the City of Albuquerque, the rapid, heavy withdrawal of groundwater from concentrated areas (well fields) has modified the geometry of the water table surface and has locally altered groundwater flow directions (Figure 3-28). Withdrawal rates by the city during the last 12 months are summarized in Table 3-23. As noted from this table, monthly withdrawals of 4 billion gallons can be expected in the summer months. Additional stress is placed on this aquifer by Albuquerque residences and businesses that obtain groundwater from private wells. Kirtland Air Force Base presently obtains water supplies from a system of 12 wells screened in the valley fill deposits and by purchasing additional supplies from the City of Albuquerque. Wells at KAFB have been constructed individually and are not installed in well fields as are the city wells. As shown in Table 3-23, total capacity of the city wells is about 10,125 gpm (440 million gallons/month).

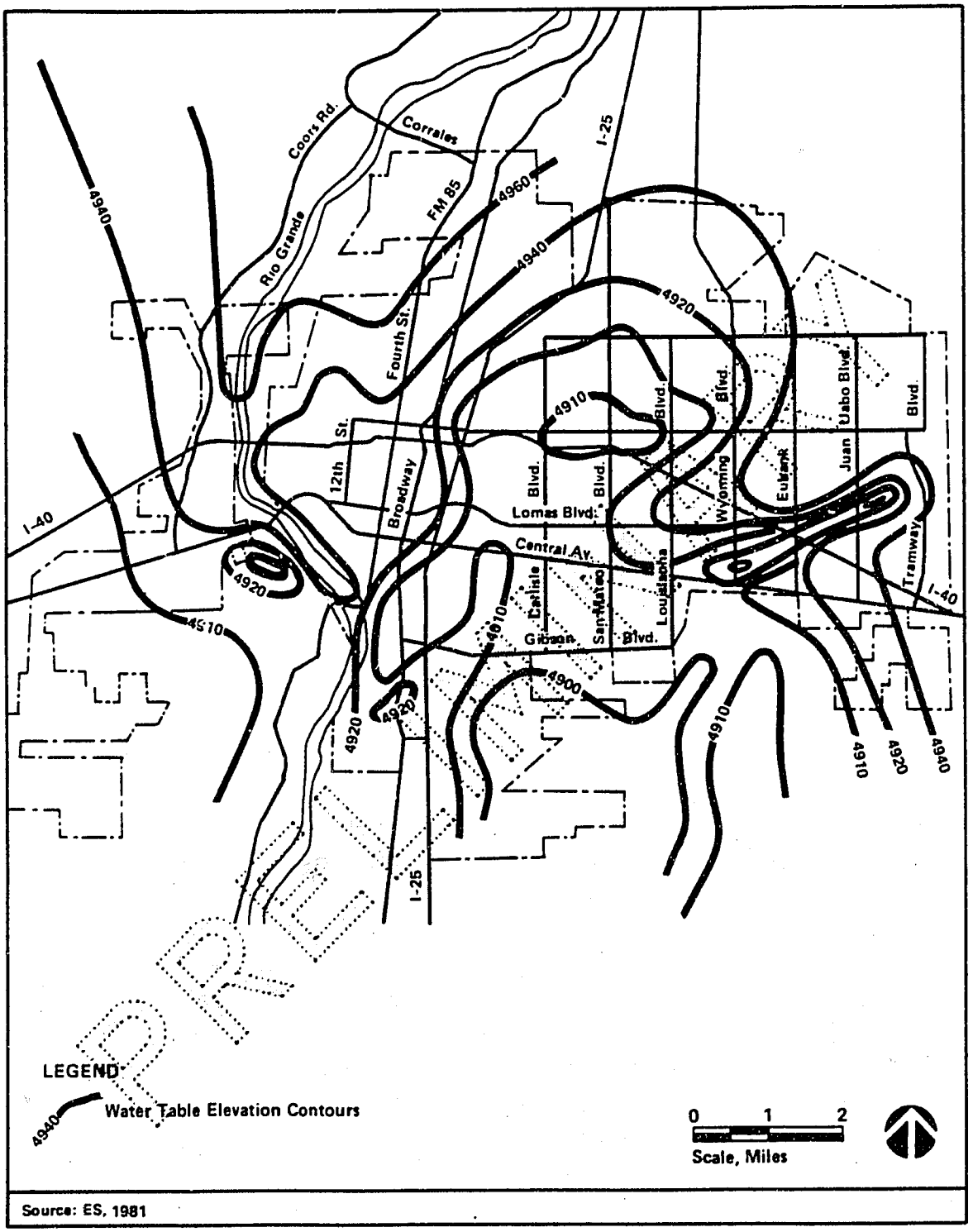
The locations of KAFB supply wells are shown on Figure 3-29. Base wells now in service average 1,000 feet to finished depth. Static water levels recorded in the wells west of the en echelon faults vary from 403 feet below ground surface at Well 13 to 580 feet at Well 11. The water depth in the two wells (no longer used) near LS-1 (29055 and 29056 in Figure 3-29) is reportedly 54 feet below the ground surface (ES, 1981).



PRELIMINARY

Source: ES, 1981

EVAPOTRANSPIRATION IN ALBUQUERQUE – KIRTLAND AIR FORCE BASE FIGURE 3-27



Source: ES, 1981

ALBUQUERQUE AREA WATER TABLE ELEVATIONS FIGURE 3-28

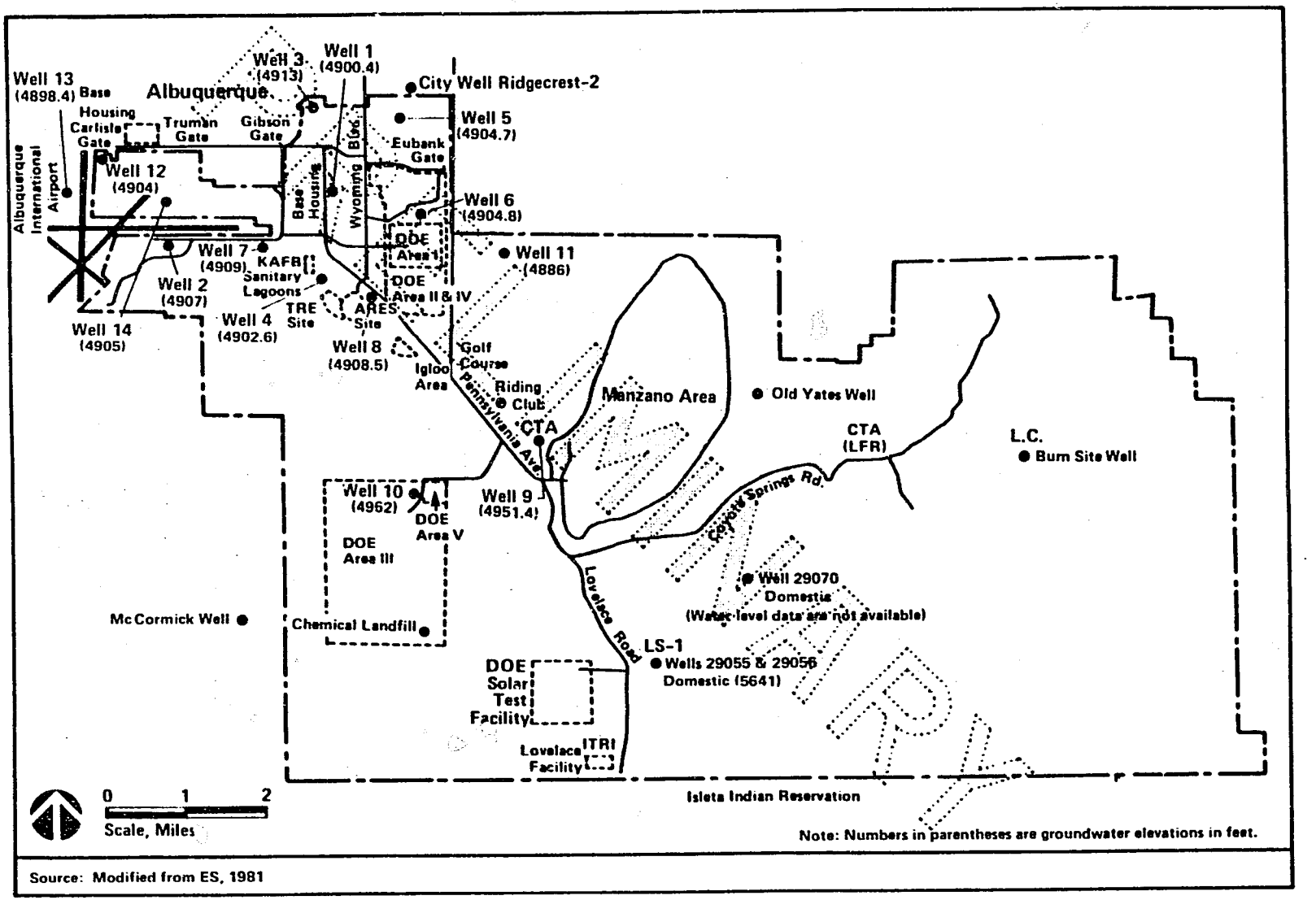
TABLE 3-23

MONTHLY WELL WATER PRODUCTION FOR THE CITY OF ALBUQUERQUE

Month	Well Water Production	
	Gallons	Acre-Feet
1986		
August	4,237,960,200	13,005.9
September	NA	NA
October	2,382,151,800	7,310.6
November	1,897,062,910	5,821.9
December	1,729,815,000	5,308.5
1987		
January	1,791,310,200	5,497.4
February	1,602,028,200	4,916.2
March	2,309,439,600	7,087.8
April	2,987,756,400	9,169.0
May	3,683,081,400	11,303.1
June	4,222,130,400	12,957.3
July	4,911,709,920	15,073.3

Note: July 1986 pumpage totaled 3,721,279,800 gallons (11,420.2 acre-feet).

Data supplied by: City of Albuquerque, 1987



Source: Modified from ES, 1981

WELL LOCATIONS AT KIRTLAND AIR FORCE BASE

FIGURE 3-29

Table 3-24 presents monthly well water production totals for the 11 operating KAFB wells. The data cover the period from August 1986 through June 1987. The maximum withdrawal rate for this period was 203,978,000 gallons for August 1986. This figure is approximately 5 percent of the corresponding production rate for the City of Albuquerque in the same month.

Two relatively new wells have been installed at DOE facilities. The well at the Burn Site in Lurance Canyon has a capacity of about 12 gpm. Water depth in this well was measured during the Survey at about 67 feet. During August 1987, a well producing about 8 gpm was installed in decomposed granite at the Optical Test Range. A static water level was observed at a depth of 150 feet.

Regional Groundwater Quality

Groundwater in the Rio Grande (valley fill) Underground Water Basin is generally of good quality and has been defined by New Mexico as a "delared underground water basin" and is regulated as a sole source of potable water (ES, 1981). Personnel from KAFB periodically sample selected base water supply wells and analyze the samples for chemical and radiochemical contaminants. Analytical data provided by KAFB for 1985 and 1986 indicate that water quality meets drinking water standards (see Section 3.3) except for iron in some wells (Table 3-25). Overall, the groundwater from all wells is calcium-rich, as evidenced by the bicarbonate, hardness, and calcium values. In addition, the groundwater in these wells isessentially free of contamination by organic compounds. Other monitoring data show that manganese content may also exceed drinking water standards in some KAFB wells.

Coyote Springs, a natural spring occurring along the fault alignment, is also periodically sampled by personnel from KAFB. The samples collected indicate that the spring water is extremely hard and that arsenic, chloride, chromium, iron, manganese, and selenium levels exceed drinking water standards. The chemical quality of the spring water is believed to be fairly characteristic of springs in metamorphic rock environments and does not necessarily indicate human-induced (anthropogenic) contamination (DOE-AL, 1987).

TABLE 3-24

MONTHLY WELL WATER PRODUCTION FOR
KIRTLAND AIR FORCE BASE

Month	Well Water Production	
	Gallons	Acre-Feet
1986		
August	203,978,000	625.98
September	167,057,000	512.68
October	118,696,000	364.26
November	86,235,000	264.65
December	78,334,000	240.40
1987		
January	96,685,000	296.71
February	80,336,000	246.54
March	128,437,000	394.16
April	157,917,000	484.63
May	174,025,000	534.06
June	180,450,000	553.78

Data supplied by: Kirtland Air Force Base

PRELIM

TABLE 3-25
CHEMICAL QUALITY OF DRINKING WATER - KAFB WELLS[a]

Parameter	Units	Well No 1	Well No 2	Well No 3		Well No 4		Well No 7		Well No 8		Well No 11				Well No 12		Well No 14		Coyote Springs	Building 1055	Building 22000		Building 30116
		5/15/86	5/15/86	12/26/85	5/15/86	5/5/85	5/15/86	12/27/85	5/15/86	5/2/85	5/15/86	7/27/81	5/2/86	5/21/85	5/15/85	2/3/86	5/15/86	1/28/86	5/15/86	2/1/85	9/2/86	4/16/85	9/2/86	9/2/86
Conductance, Specific	µmhos											470	600											
Residue, Total Filterable	mg/l											388	380											
Residue, Total Nonfilterable	mg/l			<1		10		2		<10		<1	<1			1		8						
Residue, Volatile, Total	mg/l												289											
Residue, Total	mg/l												380											
Residue, Settleable	ml/l												<0 5											
Turbidity	units											<1	<1											
Acidity, Total	mg/l											39	5											
Alkalinity, Total	mg/l											165	143											
Alkalinity, Bicarbonate	mg/l												143											
Bromide	mg/l												<0 1											
Chloride	mg/l											24	16											
Cyanide	mg/l			<0 01		<0 01		<0 01		<0 01		<0 01	<0 01			<0 01		<0 01						
Cyanide, Free	mg/l			<0 01									<0 01			<0 01		<0 01						
Fluoride	mg/l											0 5	0 3											
Hardness, as Calcium Carbonate	mg/l			100		158				119		200	180			136		115						
Nitrogen, Ammonia	mg/l											0 2	<0 2											
Nitrogen, Nitrate	mg/l	0 74	0 17		1 27		1 00		0 67			5 6	3 6		3 43		0 63		0 08					

[a] Data supplied by KAFB

TABLE3-25
CHEMICAL QUALITY OF DRINKING WATER - KAFB WELLS (Continued)

Parameter	Units	Well No 1	Well No 2	Well No 3		Well No 5		Well No 7		Well No 8		Well No 11				Well No 12		Well No 14		Coyote Springs	Building 1055	Building 2200		Building 30116
		5/15/86	5/15/86	12/26/85	5/5/86	5/5/85	5/5/86	1/22/85	5/15/86	5/2/85	5/15/86	7/27/81	5/2/85	5/21/85	5/15/86	2/3/86	5/15/86	1/28/85	5/15/86	2/1/85	9/2/86	4/16/85	9/2/86	9/2/86
Nitrogen, Nitrite	mg/l												<0 02											
Nitrogen, Total Kjeldahl	mg/l												<0 2											
Silica	mg/l											30 0												
Aluminum, Total	µg/l												<100											
Antimony, Total	µg/l			<10		<10		<10		<10			<10			<10		<10						
Arsenic, Total	µg/l			<10		<10		<10		<10		<10	<10			<10		<10						
Barium, Total	µg/l			<200		<200		<200		<200		<1	<200			<200		<200						
Beryllium, Total	µg/l			<10		<10		<10		<10			<10			<10		<10						
Boron	µg/l			<500		<500		<500		<500			<500			<500		<500						
Cadmium, Total	µg/l			<10		<10		<10		<10		<10	<10			<10		<10						
Calcium, Total	mg/l			31 6		47 5		30 7		29 4		59 7	52 4			43 1		33 7						
Chromium, Total	µg/l			<50		<50		<50		<50		<50	<50			<50		<50						
Cobalt, Total	µg/l												<10											
Copper, Total	µg/l			<20		<20		36		133		<20	<20			<20		31						
Iron, Total	µg/l			<100		<100		1183		214		<100	<100			<100		454						
Lead, Total	µg/l			<20		<20		<20		<20		60	<20			<20		<20						
Magnesium, Total	mg/l			5 1		9 5		5 7		11 1		12 3	12 2			18 2		7 5						
Manganese, Total	µg/l			<50		<50		80		<50		<50	<50			<50		<50						
Mercury, Total	µg/l			<1		<1		<1		<1		<5	<1			<1								
Molybdenum, Total	µg/l												<10 0											
Nickel, Total	µg/l											<0 10	<0 1					<50						

TABLE 3-25
CHEMICAL QUALITY OF DRINKING WATER - KAFB WELLS (Continued)

Parameter	Units	Well No 1	Well No 2	Well No 3		Well No 4		Well No 7		Well No 8		Well No 11				Well No 12		Well No 14		Coyote Springs	Building 1055	Building 22000		Building 30116
		5/15/86	5/15/86	12/26/85	5/5/86	5/5/86	5/5/86	1/22/85	5/15/86	5/2/85	5/15/86	7/27/81	5/2/85	5/21/85	5/15/86	2/3/86	5/15/86	1/28/86	5/15/86	2/1/85	9/2/86	4/16/85	9/2/86	9/2/86
Phosphorus, as Phosphate	µg/l											<0 10	<0 1											
Phosphorus, Total	µg/l												0 4											
Potassium, Total	mg/l			2 3		2 5		1 9		2 7		2 6	2 5			3 1		3 3						
Selenium, Total	µg/l			<10		<10		<10		<10		<10	<10			<10		<10						
Silver, Total	µg/l			<10		<10		<10		<10		32	<10			<10		<10						
Sodium, Total	mg/l			22 1		24 1		20 3		23 4		32 3	31 9			21 2		17 3						
Thallium, Total	µg/l			<10		<10		<10		<10			<10			<10		<10						
Zinc, Total	µg/l			<50		<50		<50		<50		<50	<50			<50		59						
Chemical Oxygen Demand	mg/l			<10		<10		<10		<10			<10			<10		<10						
Oil and Grease	mg/l			<0 3		<0 3		2 2		<0 3		<0 3	<0 3			<0 3		<0 3						
Phenols	µg/l			<10		<10		<10		<10		<10	<10			<10		<10						
Surfactants, MBAS as LAS	mg/l											<0 1	<0 1											
Bromodichloro-methane	µg/l													X							X	X	1 2	0 8
Bromoform	µg/l													X							1 1	1 1	2 7	9 0
Chloroform	µg/l													X							1 2	X	1 7	1 7
Dibromochloro-methane	µg/l													X							X	1	7 4	3 2
Total Trihalomethanes	µg/l																				<100	<100	<100	<100
Aldrin	µg/l					X		<0 02		X						X		X		0 03				
DDD	µg/l					X		<0 02		X						X		X		<0 02				

TABLE 3-25
CHEMICAL QUALITY OF DRINKING WATER - KAFB WELLS (Continued)

Parameter	Units	Well No 1	Well No 2	Well No 3		Well No 4		Well No 7		Well No 8		Well No 11				Well No 12		Well No 14		Coyote Springs	Building 1055	Building 22000		Building 30116
		5/15/86	5/15/86	12/26/85	5/5/86	5/5/86	5/5/86	1/23/86	5/15/86	5/2/85	5/15/86	7/27/81	5/2/85	5/21/85	5/15/86	2/3/86	5/15/86	1/28/86	5/15/86	2/1/85	9/2/86	4/16/85	9/2/86	9/2/86
DDE	µg/l					X		<0.02		X						X		X		<0.02				
Dieldrin	µg/l					X		<0.02		X						X		X		<0.02				
Endrin	µg/l					X		<0.02		X						X		X		<0.02				
Heptachlor	µg/l					X		<0.02		X						X		X		<0.02				
Heptachlorepoxide	µg/l					X		<0.02		X						X		X		<0.02				
Lindane	µg/l					X		<0.02		X						X		X		<0.01				
p, p'-DDT	µg/l					X		<0.1		X								X		<0.02				
Diazinon	µg/l																							
Malathion	µg/l																							
Parathion	µg/l																							
Methoxychlor	µg/l					X		<0.2		X						X		X		<0.2				
o,p-DDT	µg/l					X		<0.1		X						X		X		<0.02				
Chlordane	µg/l					X		<0.2		X						X		X		<0.2				
Alpha-BHC	µg/l					X		<0.02		X						X		X		<0.01				
Beta-BHC	µg/l					X		<0.02		X						X		X		<0.02				
Delta-BHC	µg/l					X		<0.02		X						X		X		<0.02				
Toxaphene	µg/l					X		<2		X						X		X		<1				
2,4-D	µg/l					X		<0.05		X			<0.06			X		X		<0.06				
Silvex	µg/l					X		<0.05		X			<0.06			X		X		<0.06				
2,4,5-T	µg/l					X		<0.05		X			<0.06			X		X		<0.06				
Dursban																X		X						

Two of the City of Albuquerque wells in the San Jose field and a private well nearby (all located west of KAFB) have been contaminated by industrial chemicals (Figure 3-9). The area of the contaminated wells is undergoing Remedial Investigations/Feasibility Study (RI/FS) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) studies. This site is underlain by highly permeable soils with a shallow water table. Groundwater withdrawal rates are high (see Section 3.3.1.5).

3.4.2 General Description of Pollution Sources and Controls

This section describes the sources of groundwater pollution and the controls instituted to protect groundwater at AL's facilities on the KAFB. These facilities are operated by SNLA, CTA, TSD, Manzano Base, LS-1, BAO, and Lovelace's ITRI. Separate subsections will be devoted to SNLA and related operations, BAO, and ITRI. Also discussed are KAFB facilities used by DOE-AL and its contractors, such as the sanitary lagoons and Subtitle D ("sanitary") landfill. The discussion relating to these facilities is included under the SNLA subheading.

A listing of active and inactive waste sites on KAFB that have been or are being used by DOE-AL and its contractors is presented in Appendix H. This listing presents information on the type of waste handled, type of facility, and release controls.

Because the alluvial sediments have relatively high permeability, contaminants could readily migrate through the vadose zone if sufficient water is available to act as the driving force to establish and maintain the downward migration of contaminants. However, the thickness of the unsaturated sediments (west of the faults - Figure 3-24) should allow some filtration of contaminants and reduce the potential for migration, if the effluent source is not large enough to maintain this downward migration of contaminants. The area east of the Hubbell Springs Fault is likely to be more vulnerable to groundwater contamination because of the shallow water table and the permeability of the sediments. The scattered wells on KAFB (as opposed to concentrated well fields in the City of Albuquerque) help minimize drawdown, thereby reducing the rate of contaminant migration to the wells on KAFB (ES, 1981).

3.4.2.1 Sandia National Laboratories-Albuquerque

As noted in the waste site listing presented in Appendix H, more than 115 potential

CERCLA and Resource Conservation and Recovery Act (RCRA) waste sites have been identified at SNLA and described in the Comprehensive Environmental Assessment and Response Program (CEARP) report (DOE-AL, 1987). In addition to these sites, several sites not included in the CEARP Report were identified during the Survey and during the facility assessment of solid waste management units (Kearney and Lawson, 1987). These sites are also described in the Appendix H tabulations.

The paragraphs that follow describe those sites at SNLA which have the greatest potential for impacting groundwater quality, as well as selected sites typifying those that have a lower potential for impacting groundwater quality. In order for hazardous substances and other contaminants to migrate through the geologic column and contaminate the water table aquifer at KAFB, there must be a source of contaminants and a mechanism to transport them through the unsaturated (vadose) zone to the saturated zone of the aquifer. Because of the high evapotranspiration rate in the area (Figure 3-27), precipitation alone is unlikely to provide the mechanism except where groundwater occurs at a very shallow depth (several tens of feet). Thus, in general, liquid effluents are more likely to transport contaminants to the water table when both the volume has been large and the discharge period has been long in relation to the depth of the water table.

Sites with High Potential for Groundwater Contamination

The potential for groundwater contamination is considered high where the groundwater is relatively shallow and effluent discharges have been sufficiently large to transport contamination to the water table. Geographically, shallow groundwater exists east of the Hubbell Springs and Tijeras Faults (Figure 3-24). Several waste sites are associated with high potentials for contaminating the groundwater, as described below:

- Septic tank and drain fields at Building 9990 (Figure 3-24; Appendix H, CEARP ID Number 116). This septic system has received film-developing effluent believed to contain spent acids, solvents, and silver, among other hazardous substances. Groundwater at this site is estimated to be at a depth of 100 feet or less.

- Unlined surface impoundments at the Old Burn Site (Figure 4-7; Appendix H, CEARP ID Number 68). Burning experiments with fuel oils were performed on targets containing depleted uranium, lead, and thorium. Groundwater at this site is estimated to be at a depth of 100 feet or less.

- Unlined surface impoundments at the Lurance Canyon Burn Site (Figure 3-29; Appendix H, CEARP ID Number 13). One large unlined surface impoundment (and potentially another surface depression located during the Survey) received wastewater contaminated with JP-4 and perhaps other hazardous substances utilized in burning experiments. Burning was performed in lined pits by floating JP-4 on water. This water was discharged to the surface impoundment(s) to control the burning rate or at the conclusion of experiments. Discussions during the Survey with knowledgeable SNLA staff indicated that the impoundment(s) was (were) not extensively used. Based on measurements in the Lurance Canyon well made during the Survey, groundwater at this site is estimated to be at a depth of about 70 feet.

- Septic tank and drain field at Building 9820 (Figure 4-9; Appendix H, CEARP ID Number 49). This septic system is suspected of receiving wastewater contaminated with solvents and high explosives. Groundwater is estimated to be at a depth of 100 feet or less.

Sites with Moderate Potential for Groundwater Contamination

The potential for groundwater contamination is considered moderate where the groundwater is deep and effluent discharges have been sufficiently large to transport contamination to the water table. Geographically, deep groundwater exists west of the Sandia Fault (Figure 3-24). Groundwater at intermediate depths exists within the en echelon fault zone east of the Sandia Fault and west of the Hubbell Springs and Tijeras Faults. Several waste sites are associated with moderate potentials for contaminating the groundwater, as described below:

- Chemical Landfill, Surface Impoundment, and Drum Storage/ Repackaging Area (Figures 3-29 and 4-1; Appendix H, CEARP ID Numbers 73 and 74). Disposal records show that this 1.9-acre site in Technical Area III received acids, bases, metals, metal-containing solutions, and volatile and semi-volatile organic compounds (Weston, 1984). Chromic acid was disposed of in an unlined pit and is currently being disposed of in a lined surface impoundment. The disposal trenches and pits have been covered with dirt. Coring performed in 1981 indicated that a chromium front had advanced to a depth of about 46 feet in the vadose zone based upon a single boring, the location of which could not be confirmed later. Later Coring performed in 1983 showed the front to extend to a depth of 55 feet (Thompson and Smith, ca. 1983), however the locations of these borings could not be correlated with the 1981 boring. If in fact chromium is moving downward without any appreciable driving head, it would appear to invalidate the prediction developed by Wierenga (1982; cited by Thompson and Smith, ca. 1983) of a travel time of 445 years for the peak concentration to reach the groundwater. The potential downward migration rate appears to be about 10 feet/year. This would imply a vertical travel time from the landfill to the groundwater on the order of 50 years. Additional borings in the 1983 locations would be necessary to compute an accurate travel time. Thompson and Smith (ca. 1983) also indicate that the chromium in the contamination front should travel as a conservative species without effects by sorption phenomena. Spillage/leakage to the ground surface from the Drum Storage/Repackaging portion of the facility was noted during the Survey. Additional details are provided in Section 4.1.1.1. Groundwater at this site is at a measured depth averaging about 485 feet.

- Sandia Engineering Reactor Facility (SERF) Liquid Waste Disposal Drain Field and Surface Impoundments (Figure 3-24; Appendix H, CEARP ID Numbers 4 and 5). The liquid wastewater disposal system for SERF in Technical Area V received all wastes from the main reactor, experimental facilities, and support facilities (Buildings 6580 through 6583). The majority of the radioactive wastewater was generated when the primary coolant water filter was backflushed and when the demineralizer resins were regenerated and rinsed. The drain field was used from 1963 until

1967 when it failed. During its operation, the SERF discharged about 20 curies of cesium-137, cobalt-60, and other activation products dispersed to the subsurface environment in about 6.5 million gallons of wastewater. Between 1967 and 1971, another 12.0 million gallons of wastewater with 14 curies of activation products was discharged to the surface impoundments (designated locally as Lake 1 and Lake 2) with clay bottoms. Data provided by SNLA health physics staff in Technical Area V indicate that the activation products decayed rapidly. Only about 1 curie of radioactivity remains in the environment at very low concentrations (not exceeding a few pCi/g or pCi/L). Wastewater, primarily cooling water, is currently being discharged to Lake 2 at a rate up to 100 gpd (DOE-AL, 1987). No groundwater monitoring is performed at this waste site. Field conductivity measurements made with an EM-31 during the Survey were inconclusive with regard to the presence of any potential shallow plumes extending from the surface impoundments, because of interference with nearby fences and other metallic objects. Groundwater at this site is estimated to be at a depth in excess of 450 feet.

- Radioactive Waste Burial Ground and Low-Level Classified Waste Disposal Facility (Figures 3-12, 3-24, and 4-2; Appendix H, CEARP ID Number 76 and RFA Nos. 24-30, 115, and 116). The active 1.6-acre radioactive burial site in Technical Area III has received a variety of low-level radioactive wastes, including radioactive hazardous solid and liquid wastes. In 1967, approximately 270,000 gallons of low-level radioactive wastewater with about 1 curie of activation products was received from the SERF (DOE-AL, 1987; see description above). Over the 30 years of operation, the primary radionuclides disposed of at these sites include uranium, tritium, plutonium, cobalt-60, and cesium-137. Known hazardous wastes placed in the burial site include naphthalene scintillation solution, acids, solvents, and lead. Waste radioactive oils have also been disposed of at this site. Based on information obtained in interviews during the Survey, this site meets the definition of a mixed waste site. Inactive trenches have been covered with dirt and inactive classified-waste disposal pits have been backfilled with dirt and covered with concrete (Millard et al., 1987). During the Survey, precipitation

runon and dewatering water from a trench under construction was observed to reach some of these disposal trenches/pits, causing ponding and allowing surface water to potentially contact waste (Section 3.3.2.1). Additional details are provided in Section 4.1.1.1. Groundwater depth at this site is estimated to be in excess of 450 feet.

- Old Acid Waste Line Outfall (Figure 4-9; Appendix H, CEARP ID Number 46). The inactive Old Acid Waste Line was used to discharge about 130,000 gpd of acidic wastewater from Technical Area I to an open ditch that emptied into the Tijeras Arroyo (Figure 3-8). Although most of this effluent was from cooling tower blowdown, the wastewater contained approximately 200 gpd of chromic acid and an unknown quantity of ferric chloride probably associated with etching processes. Soil samples in the outfall area have shown high levels of ferric chloride, but no chromates were detected (DOE-AL, 1987). Groundwater depth at this site is estimated to be in excess of 450 feet.

- Contaminated Septic Drain Fields, Technical Area II (Figure 3-24; Appendix H, CEARP ID Number 48). Industrial and sanitary wastes from the Technical Area II buildings have been and are currently being discharged through a system of septic tanks and drain fields without groundwater monitoring. Buildings 904 and 907 drain systems may be contaminated with high explosives and solvents from process washdown (DOE-AL, 1987). These relatively large and repetitive wastewater discharges within a limited area of SNLA may be sufficient to transport contaminants to the groundwater, which is estimated to be at a depth in excess of 450 feet.

- Oil Surface Impoundment, Technical Area IV (Figure 3-24; Appendix H, CEARP ID Number 77). This unlined surface impoundment on the south side of Technical Area IV was used for disposal of water contaminated with small quantities of waste hydraulic oil from sumps near the large accelerator oil tanks. This impoundment is currently undergoing remediation. A new liner is being installed (DOE-AL, 1987). During the Survey, interviews with SNLA staff indicated that a similar unlined surface impoundment receives wastewater with small quantities of

waste oil. Groundwater is estimated to be at a depth in excess of 450 feet at these surface impoundments.

Sites with Low Potential for Groundwater Contamination

The potential for groundwater contamination is considered low where the effluent discharges have been relatively small in relation to the depth of groundwater. The effluent discharges remain the principal mechanism for contaminant transport to the water table. In some instances where the groundwater is shallow (east of the Hubbell Springs and Tijeras Faults), infiltration of precipitation alone may be sufficient to transport contaminants to the water table. Examples of these waste sites, none of which have groundwater monitoring, are described below:

- Old and New Aerial Cable Test Sites (Figure 4-7; Appendix H, CEARP ID Numbers 81 and 82). Debris from scrap yards and open dumps, as well as from experiments, including explosives, rocket propellant, lead, beryllium, and depleted uranium, is believed to be contaminating the ground surface in the vicinity of these test facilities (DOE-AL, 1987). During the Survey, spilled oil and fuel were observed at the locations of diesel electric generators. Interviews with SNLA staff indicated that such spillage was a common occurrence. Groundwater is estimated to be at a depth of less than 100 feet at these aerial cable test sites.

- Mineshafts and Adits (Figure 4-7; Appendix H, CEARP ID Numbers 28 and 67). DOE-AL (1987) reports that aluminum-cased rocket motors were burned in a mineshaft near the Frustration Site and that chemical, radioactive, mixed, and solid wastes may have been disposed of in some mineshafts and adits. SNLA staff interviewed during the Survey indicated that solid wastes were disposed of in mineshafts near the New Aerial Cable Test Site. ES (1981) reports that in 1971 several mineshafts were located that exhibited radiation levels of two to three times background levels, but that in 1980 no increase above background radiation was observed at these mineshafts. Other details are provided in Section 4.5.2.3. The potential for groundwater contamination could be higher where mines were taken to the groundwater or where they actually

encountered groundwater in their operation. Groundwater depths at these locations are expected to be shallow.

- Building 9939 and 9960 Septic Drain Fields (Figure 4-9; Appendix H, CEARP ID Number 106). High explosives machining was performed in these buildings. Washdown water and sanitary wastewater were discharged to septic tanks and drain fields at these two buildings (DOE-AL, 1987). Groundwater is estimated to be at a depth of less than 300 feet at these sites.

- Building 9940 Firing Site (Figure 4-7; Appendix H, CEARP ID Number 108). According to DOE-AL (1987), Building 9940 was used for explosive shots for many years, including those using depleted uranium and chromium. Interviews with SNLA staff during the Survey suggest that the test pad was regularly washed down after explosive testing. Groundwater is estimated to be at a depth of less than 300 feet at this site.

- Thunder Range Crater Site (Figure 4-7; Appendix H, CEARP ID Number 56). A series of nonnuclear high explosive tests were conducted using charges ranging in size from about 0.1 to 15 metric tons of high explosives. Some high explosive residuals may remain in the area. In addition, a potassium permanganate solution was used to determine the volume of the craters (DOE-AL, 1987). Groundwater is estimated to be at a depth in excess of 450 feet at this site.

- Building 9950 Septic Drain Fields (Figure 3-24; Appendix H, CEARP ID Number 116). Interviews with SNLA staff during the Survey indicated that effluents from the photographic laboratory were discharged to the septic drain field for Building 9950. These effluents are likely to contain solvents as well as silver. Groundwater is estimated to be at a depth in excess of 450 feet at these sites.

- Building 9956 Sump (Appendix H, CEARP ID Numbers 109 and 112). Beryllium and depleted uranium were used in some experiments conducted in Building 9956. The residues were washed down the drain

and into an outside sump (DOE-AL, 1987). Groundwater is estimated to be at a depth in excess of 450 feet at this site.

- Radioactive Burial Site, Technical Area II (Figure 3-24; Appendix H, CEARP ID Number 1). For 10 years prior to 1959 a variety of radioactive and potentially radioactive hazardous chemical solid and liquid wastes were disposed of in this burial ground. The primary radionuclides disposed of here include depleted uranium, tritium, radium, cobalt-60, and cesium-137. Additional details are provided in Section 4.1.1.1. Groundwater is estimated to be at a depth in excess of 450 feet at this site.

Central Training Academy

With the mission of training DOE's Safeguards and Security personnel, the CTA has two distinct campus areas. The main campus area is located on the old Manzano Administrative Area (Figure 3-29), which is under control of KAFB. The second campus is a 675-acre area known as the Live Fire Range (LFR) (Apodaca, 1981; see Figure 3-29).

Three areas of the CTA have low to moderate potential for contaminating the underlying groundwater, namely the septic drain field systems, the LFR, and an oil spill of March 1987. Because the groundwater is estimated to be deeper at the Manzano Area campus than at the LFR campus, the septic drain fields and the oil spill site at Manzano Area are associated with a low potential for groundwater contamination. The area of the oil spill was cleaned up and contaminated soil removed within a month of the incident (Smith, 1987). A moderate potential for groundwater contamination exists on the LFR at the septic drain fields, but only a low potential exists at the actual firing range site. The LFR (Appendix H, CEARP ID Number 95) is a target area for pistol and rifle practice. Lead particles and bullets that have been scattered in the area behind the targets could be leached by precipitation and the lead (in solution) carried to the water table.

Transportation Safeguards Division Facility

At the Transportation Safeguards Division Facility (TSD in Figure 3-24), the septic drain fields are associated with a low potential for contaminating the shallow groundwater.

Life Sciences 1 Facility (LS-1)

Several locations at LS-1 (Figures 3-14 and 3-29) were noted during the Survey as having the potential for contaminating the groundwater, which lies at a depth of approximately 55 feet (ES, 1981). LS-1, operated by Los Alamos National Laboratories, conducts biodynamics studies with sheep. After autopsy, sheep carcasses are disposed of in a shallow trench, which is occasionally covered with soil. At least three covered trench areas were observed during the Survey. These burial trenches have a low potential for contaminating the groundwater, because uncontaminated remains are buried. Some biodynamics experiments using explosive charges are conducted in Lake Christian, a lined surface impoundment. The condition of the liner is unknown, but may be leaking because of its age and the effects of explosive testing. Therefore Lake Christian has a high potential for contaminating the shallow groundwater. Contaminants of concern are nitrates and organic compounds associated with the explosives. The septic drain field is assigned a moderate potential for groundwater contamination because it does not possess the hydrostatic head found at Lake Christian. For many years the drain field has received repeated discharges of wastewater.

Manzano Base

Other than the CTA discussed above, no SNLA facilities were observed at Manzano Base that were considered likely to contaminate the groundwater.

Kirtland Air Force Base

Several KAFB facilities have been used by DOE-AL for the disposal of solid and liquid sanitary wastes. These waste sites are briefly described below in relation to their potential for groundwater contamination:

- KAFB Sanitary (Subtitle D) Landfills (Figure 3-24; Appendix H, CEARP ID Numbers 29 and 80). The Department of Defense has operated five sanitary landfills and several surface dumps within the present boundaries of KAFB. Landfill 1 is known to contain some hazardous wastes which may be partially the responsibility of SNLA. Landfills 2 and 3, used for the disposal of wastes from military and SNLA activities from

Management finding). Sampling and analysis of tunnel effluent and pond water and sediments is planned by the Survey.

4. Lack of Information on Nonradioactive Constituents in Groundwater. There is a general lack of information on the nonradioactive quality of the groundwater at NTS. Groundwater samples have not been analyzed for organics other than PCBs and trihalomethanes, and are analyzed infrequently for nonradioactive inorganics. (Monitoring of water supply wells for volatile organic compounds will be required in 1991 under provisions of the 1986 amendments to the Safe Drinking Water Act.) Unidentified contaminants could potentially be present as a result of decontamination and other operations at the NTS. For example, Area 6 has several water supply wells and several potential sources of contamination. These include a decontamination pond, two steam cleaning effluent ponds, and three sewage lagoons, all of which may be receiving solvents, dilute acids and caustics, and metal-containing liquids. Water from the decontamination pond was sampled in June 1986 and found to contain 130 ppb acetone, 250 ppb chlorobenzene, 45 ppb methylene chloride, and 36 ppb total xylenes. Although the regional water table is quite deep, the potential for groundwater contamination exists from repeated recharge at such wastewater disposal sites.

5. Use of Wells for Waste and Wastewater Disposal. Groundwater contamination may result from the presence of open wells that can be used for waste disposal. The permit status of such wells is addressed in Category II findings in the Surface Water Section 3.3.4.2.2 and the Waste Management Section 4.1.3.2.1. However, the nature of the facility and the waste discharged determine whether environmental contamination occurs, not the presence or absence of a permit. Although groundwater in many on-site areas may already be contaminated from underground nuclear testing, the addition of other waste materials, including wastewater, may increase the migration potential of existing radionuclides, as well as serving as an additional source term for radioactive and nonradioactive contaminants. Additionally, while certain wastes are disposed of into test cavities and chimneys, some wastes may go into wells which were drilled as exploratory holes and may not be otherwise contaminated.

"Injection wells" of various kinds, depths, and uses exist at the NTS. Details are presented in Sections 3.4.2.4 and 3.4.2.6. Some injection wells are shallow holes, possibly abandoned emplacement holes, which are used for wastewater disposal. Discharges of wastewater into these injection wells are creating probable soil contamination and the potential for groundwater contamination. Although the depth of these wells (48-100 feet where known) is well above the regional water table (500-3,000 feet below the surface), the potential for

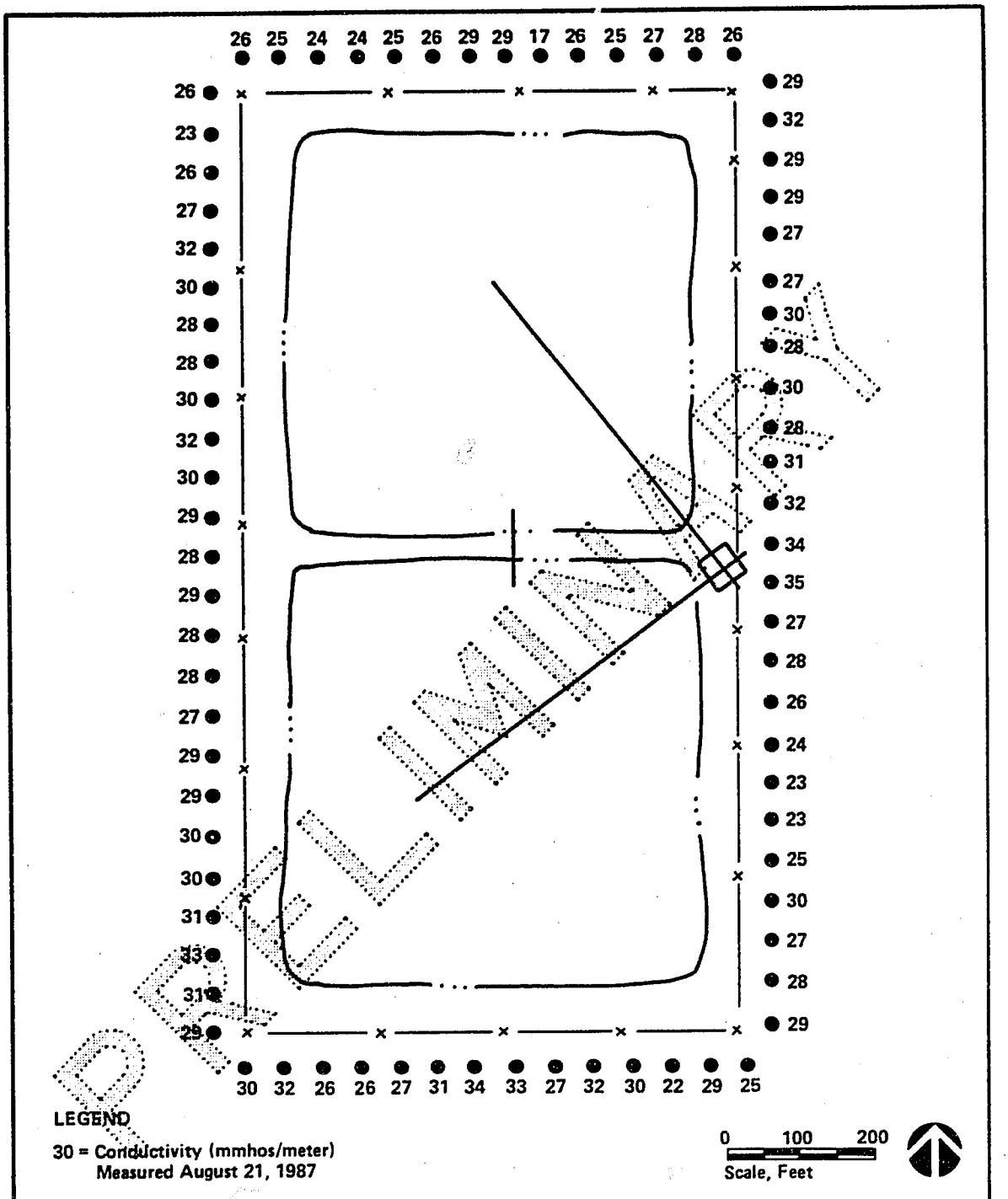
groundwater contamination is greater than that for discharges directly to the land surface (see Finding 3.2.4.3.2 in the soils section) because infiltration rather than evaporation is a major pathway.

A post-shot (PS1a) reentry hole at U8d has been used for disposal of liquids contaminated with radioactivity, including liquid waste from an experimental farm. Another liquid waste disposal hole, U9ITS-Y30-PS1a, was used for similar wastes (Forry, 1987). No information is available for this second deep hole. However, the U8d-PS1a hole received an estimated annual volume of 2.5×10^4 gallons during 1986. The cumulative volume since June 1984 is 8.0×10^4 gallons. Both cobalt-60 and cesium-137 were present in these wastes. No breakdown between these two nuclides is available, but the average concentration is 1.0×10^3 pCi/l and the average annual discharge is 7.0×10^{-5} Ci. It is not known if other wells, such as Pahute Mesa No. 1, have been used for waste disposal.

6. Wastewater Discharges to Surface Impoundments. Discharges of wastewater to unpermitted sumps, lagoons, and ponds are creating the potential for groundwater contamination. The permit status of such discharges is addressed in a Category II finding in the Surface Water Section 3.3.4.2.3, and the status of such facilities with respect to RCRA regulation is covered in a Category II finding in the Waste Management Section 4.1.3.2.1. Section 3.4.2.6 lists these surface impoundments. The nature of such impoundments and the wastes discharged into them determines their potential for environmental contamination, not their permit status. Although the regional water table is 500-3,000 feet below the surface, infiltration, as well as evaporation, is an important mechanism for water movement from these ponds. Thus, recharge from standing water at these point sources can occur, and such recharge creates the potential for groundwater contamination. Survey-related sampling and analysis is being conducted at several of these potential sources to determine the nature and concentration of possible contaminants.

3.4.4.4 Category IV

1. Absence of Well Purging Requirement in Sampling Procedure. The REECo and EMSL well-sampling procedures do not require that wells be purged before sampling. Therefore, analytical data may not represent concentrations of substances in the aquifer at the time of sampling. The purging of three to five well volumes is standard practice to ensure that actual formation water is being obtained.



Source: Sketch by D. Riddle and P. Feldhausen, 1987

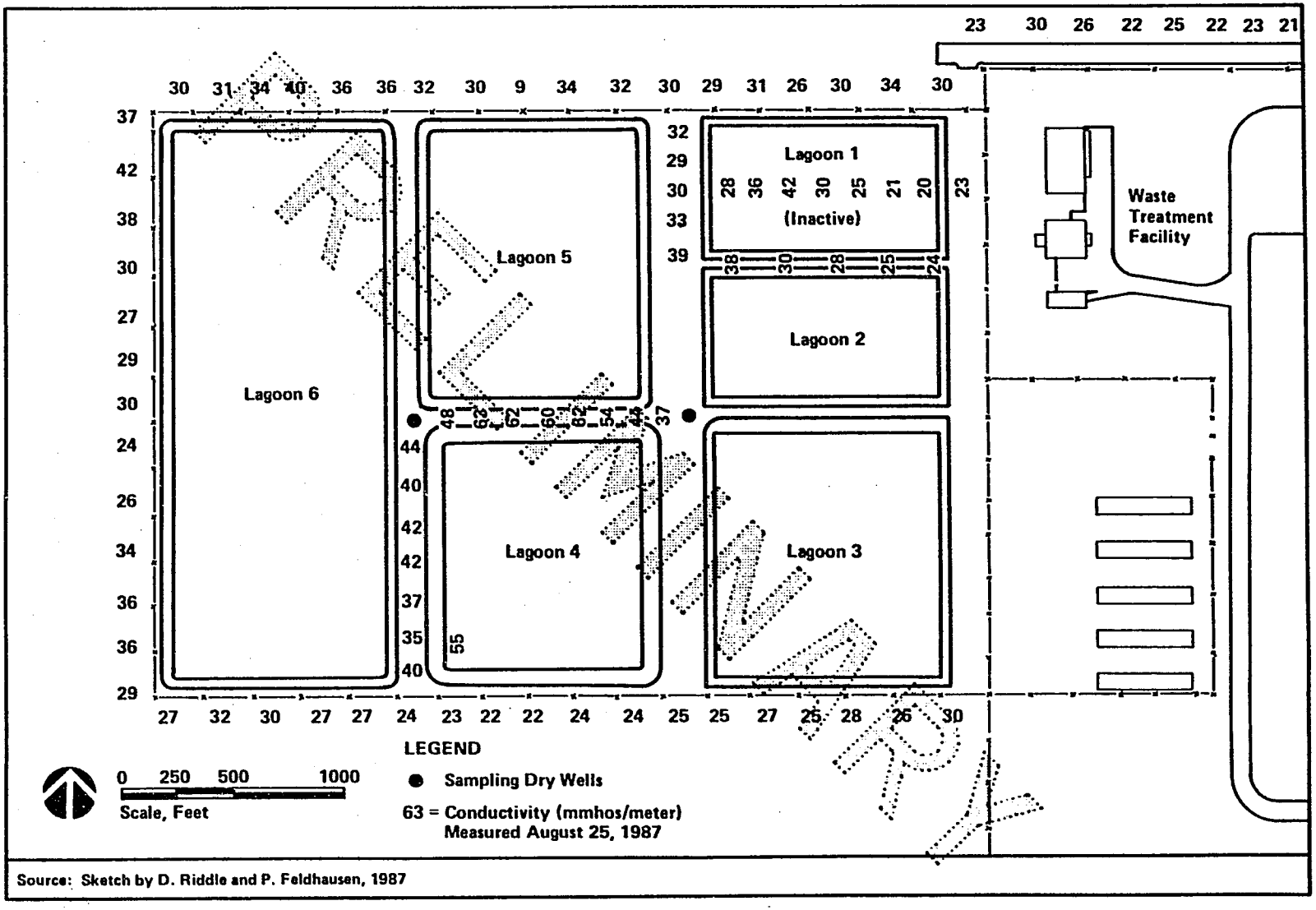
EM-31 FIELD CONDUCTIVITY SURVEY DETAIL OF KAFB SANITARY SEWAGE STABILIZATION LAGOONS

FIGURE 3-30

3.4.2.3 Inhalation Toxicology Research Institute

ITRI maintains 6 surface impoundments (wastewater lagoons; Lagoon 1 is inactive) covering approximately 5 acres which receive approximately 30,000 gpd of sanitary wastes (see Figures 3-29 and 3-31). In addition, the wastewater discharge contains small quantities of low-level radioactive effluents and laboratory chemicals (Thompson, 1987a). Until the early 1980s these impoundments may have received hazardous wastes. Additional discussion is provided in Sections 3.3.2.3, 4.1.1.3, 4.3.2.3, and 4.5.1.3.

Lagoon 1, unused for 17 years, is covered with 1 foot of soil because of contamination by cesium-137. In 1973, the inventory of radionuclides in the six impoundments included 1.8 curies of cesium-137, 0.37 curies of cerium-144, and 1.1 curies of strontium-90 (McClellan, 1973). McClellan (1984) reports that in 1983 the lagoon water was contaminated with mercury at concentrations (0.007 mg/L) above its maximum contaminant level (MCL = 0.002 mg/L) and nickel at concentrations (0.035 mg/L) above its water quality criteria (based on human consumption of water and fish of 0.013 mg/L). ITRI has reported that analyses of potable water at that time show equal mercury concentrations and higher concentrations of nickel than in the lagoon water. Subsequent later years' analyses using a different outside lab show no repeat of these values for either metal. In addition, nitrate concentrations several times the drinking water standard have been recorded in the recent past. The problem of high nitrate values in the lagoon water samples was investigated recently by ITRI in conjunction with an application to the State of New Mexico for a discharge permit. Lagoon water was sampled (four samples taken from each of four different lagoons) on November 11, 1987, kept on ice and analyzed the same day by ion chromatography. The highest nitrate value for all 16 samples was 1.2 mg/L (as N). Another suite of lagoon water samples was taken on November 25, 1987, in conjunction with sampling being conducted by the State of New Mexico. These samples were preserved with sulfuric acid and refrigerated. They were analyzed for nitrate by Hager Labs in Denver, using EPA Method 418C. The highest nitrate value reported was 0.7 mg/L for Lagoon 2, while the remaining lagoons were reported as being less than detectable at a detection limit of 0.05 mg/L. In reviewing the sample handling and storage procedures in effect when the previous samples were



Source: Sketch by D. Riddle and P. Feldhausen, 1987

EM-31 FIELD CONDUCTIVITY SURVEY OF THE ITRI SANITARY LAGOON SYSTEM FIGURE 3-31

analyzed for nitrate, ITRI asserts that the high values were due to lack of preservation and/or refrigeration between the time the samples were taken and when they were analyzed.

ES (1981) reports that Lagoons 1, 2, and 3 have liners placed over the excavated soil bottoms, whereas Lagoons 4, 5, and 6 have compacted soil bottoms but no liners. The condition of these liners after nearly 30 years of service is unknown. The compacted soil bottoms of the three other lagoons are unlikely to be effective barriers to contaminant transport, particularly at Lagoon 6, which is perturbed by wetland plant growth. The constant head maintained in Lagoons 3 and 5 and during the wetter seasons in Lagoon 6 would likely cause breakthrough of contaminated water within a relatively short period of time. The potential for groundwater contamination resulting from these six surface impoundments is considered high.

From the late 1960s until 1986, ITRI also discharged intermediate-level radioactive effluents to two lined surface impoundments (hot ponds), each about 20 feet square and about 5 feet deep. Other hazardous substances may have been discharged to these impoundments during their history of operation. The polyethylene liners beneath the hot ponds exhibit signs of appreciable deterioration and the condition of the underlying concrete is unknown. A gravel sump (now closed) adjacent to the hot ponds may have also received similar wastes.

Discharges to the hot ponds were discontinued in August 1986, at the request of DOE-AL (Thompson, 1987a). Currently, the liquid level in the ponds ranges from about 0.5 to 3 feet as water is added to control fugitive dust emissions. The potential for groundwater contamination resulting from these two surface impoundments is considered high.

Groundwater monitoring is not performed at the ITRI surface impoundments. The water table is expected to be shallow because ITRI lies east of the Hubbell Springs Fault. The water table is at a depth of about 55 feet at the LS-1 facility, which is approximately 1 mile northeast of ITRI (Figure 3-29). Borings at these lagoons have not encountered groundwater at depths of about 60 feet, and dry wells at depths of 17.5 and 24 feet have remained dry. Experience suggests that, in a dry climate, where the migration of moisture through the vadose zone is predominantly vertical, water is not expected to accumulate in dry wells such as those at the ITRI

sanitary lagoons. Field conductivity measurements made during the Survey with an EM-31 indicate generally higher readings in the northwest corner of Lagoon 6 (Figure 3-31). These higher readings could indicate a zone of shallow groundwater movement derived from the lagoons. The topographic setting of ITRI and its proximity to the Hubbell Springs Fault suggest that groundwater flow beneath ITRI may be toward the Isleta Indian Reservation to the south and southwest.

3.4.3 Environmental Monitoring Program and Data

The sections that follow describe the groundwater monitoring program for DOE-AL facilities at KAFB. Two programs have been initiated, radiological analyses at the groundwater production wells and RCRA monitoring at the Chemical Landfill. Groundwater monitoring is not performed at any of the other SNLA sites with potentials for impacting groundwater quality (see Section 3.4.2) or those operated by CTA, Transportation Safeguards Division, ITRI, or KAFB (sanitary lagoons in particular).

3.4.3.1 Sandia National Laboratories-Albuquerque

Radiological Program at SNLA

On-site groundwater monitoring and reporting have been conducted routinely for radioactive constituents in the water pumped from KAFB wells and the data reported in the annual environmental monitoring reports prepared by SNLA. Groundwater samples for radiological analysis are collected from KAFB wells in use at the time of sample collection. Thus, the sampled wells may change from one year to the next (Millard et al., 1987). Recent monitoring data obtained from KAFB are presented in Table 3-26. Except for some observations at Coyote Springs, the data presented in annual monitoring reports (Millard et al., 1987) are at or near the minimum detection limits and are well within the groundwater standards for New Mexico (Table 3-15). The elevated gross alpha and beta data for Coyote Springs may be above drinking water standards (40 CFR 141). Specific analyses for radium-226, radium-228, and strontium-90 would be needed to further evaluate the ability of the spring water to meet these standards.

TABLE 3-26

RADIOACTIVITY IN DRINKING WATER AT KAFB WELLS*

PARAMETER	CONCENTRATION (PICOCURIES PER LITER)																		
	WELL NO. 1		WELL NO. 2	WELL NO. 4	WELL NO. 8	WELL NO. 11		WELL NO. 12	WELL NO. 13	WELL NO. 14	EAST FIRE STATION	WEST FIRE STATION	LOUIS AND GIBSON	COYOTE SPRINGS			BUILDING 370		
	8/25/84	12/11/84	5/5/85	5/5/85	5/1/85	8/25/81	5/5/85	8/25/81	8/25/81	8/25/81	8/25/81	8/25/81	8/25/81	1/15/81	12/28/81	2/1/85	1/13/85	9/22/85	12/2/85
Gross Alpha	2.	3. ± 1	<1.	<1.	<1.	2.	1. ± 1.	2.	<1.	<1.	2.	2.	2.			<3 3	2.7±0 4 (A)	2.4±0 3 (A)	1 0±0 4 (A)
Gross Alpha, Dissolved														12.	5 4 ± 3 0		3 6± 0 6 (B)	3 3±0 6 (B)	1 3±0 5 (B)
Gross Alpha, Suspended														1.	1 2 ± 0 9				
Gross Beta			5.0 ± 2.0	4. ± 2.	4. ± 2.											31.1±8 2	3 0 ± 0 6 (C)	3 4 ± 0 8 (C)	2 0 ±0 7 (C)
Gross Beta, Dissolved														29	41 5 ± 5 4				
Gross Beta, Suspended														3	0 0 ± 10 0				
Cobalt 60			<4.7	<4.6	<4.7									5.		<4 3			
Chromium 51			<34.	<28.	<17.											<26.			
Cesium 134			<3.4	<3.8	<3 5											<3 6			
Cesium 137			3.3 ±2.9	<3.0	<0 23											<2 2			
Europium 152			<7.0	<8.9	<9.4											<0 5			
Europium 154			<6.7	<8.6	<6.9											<5 9			
Niobium 95			<3.3	<1.6	<3.4											<2 4			
Potassium 40			<4.3	<8.7	<5 2									70		<2 7			
Ruthenium 103			<1.4	<0.25	<2.7											<21.			
Ruthenium 106			<22.	<14.	<24.														
Zirconium 95																<0 6			

(A). With Am-241 Reference; (B) With Natural U Reference; (C) With Cs-137 Reference.

*Data supplied by KAFB.

RCRA Program at SNLA

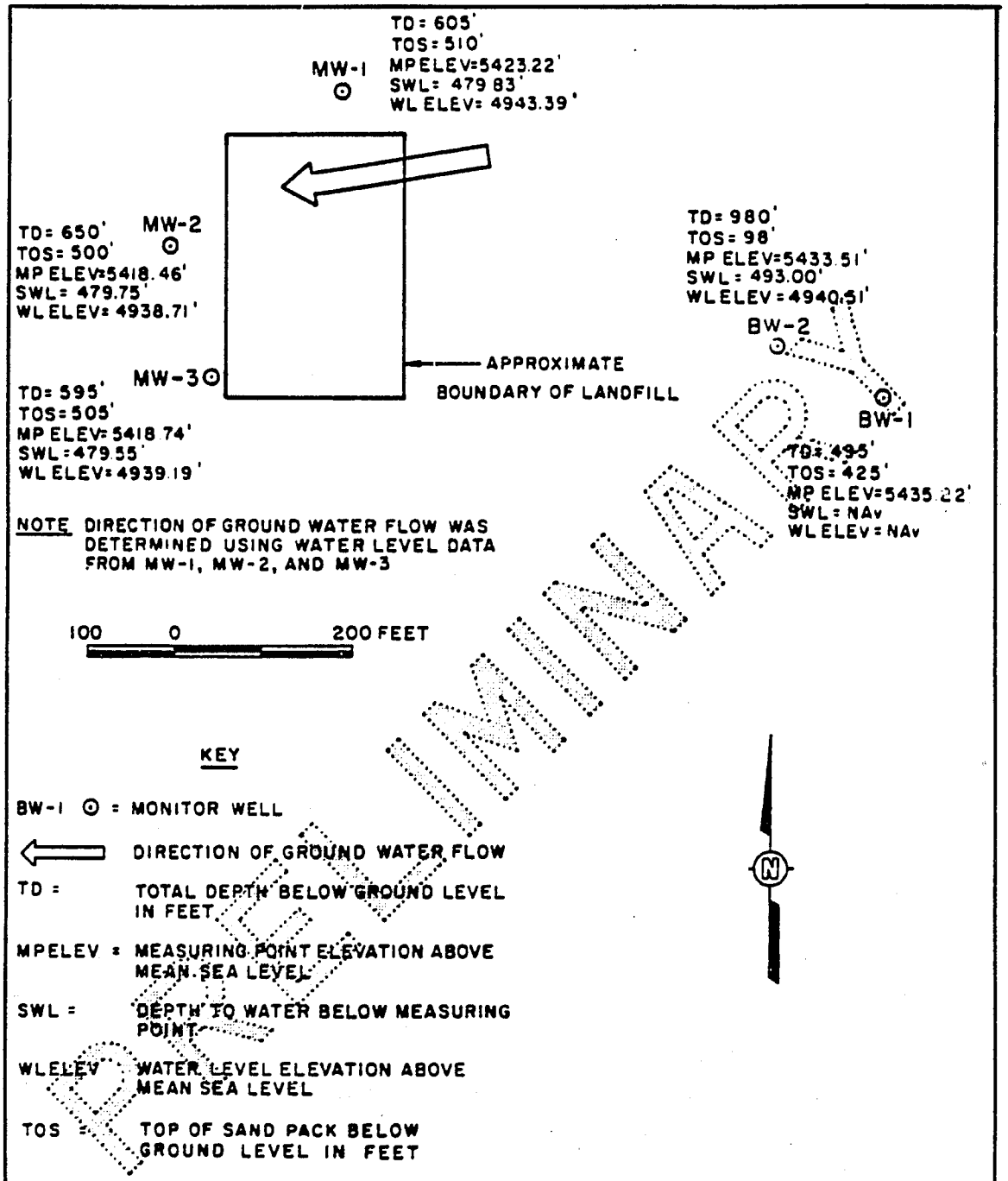
As noted in Section 3.4.2, the Chemical Landfill/Surface Impoundment and the Radioactive Waste Burial Ground in Technical Area III are both associated with a moderate potential for groundwater contamination. The Chemical Landfill/Surface Impoundment is an interim-status RCRA facility, and, as such, groundwater monitoring is performed in accordance with the Interim Status Groundwater Monitoring Plan developed by IT (1985).

On May 1, 1987 (52 FR 15937), DOE acknowledged EPA's role in regulating under RCRA the hazardous waste fraction of mixed wastes. This action confirmed the authority of EPA established under RCRA (42 U.S.C. 6901, et seq.) and the DOE-EPA Memorandum of Understanding of February 22, 1984. Based on information obtained during the Survey, the Radioactive Waste Burial Ground is a mixed waste facility subject to RCRA. However, no monitor wells required by RCRA have been installed at this facility.

Construction of Monitor Wells

SNLA's groundwater monitoring program consists of five monitor wells surrounding the inactive chemical landfill (Figure 3-32). The wells are of 2-inch-diameter stainless steel construction with 0.060-inch wire-wrapped flush joint screen. However, Well B-2 is constructed of nominal 6-inch carbon steel pipe and uses 10-foot sections of stainless steel screen with 0.030-inch wire-wrapped slots alternating with 20-foot sections of "blank" well casing. Total depths range from 495 feet to 980 feet (Figure 3-32). The static water level in each well usually lies above the bentonite plug and the top of the first well screen in all wells. In addition, none of the well screens are set at the same elevation so that the same portion of aquifer is sampled by each well. The elevations of the top of the well screen are listed below:

Monitor Well	Top of Screen Elevation (ft., NGVD)
B-2	4943.51
M-1	4888.22
M-2	4898.46
M-3	4893.74



Source: IT, 1987c

SNLA
CHEMICAL WASTE LANDFILL WELL LOCATIONS
AND GROUNDWATER ELEVATIONS

FIGURE 3-32

The carbon steel used in B-2 may influence samples obtained for analysis. Stainless steel and fluorocarbon resin materials meet well construction guidance (EPA, 1986), whereas carbon steel does not. In addition, the wells should have been constructed so that the potentiometric surface is not above the well screen (EPA, 1986). The well construction prevents the detection of "floaters and sinkers" (low and high specific gravity constituents), should they be of concern. The location of screened intervals and the total length of well screen may prevent collection of representative groundwater samples.

Upgradient and Downgradient Wells

In general, the groundwater at this site occurs at a depth of about 485 feet. During the first year of monitoring, the median groundwater elevations at the monitor wells are as follows:

Monitor Well	Median Groundwater Elevation (ft., NGVD)
B-1 (1 observation)	4950.43
B-2	4939.06
M-1	4939.87
M-2	4938.96
M-3	4941.84

As shown above, the groundwater gradient is relatively uniform across the site. Monitor Well B-1 is an upgradient well (EPA, 1986). However, this well usually does not yield sufficient water to be used as a monitor well. Statistical analysis of the groundwater elevation data for the first year of monitoring, using the 2-tailed, paired Student's t-Test at the 95 percent significance level, shows that the monitor well pairs B-2/M-3 and M-2/M-3 are significantly different. For the first year, M-1 and M-3 have been the upgradient monitor well, depending on the quarter of the measurement. Well B-2 is believed to be too remote from the facility to ensure that it immediately detects any statistically significant amounts of hazardous waste or hazardous constituents that may migrate from the waste management area to the uppermost aquifer.

In February 1987, M-1 was the upgradient monitor well and both B-1 and B-2, as well as M-2 and M-3, were downgradient. Well B-2, however, was upgradient during the second semi-annual sampling performed in August 1987, during the Survey. Groundwater elevations during the Survey were as follows:

Monitor Well	Groundwater Elevation (ft., NGVD)
B-1	4966.93
B-2	4939.81
M-1	4938.28
M-2	4937.66
M-3	4937.99

Well Purging and Sampling

All wells are purged and sampled with a "portable" Bennett submersible piston pump that is decontaminated with distilled water between each use. However, Well M-1 has a restriction in the casing and can be purged and sampled only by bailing. EPA guidance (1986) suggests bladder pumps or bailing be used for purging and sampling. However, bladder pumps are not effective at the groundwater depth encountered at the Chemical Landfill and bailing is very time-consuming.

During the Survey, the purging and sampling operation was observed. Although Well M-1 is purged and sampled by bailing, it is not purged until the turbidity of the water is less than 5 nephelometric turbidity units (NTU) (EPA, 1986). Purging of the other wells produced water that appeared to meet the 5 NTU criterion. Purging was performed until the temperature, pH, and specific conductivity values stabilized, as described in the sampling plan (IT, 1985). However, it was noted that the tubing for the Bennett pump and some pump accessories were not made of fluorocarbon resin materials and that the pump was lowered to depth such that the "bundling" tape (nonfluorocarbon resin material) around the air supply and water discharge tubes could have been placed below the water, and thus contribute to contamination observed in the sampled groundwater. Further, the purge water was disposed of on the ground, which could pose a health hazard if the groundwater is later determined to be contaminated. To date, contaminated groundwater has not been detected at this site.

Appropriate chain-of-custody forms were prepared and sample handling with field and trip blanks met EPA guidance (1986). One of the technicians was observed

placing his foot on the well casing adjacent to the monitor well. This could have caused inadvertent contamination of the groundwater within the well.

Statistical Testing of "Indicator Parameters"

In compliance with the interim-status groundwater monitoring requirements, four replicate samples of the four parameters of groundwater contamination [pH, specific conductance, total organic carbon (TOC), and total organic halogens (TOX)] were obtained at each of the four monitor wells during the first year's sampling. The median values for these indicator parameters are provided below:

Monitor Well	Indicator Parameter's Median Concentration			
	pH	Specific Conductance (µmhos/cm)	TOC (mg/l)	TOX (mg/l)
B-2	6.84	1100	4.55	0.025
M-1	6.96	1100	3.03	0.030
M-2	6.68	1125	2.69	0.022
M-3	6.76	1100	2.84	0.030

At the end of the first year of sampling, the replicated indicator parameters should be evaluated with the Student's t-Test to identify any wells that show a significant increase (or decrease with respect to pH) from upgradient to downgradient wells. The interim-status groundwater monitoring regulations are not specific to the Student's t-Test to be performed when evaluating replicated monitoring results for the four parameters of groundwater contamination (40 CFR 265, Appendix IV). However, the regulation does specify that a single-tailed test should be used for all parameters except pH, where a two-tailed test should be used. The regulations set the significance level at 0.99 percent.

As part of the Survey, the data (1986 sampling year) for each parameter were tested for significant changes between upgradient and downgradient wells using an unpaired t-Test which accounts for both equal and unequal sample variances. Results of these analyses showed the following:

- A significant decrease in pH between Well M-1 and both M-2 and M-3;
- A significant increase in TOX between Well M-1 and Well M-2.

These results suggest that resampling should have been performed shortly after the results were received and that plans for groundwater quality assessment should have been reviewed.

Other Results of Chemical Analyses

Overall, the groundwater from all four wells was found to be rich in calcium bicarbonate and chemically very similar. Nitrate levels were slightly elevated relative to the City of Albuquerque well fields, but are typical of nitrate levels in wells on KAFB. All inorganic, nonmetallic parameters were detected at concentrations below the primary and secondary maximum contaminant levels specified for drinking water.

All analyses for dissolved metal and total metal were similarly below drinking water standards, except for total chromium, total iron, and total manganese from Well M-1 (0.09, 1.2, and 0.07 mg/L, respectively). These concentrations may be related to the high turbidity found in M-1, as the total metals analyses were performed on unfiltered samples. None of the hazardous-substance list volatile or semi-volatile organic compounds were detected in any of the groundwater samples obtained in February 1987. Similarly, no pesticide, herbicide, or PCB compounds were detected. Gross alpha, gross beta, and radon (radium-226 and radium-228) were all within acceptable limits.

Groundwater Characterization

The hydrogeologic regimes at DOE-AL facilities on KAFB have only been partially characterized with respect to water levels, groundwater flow directions, aquifer hydrodynamic properties, and groundwater quality. The Chemical Landfill is the only waste site with groundwater monitoring wells. Groundwater level/quality data base(s) are not maintained by SNLA.

Characterization of the hydrogeologic regimes is needed to address the fate and effect of hazardous substances released to the environment. As noted in Section 3.4.1, the control that the faults along the eastern margin of the Rio Grande depression have on local groundwater transport is not well-known. Investigation of this topic would provide information on the transport of contaminants at waste

sites in the canyon areas, as well as those as far west as Manzano Base and Lovelace Road. Additionally, if the McCormick well, which is normally dry, was found to contain water during some periods of the year, then the potential for contaminating groundwater in Thunder Range, the 9000 Area, and Technical Area III might be significantly higher than estimated in Section 3.4.2.

3.4.3.2 Bendix Albuquerque Operations

BAO does not conduct any groundwater monitoring.

3.4.3.3 Inhalation Toxicology Research Institute

ITRI does not conduct any groundwater monitoring.

3.4.4 Findings and Observations

The section that follows discusses the hydrogeologic findings and observations that have resulted from this Survey of DOE facilities at the KAFB. Findings and observations associated with SNLA are discussed first, followed by those for ITRI. Those for the CTA, LS-1, and KAFB are included in the section for SNLA. More detailed descriptions of the potential sources of contamination and monitoring results than those briefly provided below are contained in Sections 3.4.2 and 3.4.3 and in Appendix H.

3.4.4.1 Category I

None

3.4.4.2 Category II

1. Inadequate monitoring of groundwater at the SNLA low-level mixed waste management facility. Groundwater monitoring is not being performed at the Radioactive Waste Burial Ground in Technical Area III (CEARP ID Number 76).

   Hazardous wastes containing radioactivity have been disposed of at the Radioactive Waste Burial Ground in Technical Area III, including naphthalene

PRELIMINARY

scintillation vials, solvents, acids, and lead. Mixed hazardous and radioactive wastes are subject to regulation under 40 CFR 260-270 as established by RCRA (42 U.S.C. 6901, et seq.), the DOE-EPA Memorandum of Understanding of February 22, 1984, and 10 CFR 962 (52 FR 15937).

The Radioactive Waste Burial Ground has received substantial quantities of liquid effluent. Surface water controls do not prevent runon from entering disposal trenches. These liquids provide a driving force for moving contaminants toward the underlying groundwater. No groundwater monitoring is performed to determine if the groundwater is being contaminated by waste disposal at this site.

2. Potential groundwater contamination from ITRI surface impoundments. Groundwater contamination may occur as the result of operation of the sanitary lagoons and "hot ponds" (surface impoundments) at ITRI.

Hazardous substances (as defined by CERCLA) have potentially been disposed of in surface impoundments (SIs) at ITRI. The underlying groundwater may become contaminated by these hazardous substances and migrate off-site. The aquifer underlying these SIs has been defined as "a declared underground water basin" and is regulated as a sole source of potable water by the State of New Mexico.

Groundwater monitoring is not performed at the locations of these SIs, specifically the hot ponds and the sanitary wastewater lagoons. The water table is expected to be relatively shallow because the site lies within the eastern portion of the en echelon fault complex west of the mountains. For example, the water table is at a depth of about 55 feet approximately 1 mile northeast of ITRI. However, borings at the lagoons have not encountered groundwater at depths to about 60 feet, and wells to a depth of about 24 feet have remained dry. The topographic setting of ITRI and its proximity to the Hubbell Springs Fault suggest that groundwater flow beneath ITRI may be toward the southwest.

ITRI, which lies adjacent to the boundary between DOE-controlled property and the Isleta Indian Reservation, operates a sanitary lagoon system consisting

of 1 inactive and 5 active lagoons with a total area of about 5 acres. Wastewater discharged at a rate of about 30,000 gpd maintains a constant head at 4 to 5 of the 5 active lagoons. The effluent consists primarily of sanitary wastes; small quantities of low-level radioactive effluents and small quantities of laboratory chemicals are also discharged to the lagoons. Lagoon 1 was closed and covered with about 1 foot of soil because of contamination by cesium-137. In 1973, the inventory of radionuclides in the 6 impoundments included 1.8 curies of cesium-137, 0.37 curies of cerium-144, and 1.1 curies of strontium-90. In 1984 the lagoon water was contaminated with mercury at concentrations to 0.007 mg/L [maximum contaminant level (MCL) of 0.002 mg/L] and nickel at concentrations to 0.035 mg/L [water quality criteria (based on human consumption of water and fish) of 0.013 mg/L]. In addition, nitrate concentrations several times the drinking water standard have been recorded in the recent past. Additional sampling and analyses by ITRI for mercury, nickel, and nitrate, however, have shown that the above data may be possibly suspect for those parameters.

Lagoons 1, 2, and 3 are lined, but lagoons 4, 5, and 6 have only compacted soil bottoms. The constant head would likely cause breakthrough of contaminated water within a relatively short time at Lagoons 4, 5, and 6 and where liners are in poor condition. The floor of Lagoon 6 is perturbed, as evidenced by wetland plant growth.

From the late 1960s until 1986, ITRI also discharged intermediate-level radioactive effluents to two lined SIs (hot ponds), each about 20 feet square and about 5 feet deep; other hazardous substances may have been discharged to these SIs. The polyethylene liners exhibit signs of appreciable deterioration; the condition of the underlying concrete is unknown. A gravel sump (now closed) reportedly adjacent to the SIs may have also received similar wastes. No information appears to be available on the size of the sump or on the nature of chemicals discharged to the sump, if any.

Sampling and analysis is planned.

3.4.4.3 Category III

1. Potential groundwater contamination at SNLA. The potential exists for groundwater contamination of the aquifer underlying active and inactive waste sites at SNLA, CTA, and KAFB as the result of the hazardous substances (as defined in CERCLA) disposed of or stored at these sites.

   Hazardous substances are suspected of being disposed of at most of the sites identified in Appendix H; some of the substances have been disposed of in the soil column, in surface impoundments, in drain fields, or on the surface of the ground. There is the potential for these hazardous substances to migrate through the geologic column and contaminate the water table aquifer. This aquifer has been defined by the State of New Mexico as a "declared underground water basin" and is regulated as a sole source of potable water.

   The potential for groundwater contamination can be divided into three cases (high, moderate, and low) based on the hydraulic factors responsible for transport of contaminants through the unsaturated (vadose) zone to the underlying saturated zone (aquifer). Each case, listed below, addresses the basis for this finding:

   a) The potential for groundwater contamination is high where the groundwater is relatively shallow (i.e., east of the Hubbell Springs and Tijeras Faults) and the effluent releases containing hazardous substances have been sufficiently large to transport contamination to the water table. Examples of these sites include:

      - Septic tank and drain field at Building 9990 (CEARP ID Number 116) -- This septic system has received spent chemicals from developing film. These chemicals are hazardous substances, and include acids, solvents, and silver. Groundwater at this site is estimated to be at a depth of 100 feet or less.

      - Unlined surface impoundments at the Old Burn Site and Lurance Canyon Burn Site (CEARP ID Numbers 68 and 13) -- These surface impoundments are believed to have received wastewaters

contaminated with small quantities of fuel (e.g., JP-4) as the result of burning studies. Groundwater at these sites is estimated to be at a depth of 100 feet or less.

- Building 9820 Drain System (CEARP ID Number 49) -- This drain system is suspected of receiving wastewater containing high explosive contamination and small quantities of solvents. Groundwater is estimated to be at a depth of 100 feet or less at this site.

- Lake Christian -- This LS-1 lined surface impoundment has been used for explosive biodynamic testing; the explosive testing and age of the liner makes its leak integrity questionable. Thus, nitrates and explosive residues could migrate to the shallow groundwater, estimated to be at a depth of about 55 feet.

b) The potential for groundwater contamination is moderate where releases of wastewater containing hazardous substances have been sufficiently large to carry contaminants to the water table, which is relatively deep. Examples of these sites include:

- Chemical Landfill and Surface Impoundments (CEARP ID Numbers 73 and 74) -- Disposal records show that this 1.9-acre site with four RCRA monitor wells received acids, bases, metals, metal-containing solutions (chromic acid disposed of in unlined SIs), and volatile and semi-volatile organic compounds. Chromium in the vadose zone has been detected to a depth of about 55 feet and is expected to migrate downward without attenuation by sorption phenomena. Although specific constituent contamination of the groundwater is not readily evident, statistical testing has shown differences between well pairs M-1/M2 and M-1/M-3 for pH, and M-1/M-2 for TOX. Groundwater is at a depth of about 485 feet at this site.

- Radioactive Waste Burial Ground and Low-Level Classified Waste Disposal Facility (CEARP ID Number 76; RFA Nos. 24-30, 115, and 116) -- This unmonitored (groundwater) 1.6-acre mixed waste

disposal site has received low-level liquid and solid radioactive and mixed waste over the last 30 years. Approximately 270,000 gallons of low-level radioactive wastewater was received from the SERF in 1967. Precipitation runon has also reached some disposal trenches/pits. Groundwater depth at this site is estimated to be in excess of 450 feet.

- KAFB Sanitary Waste Lagoons -- SNLA has discharged volatile organic compounds into the 14-acre facility consisting of two lined (cement sides and clay bottom) and unmonitored (groundwater) SIs with a constant head of about 5 feet. Analysis of the lagoon water has detected acetone at 2.2 mg/L, trichloroethane at 0.080 mg/L, and methylene chloride at 0.013 mg/L. These hazardous substances may have been discharged from the motion picture laboratory at Building 863. Groundwater at this site is estimated to be at a depth in excess of 450 feet.

- Old Acid Waste Line Outfall (CEARP ID Number 46) -- The old acid waste line was used to discharge about 130,000 gpd of acidic wastewater from Technical Area I to an open ditch that emptied into the Tijeras Arroyo. These wastewaters included about 200 gpd of chromic acid and an unknown quantity of ferric chloride. Soil samples in the outfall area have shown high levels of ferric chloride, but no chromates were detected. Groundwater at this site is estimated to be at a depth in excess of 450 feet.

- Oil Surface Impoundment, Technical Area IV (CEARP ID Number 77) -- This unlined SI located on the south side of Technical Area IV was used for disposal of water contaminated with small quantities of waste hydraulic oil from sumps undergoing remediation. A new liner is being installed. A similar unlined SI receives wastewater contaminated with small quantities of waste oil. Groundwater is estimated to be at a depth in excess of 450 feet at these SIs.

- Contaminated Septic Drain Fields, Technical Area II (CEARP ID Number 48) -- Industrial and sanitary wastes from the Technical

Area II buildings have been and are currently being discharged through a system of septic tanks and drain fields without groundwater monitoring. These relatively large and repetitive wastewater discharges within a limited area of SNLA may be sufficient to transport contaminants to the groundwater, estimated to be at a depth in excess of 450 feet.

c) The potential for groundwater contamination is low where the effluent discharges have been relatively small in relation to the depth to groundwater, but remains the principal mechanism for the transport of contaminants to the water table. In some instances where the groundwater is shallow (east of the Hubbell Springs and Tijeras Faults), infiltration of precipitation alone may be sufficient to transport contaminants to the water table. Examples of these sites include:

- Old and New Aerial Cable Test Sites (CEARP ID Numbers 81 and 82) -- At these areas, the surface of the ground has been contaminated with rocket propellant, as well as spilled oil/fuel, lead, beryllium, and depleted uranium. Groundwater is estimated to be at a depth of less than 100 feet at these aerial cable test sites.

- Mineshafts and Adits (CEARP ID Numbers 28 and 67) -- Reports and interviews made during the Survey indicate that mines were used for burning aluminum-cased rocket motors, and that chemical, radioactive, mixed, and solid wastes may have been disposed of in some mines. Groundwater depths at these locations are expected to be shallow.

- Building 9940 Firing Site (CEARP ID Number 56) -- The test pad at this firing site was washed down after explosive testing with depleted uranium and chromium. Groundwater is estimated to be at a depth of less than 300 feet at this site.

- Building 9950 Septic Drain Fields (CEARP ID Number 116) -- These septic drain fields received effluents containing spent chemicals

(solvents and silver) from photographic laboratories. Groundwater is estimated to be at a depth in excess of 450 feet at these sites.

- Inactive Radioactive Burial Site (CEARP ID Number 1) -- For 10 years prior to 1959, this Technical Area II site received radioactive wastes (depleted uranium, tritium, cobalt-60, cesium-137, and radium). Radioactively contaminated potentially hazardous substances were disposed of in its pits and trenches. Groundwater is estimated to be at a depth in excess of 450 feet at this site.

- Building 9956 Sump (CEARP ID Number 109) -- Past disposal practices washed beryllium and depleted uranium into an exterior sump at this site. Groundwater is estimated to be at a depth in excess of 450 feet at this site.

- Thunder Range Crater Site (CEARP ID Number 56) -- At this site potassium permanganate solutions were used to measure the volume of craters and channels created with up to 30,450 pounds of explosives. Some high explosive residuals may remain in the area. Groundwater is estimated to be at a depth in excess of 450 feet at this site.

- Live Fire Range (CEARP ID Number 95) -- This CTA site is a target area for small arms practice. Lead particles and bullets that have been scattered in the area behind the targets could be leached by precipitation and the lead in solution carried to the water table, estimated to be at a depth of less than 100 feet at this site.

  Sampling and analysis is planned.

2. Lack of hydrogeologic characterization at SNLA. The hydrologic regimes have only been partially characterized with respect to water levels, groundwater flow directions, aquifer hydrodynamic properties, and groundwater quality.

   The Chemical Landfill is the only waste site with groundwater monitor wells. Groundwater level/quality data base(s) are not maintained by SNLA.

At least three hydrogeologic regimes are likely to exist at SNLA, namely:

- The western flank of the mountains to the Coyote Canyon Fault;
- The en echelon fault zone, bounded on the east by the Coyote Fault and on the west by the Sandia Fault; and
- The portion of the basin east of the fault zone.

Hydrogeologic characterization is needed to define:

- The direction and rate of groundwater flow;
- Transport of hazardous substances within the vadose zone;
- Transport of hazardous substances that have been or might be released to the groundwater; and
- Background groundwater quality.

Sampling and analysis is planned.

3.4.4.4 Category IV

1. Questionable interim-status groundwater monitoring data at SNLA. The validity of the interim-status groundwater monitoring data at the SNLA Chemical Landfill is questionable because of the methods used to collect the samples.

   The methods used to collect groundwater samples as part of the interim-status groundwater monitoring program may result in the nondetection or underestimation of hazardous-constituent concentrations that have been released to the groundwater from the inactive chemical landfill/surface impoundment facility. The reasons the data are suspect are discussed below:

PRELIMINARY

a) The monitor well designated as the background well (B-2) in the 1986 sampling year does not meet the requirements of regulations and the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD), in that the well:

- Has been downgradient and not upgradient during monitoring for the first year and the first sampling period of the second year; and

- Is too far from the boundary of the facility to immediately detect the release of hazardous constituents, when the well is used as a downgradient monitor well.

b) None of the four wells are screened in the same interval as the other three monitor wells. Top of screen elevations differ by as much as 50 feet.

c) The well screen lengths are too long and sampling has been performed some 30 to 35 feet below the groundwater surface in the well. Thus, the concentrations of hazardous constituents present could be more dilute than their true value.

d) Groundwater sampling has not been performed in accordance with the RCRA TEGD, in that:

- Sampling to detect sinkers and floaters has not been performed or discussed, being dismissed in the groundwater sampling plan. Screen placement with respect to the potentiometric surface makes the detection of sinkers and floaters difficult.

- Volatile organic compound (VOC) samples are obtained by a piston pump in three of the four monitor wells instead of by bailing. Agitation by the pump could volatilize the VOCs, reducing their concentration in the groundwater sample. This is generally not the case for sampling by bailing.

e) The pumping system may introduce contaminants into the water samples because:

- The tape (not fluorocarbon resin) binding the pump sampling string is likely to have been placed below the surface of groundwater;

- Polyethylene (not fluorocarbon resin) tubing is used to convey the water from the pump to the environment and the sampling containers;

- The flow meter is made of plastic and not fluorocarbon resin.

f) The sampling technicians may introduce contaminants into the wells by placing objects on the protective well casing. The protective well casing is at about the same elevation as the top of the monitor well. One technician was observed resting a foot on the casing. Particulates may have fallen from his shoe into the monitor well, contaminating water within the well.

g) Monitor Well M-1 has not been properly developed or is bailed in a manner that increases the turbidity to levels in excess of 5 NTU. In addition, it is bailed using methods that may introduce contaminants into the groundwater, in that:

- The purging bailer was made of galvanized steel and had a brass check valve. These components could contaminate the groundwater in the well with heavy metals.

- When handling the purging bailer, the technician performing the bailing used standard work gloves instead of gloves made of a relatively inert substance.

4.0 NON-MEDIA-SPECIFIC SURVEY FINDINGS

4.1 Waste Management

This section describes the types and sources of waste materials generated at Sandia National Laboratories-Albuquerque (SNLA) and other U.S. Department of Energy (DOE) facilities located at Kirtland Air Force Base (KAFB), as well as the facilities and procedures for management and disposition of those wastes. This is followed by a discussion of waste-related environmental problems that were identified at the Albuquerque facilities as a result of the Environmental Survey activities.

4.1.1 General Description of Pollution Sources and Controls

Facility operations at SNLA generate a variety of solid and liquid wastes, including hazardous wastes, low-level radioactive wastes (LLW), transuranic (TRU) waste, mixed radioactive and hazardous wastes, and nonradioactive/nonhazardous wastes. The following are brief definitions of these various waste types:

- Hazardous wastes are those wastes identified as such in 40 CFR 261 [i.e., regulated under the Resource Conservation and Recovery Act (RCRA) and the New Mexico Hazardous Waste Act]. Such wastes are ignitable, reactive, corrosive, or toxic, or contain materials listed in 40 CFR 261.

- Radioactive wastes are solid, liquid, or gaseous materials of negligible economic value that contain radionuclides in excess of threshold quantities, except for radioactive material from past weapons test activities (DOE Order 5820.2).

- LLW is described in 10 CFR 61 as radioactive wastes not classified as high-level radioactive waste, TRU waste, spent nuclear fuel, or by-product material as defined in Section 11e(2) of the Atomic Energy Act (i.e., uranium or thorium tailings and waste). Such wastes include depleted uranium and waste that is contaminated with low levels of radioactivity (i.e., naturally occurring radionuclides and TRU nuclides at concentrations of less than 100 nanocuries/gram).

- Transuranic waste is defined in 40 CFR 191 as waste containing more than 100 nanocuries of alpha-emitting TRU isotopes, with half-lives greater than 20 years, per gram, except for high-level radioactive wastes.

- Mixed (radioactive and hazardous) wastes are co-contaminated with radioactive and hazardous waste materials.

- Nonradioactive/nonhazardous wastes contain very little or no radioactive contamination (i.e., less than 32 picocuries/gram) and no chemical contamination as defined under RCRA.

Waste management facilities and procedures at SNLA and associated facilities vary by facility and by operator. The following subsections include discussions of Sandia National Laboratories-Albuquerque (4.1.1.1); Bendix Albuquerque Operations (BAO) (4.1.1.2); and the Inhalation Toxicology Research Institute (ITRI) (4.1.1.3). Included with the discussion of SNLA in Section 4.1.1.1 are the Central Training Academy (CTA) and the Transportation Safeguards Division (TSD).

4.1.1.1 Sandia National Laboratories - Albuquerque

Hazardous chemical wastes are generated at SNLA by the numerous research and development activities conducted throughout the facilities. Major waste generators include the development shops (e.g., Plating, Plastics, Glass) and chemical laboratories. Wastes consist of a large number of different reagents, chemicals, solvents, alkalis, acids, and other general laboratory wastes.

Waste management is conducted by the Environmental Protection and Hazardous Waste Management Division (3314). Divisional operations include hazardous waste pickup and on-site transportation, repackaging, storage, and subsequent disposal (including off-site recycling, treatment, and landfilling and on- and off-site incineration). Approximately 10,000 kilograms of solid chemical waste and 63,000 liters of liquid waste were handled through SNLA's hazardous waste program during Fiscal Year (FY) 86 (SNLA, 1986b).

Hazardous waste management facilities at SNLA include:

- Chemical Waste Landfill (Technical Area III)
- Repackaging and Hazardous Waste Storage Building - 895 (Technical Area I)
- Drum Staging area (Technical Area III)
- Thermal Treatment Facility (Technical Area III)
- Surface Impoundment (Technical Area III)

These facilities, including their sizes and contents, are discussed in subsequent sections.

All of the above-listed facilities are included in SNLA's RCRA Part A permit, which grants the facility interim operating status for facilities that are used to treat, store, or dispose of hazardous waste. SNLA has prepared a RCRA Part B permit application for consideration by the U.S. Environmental Protection Agency (EPA). The Part B application names only a new proposed hazardous waste management facility (WMF). Upon authorization and completion of the planned WMF, SNLA plans to close all the facilities currently listed on the Part A application, with the exception of the Thermal Treatment Facility. The Thermal Treatment Facility will be added to the Part B application upon promulgation of thermal treatment regulations by the EPA.

The SNLA Part A permit application is currently being revised to include the mixed radioactive and hazardous waste disposal area (Technical Area III). All RCRA permits for hazardous and mixed waste facilities will be issued by the State of New Mexico. The state has authorization to regulate hazardous wastes and the hazardous components of radioactive mixed wastes.

Radioactive waste at SNLA is generated in both technical and remote test areas as the result of research and development activities. Most of the waste generated is LLW. Sources include depleted uranium, tritium, induced activity, and fission products. The largest radioactive waste source by activity is tritium. The largest radioactive waste source by mass and volume is depleted uranium. Most of the waste generated at SNLA consists of contaminated equipment and combustible decontamination materials and cleanup debris. Small quantities of TRU wastes

are also generated. Table 4-1 below shows the radioactive waste inventory for 1983-1985.

Mixed radioactive and hazardous chemical wastes generated at SNLA include radioactively contaminated oils and occasionally solvents, and radioactively contaminated or activated lead or other heavy metals. Other mixed wastes may be generated as a result of weapons tests. The lead-contaminated waste is currently the largest-volume mixed waste. The liquid scintillation cocktails (LSCs) previously used at SNLA have been replaced with nonhazardous cocktails and are not classified as possible mixed wastes. Classified radioactive waste produced at SNLA is primarily tritium-contaminated equipment and uranium shapes.

Radioactive and mixed waste pickup and transportation is handled by the Health Physics Division (3312). Disposal operations are coordinated with Waste Management personnel. With the exception of TRU wastes, radioactive waste disposal consists of shallow land burial on-site at Technical Area III. TRU wastes are stored at the Manzano Base for later shipment off-site. These disposal practices are discussed in more detail in a subsequent section.

For purposes of this discussion, facilities at SNLA have been divided into their designated geographic zones, including Technical Areas I, II, III, IV, and V, and the Coyote Test Field (CTF) complex. Specific pollution sources and controls within each of these areas and also within the CTA and the TSD are delineated in the discussions that follow.

Technical Area I

This section describes the current generation and management of wastes within Technical Area I of SNLA. Offices, laboratories, shops, storage vaults, and the steam plant are located in this area. While much of the discussion of waste generation and management practices presented here applies to all areas at SNLA, by far the greatest quantity of waste is generated by the development laboratories and technical support shops in Technical Area I.

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TABLE 4-1

RADIOACTIVE WASTE INVENTORY

FY	Category	Primary Constituent	Activity (Ci)	Volume (ft^3)	Mass (lb)
1983	LLW	U, H-3, Co-60, Cs-137	86	1080	20,130
1984	LLW	U, H-3, Co-60, Cs-137	151	6420	269,500
1985	LLW	U, H-3, Co-60, Cs-137	151	1420	205,000
1985	TRU	Pu		0.5	

Source: Millard et al., 1986

Hazardous Waste

SNLA generates three categories of hazardous chemical waste: (1) waste process materials from the development laboratories and technical support shops, (2) expended chemicals from the research laboratories, and (3) scrap materials from test and evaluation operations.

As listed in its RCRA Part A application, SNLA generates 71 RCRA listed hazardous waste streams. Typical hazardous chemical wastes and annual volumes generated by SNLA are given in Table 4-2. Acids, organic solvents, and alkalis make up the largest volumes of hazardous waste.

Hazardous chemical wastes are generated in Technical Area I in the laboratories and shops in Buildings 802, 805, 806, 807, 808, 828, 834, 835, 839, 840, 841, 844, 845, 846, 848, 863, 865, 869, 870, 875, 880, 887, 892, 893, 894, and 900. Major hazardous chemical waste contributors include the Photoprocessing Laboratories, the Ceramics Laboratory, the Microelectronics Production Facility, the Plastic Formulation Laboratory and Shop, the Plating Shops, the Glass Shop, and the Research and Development Laboratories. Operational buildings which may handle or release significant quantities of hazardous chemicals are further described below. Development shops are discussed first, followed by research and development laboratories, and support shops.

TABLE 4-2
TYPICAL HAZARDOUS CHEMICAL WASTES GENERATED BY SNLA

Waste	Quantity (kg/yr)
Corrosive laboratory waste - acidic	10,000
Corrosive laboratory waste - caustic	10,000
Ignitable laboratory waste	12,500
Reactive laboratory waste	200
Acetone	4,000
Acetonitrile	80
Acrylonitrile	1
Ammonium persulfate	8
Benzene	10
Bromoform	2
t-butyl alcohol	1
Carbon tetrachloride	3
Chlorobenzene	4
Chloroform	22
Cyclohexane	2
o-dichlorobenzene	1
1,2-dichloroethane	14
Dichloromethane	20
Di-n-octyl phthalate	1
Formaldehyde	40
Magnesium perchlorate	8
Methyl alcohol	4
Methyl isobutyl ketone	2
Methylene chloride	20
Monochlorobenzene	3
2-nitropropane	1
Phosphoric anhydride	1
Pyridine	1
Tetrahydrofuran	200
Toluene	500
Toluene diisocyanate (contained in epoxy resins)	500
1,1,1-trichloroethane	7,000
Trichloroethylene	3,000
Trichlorofluoromethane	1,200
Xylene	300
Beryllium-contaminated laboratory waste	200
Hydrofluoric acid-contaminated laboratory waste	20
Lead-contaminated laboratory waste	500
Mercury-contaminated laboratory waste	700
Selenium-contaminated laboratory waste	1
Spent cyanide plating bath solutions from electroplating operations	200
Spent ignitable solvents	500
Carburetor cleaner/Stoddard solvent	700
Other	20,000

Source: Millard et al., 1987

The Ceramics Shop (Building 840) is used to fabricate ceramic components (particularly lead zirconium titanate components) for SNLA research and testing activities. The shop generates about 500 to 700 pounds of hazardous chemical waste per year, including lead oxides and other lead compounds, and spent cyanide salt baths. Waste polyvinyl alcohol binder and some solvents (primarily acetone and methyl alcohol) are collected in containers for pickup by Waste Management personnel. The foundry (Building 841) is used for casting aluminum (10,000 lb/month) and lead (2,000 lb/month). For the most part, lead waste produced from the lead casting process is recycled.

The Glass Shop generates about 1,000 liters of chlorinated waste solvents annually. These wastes are collected into drums stored outside the building on concrete pads in a fenced area. Routine collection of wastes is made by SNLA Waste Management personnel at a frequency greater or equal to once every 90 days. Due to the large degree of hazardous waste generation, this shop has been designated as per RCRA regulations by SNLA Waste Management personnel as a satellite waste accumulation facility. To comply with this designation the storage of wastes at this shop is more closely monitored and more adequately designed than that of other waste accumulation areas at SNLA.

The numerous machine shops and electronics labs in Technical Area I do not generate large quantities of hazardous wastes. Some waste trichloroethylene (TCE) is generated from maintenance of vapor degreasers located in a few buildings. This waste is collected for disposal by SNLA Waste Management personnel. It was observed that these shops produced solvent-laden rags and tissues from cleaning operations, and that these were disposed of in the nonhazardous trash. Additionally, many of the electronic labs disposed of lead soldering flux in the non-hazardous trash.

The Toxic Machine Shop (Building 869) is used to process and machine beryllium, uranium, cadmium, thorium, and other toxic metals. Fine beryllium particles may become airborne during the machining process. Air from the process areas is exhausted through a high-efficiency particulate air (HEPA) filter unit prior to discharge. HEPA filters, waste metal, and contaminated clothing and toweling are collected by Health Physics personnel for disposal at the on-site radioactive waste burial site (Technical Area III).

The Paint Shop is located in Building 841. Methylene chloride is used as a stripper in Paint Shop operations. About 1 drum/month of waste is generated. This is collected by SNLA Waste Management personnel.

The Plastic Formulation Lab and Shop (Building 834) generate about 75 gallons of waste acetone a week and about 400 gallons of chlorinated hydrocarbon wastes a year. The acetone is used to wash out uncured epoxy from the containers used to mix the epoxy resins. Waste acetone is collected in drums stored in a fenced area outside the building by means of a gravity return. As reported by Shop personnel, this waste drum may also receive waste toluene. Waste drums are routinely (at least once every 90 days) collected by SNLA Waste Management personnel for disposal. As evidenced by stains on the concrete pad of the storage area, drums have possibly leaked in the past. As with the Glass Shop, this shop is designated a satellite accumulation facility by Waste Management personnel.

The Photofabrication Laboratory (Building 841) includes photochemical lithography, circuit board fabrication, and circuit component development. Photographic developing chemicals are used in the photochemical lithography process. The chemicals are collected in drums by SNLA Waste Management personnel for eventual recycling or disposal. The circuit board fabrication process uses a variety of solvents (acetone, isopropyl alcohol, and TCE), acids (sulfuric, nitric, and acetic), and plating solutions (copper sulfate and precious metals). The TCE and other solvents are also collected by SNLA personnel for off-site recycling or disposal.

The Plating and Coating Shop (Building 841) is used for electroplating, anodizing, coating, and chemical etching of ferrous and nonferrous materials. Chemical solutions used in the process include nickel acetate, cadmium cyanide, sodium dichromate, copper sulfate, nickel sulfate, copper cyanide, precious metals, sulfuric acid, nitric acid, and sodium hydroxide.

Besides the plating solutions, large quantities of acids, caustics, and spent solvents are also generated. Plating baths are periodically (every 2 years) changed by pumping the spent solutions into drums. SNLA Waste Management personnel then collect these drums for disposal. Precious-metal bath solutions are reclaimed. Large amounts of methylene chloride wastes are generated by the Printed Circuits Shop. Methylene chloride is used as a stripper to remove coatings. Trichloroethane wastes

are generated in large amounts from the developing baths. Wastes drain to a drum outside the building and the drum is eventually collected by SNLA Waste Management personnel. Several drums and containers of wastes were observed outside (uncovered) on the loading dock area without proper labeling or storage. Although wastes are accumulated at this area, it is not designated by SNLA as a satellite waste accumulation area, and is therefore not supervised as closely as other accumulation areas at SNLA.

The Plating Shop and other labs, where pickling solutions are used, generate nearly 10,000 liters of organic and inorganic acids along with about 1,000 liters of caustic per year.

The SNLA research laboratories (Buildings 802, 805, 806, 807, 808, 828, 893, and 894) generate lesser quantities of hazardous wastes than the development shops. About 200 liters of mineral acid solutions and less than 400 liters of nonhalogenated organic solvents are generated per year. Chlorinated hydrocarbon solvents are generated in small quantities. The research laboratories also generate about 8,000 liters of liquid waste and 200 kilograms of miscellaneous solid waste inorganic chemicals, with most of the waste being individual small amounts of expended reagent chemicals. In addition, approximately 8,000 kilograms of reactive wastes, mostly battery components, are generated annually. Most of these wastes are disposed of down the drains. Guidelines distributed by SNLA Waste Management personnel allow sink disposal of less than 100 g of water-soluble, biodegradable chemicals, although there are no guidelines as to frequency or concentration. Because of the general nature of this policy, there is the potential that greater amounts of hazardous wastes could be disposed of to the sanitary sewer than management practices estimate. This disposal practice and potential environmental problems associated with it are discussed further in Section 3.3.2.

Empty chemical containers from research laboratories are disposed of in the nonhazardous trash. One lab was found to be storing small amounts of waste mercury contaminated with explosives for which there are no safe disposal procedures.

The Reclamation Yards located in Technical Area I often receive miscellaneous hazardous wastes that have been included in shipments to them of nonhazardous

salvageable equipment. Workers at the yards segregate any hazardous or potentially hazardous wastes and contact the SNLA Waste Management Division for pickup and removal. Radioactively contaminated equipment may also be received.

The SNLA steam plant is a gas-fired steam-generating facility that is also equipped to burn oil. Gas-firing operations emit nitrogen dioxide and oil-firing operations emit nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulates. No hazardous wastes appear to be produced.

Hazardous Waste Management Program

SNLA's waste management program as administered by the Environmental Protection and Hazardous Waste Management Division is described in this section. While the majority of waste generation and collection occurs in Technical Area I, the waste handling operations described above apply to other areas at SNLA as well. At present, management of hazardous wastes at SNLA generally involves the temporary storage of wastes at satellite accumulation and waste accumulation areas, eventual collection of wastes at these points of generation, and transfer to permitted storage facilities (Building 895 and the chemical landfill storage area). These activities are conducted by SNLA Waste Management personnel and commercial contractors. Those personnel directly involved with waste management receive initial and refresher training in hazardous waste management and safety procedures.

The hazardous waste management program at SNLA places the primary responsibility for waste segregation on the generator. The generator is responsible for ensuring that hazardous wastes are not mixed with nonhazardous or radioactive wastes. SNLA research personnel are instructed to segregate hazardous wastes by basic categories such as halogenated solvent wastes, nonhalogenated solvent wastes, toxic wastes, hazardous solid wastes, and reactive or corrosive wastes. Personnel are then responsible for disposing of waste materials in appropriate containers, as provided. Waste receptacles that were observed to be used included original containers, "jerry jugs" for waste solvents, hoppers for metal or wood scrap, and trash cans. Empty chemical containers are disposed of in ordinary trash cans.

Except for the routine collection of wastes from the Glass and Plastics Shops, hazardous chemical wastes are collected at a generator's request by SNLA Waste Management personnel from the various points of waste generation. Generators request pickup by submitting waste disposal sheets when they have wastes they want collected. These sheets supply information on the type and quantity of waste to be collected. Personnel perform waste collection activities on a once-per-week basis.

As discussed above, many of the points of waste generation (e.g., Printed Circuits Lab) in Technical Area I were observed to be accumulating substantial quantities of hazardous wastes (greater than 55 gallons) for substantial periods of time (more than 3 days). Indications of past spills, containers in poor condition, and inadequate storage (i.e., improper stacking/storage of containers; storage outside buildings for apparently long periods) were observed at several areas of waste accumulation points during the Survey. Pickup of these wastes by SNLA Waste Management personnel can be infrequent, since only the designated satellite accumulation points are routinely visited for waste removal.

Materials such as plating bath solutions and waste acetone are drummed at the points of generation for removal by SNLA Waste Management personnel. Except for the larger development shops, chemical wastes collected from the various waste-generating laboratories and shops at SNLA are often received in small (i.e., containers of a gallon or less) bottles or containers.

Generally, the contents of the waste containers collected during pickups by Waste Management personnel are known (original label is intact or a label has been affixed by the generating laboratory). If the contents are not known, the chemical substance is sufficiently characterized to permit proper handling, segregation, and disposal. A Hazcat kit is initially used to allow preliminary classification of the waste for proper storage, until a more definitive analysis can be performed. Much of this characterization occurs at the storage area located in Technical Area III.

After collection, SNLA Waste Management personnel transport wastes to on-site storage facilities. Materials collected from Technical Area I are most often taken to Building 895, a temporary waste handling and storage facility. This is the only hazardous waste management facility currently operated within Technical Area I. It

consists of a concrete block building and is designated the Hazardous Waste Repackaging and Storage Facility (Building 895). Building 895 is used to temporarily store wastes (less than 90 days as designated by RCRA) and to containerize or repackage hazardous wastes collected from the various generator groups at SNLA (e.g., smaller, reagent-size containers are repackaged in a labpack for disposal). Also, liquid wastes are solidified here inside 55-gallon drums by the addition of vermiculite.

Building 895 is divided into bermed bays with sealed floors, separated by concrete walls. Hazardous chemical wastes generated at the various SNLA facilities are transported to Building 895 where they are segregated into compatible types and placed into the appropriate bay. During the Survey, some mis-segregation was observed within bays.

Materials stored at Building 895 are moved to the waste handling area at the chemical landfill (Technical Area III) as they near the regulatory limit for temporary storage (90 days). However, containers of hazardous waste were observed that had been in storage at the building longer than 90 days. Also observed were hazardous waste containers on which the date accumulation began was not marked.

Additionally, some containers that were not labeled as hazardous waste were observed, and two were found to be leaking. During subsequent cleanup of the leaking containers by SNLA personnel, it was observed that the facility was not readily equipped to deal with spills (e.g., absence of absorbent materials/spill pillow, over-pack containers).

SNLA plans to use Building 895 only until a planned WMF described in the Part B Application is constructed and becomes operational. The planned WMF will be located south of Technical Area I. This facility will be used to temporarily store and package or solidify hazardous wastes, and will replace Building 895 and the fenced container storage area in Technical Area III. All hazardous wastes, even if properly containerized at the generation point, will go to the new WMF for labeling and marking. When ready, hazardous wastes will be transported off-site for recycling or disposal at a licensed facility.

The WMF is planned to consist of two buildings. The westernmost building will provide waste storage space. The easternmost building will be used for waste repackaging. A maximum of 468 55-gallon drums can be stored at the facility. Containers to be stored will include 55-gallon drums containing free liquid wastes, 55-gallon drums containing solidified liquid wastes, 55-gallon labpack drums, 85-gallon overpack drums for damaged or leaking 55-gallon drums, and small (50-gallon or less) containers. The volume of liquid waste stored in the WMF will not exceed 26,540 gallons.

The 10,000 kilograms of solid chemical waste and 63,000 liters of liquid waste handled through the SNLA hazardous waste program during FY86 consisted of solid wastes -- toxic metals, reactive metals, and corrosives; and liquid wastes -- solvents, oils, poisons, metallic solutions, and corrosives.

Currently, the entire waste stream is eventually shipped off-site to licensed, permitted, commercial disposal or recycling facilities. Transportation of hazardous wastes off-site is conducted by a permitted commercial transporter. Prior to 1985, hazardous wastes were disposed of in the chemical landfill (Technical Area III).

Although the SNLA Environmental Protection and Hazardous Waste Management Division has direct responsibility for the proper storage, treatment, and disposal of hazardous wastes, implementation of waste management procedures at the site is a coordinated effort among the individual production and laboratory areas as well as several site divisions including Labor Support, Transportation, and Security, among others.

Radioactive Waste

Small quantities of LLW are generated in Technical Area I. Most of the currently generated tritium wastes as well as uranium wastes come from facilities in Technical Area I. The primary wastes are depleted uranium scraps and depleted-uranium-contaminated lapping compound (an oil-based abrasive) from the Metallography Laboratory in Building 805; classified waste, including some tritium and depleted uranium from the Weapons Laboratory in Building 809; depleted uranium and tritium-contaminated equipment from the Nuclear Material Handling and Storage Facility (Building 819); thin-film tritiated targets and tritium-contaminated

tritium-contaminated equipment (approximately 10 curies per year) from the Tube Development Laboratory in Building 891; depleted uranium and decontamination debris from the Weapons Storage Facility; induced activity from the Irradiated Electrical Component Test Facility; and radioactive sources in the millicuries to centicuries range which may contain lead for shielding (Millard, 1985).

LSC vials containing tritium and dioxane/naphthalene were formerly generated in the Environmental Health Radiochemistry Laboratory in Building 869 (the dioxane was evaporated in the laboratory hoods, about 4,500 grams of naphthalene and 0.135 microcuries of tritium per year). However, SNLA recently started using a different type of scintillation cocktail vial which contains no hazardous chemicals.

Generators of radioactive wastes at SNLA complete waste disposal sheets at the time of disposal. These sheets provide a characterization of the generated wastes--classification category, origin, mass, volume, and percent combustible--so that proper disposal may be achieved.

Radioactive waste management at SNLA is conducted jointly by Health Physics and Environmental Protection and Hazardous Waste Management personnel. Health Physics personnel collect low-level radioactive wastes for disposal in an on-site facility managed by SNLA Waste Management personnel (Technical Area III). Personnel are trained in the handling and disposal of such wastes. Management of radioactive and mixed waste at SNLA is described further in the discussion of Technical Area III.

Mixed Waste

Mixed radioactive wastes generated within Technical Area I include radioactively contaminated lead waste. As described above, LSC vials used in past operations (Building 869) contained hazardous chemicals. In past operations, no distinction was made between radioactive and mixed radioactive wastes for purposes of waste disposal. Current and past disposal practices for radioactive mixed wastes at SNLA are described along with the discussion of Technical Area III activities.

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Nonhazardous, Nonradioactive Waste

Solid wastes that are not hazardous or radioactive are disposed of by SNLA at the KAFB Sanitary Landfill. These wastes are picked up by SNLA personnel on a routine basis from the various trash cans and dumpsters located throughout the SNLA facilities. Solid wastes generated as a result of contractor activities (construction, etc.) are also disposed of in the KAFB landfill. However, the disposal occurs only on an as-needed basis, and is handled by the contractor.

As with hazardous wastes, the responsibility for initial segregation of wastes lies with the source or generator of the waste materials. KAFB landfill personnel stated during the Survey that on occasion they have found chemical waste (e.g., photoprocessing chemicals) dumped in with the solid wastes. When the waste was found, the KAFB personnel notified the SNLA Waste Management Division for removal and proper disposition of the waste materials. Since the landfill is open 24 hours a day without a full-time operator, the KAFB personnel speculated that inappropriate disposal of SNLA chemical wastes could also occur undetected. They attribute the observed and speculated inappropriate disposal activities to SNLA contractors who may not be adequately instructed as to what wastes may not be disposed of at the KAFB Sanitary Landfill. In addition, they raised the concern that once a contractor has access to the landfill, there is the possibility that the contractor could be disposing of other inappropriate materials that originated off-site. A July 16, 1987, memorandum of a June 18, 1987, landfill inspection reported a septic tank truck dumping "questionable" property at the KAFB Sanitary Landfill (Ayers, 1987). The driver claimed that the material was a cooling agent, but also mentioned that the truck had previously contained some waste from an off-site location. Evidence of recent tank truck discharges was observed at the KAFB Sanitary Landfill during the Survey.

Technical Area II

Technical Area II is a small facility south of Technical Area I developed to support hazardous testing needs for Technical Area I. Past use of Technical Area II included component manufacture, nuclear weapons assembly, and radioactive materials disposal. Present facilities include environmental testing and chemical laboratories; explosives development and testing laboratories; component assembly and testing

facilities; decontamination facility; polychlorinated biphenyl (PCB) storage; inactive radioactive waste disposal area; and an active disposal area for nonradioactive, classified wastes.

Generally, wastes are generated in small quantities in Technical Area II. Types of wastes generated include organic solvents (such as ethanol, xylene, etc.) on wipes; residues from explosive materials; depleted alkali metal vapor heat pipes; and radioactive materials (tritium metal hydrides) from destructive testing of neutron generators. Chemical wastes and depleted heat pipes are disposed of through the SNLA Waste Management Division. Explosive material residues are disposed of by the Explosives Handling group at the 6000 Igloos, and the radioactive materials are turned over to health physics for disposal at the classified radioactive waste disposal area in Technical Area III. Approximately "2 garbage cans full" of the radioactive wastes are accumulated in a small room at the south end of Building 935 before disposal is requested. It was observed during the survey that this room had a radioactive materials warning sign within the room, but not on the outside entrance door. Also observed during the Survey were a drum of methylene chloride wastes that had been accumulating for about 3 years behind Building 904, and several small (approximately 20-gallon) drums labeled "Flammable Solid" behind Building 919.

An old radioactive waste burial area is located in the far eastern corner of Technical Area II. This area was used between 1949 and 1959, and is said to consist of three pits and three trenches containing 11,110 cubic feet of uncontained LLW and radionuclide-contaminated hazardous wastes (including chemicals and classified wastes). Radioactive wastes disposed of in this area included depleted uranium, tritium, cobalt-60, cesium-137, and plutonium (Kearney and Lawson, 1987). The disposal trenches and holes are estimated to be 15 and 25 feet deep, respectively, and are assumed to have 3 feet of concrete and soil cover. This area is also included in the discussion of inactive waste sites in Section 4.5.1.

The classified waste disposal area located in Technical Area II consists of several pits and a trench behind (east of) Building 919. This area is used for disposal of nonradioactive, solid, classified wastes (records, shapes, etc.). The currently used trench extends eastward and has been backfilled with soil on the eastern end as the wastes have been disposed of. The exposed portion of the trench is estimated to be

approximately 30 feet wide and 150 feet long and up to 40 feet deep. Adjacent to the trench are approximately 40-50 pits which were said by facility personnel to have been filled with nonradioactive classified wastes, then backfilled with mounds of soil and marked with metal posts with tags for identification. Disposal in these now inactive pits is said to date back to the 1940s (Kearney and Lawson, 1987). No information was available during the Survey as to the exact contents of the pits. One of the metal marker poles adjacent to the trench and pit access road was observed to have been knocked down, presumably by a vehicle. According to a recent site inspection report (Kearney and Lawson, 1987), a chemical waste disposal pit was located adjacent to the pits and trench. This pit was reported to have been used prior to the early 1960s for disposal of nonradioactive hazardous wastes, although specific information regarding the probable location, size, and contents of the pit was not provided. This area is also discussed in detail in Section 4.5.1.

An approximately 100-foot by 50-foot area on the southwest side of Technical Area II is used for storage of scrap metal and equipment contaminated with LLW. Although this area is fenced and marked with warning signs, the equipment is placed directly on the ground with no provision for controlling surface water runon or runoff. Similarly, an active decontamination area (used for wash-down of test materials for the Nevada Test Site) located at Building 906 does not have controls for runoff or runon (Kearney and Lawson, 1987).

Technical Area III

Technical Area III, located approximately 3.5 miles south of Technical Area I, comprises about 20 environmental testing and support facilities for SNLA's weapons components testing programs. These test facilities include centrifuges; sled tracks; vibration, complex wave, and shock testing facilities; impact and explosive test facilities; and the radiant heat facility. In addition, the area contains the sodium purification loop; a photoprocessing laboratory; office, storage, and maintenance facilities; and the radioactive and hazardous waste management facilities serving the entire SNLA complex.

Little hazardous or radioactive waste is generated from the Technical Area III test and support facilities. Small quantities of depleted uranium waste are generated

on occasion from the Melt Climate Facility at Building 6630; the small arms range at Building 6750; and the sled test tracks (may also include beryllium and lithium contaminants).

Hazardous chemical wastes generated by shops within this area include small quantities of spent solvents (used for cleaning) and photochemicals. Solvent-laden rags are disposed of in trash cans with subsequent pickup and disposal in the KAFB Sanitary Landfill. Potentially lead-contaminated wastes, generated by the indoor gun facility, are also being disposed of in the trash.

Tests conducted at the sled track facilities have occasionally involved weapons components and test assemblies constructed of depleted uranium, lead, beryllium, and other metals. There is the potential that the area surrounding the sled facilities may be contaminated with finely divided particles of these metals and rocket propellant residues. As a result of this potential, this facility was identified during Phase I of DOE's Comprehensive Environmental Assessment and Response Program (CEARP) as a potential RCRA site.

Hazardous Waste Management Facility

Much of SNLA's chemical and hazardous waste was handled through the Chemical Waste Landfill Area (CWLA) in the southeast quadrant of Technical Area III. The landfill is a fenced area of approximately 1.9 acres that was used from 1962 to 1985 for disposal of various chemical wastes from the SNLA research and development laboratories. Liquid and solid wastes were typically disposed of in several unlined trenches, excavated to 10 feet deep, then backfilled with soil to ground-surface level. Procedures for hazardous waste collection are undocumented for the period prior to 1975. It has been estimated that as much of 90 percent of the pre-1975 wastes were nonhazardous. After 1975, waste collection was provided as needed. Chemical disposal tickets were completed by the Industrial Hygiene Division to show the location of waste pickup, type of material, designated disposal location, etc. Wastes were disposed of in the trenches designated for particular waste types as follows:

- Acids, mineral acids
- Oxidizers

- Reducers
- Organics
- Reactives, hyperbolic pairs, sodium, calcium
- Metals, neutral salts, bulky materials, and unknowns.

When a trench of one type would reach capacity, a new trench would be constructed for receiving the same types of waste. In addition to the trenches, there was an unlined pit for receipt of chromic acid. A lined surface impoundment was also used between 1979 and 1982 for the disposal of liquid chromic acid and ferric chloride. A spent-cyanide tank was reported to have been buried on the northeast side in 1975 (Weston, 1984).

It is estimated that the entire land disposal area contains approximately 22,500 cubic yards of waste, waste residue, and contaminated soils. A list of the types and volumes of hazardous wastes disposed of in the landfill during 1985 is provided in Table 4-3 (IT, 1985). A review of disposal tickets dated 1979-1981 showed that the following radioactive materials were mistakenly disposed of at the chemical landfill site:

Uranyl nitrate	15 bottles	Pit 2a	10/10/75
Uranium	0.5 liters	Pit 5	3/13/79
Thorium oxide	0.2 pounds	Pit 4	1981

The landfill operation was discontinued in 1985. All trenches and pits were covered with soil backfill. The lined chromic acid surface impoundment remains open at the south end of the site. The landfill area is now operated under RCRA interim status (NM5390110518) as a hazardous waste drum storage facility with a capacity for approximately 300 drums, although it appeared that more than 300 drums were present at the time of the Survey (see page 4-29). Waste drums are staged in segregated areas (as shown in Figure 4-1) according to the type of contents. These drums are marked with SNLA waste-type identification code numbers and accumulation dates. Also present on the landfill area are a drum compactor, an office trailer, and three equipment storage trailers. Several closure plans have been prepared for the landfill, the most recent by Jacobs Engineering submitted to SNLA in rough draft form in 1987. It is the intention of SNLA to close the landfill in-place

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985

Date	Compound	Amount
1/10/85	PbO-50%, ZrO_2-50%, TiO_2	7 QT cans
"	Titanium powder	1 QT can (3 lb)
"	'Dag' dispersion	1 QT can (2 lb)
"	Rubidium powder	1 QT can
1/17/85	Shale oil solids, Coal tar wastes	1 lg plastic bag
"	PC-793 & PC 795 polymers pwdr.	2 QT glass jars
"	Bismuthrhenium. Lead osmium, & HCPB	2 sm plastic bags
"	Se & selenophen residue in glassware	3 pieces
"	Solid selenophen	150 g
"	Potassium nitrate	6 lb
"	Sodium Azide	800 g
"	Tin metal	1 lb
"	Cuprous chloride 100%	1 lb
"	Hydroxylamine hydrochloride 100%	400 g
"	Potassium acetate 100%	1 lb
"	Potassium bromide 100%	1 lb
"	Potassium dichromate 100%	1 lb
"	Potassium hydroxide 100%	3 lb
"	Potassium nitrate 100%	1 lb
"	1,3,5-Tribromobenzene 100%	1 kg
"	1,3,5-Trichlorobenzene 100%	1.2 kg
"	2,4,6-Triiodophenol 100%	275 g
"	1,3,5-Trimethoxybenzene 100%	300 g
"	Triphenylamine 100%	75 g
"	Triptycene 100%	30 g

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
1/17/85	Urea 100%	113 g
"	m-Nitroanisole 100%	200 g
"	m-Nitrobenzaldehyde	100 g
"	p-Nitrosodiphenylamine 100%	10 g
"	Phloroglucinol 100%	100 g
"	Phloroglucinol 100%	10 g
"	Phloroglucinol dihydrate 100%	900 g
"	1,2,3,4-Tetrachlorobenzene 100%	100 g
"	1,2,3,5-Tetrachlorobenzene 100%	55 g
"	Dinitromesitylene 100%	75 g
"	1,5-Dinitronaphthalene 100%	100 g
"	2,4-Dinitrotoluene 100%	100 g
"	2,6-Dinitrotoluene 100%	100 g
"	Diphenylacetylene 100%	285 g
"	Hexachloroethane 100%	600 g
"	Hexachloroethane 100%	50 g
"	Methyl Sulfane 100%	1000 g
"	m-Diiodobenzene 100%	250 g
"	5,5-Dimethyl-1,3-Cyclohexanedione 100%	200 g
"	N,N-Dimethyl-p-Nitrosoaniline 100%	400 g
"	3,5-Dinitroaniline 100%	50 g
"	2,4-Dinitroanisole 100%	250 g
"	m-Dinitrobenzene 100%	5 g
"	2,4-Dinitrobenzenesulfenyl chloride 100%	25 g
"	3,5-Dinitrobenzoic Acid 100%	1,000 g
"	CPCN 100% (Co complex)	500 g

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
1/17/85	Cupferron Flakes 100%	0.25 lb
"	1,5-Diaminonaphthalene 100%	300 g
"	3,5-Dichloroanisole 100%	50 g
"	1,5-Dichloro-2,4-Dinitrobenzene 100%	100 g
"	3,5-Dichlorophenol 100%	250 g
"	Dicyclohexano-18-Crown-6 100%	30 g
"	1-Bromo-2,4-Dinitrobenzene 100%	100 g
"	1-Bromo-2-Nitrobenzene 100%	400 g
"	P-Bromonitrobenzene 100%	100 g
"	CF 100% (Co complex)	10 g
"	Acetanilde 100%	5 g
"	5-Aminotetracole Monohydrate 100%	100 g
"	APFC 100% (Co complex)	150 g
"	4,4-Azoxydianisole 100%	25 g
"	Benzil 100%	50 g
"	Bibenzyl 100%	50 g
"	Bis (4-Fluoro-3-Nitrophonyl) Sulfane 100%	25 g
1/31/85	Magnesium Carbonate	1 lb
"	Gallia 99.9%	1 lb
"	Aluminum Oxide	5 lb
"	Silicon Nitride	2.2 lb
"	Strontium Titanate	5 lb
"	Magnesia Alumina Spinel	5 lb
"	Silica	5 lb
"	Magnesium Oxide	1 lb
"	Silicon Powder 99.9%	5 lb

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
1/31/85	Lead Fluoride, Anhydrous 99.9%	25 lb
"	Germanium Metal Powder	5 lb
"	Boric Acid 100%	5 lb
"	Lead Oxide	5 lb
"	Hafnium Oxide	5 lb
"	Trash Contaminated w/Acid	2 lb
2/14/85	Aluminum Oxide Abrasive Powder	1 gal
"	Mercuril Chloride 100%	1 lb
"	(Ethylene Dinitrillo)-Tetraacetil Acid 100%	1 kg
"	Ferric Chloride 100%	5 lb
"	Ferrous Ammonium Sulfate 100%	453 g
3/7/85	Lead Oxide Waste	200 lb
"	Trichloroethylene 100% on rags	1 cu ft
3/14/85	Activated Charcoal from Filters in Bldg. 841A-TCE and other Hydrocarbons	50 lb
"	Organics on Paper Towels	1 lb
"	Contaminated Cans Used for Organics	5 lb
3/21/85	ST	1 oz
"	Lead Oxide	1.1 lb
"	Lead Chloride	1 lb
"	Rubidium Chloride	50 g
"	Potassium Carbonate	*
"	Ammonium Sulfate	1 lb
"	Magnesium Carbonate	1 lb
"	Copper Metal	2.1 lb
"	Potassium Iodide	2 lb
"	Potassium Nitrate	1 lb
"	Magnesium Chloride	1 lb

* Amount not reported.

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
3/21/85	Potassium Chloride	5 lb
"	Ammonium Sulfate	1 lb
"	Ferric Chloride	1 lb
"	Lead Oxide	1 lb
"	Lead Sulfide Galena	1 lb
"	Lead Nitrate	1 lb
"	Strontium Chloride	1 lb
"	Kaolin	1 lb
"	Magnesium Sulfate	1 lb
"	Rags (Texwipes) w/Ethylendiamine-Pyrocatacol Etchant 100%	*
4/4/85	Laboratory Waste Paper and Organic Etchant	3 lb
4/11/85	Plastic Bag HCPB (H2 Getler) Contaminated Material	1 lb
"	Contaminated Materials Organometallics	2 lb
"	Strontium Carbonate	0.5 lb
"	Kodak X-Ray Fixed (Unophenol)	11.75 lb
"	Plastic Bags w/Organo-Lead	*
"	Contaminated Glassware	1 lb
4/18/85	Filters	2 lb
5/2/85	Lead Oxide	5 lb
"	Bag of Charcoal w/Absorbed TCE	3 lb
"	Caustic Soda	300 lb
"	Safe Acid (NALCO)	200 lb
"	1,1,1-Trichloroethane in Waste Rags	2 lb
"	Tissues Al Foil Glass Bottles Contaminated w/Mercury	0.5 cu ft

* Amount not reported.

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
5/16/85	Resin (Polystyrene Beads)	25 lb
5/23/85	Inorganic Lead Compounds 95%	90 lb
"	Ammonium Chlorate	100 g
"	Lanthanum Ytterbium Alloy	100 g
"	Titanium Sulfate	100 g
"	Barium Acetate	50 g
	Cadmium Sulfate	50 g
"	Cadmium Chlorate	100 g
"	Chromium Bromide	100 g
"	Chromium Iodide	50 g
"	Hydroquinone	50 g
"	Thallium Iodide	500 g
"	Tetracyanoglinodimethane	5 g
"	Hydrogen Iodate	50 g
"	Lead Sulfide	500 g
"	Lead Titanate	100 g
"	Nitrotoluene	*
"	Potassium Bromide	100 g
"	Praseodimium	50 g
"	Strontium Chloride	100 g
"	Titanium Dioxide	1 lb
"	Rubidium Chloride	1 kg
5/16/85	Plastic bag tape contaminated w/Be	3 rolls
5/23/85	Manganese Solenide	2 kg
"	Tetrabutyl Ammonium Perchlorate	500 g
"	Lanthanum Nitrate	500 g

* Amount not reported.

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

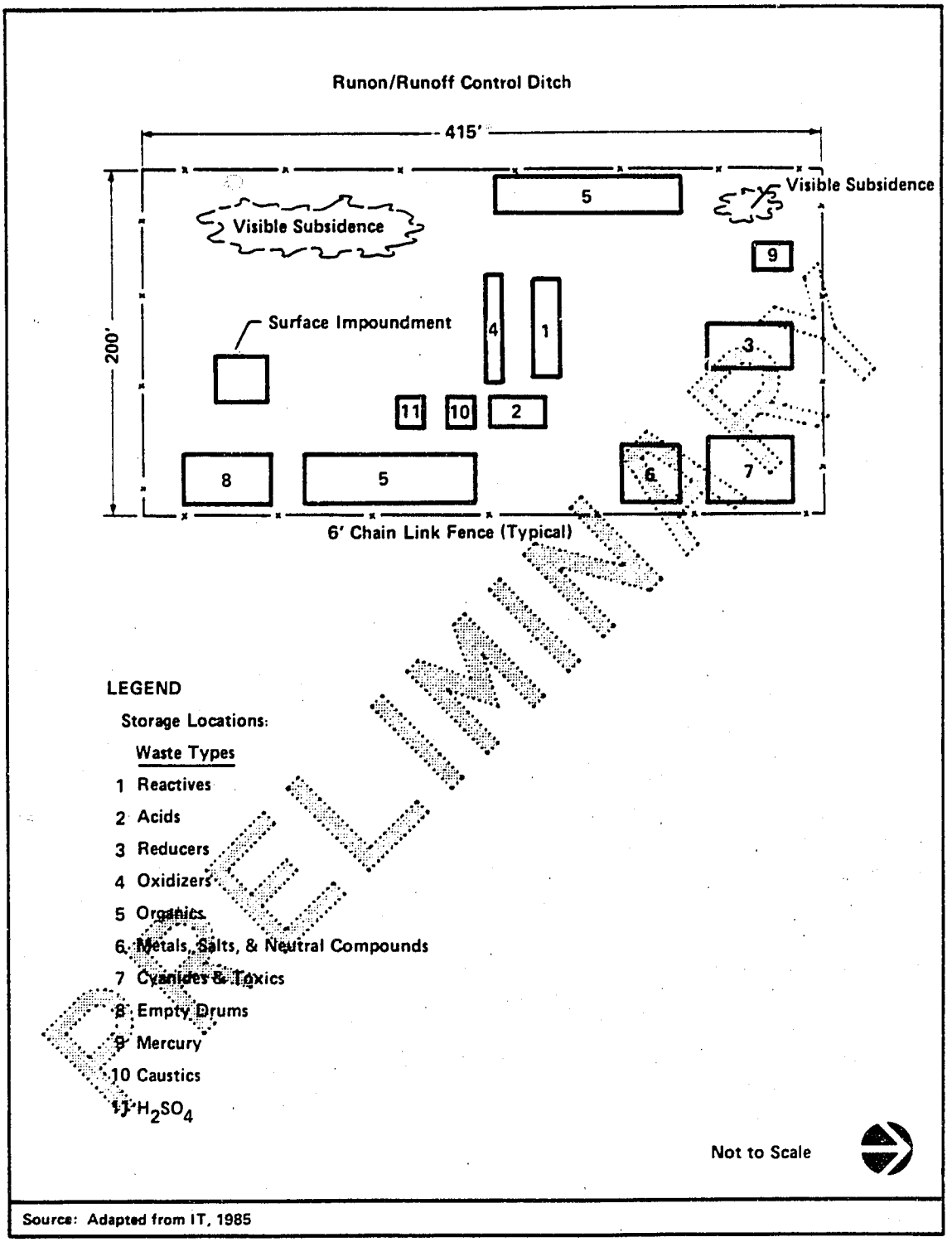
Date	Compound	Amount
5/23/85	Ferric Sulfate	500 g
"	Zirconium isopropoxide	100 g
"	Potassium Oxalate	100 g
"	Lead PZT Powder Waste	3 lb
6/6/85	Lead Contaminated Al Foil and Paper	20 lb
"	Limelf in Carbon Crucible	0.5 lb
6/20/85	Ferric Chloride	3 lb
7/4/85	Potassium Chloride	1 lb
"	Sodium Borohydride	400 oz
"	Yttrium Phosphate	100 oz
"	Zinc Fluoride	1 lb
"	Stannous Pyrophosphate	50 lb
"	Potassium Permanganate	2 lb
"	Bismuth Trioxide	1 lb
"	Aluminum Fluoride	1 lb
"	Lead Fluoride	1 lb
"	Niobium Carbide	200 oz
"	Silver Sulfide	50 oz
"	Potassium Fluoride	1 lb
"	Potassium Chloride	1 lb
"	Copper Pyrophosphate	5 lb
"	Cadmium Carbonate	4 oz
"	Cupric Chloride	5 lb
"	Cuprous Chloride	2 lb
"	Chromium (III) Acetylacctonate	500 oz
"	Cuprous Sulfide	1 lb
"	Ammonium Fluoride	1 lb

TABLE 4-3

SOLIDS DISPOSED OF INTO PITS OF TECHNICAL AREA III CHEMICAL LANDFILL DURING 1985 (Continued)

Date	Compound	Amount
7/4/85	Cobaltous Sulfate	4 lb
"	Cadmium Sulfide	3 lb
"	Aluminum Nitride	100 g
"	Potassium Permanganate	113.4 g
"	Niobium Carbonate	500 g
"	Potassium Permanganate	4 lb
"	Oxalic Acid	6 lb
"	Oxalic Acid	1 kg
7/18/85	Meso-Azo-Bis-Alpha-Phenylethane	150 g
"	Bromine <1% on rags in plastic bags	1 cu ft
"	Arsenic Metal 100%	10 g
8/15/85	Stainless Steel Powder	267 g
"	Cerium Oxide	31 g
"	Silicon Carbide	37 g
"	Molybdenum	71 g
"	Ground Aluminum Oxide Glass	*
9/12/85	Lead Contaminated Foil	2 cu ft
9/26/85	Chromium Oxide Sesqui 100%	453 g
"	Titanic Oxide	453 g
"	Aluminum Oxide 98.5%	453 g
"	Naphthalene 99%	250 g
"	Phenanthrene 98%	100 g
"	Cupric Oxide 99%	453 g
"	Glyoxal Sodium Bisulfite 98%	250 g
"	Zirconium Oxide 100%	500 g
"	Stannic Oxide 99%	453 g
"	2-Nitropropane 100%	1 kg
"	Rhodamine 590 100%	5 g

* Amount not reported.
Source: IT, 1985



Source: Adapted from IT, 1985

CHEMICAL WASTE LANDFILL AND CONTAINER STORAGE AREA FIGURE 4-1
TECHNICAL AREA III

in accordance with RCRA upon completion of the new hazardous waste management facility.

An inspection of the landfill by the New Mexico Environmental Improvement Division (EID) in January 1987 resulted in a Notice of Violation dated April 3, 1987. The notice cited noncompliances with several New Mexico Hazardous Waste Regulations. Most of the noncompliances dealt with administrative issues such as exceedance of listed storage capacities, timely submission of closure and monitoring plans, recordkeeping, aisle space, etc. The facility responded on April 30, 1987, documenting corrections of the items cited.

During the Survey, an estimated 500 drums were observed within the fenced Chemical Waste Landfill area. These drums were marked and segregated by waste type, although markings were not evident in some cases. The drums were marked according to SNLA's internal waste coding system as opposed to EPA or U.S. Department of Transportation (DOT) classifications. The drums were stored upright on pallets, with no protection from the elements. Some of the drums were observed to be slightly bulged.

Subsidence of the landfill area was evident, particulary in the northwestern and southwestern parts. Portions of old, crushed drums were partially exposed in some of the subsided areas. Also observed in the northwestern portion was a rubbery, foam-like substance that appeared as if it had emerged from beneath the landfill surface.

As empty drums are accumulated at the Chemical Waste Landfill, they are crushed for subsequent disposal at the KAFB Sanitary Landfill. SNLA follows the RCRA definition of "empty" (i.e., less than 1 inch of material remaining). Vermiculite is added to absorb any residual liquids in the empty drums prior to crushing and disposal. This practice is in accordance with RCRA. However, RCRA does require that containers of acutely toxic wastes (listed in 60 CFR 261.33(e) with hazardous waste code numbers beginning with the letter "P") be at least triple - rinsed with a solvent capable of removing the container contents before the container is considered empty (40 CFR 261.7). Disposal of empty P-series waste drums was not observed during the Survey. However, triple-rinsing was not described as a drum disposal practice, although some of these wastes (including PO15, and PO96) are included in the current Part A Permit Application.

Thermal Treatment Facility

The Thermal Treatment Facility is located adjacent to Building 6715. Included under SNLA's RCRA Part A interim status, the facility is used to destroy wastes generated by the Light-Sensitive Explosives Laboratory in Building 6715. The facility consists of a 4-foot by 4-foot, square, curbed, concrete slab enclosed by an 8-foot-high steel mesh screen. Two remotely controlled propane flame jets project over the slab to ignite and burn the wastes placed on a solid steel pan inside the cage. The wastes thus treated consist of acetonitrile and acetone contaminated with nitric acid and silver nitrate. The waste explosive is light- and shock-sensitive, but is nonexplosive in liquid form. Bucket quantities of liquid waste from explosive formulation are placed within the unit, and the propane jets are activated to dry the waste, thus detonating it. Also destroyed in this manner are filters and paper masks used at the facility. The waste will be allowed to burn completely. Facility personnel described the residues as Extraction Procedure (EP)-toxic for silver and therefore, the residues are disposed of by the SNLA Waste Management Division. Facility personnel estimated that about 20 to 25 gallons of liquid wastes are treated monthly over a 7-month period.

Although the unit has RCRA Part A interim status, SNLA deleted it from its most recent Part B permit submission (Revision 2.0, June 1985) until such time as final thermal treatment regulations are promulgated. Under interim status, however, a closure plan is required (40 CFR 265, Subpart P) and SNLA was cited for noncompliance in the New Mexico EID April 3, 1987, Notice of Violation. SNLA provided an "informational" closure plan (dated April 9, 1987) with its response to the state.

Radioactive and Mixed Waste Management

Generators of radioactive wastes collect and package low-level wastes in labeled plastic bags for pickup and removal. Radioactive waste collection and transport to the radioactive waste disposal site in Technical Area III is performed by Health Physics personnel. They then identify the disposal destination of the wastes, whether to the classified pit, unclassified trench, or uranium pit.

The Technical Area III Radioactive Waste Disposal Facility is used for disposal of solid LLW. Both classified and unclassified solid LLW are accepted at this facility. Any

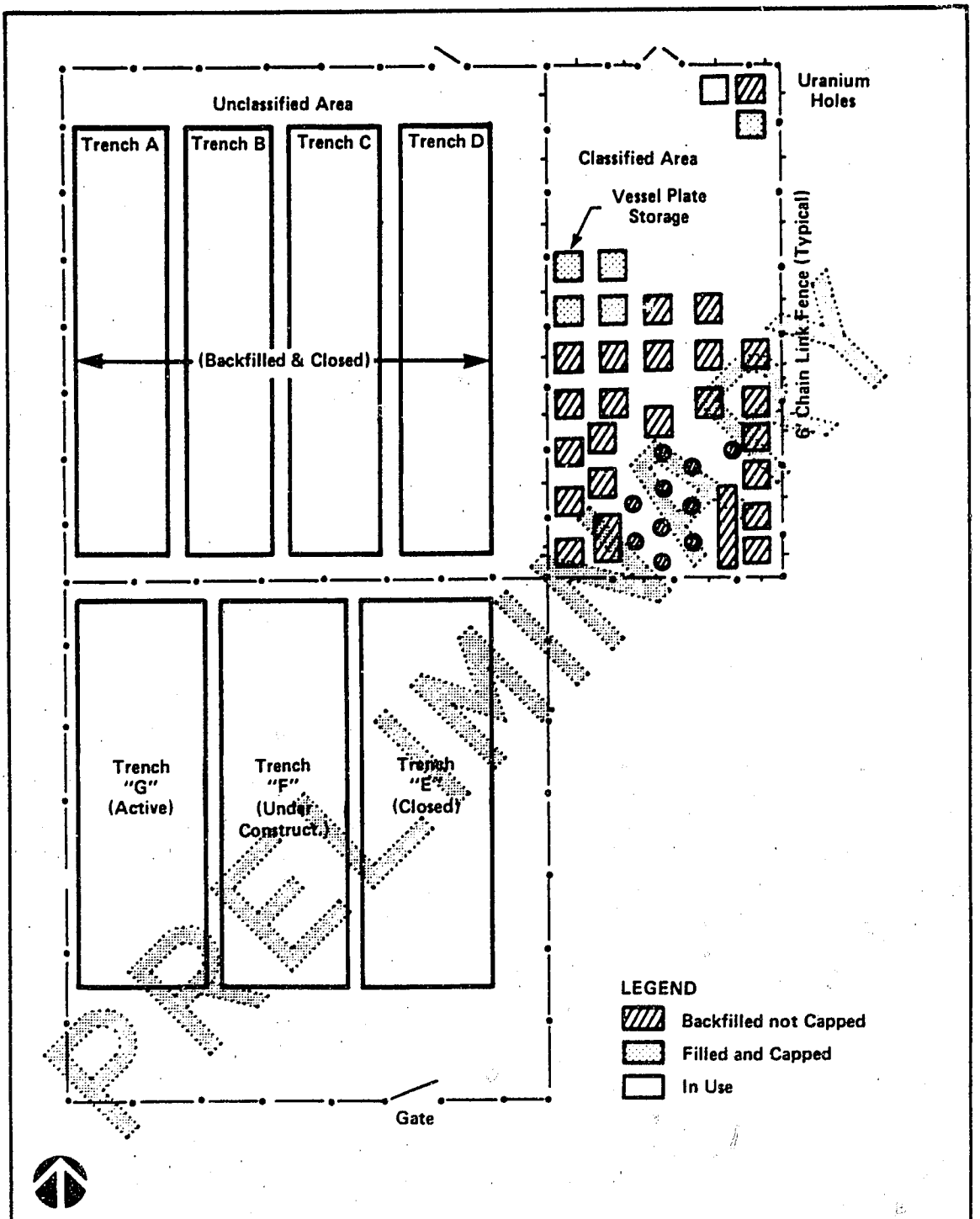
low-level liquid waste that is generated is solidified prior to disposal. Disposal of radioactive materials with hazardous chemical constituents (mixed waste) also occurs at this facility and is discussed subsequently. The facility is located just west of the sled track facility. The site has been active since 1959 and covers an area of about 1.6 acres. A diagram of this facility is given in Figure 4-2.

All disposal of radioactive wastes is overseen by Health Physics personnel to help ensure that packaging and disposal of the waste is done according to Federal regulations. Radioactive materials are packaged, transported, and disposed of using approved procedures, appropriate clothing, and radiation monitoring equipment. A government vehicle specially equipped with an emergency radio, placards, full-face respirators, and anti-contamination supplies is used to transfer the wastes.

In past operations, liquid wastes were placed directly into the radioactive waste burial trenches. Radioactive liquid wastes are no longer accepted for on-site disposal. Only solid wastes are now allowed to be disposed of at the radioactive waste disposal site.

The disposal site consists of a series of pits and trenches for shallow-land burial of waste. Originally, wastes were disposed of in cylindrical pits about 5 feet in diameter and 20 feet deep. These pits covered an area of about 100 feet square, and were backfilled and marked with posts. The original pits make up the southern half of the current classified disposal area. The newer unclassified waste disposal area consists of six trenches (each about 40 x 130 x 25 feet), five of which have been closed, backfilled with soil, and covered. The sixth trench (F) is open and active. Alongside the active trench, a new trench is being dug for use once the active one is closed. None of the waste disposal pits or trenches are lined.

There are also some smaller fenced disposal pits (10 x 10 x 25 feet) at the site for burial of classified items, uranium, radioactive sources, and materials above 100 mR/hr. Closed classified pits are capped with concrete and marked with a pipe. A specially designated pit within the classified area is used for uranium disposal. New trenches and pits will be added as needed. The estimated volume and radioactivity level of waste buried at the Technical Area III Radioactive Waste Disposal Facility are shown in Table 4-4.



Source: Adapted from ES, 1981

RADIOACTIVE WASTE DISPOSAL FACILITY FIGURE 4-2

TABLE 4-4

ESTIMATED VOLUME AND RADIOACTIVITY LEVEL OF WASTE BURIED IN THE TECHNICAL AREA III RADIOACTIVE WASTE DISPOSAL SITE FROM 1979 to 1985

Waste Type	Activity (curies)	Volume (ft^3)
Plutonium (alpha)	6.47	
Uranium/thorium	6.41	
Tritium	5940.	
Fission products	54.5	
Induced activity	143.	
Volume (1979-1985)		20,700
TOTAL ESTIMATED VOLUME (1959-1985)		720,000

Source: Data from Department of Energy Solid Waste Information Management System Annual Summary

The active LLW disposal trench has a ramp at the south end for vehicle access. Disposal of material begins at the north end of a trench. As material accumulates, the trench is periodically backfilled. Backfilling would appear to be an infrequent occurrence, as bags of radioactive wastes remained uncovered in the active trench during the period of the DOE Survey.

The area is fenced and radiation warning signs are posted on the fence. However, it was observed during the Survey that the fence had been knocked down by heavy equipment during the digging of the new trench.

The burial site has received a variety of radioactive and radioactive/hazardous chemical mixed wastes. Wastes buried at the site are primarily depleted uranium from weapons components and neutron generator tubes containing tritium. Also buried at the site are the following types of wastes: metals with induced activity and low-level fission products from the reactors; HEPA filters from the reactor and hot cell facilities; neutron-activated materials from weapons experiments at the

Nevada Test Site (NTS); radioactive tracers from small-scale chemistry experiments; encapsulated beta/gamma sources (cobalt-60 and cesium-137) placed in drums filled with concrete; radioactively contaminated oils and other liquids from the laboratories placed in drums with dirt, plaster-of-paris, or concrete; LSC vials; radioactive and beryllium-contaminated materials (including pieces of weapons, planes, and trucks) brought back from the NTS; and lead-filled spent-fuel shipping casks and other contaminated shielding equipment. As mentioned in the introduction to this section, classified waste buried at SNLA consists primarily of tritium-contaminated equipment and classified uranium shapes. Other materials that are buried at the site are as follows.

Certain pits within the area were designated to contain special projects. A radioactive acid pit located in the southeast corner of the facility was used prior to 1969 to dispose of contaminated chemicals including solvents and acids. Materials containing plutonium are buried in one pit, and beryllium in another. Drums of TRU waste under 100 nCi/gram have been buried in Trench E (Millard et al., 1987).

The Technical Area III radioactive burial site has received and continues to receive radioactive/hazardous chemical mixed waste, and as such is more correctly being called the Technical Area III radioactive mixed waste burial site. Known hazardous wastes placed in the burial site include solvents, acids, radioactively contaminated oils, LSC vials, and activated and contaminated lead and cadmium waste.

As discussed in the introduction to Section 4.1.1.1, SNLA is preparing for submittal to EPA a revised RCRA Part A permit application that includes radioactive mixed waste generation and disposal. There are currently no groundwater monitoring wells located at the radioactive disposal area. This is discussed in greater detail in Section 3.4.

Health Physics personnel inspect the disposal site at least weekly to help ensure that radioactive materials are being disposed of properly. A quarterly maintenance inspection is also done by Health Physics. Weekly inspections of the radioactive disposal facilities are also done by the SNLA Waste Management Division to help ensure that waste disposal is done in an appropriate manner and in compliance with applicable regulations.

Radioactively contaminated wastewater has been discharged into older trenches. During the Survey, rainwater was observed being pumped from the bottom of the newly dug trench and discharged on top of the active landfill. This water could potentially have caused increased migration of contaminants through the soil column.

Older trenches and pits were also observed to show signs of subsidence, and rodent holes were observed on top of burial areas. There are no runoff control measures at the site.

There are no current plans to surplus or decommission radioactive waste facilities at SNLA. If any new facilities are constructed in which radioactive or hazardous materials are utilized, SNLA plans to design them to limit dispersion of these materials and to simplify decontamination and decommissioning or reuse. SNLA does plan to discontinue on-site burial of radioactive wastes sometime in 1988.

Technical Area IV

As previously discussed, Technical Area IV is a relatively new technical area at SNLA, and conducts research in inertial confinement fusion and pulsed power. Several large accelerators, not all of which are yet operational, plus accompanying support facilities, are located within the area.

Hazardous chemical wastes generated within the area consist mainly of small amounts of expended cleaning solvents and solvent-laden rags from technical support shops. Empty solvent containers and rags are disposed of as trash. Other wastes that are occasionally generated include Freon, $CuSO_4$, and transformer oil filters (non-PCBs). These wastes are collected and handled by the SNLA Waste Management personnel.

No radioactive wastes are currently being generated as a result of Technical Area IV operations. In the near future it is projected that small amounts of tritium-contaminated solid waste may be produced. Additionally, small amounts of proton-activated metal waste, including lithium metal, and lithium nitrates and hydroxides, may be produced. This waste may be construed as radioactive mixed waste.

Technical Area V

As previously discussed, facilities in this area include electron beam accelerators, three research nuclear reactors, a gamma irradiation facility, and a hot cell facility.

Hazardous chemical wastes generated within the area include expended solvents and solvent-laden rags from support shops (e.g., Machine Shop). Spent solvents generated from such shops do not appear to be systematically handled by the generators through the SNLA Hazardous Waste Management Program.

Radioactive wastes generated in Technical Area V include LLW, TRU waste, and radioactive mixed waste. The majority of induced activity wastes generated at SNLA come from the facilities located in Technical Area V. Uranium-contaminated wastes are also produced. Wastes are generated by the:

- Reactor and reactor-related facilities
- Gamma Irradiation Facility (GIF)
- Technical Area V Hot Cell Lab (HCL)

The reactor and reactor-related facilities such as the Glove-Box Lab generate most of the radioactive LLW in Technical Area V. This includes induced activity waste and small amounts of uranium-contaminated waste. The LLW consists of contaminated equipment, HEPA filters, cleanup combustibles, and reactor resin beds which are exchanged periodically.

The Gamma Irradiation Facility generates large amounts (1,000 lb, SNLA, 1986a) of induced LLW (cobalt-60 and cesium-137) in the form of contaminated resins whenever the facility resin beds are changed. The degree of contamination is reportedly minimal. Resins are discarded by removal of a spent resin bed to the loading dock followed by transfer of the contained resins to a storage drum for eventual pickup and disposal by SNLA Health Physics personnel. A resin bed in the process of being changed was observed being stored outside, open-ended, and was filled to overflowing with rainwater. Transfer to the accompanying storage drum, which contained previously collected resins, had not been accomplished within at least 2 weeks of removal of the bed to the loading dock. The storage drum used to

collect the resins was also observed to be unsecured, as its lid was ajar and it was situated on the edge of the dock.

The Technical Area V Hot Cell Lab produces LLW, TRU wastes, and radioactive mixed wastes. Fairly large volumes of LLW are generated (mainly from the glove boxes) in the lab and include gloves and paper trash. These are put into appropriately labeled plastic bags for pickup and disposal at the radioactive disposal site (Technical Area III) by SNLA Health Physics personnel.

Wastes generated within the Hot Cell include solvents, acids, bases, radioactive materials, and radioactively contaminated equipment and wastes. Wastes are placed into paint cans for removal from the cell and, if liquid chemicals are present, the waste is solidified prior to removal. Once removed, the radioactive materials and wastes are checked for levels of activity and placed within cement-lined 55-gallon drums.

If activity levels are found to be high (greater than 100 nCi/g), the wastes are transported to and stored within an old reactor room located within the building. Materials have been accumulating within the reactor room for up to 5 years. This includes TRU wastes. Eventually it is planned that this waste will be shipped to Los Alamos National Laboratory for certification and eventual disposal at the Waste Isolation Pilot Plant (WIPP) site.

Radioactive materials and wastes with lower activities are transported to and disposed of at the radioactive waste landfill in Technical Area III. This includes the plastic bags of LLW and the drums containing materials removed from the Hot Cell.

Much of the radioactive waste removed from the Hot Cell can be classified as mixed waste, since it is often commingled with laboratory chemicals. At the present time these mixed wastes are disposed of at the radioactive disposal site (Technical Area III) or, if activity levels are found to be high, are stored within the old reactor room.

As with other areas at SNLA, Health Physics personnel oversee the disposal and storage of radioactive wastes at Technical Area V. They are also responsible for monitoring the storage of materials in the reactor room. Waste Management personnel are actively involved in the disposal of Technical Area V materials at the

radioactive waste landfill and also provide instruction for handling and disposal or storage of the generated radioactive mixed wastes.

Coyote Test Field

The Coyote Test Field (CTF) has provided remote field areas for conducting large hazardous experiments, often involving the detonation of large quantities of chemical explosives. As previously discussed, operational areas include the new and old aerial cable sites, the Madera Canyon rocket launcher pads, the Lurance Canyon burn site, the shock tube facilities, explosives firing sites at Thunder Range, the Electroexplosive Facility (Building 9990), the Laser Facility, the pressure vessel test area, small explosives firing sites (Buildings 9920 and 9927), and CTF Headquarters.

Hazardous chemical wastes appear to be generated in only small quantities by the types of operations conducted at CTF. Solvents and inorganic acids are occasionally used by the explosives testing labs. Solvents include alcohols, toluene, TCE, and acetone, which are generally used for cleaning. It would appear that there have been instances in which improper disposal, such as dumping spent solvents into the ground or drain, has occurred. As with other areas at SNLA, it appears that solvent-laden rags and tissues are disposed of in the trash. Additionally, some of the explosives test labs at CTF also house darkrooms that use a variety of photoprocessing chemicals, which are not systematically disposed of (i.e., may be disposed of down the drain) through SNLA Waste Management personnel.

Mercury switches that comprise part of the linear accelerator in Building 9990 are occasionally replaced. These switches are returned to the manufacturer for disposal. On an occasion where one has broken, Health Physics personnel responded to the resulting spill, collecting the mercury and switch parts for proper disposal.

Drums containing unknown materials were observed in storage behind the CTF Headquarters building. It is not known whether these drums contained wastes, hazardous or otherwise, but the drums appeared to have been there for a long time.

Past field operations within the CTF complex have generated beryllium-contaminated protective clothing (SNLA, 1984a). These wastes were disposed of at the hazardous waste landfill in Technical Area III.

Probably the largest potential for the generation of hazardous wastes in CTF stems from the explosives testing operations conducted at the various sites. Potential wastes include explosives debris (possibly containing barium) and metallic debris (lead, beryllium, depleted uranium). As a result of this potential, several of the facilities within CTF were identified during Phase I of DOE's CEARP as potential RCRA sites. These are listed in Table 4-5. The identification of these various waste disposal sites, test areas, and treatment processes was based on judgment as to whether these sites may have received or treated hazardous chemical wastes after the 1980 RCRA hazardous waste regulations became effective.

Explosives used during test operations are often completely detonated, thereby leaving little or no hazardous residue. When there is a misfire or larger explosive particles are generated, they are collected and disposed of by SNLA Waste Management personnel. Larger pieces of shrapnel and other debris that may be generated are also collected. Residual explosives are also occasionally destroyed by burning with propane torches or, if generated within an explosive test lab, residual powders are often removed by wiping them from surfaces with alcohol-saturated tissues. Although such measures are taken, in an open test area, any finely divided material may be scattered on the ground or particles may become embedded within the earth. Whether these residual high explosives and metal particles constitute hazardous waste, and thus an environmental hazard, is unknown. The extent to which such dispersion or contamination has occurred is also unknown.

Radioactive wastes produced by CTF operations include uranium debris from the Burn Site (infrequently generated) and some of the other facilities. Except for finely divided materials, such debris is collected by Health Physics for disposal in the classified disposal area uranium pit (Technical Area III) and the radioactive disposal trench.

TABLE 4-5

POTENTIAL RCRA SITES IN COYOTE TEST FIELD IDENTIFIED DURING CEARP PHASE I

Site	Potential Waste Generated
Gas Cylinder Disposal Area (Thunder Range)	Hazardous gases
Burial Site, Open Dump, and Test Area (New Aerial Cable Site)	Testing debris, possibly Pb, Be, depleted U, or residual rocket propellant
Scrap Yard, Open Dump and Test Area (Old Aerial Cable Site)	Testing debris, possibly U, and other metals (Pb, Be) rocket propellant, or residual high explosives (Ba)
Building 9920 Firing Site	Testing debris, possibly Be, Cd, Li, Mn, Pb, or depleted U or residual high explosives (Ba)
Building 9927 Firing Site	Testing debris, possibly residual high explosives (Ba), Pb, Be, or depleted U
Building 9990 Firing Site	Testing debris, possibly residual high explosives, Pb, Be, or depleted U
Firing Site (Guard Tower and Trailer)	Possibly residual high explosive, including Ba, Pb, Be, or depleted U
Thunder Range	Testing debris, possible Pb, depleted U, residual high explosive (Ba), or Be
Beryllium Firing Site	Possibly high explosive or Be
Pressure Vessel Test Site	No hazardous materials observed to be generated
Rocket Launcher Pads (Madera Canyon)	Possibly residual rocket propellant (explosive)
Lurance Canyon Burn Site	Possibly metallic particulates, explosives residuals, Be, depleted U
Explosive-Contaminated Sumps, Drains, and Drainfields (Bld. 9920)	Possibly residual high explosives or solvents

Source: DOE-AL, 1987

Radioactive mixed wastes are also produced by CTF operations. These consist primarily of lead wastes contaminated with radioactive materials. The extent of such waste generation, while unknown, may be small since the package or weapon being tested is most often returned to its owner. Again, finer residual materials may remain after testing. As with nonradioactive materials, the degree of such generation is not really known, nor is the potential for environmental hazard known.

Manzano Base

The Manzano Base is a KAFB secured area in the Manzano Mountains east of the SNLA technical areas. The Manzano Base includes a fire training area, a landfill, and several radioactive burial areas that are associated solely with KAFB activities. The prominent feature of the Manzano Base is the presence of numerous secured concrete storage bunkers, or igloos, that dot the mountainside. These igloos are used primarily for secured storage of KAFB defense properties, and several are shared by SNLA for storage of a variety of materials previously used or to be used in SNLA research and development activities.

Approximately 10 igloos containing SNLA properties were visited during the Survey. These were observed to contain a wide variety of materials, including various packaged radioactive or irradiated materials; rocket motors; explosive materials, including TNT; and chemicals, including lanthanum acetate, zirconium oxide or dioxide, and beryllium. Most of these items appeared to be stored acceptably on pallets. However, SNLA personnel expressed some concern that the contents of some materials may not be fully known, and that the radioactive materials may have to be characterized and treated as mixed wastes when they are designated for disposal. At present, no wastes are stored in the igloos, and the materials will not be considered as wastes until they are released by the experimenters and the SNLA Environmental Protection and Hazardous Waste Management Division is notified. This Division has also designated structure 7049 at Manzano Base the location at which TRU-contaminated wastes (greater than 100 nCi/g) from SNLA will be stored pending shipment to an authorized disposal facility.

Central Training Academy

The CTA encompasses the campus area near Manzano and the Live Fire Range (LFR) in Coyote Canyon. Both areas are administered by KAFB, with the LFR being U.S. Forest Service land permitted to the DOE.

Hazardous chemical wastes generated by CTA are few and are produced in small amounts. They consist of gun-cleaning solvents ("Breakfree" and Hoppes No. 9) used at a weapon cleaning building located in the parking area of the LFR. An ultrasonic cleaning bath is in the building, which contains approximately 5 gallons of solvent. The bath is emptied or changed about four times a year.

In a cooperative agreement with SNLA, Environmental Protection and Waste Management Division personnel handle these wastes for CTA. This includes the pickup or removal of wastes, repackaging (if necessary), and ultimate disposal. Rags soaked with solvents and used for gun cleaning are disposed of in the trash and then picked up and subsequently disposed of with other sanitary wastes at the KAFB Sanitary Landfill. The CTA also captures waste oil, which is subsequently sent for recycling. This waste is handled by SNLA's Motor Pool facility.

The only other potential source of hazardous waste generated by the CTA would be spent ammunition used in target practice that becomes scattered in the area behind the target and lodges within earthen berms at the LFR. Whether this material constitutes a hazardous waste, and thus an environmental problem due to lead content, has not yet been evaluated or regulated.

No radioactive or mixed wastes are generated by the CTA.

Transportation Safeguards Division

Located in the CTF complex, the Transportation Safeguards Division (TSD) conducts training of DOE nuclear materials couriers. It is operated by DOE-AL and its activities and administration are unrelated to those of SNLA. The TSD facility includes administrative trailers and a firing range with accompanying trailers for gunsmithing and ammunition storage.

Hazardous chemical wastes are produced infrequently and in small amounts. Such wastes are generated as a result of gun-cleaning activities that occur in the weapons cleaning room. Cleaning solvents are used on rags and in a cleaning bath. The bath has received infrequent use until recently. At the present time there is no program in place for the proper removal and disposal of waste solvents generated in this bath. What past disposal operations consisted of is unknown. Solvent-laden rags are allowed to evaporate and are then put into the trash with subsequent garbage pickup and disposal. As with the CTA, lead bullets become lodged in the earthen berms of the firing range as a result of training activities.

No radioactive or mixed wastes are generated by the TSD.

4.1.1.2 Bendix Albuquerque Operations

The Bendix Albuquerque Operations (BAO) is a custom semiconductor manufacturing facility located in the Building 870 complex of SNLA Technical Area I. Although co-located with the SNLA facilities, BAO is operated by the Kansas City Division of the Bendix Aerospace Sector of Allied-Signal Corporation.

BAO produces radiation-hardened, custom-designed integrated circuit functions such as random access memory, custom linear and digital electronic functions, electronic interfaces, and microprocessors. The integrated circuit operation begins with purchased silicon wafers which are transformed into discrete integrated circuit packages by a series of over 350 separate wafer fabrication, integrated circuit assembly, and testing procedures. These processes make use of several chemicals, including acids, alkalis, organic solvents, Freon, and toxic gases. Approximate amounts of liquid chemical wastes produced by the processes and discharged into the BAO solvent capture system (SCS) are reported as follows:

Chemical	Gallons/Month (approximate)
Acetone	75
Ammonium Hydroxide	1
Freon	80
Nophenol	35
Photoresist *	40
Pump Oil	25
2-Propanol	43
R-10 Photoresist Stripper **	5
Tergitol TX-100 (surfactant)	<1
Deionized Water	225
Xylene	12
Total	542

*Ethylene glycol monoethyl ether acetate
**Diethylene glycol monobutyl ether 70% and ethanol amine 30%

The BAO facility is identified with the U.S. EPA and the New Mexico EID as a hazardous waste generator (identification number NM4890110519, issued November 1986). Because wastes from the SCS tank are picked up by SCA Chemical Services of Chicago, Illinois, for disposal by incineration, BAO also holds Illinois generator identification number 9350015009. Drummed wastes are disposed of through Chemical Waste Management, Inc., at the rate of approximately 10 drums every 90 days. Because wastes are automatically shipped out every 90 days, the facility is not required to hold a permit for waste storage.

Waste management facilities at BAO include the aforementioned SCS, the Elementary Neutralization Unit (ENU), and a hazardous waste holding area. These facilities are located north of and across L Street from Building 870.

The SCS is a 1,700-gallon stainless steel tank installed below grade in a sealed concrete pit. The tank is fed by a gravity drain network originating at wet benches 4, 5, and 8 and at scrubber tracks 1 through 5. The tank capacity was based on the maximum quantity of solvent waste likely to be generated at the wet benches and scrubber tracks during a 90-day period. A schematic diagram of the system shows it to be equipped with flame arrester, level indicator controller, and a sump at the

bottom of the concrete pit. All associated underground piping is described as being double-contained with leak detection and freeze protection devices installed within the secondary containment. The SCS is inspected daily.

The ENU is a pH adjustment system for neutralization of acid and caustic wastewater prior to discharge to the local sanitary sewer. Further discussion of the ENU is provided in Section 3.3.2 of this report.

The Hazardous Waste Holding area is presently located outdoors within the ENU area. Approximately 370 square feet of indoor holding space will be available for use in the new BAO chemical store (Building 870-C) currently under construction. Under present conditions, waste drums and cans are held on pallets on the concrete pads surrounding the acid and caustic bulk tanks of the ENU. No curbing or other secondary containment was provided for the drums. Observed at the time of the Survey were approximately 20 empty sodium hydroxide drums; four 5-gallon cans of Freon precision cleaning agent (said to be waiting for decanting into a 55-gallon drum for recycling); 10 empty 55-gallon drums; 100 empty 5-gallon precision cleaning agent cans; and 40 empty antifreeze cans. Standard practice at BAO is to drip residual drum or can contents onto sawdust, fill the bottom of the container with about 1 to 3 inches of vermiculite, and then send the drum to the SNLA Technical Area III drum storage area for subsequent disposal. There is no rinsing of the thus-emptied container prior to disposal. The wastes from the emptied drums are disposed of by landfilling or incineration, as appropriate, by the disposal contractor.

A small metal pan (approximately 3 feet wide x 5 feet long x 6 inches deep) between the SCS tank and the ENU was observed to contain several small glass and metal containers. These containers held waste chemicals which were brought to the pan by BAO employees for subsequent transfer into the appropriate disposal containers by BAO environmental personnel. Access to the Hazardous Waste Holding Area is not controlled, and warning signs of potential hazards are posted within the holding area, not outside. Inspection records, manifests, and other waste management records are kept by BAO personnel in accordance with guidance from the Bendix Kansas City Division.

4.1.1.3 Inhalation Toxicology Research Institute (ITRI)

As previously discussed, the ITRI conducts studies on the effects of inhalation of toxic and radioactive pollutants. As a result of laboratory research activities, hazardous, radioactive, and radioactive mixed wastes are generated.

The waste handling program at ITRI is administered by the Health Protection Operations (HPO) Unit. HPO personnel collect, transport, package, monitor, and store all hazardous and radioactive wastes.

Waste Generation

The types of nonradioactive hazardous wastes produced by ITRI's operations include laboratory chemical wastes, biological wastes, and carcinogenic wastes. Chemical wastes are produced as a result of a variety of chemical processes, including dissolutions, chromatography, tissue digestion, sample preparation, and assorted analytical and histopathologic techniques. These are, generally, either organic liquid wastes, aqueous liquid wastes, or solid chemical wastes. A wide variety of hazardous and carcinogenic chemicals are used in inhalation tests; however, the quantity of test chemicals is low. The hazardous wastes currently being generated at ITRI mainly consist of spent solvents (both halogenated and nonhalogenated), spent acids, and miscellaneous discarded lab chemicals. The greatest volumes of hazardous wastes are spent solvents, ethanol and xylene, originating in the histopathology laboratories (ITRI, 1987a). Small quantities of chromic acid, metallic mercury, cyanides, and arsenic waste are also generated. The amount of hazardous-chemical waste generated at ITRI is reported to be about 500 gallons per year (ITRI, 1987a).

There are a large number of biological waste sources at ITRI, including excrement, tissue samples, and animal carcasses. The majority of these wastes may not be hazardous, as defined by RCRA, since the quantities and concentrations of hazardous materials contained in carcasses or tissues are very low. However, these wastes can constitute radioactive wastes due to the common practice of radio-labeling. Approximately 3,000 kilograms of animal wastes are reportedly generated each year, excluding excrement (ITRI, 1987a).

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Materials used for research purposes at ITRI include the potential carcinogens polycyclic aromatic hydrocarbons [benzo (a) pyrene and benzo (a) anthracene], fibrous materials (asbestos and fiberglass), and nickel compounds. Lab wastes potentially contaminated with carcinogens include paper, glassware, gloves, etc. The concentration of carcinogens present in contaminated waste is reported to be very low (ITRI, 1987a). Waste that bears significant quantities of suspected carcinogens but is not radioactive reportedly totals less than 100 kg/year. The total amount of carcinogens contained by this waste is reported to be on the order of 10 kilograms or less, excluding nickel compound wastes (ITRI, 1987a).

The research activities at ITRI produce a variety of radioactive wastes including low-level, stream or TRU, and low-level mixed wastes. Similarly to hazardous wastes, the types of radioactive wastes produced by the facility operations include biological wastes, chemical wastes, and carcinogenic wastes. Both liquid and solid wastes are generated. Radioactive nonhazardous wastes that are produced by research activities include contaminated paper (e.g., animal bedding, protective clothing), polyethylene, washwater, spent laboratory solutions, urine, tissue, carcasses, and excrement.

The quantity of LLW produced annually (1986) at ITRI is reported to be 17,500 pounds. Quantities of TRU waste produced were estimated at 300 pounds. Mixed waste currently generated by ITRI consists of actinide LSC vials, actinide acid digest liquid, lead contaminated with radioactivity, radiolabeled benzo (a) pyrene, and possibly activated charcoal containing tritium-labeled benzene. As previously mentioned, the radioactive biological wastes that are generated probably do not constitute mixed waste, due to the low concentrations of hazardous components in such wastes.

The amount of LSC vials generated at the ITRI is about 70,000 per year (ITRI, 1986b). Of this total, about 75 percent contain tritium and carbon-14 and are considered to be nonradioactive hazardous waste for purposes of waste disposal. The remaining 25 percent contain actinides and must, therefore, be disposed of as a mixed stream waste. The generation rate for mixed radioactive wastes at ITRI has been estimated at 12.75 m^3/yr (ITRI, 1987a).

Hazardous Waste Management

Liquid chemical wastes generated in the normal course of ITRI usage are disposed of by pouring them down the sink. These wastes then end up in a sanitary lagoon system located behind the facility. Laboratory personnel are instructed not to do this with larger quantities (more than 1 liter) of flammable and corrosive wastes. Additionally, there are instructions against the disposal of concentrated acid or bases (e.g., chromic acid), acutely toxic materials that contain certain levels of radioactive, carcinogenic materials, or heavy toxic metals to the drains.

Until relatively recently, all chemicals were disposed of down the drain. Most laboratories are now equipped with 5-gallon polyethylene containers or flammable liquid safety waste containers, and hazardous chemical wastes that are not poured down the drain are collected in the laboratories in these containers. Included are wastes such as xylene, toluene, and methyl ethyl ketone. HPO personnel collect these wastes for off-site disposal. Liquid chemical wastes and volatile solvents are placed into 55-gallon drums for eventual commercial disposal off-site. Heavy-metal-bearing wastes (i.e., toxic metals) are also placed in lined 55-gallon drums for eventual off-site commercial disposal.

The largest quantity of toxic waste normally generated is concentrated chromic acid. Waste acid is placed into plastic-lined drums and then neutralized. Contents are allowed to evaporate under cover. When the drum is full and all liquid has been evaporated, it is sealed and prepared for eventual shipment off-site.

Solid chemical wastes that laboratory personnel deem nonhazardous are disposed of by either dissolving and pouring down the drain or by placing in the normal trash, which is landfilled at the KAFB landfill. If laboratory personnel consider the wastes hazardous, they can call HPO personnel who then collect the waste and take it to an on-site waste storage and disposal area (discussed below). Wastes are subsequently placed into 55-gallon lined drums (Labpacks). Chemicals are kept in original containers. HPO personnel are knowledgeable that incompatible chemicals should not be packaged together. Vermiculite is placed around all containers as a shock-absorbing inert filler and absorbent.

Mercury waste is collected from laboratory equipment spills. It is retained on-site for possible cleanup and reuse, or it is packaged and placed into a Labpack. Waste photographic chemicals containing silver from the photography lab and radiographic suites are collected for reclamation by SNLA. These quantities are normally less than 20 gallons/year.

Empty chemical bottles (liquid or solid chemicals) are discarded of in the trash. Laboratory personnel are instructed to rinse empty containers before disposing of them, or in the case of flammable solvents, to allow evaporation to dryness.

After collection, hazardous wastes are moved to an area located at the southeast corner of the facility for treatment, storage, and disposal. Repackaging, labeling, segregation, and treatment of hazardous wastes are conducted here. Additionally, this is where, after transfer to appropriate containers, collected hazardous wastes are stored. ITRI's facility consists of two small steel sheds, and two concrete-lined radioactive waste holding ponds ("hot ponds") within a fenced and marked area. This chemical and radwaste storage facility is shown in Figure 3-17. The sheds are located on a 4-inch bermed concrete pad that also surrounds the ponds. Recognizing its identification as a generator of hazardous wastes, ITRI has filed a RCRA Part A application naming this area a treatment, storage, and disposal (TSD) facility. The EPA has granted the institute interim operating status, which is contingent on the subsequent submittal of a Part B Permit application. The only hazardous waste treatment operation at ITRI is the neutralization and solidification of chromic acid.

Waste storage facilities for hazardous chemical wastes consist of the two temporary steel sheds previously mentioned. One shed is used for the transfer of waste solvents into 55-gallon drums. Full drums are stored on pallets outside the shed and most are fitted with polyvinyl chloride (PVC) drum covers. The second shed is used to store the Labpack and heavy-metal wastes (chromic acid). Drums are located on pallets within each shed.

While ITRI's hazardous waste generation rate is large enough to disqualify it from RCRA Small Quantity Generator (SQG) status, it is also small enough that the filling of drums in preparation for off-site commercial disposal becomes problematic when environmentally sound residence (storage) times are considered. A majority of

drums observed at this area had been in storage longer than 90 days and some had been there for several years. This includes Labpacks and waste solvent drums. Additionally, these waste-filled drums awaiting shipment off the site are being stored outdoors without protection from the weather.

While hazardous wastes are not currently disposed of on the site, but only stored pending shipment off the site, two hazardous waste disposal facilities were identified by ITRI on their original Part A Permit application. These were the radioactive holding ponds and the facultative lagoons. The lagoon system has since been removed from the application as the lagoons were considered not to be subject to RCRA. The holding ponds were also subsequently removed from ITRI's Part A Permit in January 1983 pursuant to information provided by the site. The holding ponds are described in more detail in the discussion below of mixed waste disposal. Current disposal of hazardous chemical wastes at ITRI consists of shipping, using a commercial transporter, containerized hazardous wastes off the site to an EPA-permitted disposal facility. If materials are waste solvents, full drums are shipped to an EPA-permitted solvent recovery facility. Waste oils are collected and transported to the KAFB oil reclamation site on the base.

Radioactive Waste Management

Laboratory personnel are instructed to segregate, package, monitor, and label radioactive wastes. Radioactive wastes are segregated by the generator into categories established by ITRI. Wastes are segregated into Class A, B, and C liquids, and into Class A (includes TRU waste), B, and C solids (ITRI, 1986a and 1986b).

Class C liquids are liquids containing less than the derived concentration guide for water (DCG_W) for unrestricted areas. Such wastes typically include animal urine, dishwater from washing lightly contaminated analytical glassware, and washwater from personnel decontamination (i.e., from basins and showers), and spent aqueous solutions from analytical chemistry operations. These wastes are typically disposed of by discharge to the sanitary sewer system.

Class B liquids are liquid wastes that contain from the DCG_W up to approximately 1,000 times the DCG_W. Typical Class B liquid wastes include filtrates from some radiochemical procedures and solubility studies, LSCs, radiac solutions from

ultrasonic decontamination of equipment, and solutions from enclosures that do not exceed 1,000 times the DCG_W. Some Class B wastes that contain organic solvents, such as LSCs, constitute mixed waste and are discussed subsequently. In the past, ultrasonic cleaning solutions containing organic solvents and potentially other solvent-containing wastes have been placed in on-site radioactive waste holding ponds.

Class A liquid wastes are those liquids containing greater than 1,000 times the DCG_W. Generator solutions and waste stock solutions from generator preps would be categorized as Class A liquid wastes. Class A liquid wastes are solidified into liquid-tight containers with plaster of paris. They are then bagged and disposed of as solid TRU or low-level waste as appropriate.

Solid wastes are also segregated into Class A, B, or C. Class C solid wastes typically include routine lab waste such as paper, rubber gloves, glassware, and small-animal bedding. These wastes are bagged by the originator and labeled according to radionuclide, approximate quantity, originating laboratory, and name of originator. The sealed and labeled bags are then placed into radioactive waste bins located around the facility for pickup by HPO personnel, who then compact such wastes when possible directly into 55-gallon waste drums for burial. About 90 percent of the solid low-level waste is compacted into drums. All Class C wastes are shipped off-site to the NTS for burial. Radioactive carcinogenic waste is included as a solid LLW and is treated the same as all Class C solid radioactive wastes.

Class B solid wastes are all wastes generated in enclosures such as glove boxes, except those qualifying as Class A solid wastes. Class B wastes are normally sealed in heavy vinyl sleeves for removal from glove boxes. These wastes are placed directly into drums without compaction and shipped off the site.

Class A solid wastes include two categories. The first category includes any waste for which the level of radioactivity would define it as a DOT Type B quantity for shipping purposes. Such wastes are packaged into 55-gallon containers for shipment and burial off-site. The second category of Class A wastes is the DOE TRU waste (greater than 100 nCi/g), which requires a 20-year retrievable container consisting of a 90-mil polyethylene liner in a 55-gallon drum. Such wastes include solids and solidified liquids. TRU wastes are prepared and packaged to meet TRU

waste acceptance criteria for the WIPP and shipped to Los Alamos National Laboratory (LANL) for retrievable storage. Low-energy gamma counting is sometimes used to screen doubtful waste packages into either TRU or LLW categories.

Urine and excrement from test animals that are not collected for analysis normally go directly into the sanitary lagoon system. Excrement that is known or suspected to be radioactive or carcinogenic is supposed to be segregated for appropriate disposal. During past operations, these wastes were disposed of to the radioactive holding ponds discussed below. Waste tissues and blood samples taken from research animals and animal carcasses are placed in an on-site Pathological-Waste Freezer as they are generated. After sufficient waste accumulates in the freezer, the waste is disposed of in a Pathological-Waste Destructor located at the facility.

On-site radioactive waste management facilities include:

- Compactor (located in Building 19252)
- Radioactive Waste Management Facility (Buildings 9221 and 9222). Includes a pathological-waste destructor, a pathological-waste freezer, and a storage area
- Fenced Radioactive Waste Holding Area

As previously mentioned, a Radioactive-Waste Compactor is used to reduce the volume of Class C wastes. Wastes normally compacted include small-animal bedding, paper, plastic bags, rubber gloves, etc. The compactor consists of a hydraulic ram which compresses the wastes directly into 55-gallon DOT Specification 17-C drums. When the drums are filled, they are sealed, monitored, labeled, and placed on a pallet in an on-site waste storage building to await shipment. Class B wastes are placed directly into drums without compaction.

The Radioactive Waste Management Facility includes a building (9222) for temporary storage, waste sorting and repackaging, decontamination of items, and other operations. The building is essentially a warehouse for the storage of waste containers.

Packaged low-level and TRU wastes are stored here pending shipment to the NTS or to LANL. A shielded storage room is used to safely store drums that emit significant gamma radiation. Radioactive wastes sealed in drums are stored in the waste storage building until enough containers are on hand to constitute a shipment. The building is periodically monitored for radiation levels. If high levels are detected, the container is stored in the shielded storage room to permit radioactive decay.

The second building of the Radioactive Waste Management Facility houses a waste incinerator. This Pathological-Waste Destructor is used to destroy noncontaminated and LLW-contaminated pathological wastes. Such pathological wastes include carcasses, tissues, solid and liquid excreta, animal bedding, and aqueous wastes arising from decontaminating animal holding and exposure equipment. Ash from the destructor and flyash from the bag filter are stabilized (e.g., with portland cement) and disposed of as solid LLW. Hazardous wastes are not destroyed in the incinerator; therefore it does not constitute a RCRA treatment facility.

The two Radioactive Liquid Waste Holding Ponds ("hot ponds") located at the chemical and radioactive storage facility at the southeast corner of ITRI are used to hold Class B liquid wastes. Wastes that have been discharged to the holding ponds for volume reduction (by evaporation) or reduction of activity (by decay) include primarily solubility study filtrates and washwater from decontamination procedures. Since Class B liquid wastes can contain concentrations of hazardous materials, the ponds potentially contain and store both radioactive and hazardous wastes. Contaminated animal bedding and plastic laboratory equipment have also been disposed of in the ponds. Wastes are not currently being disposed of in these ponds.

Each pond is approximately 20 feet long x 20 feet wide x 5 feet deep. The sides and bottoms are formed of surface-treated concrete. At one time, each pond was lined with polyethylene sheets. These liners have since partially disintegrated and are in very poor condition. Each pond is covered with half-inch hardware cloth to keep out birds and other animals. The potential for environmental contamination that may exist in regard to these ponds has been discussed in Sections 3.3.4 and 3.4.4.

At the present time, there are six sewage disposal lagoons covering a total of about 10 acres at ITRI that receive all the domestic sewage from the facility during normal

laboratory operations. Lagoons 4, 5, and 6 have no bottom liners. However, the underlying soils have been compacted to prevent percolation. Lagoon 1 is presently not being used. Lagoons 1, 2, and 3 consist of a liner placed over excavated dirt. As is apparent from the previous discussions, small quantities of hazardous wastes or radionuclides are likely to have been and are being released to these lagoons. This is discussed in Section 3.3.2. These lagoons and potential environmental problems associated with them are also discussed in Sections 3.3.2 and 3.4.2.

It is unclear to what extent these lagoons have received hazardous and radioactive wastes, and whether disposal practices characterize this system as a hazardous waste treatment surface impoundment subject to RCRA technology requirements or RCRA closure. The potential for environmental contamination in regard to these lagoons is discussed in Section 3.3.2.

Mixed Waste Management

Mixed wastes (e.g., LSC vials, radioactively contaminated lead) are collected by HPO personnel and are currently being stored on-site (at the fenced waste disposal area). As previously discussed in Section 3.3.2.2, there is a large backlog of drums (approximately 200) of old LSC vials that have accumulated over the past years of operation. Since many of these LSC vials contain actinides, there is currently no feasible way to treat or dispose of them safely other than shipment to a disposal site that will accept them. Neither the DOE-site at the NTS nor the one at Hanford have been willing to accept these wastes; therefore, the backlog continues to increase.

The drums of the mixed-stream radioactive/ignitable/acidic waste are being inadequately stored outdoors on a portion of the concrete pad that surrounds the holding ponds. Many show signs of deterioration (e.g., rusting, holes), and as discussed in Section 3.3.2., there is reason to suspect that there has been leakage from these drums. Additionally, drums are stored in a manner that allows visual observation of only those drums facing outward.

Radioactively contaminated waste is also being stored outdoors within the confines of the area.

As previously discussed, it is likely that at least small quantities of radioactive and hazardous wastes have been stored or released to the sanitary lagoons and that at least small quantities of hazardous wastes have been stored or released with radioactive wastes in the Radioactive Liquid Waste Holding Ponds. Thus, these facilities may, by definition, constitute mixed waste TSD facilities.

Future projects within ITRI's waste management program include decommissioning of the Radioactive Liquid Waste Holding Ponds, and disposing of the drums of actinide-containing LSC vials.

4.1.2 Findings and Observations

Waste-related environmental problems found by the Environmental Survey at the Albuquerque facilities are listed below. The Survey procedure to identify these problems incorporated four types of activities: (1) inspection of waste generating processes and waste management facilities; (2) interviews with SNLA Waste Management personnel; (3) review of relevant files and documents; and (4) comparison of on-site observations with reports and procedures.

4.1.2.1 Category I

None

4.1.2.2 Category II

1. Water infiltration into SNLA radioactive mixed waste disposal areas. Conditions and/or practices at the active and inactive radioactive waste burial areas permit the infiltration of surface water into the burial trenches and pits. This increases the potential for migration of radionuclides and hazardous materials into surrounding soil and, possibly, into groundwater.

   Surface subsidence is apparent at trenches in the inactive burial site of Technical Area II and in the trenches and pits of the classified and active nonclassified burial site at Technical Area III. In addition, small holes created by burrowing rodents or snakes were observed in the Technical Area III waste burial areas. No measures have been taken to prevent runoff water from

entering the active or inactive waste disposal sites. These conditions allow water to infiltrate into waste trenches.

Waste is not immediately covered after it is placed in the active (open) burial trench. At the time of the Survey, water was present in the trench bottom, around containers (bags) of waste. Also during the Survey, team members observed water being pumped from a trench being excavated into the active burial trench. The presence of water in contact with the radioactive and hazardous wastes increases the potential that radionuclides could migrate into surrounding soil and eventually may result in contamination of the groundwater.

Sampling and analysis is planned for the inactive radioactive waste burial area in SNLA Technical Area III.

4.1.2.3 Category III

1. Disposal of trash contaminated with hazardous wastes at the KAFB Sanitary Landfill. Unknown quantities of hazardous waste-contaminated trash are being disposed of at the KAFB Sanitary Landfill, creating the potential for contamination of surface and/or groundwater at or around the landfill. Examples of this are discussed below.

   - Machine shops, laboratories, and electronics shops in all Technical Areas at SNLA dispose of solvent-contaminated rags and toweling in garbage cans which then go to the KAFB Sanitary Landfill. This includes the solvents acetone, toluene, xylene, methylene chloride, etc., which are RCRA hazardous wastes. Such disposal also occurs in conjunction with operations conducted at other facilities at the site.

   - Kirtland AFB does not have ongoing controls (e.g., full-time operators) to prevent the improper disposal of wastes that do not belong in the KAFB Sanitary Landfill (e.g., reclaimable materials). Additionally, Kirtland personnel have stopped some attempted disposal of chemicals (e.g.,

photoprocessing chemicals) at the landfill in the past, and suspect that similar incidents of chemical disposal may have occurred in the past.

- SNLA's Building 6750 (Technical Area III) disposes of used vacuum bags containing lead dust and debris into the garbage with subsequent disposal to the KAFB Sanitary Landfill. Lead wastes are generated by gun firing (up to 40 firings/day) and are removed by vacuuming.

- At some electronics shops within SNLA and other facilities (e.g., Buildings 844, 891), small amounts of lead solder are being disposed of into garbage cans with subsequent disposal to the KAFB Sanitary Landfill.

- Fiberglass filters from the paint shops in SNLA's Building 841 and the motor pool (Building 876) are disposed of into garbage cans and subsequently to the KAFB Sanitary Landfill. These filters may constitute hazardous waste if they were tested.

3. Potential release of hazardous constituents from SNLA's Chemical Waste Landfill (Technical Area III). Nonconformance with RCRA landfill requirements creates the potential for the release of hazardous constituents from the Chemical Waste Landfill in Technical Area III to environmental media. The landfill does not meet full RCRA waste disposal/closure requirements. Exact contents and disposal locations within the landfill are unknown, although SNLA does have records of disposal in recent years prior to "closure" (i.e., discontinuation of landfilling). The landfill shows signs of erosion (e.g., chromic acid pit) and subsidence (e.g., northwest and southwest corners). Portions of rusted, buried drums are protruding from some areas of the landfill (e.g., northwest corner), and foam-like material was observed in soil (e.g., north-central portion of the landfill).

4.1.2.4 Category IV

1. Insufficient waste storage and segregation practices at SNLA. Insufficiencies in waste handling procedures were observed at Building 895, the Hazardous Waste Repackaging and Storage Facility, and at other areas at SNLA. The potential exists for releases from Building 895, and subsequent contamination

of environmental media. There is also the potential for contamination of soil, surface water, and/or groundwater by potential disposal of hazardous waste as nonhazardous waste. Examples of insufficiencies are discussed below.

- At Building 895 (Technical Area I), the Repackaging and Storage Facility, containers are not labeled with hazardous-waste stickers; some materials (e.g., mercury Labpack) were found to be in storage longer than 90 days; some containers (one drum, one 5-gallon container of caustic) were found to be leaking; and spill control equipment was not readily available to clean up observed spills (no empty overpack containers, no brooms, etc.).

- Appropriate segregation of waste solvents may not be occurring at some points of waste generation (e.g., Building 805). Halogenated solvents may be mixed with nonhalogenated solvents in waste containers that are subsequently picked up for disposal by SNLA Waste Management personnel.

2. Accumulation of hazardous wastes at SNLA areas not designated or designed for such storage. There are several areas of waste generation at SNLA that are accumulating hazardous wastes in substantial quantities (more than 55 gallons) for substantial periods of time (more than 3 days) without following appropriate guidelines (40 CFR 265.170) for use and management of containers. These accumulation areas are not bermed and surfaces on which wastes are stored are not impermeable. These factors create the increased potential for container leakage and spillage, resulting in potential contamination of soil and/or flow to storm drainage. Only the Glass and Plastics Shops have been designated by SNLA as satellite accumulation areas.

   Areas such as the printed circuits operations were observed to generate and store large quantities of hazardous waste (more than 55 gallons) for longer than 3 days, without transport to a 90-day storage facility. Drums at Building 904 have been used to accumulate methylene chloride wastes for 3 years without disposal. As per 40 CFR 262.34, such practices subject such areas to

the requirements of 40 CFR 265, Subpart I (Use and Management of Containers) and such areas must then manage the condition of containers, must monitor stored-waste compatibility, and must inspect areas where containers are stored. Such inspections and management are not being conducted, according to interviews with area personnel. Such areas are no longer satellite accumulation areas but storage areas.

3. Improper disposal of solvents at the Transportation Safeguards Division. There is the potential that gun-cleaning solvents have been and could continue to be improperly disposed of at the Transportation Safeguards Division (Building 9825), creating the potential for soil contamination. The gun-cleaning trailer contains an ultrasonic cleaning bath that uses a solvent (identification unknown - brand name product). This bath is currently being actively used. No procedures have been developed for the disposal of waste solvent. The bath holds approximately 3 gallons. Interviews with site personnel indicated that the bath has been emptied once since installation several years ago. It is not known how solvent was disposed of. There is potential that improper disposal occurred, possibly by dumping to soil.

4. Noncontainment of biological wastes at the LS-1 facility. The LS-1 Landfill is not covered after daily operations. Because the wastes are not covered, sheep remains have been scattered by scavengers; and decomposing sheep carcasses emit foul odors and create the potential for spreading etiologic organisms. New Mexico sanitary landfill regulations require the placement of a 6-inch earth cover on a daily or more frequent basis.

5. Improper storage of hazardous wastes at BAO. The improper storage of hazardous wastes at BAO (Building 872) is creating the potential for spills and release of hazardous materials. Storage practices could result in the spill or release of hazardous wastes, the mixture of possibly incompatible wastes, and/or the exposure of unprotected persons.

   Waste drums are stored on an uncurbed concrete pad adjacent to BAO water treatment facilities. A small metal pan (approximately 3 feet x 5 feet x 6

inches) is used for temporary placement of waste containers with no provision for segregation of the wastes. The storage area is not fenced (or otherwise secured) and warning signs are placed in the middle of the storage area, not outside it. There are no fire controls.

PRELIMINARY

4.2 Toxic and Chemical Materials

This section of the report deals with toxic substances and chemicals used for production, maintenance, and construction. The procurement, labeling, storage, and use of chemicals are assessed. The assessment involved reviewing procedures; inspecting receipt, storage, transfer, and use and disposal areas; and interviewing personnel from the various work units at these locations. The main categories of materials under consideration are process and laboratory chemicals, polychlorinated biphenyls (PCBs), pesticides, and asbestos. Since outside licensed contractors perform most of the pesticide and asbestos work, the bulk of the discussion concerns process chemicals and PCBs. The collection and disposal of waste chemicals are discussed under Waste Management (Section 4.1). If chemicals are discharged to a sewer, septic system, or surface water, the chemicals are discussed under Surface Water (Section 3.3).

The following subsections cover Sandia National Laboratories-Albuquerque (SNLA), Bendix Albuquerque Operations (BAO), and the Inhalation Toxicology Research Institute (ITRI). The Central Training Academy (CTA) and the Transportation Safeguards Division (TSD) are small separate operational units that use few toxic materials and generally rely on the SNLA staff to provide technical and logistical support for them regarding toxic and chemical materials. Therefore, in this section they will generally be covered by SNLA discussions.

4.2.1 General Description of Pollution Sources and Controls

4.2.1.1 Sandia National Laboratories - Albuquerque

Toxics Management

The responsibilities for toxics management on the Sandia site are concentrated mostly in SNLA and in particular the Environmental Safety and Health Department. BAO and ITRI have separate organizations that are responsible for toxics at their facilities, but rely on SNLA or Kirtland Air Force Base (KAFB) for technical backup or emergency assistance. CTA/TSD consist of small training staffs and rely on SNLA for

toxics management assistance to help them handle the little toxic material they have.

Sandia Laboratory Instruction SLI 2001, Environment Safety and Health (ES&H) (SNLA, 1987b), covers the policy, general responsibility for implementation, and specific organizational responsibilities for Environment, Safety and Health (under which toxics fall).

The Environment, Safety and Health (ES&H) Manual, which is currently called the "Safety Manual," (SNLA, 1981) is the primary ES&H document in which guidelines for compliance with ES&H standards, implementation, and procedures are described. A copy of this manual is sent to all division supervisors and above. Division and section supervisors are responsible for conducting operations in compliance with the ES&H Manual and originating, securing approval, and reviewing annually Safe Operating Procedures (SOPs) with which employees must comply (SNLA, 1987b). SOPs are required for processes or tests involving toxic chemicals (SNLA, 1981).

The ES&H Department develops and prepares the Safety Manual (with assistance from other Sandia organizations); reviews and approves SOPs; provides guidance for environmental and health protection, safety, and environmental monitoring; and assists or advises in related areas (SNLA, 1987b). ES&H acts more as a consultant to the line organizations, coming in when there is a problem rather than doing routine assessments, due to the organizational setup and the level of staffing. However, this organization does have the authority to suspend any operation if an unsafe condition is observed and the degree of hazard warrants this action (SNLA, 1987b). The ES&H Department is subdivided, and the organizations that have responsibilities related to toxic chemicals, PCBs, asbestos, and pesticides are the Industrial Hygiene/Toxicology Division (3311), and the Environmental Protection and Hazardous Waste Management Division (3314).

Chemicals are procured at SNLA by several different methods. Until recently (1986), stock chemicals were obtained by filling out a material requisition (MR). Compressed gases and certain hazardous materials to be stocked were received at Building 879 by Stores Management Division, and were held for issue in Hazardous Materials Stores in Buildings 879 and 878 (SNLA, 1981). For nonstock items, a

purchase request (PR) approved by the individual's supervisor and Industrial Hygiene Division (IH) was required. The material was received at Building 894 by Receiving personnel and delivered to the ordering organization (SNLA, 1981). Building 895 was also used for storage of chemicals.

According to SNLA personnel, the storage buildings were inadequate to perform their functions in a safe manner and new buildings were needed. Rather than build new hazardous chemical storage buildings, the storage function for stock chemicals (and other stock items) was transferred off-site to the suppliers by giving a handful of suppliers long-term contracts requiring them to have (or build) proper storage facilities and maintain minimum levels of items normally stocked at SNLA. The new system to obtain stock items associated with these contracts is called Just In Time (JIT).

To help implement the JIT system, a computerized receiving system was installed in one bay of a new shipping and receiving facility (Building 957) which was constructed outside the Technical Area I security fence. Subsequently, Buildings 878 and 879 were torn down. Use of Building 894 as a receiving area was discontinued (the receiving area is currently being used for storage of miscellaneous items); and use of Building 895 as a chemical storage area has been discontinued (storage bays are currently being used as a temporary holding area for hazardous waste).

Currently, to procure a stock item (including toxic chemicals) at SNLA using the new JIT system, the requestor looks up the stock numbers in the supplier's catalog. The requestor has the option of preparing a Material Requisition Form (SA 6470-H) and mailing it to General Stores (Division 3742); or preparing a Material Requisitions List (MRL) Form (SA 6490-SR), which is used to telephone in the request to an SNLA Order Entry Clerk (Edge, 1986). The clerk enters the information in a computer terminal and after the order is accepted, issues the MR number to the caller for recording on the MRL form. Approximately every 90 minutes, the orders are automatically transferred to the appropriate supplier's computer to be filled. If the computer file indicates a material safety data sheet (MSDS) has not been sent previously, one is mailed directly to Industrial Hygiene. The suppliers deliver on a daily basis to the Receiving Warehouse (Building 957).

Certain items in the various suppliers' catalogs are listed in the SNLA computer as "excluded items", which means the computer will reject the number and the items cannot be ordered. Others are listed as "restricted items" which means an approval signature most be obtained before the items can be ordered. In the latter case, an MR form is completed, approved by supervision, and sent to General Stores for entry into the JIT system. An MR form is also required to obtain specialty chemicals from other companies that the supplier does not normally distribute.

On a monthly basis, supervisors receive an MR Monthly Approval Report showing all the JIT items received by their organization (SNLA, 1985). This gives them a chance to review the items, including chemicals, that were received by their organization, as an after-the-fact review.

For new chemicals or chemicals that cannot be purchased through the JIT system, a Purchase Requisition (PR) is filled out, approved, and sent to Industrial Hygiene for review and approval. The PR is sent to Purchasing to order the chemical.

At SNLA, all material is received at the Receiving Warehouse, Building 957, located outside the security fence for Technical Area I. In the warehouse yard is a separate building for the storage of compressed gas cylinders. After being received at Building 957, bulk shipments of chemicals (such as tank trucks of acid, caustic, and gasoline) are sent to unload into the storage tanks of the requesting organization. Drums of chemicals and cases of smaller containers are unloaded on the floor of Building 957 and separated into groups by area for delivery to the requestor by SNLA delivery vehicles, which deliver daily. Some of the chemicals sit in this receiving area from 1 to 8 days. If the receiving area is backed up with supplies, drums of chemicals may be temporarily stored outside in the truck bay. Thus, the receiving area has become a temporary chemical storage area. The building was not designed as a chemical storage facility, has no facilities for segregation of incompatible materials, and has no spill control measures.

Bulk liquids, including process and waste chemicals, are stored at SNLA in 29 aboveground storage tanks (ASTs) and 86 underground storage tanks (USTs). The ASTs include one 6,000-gallon acid and one 6,000-gallon caustic tank in Technical Area IV at Building 983. The remaining ASTs hold aviation fuel, dielectric oil, fuel oil, mineral oil, waste oil, and water. The total capacity of these

tanks is 3,898,050 gallons (IT, 1987b). In general, the ASTs have spill control measures and each division has an inspection program for ASTs. However, at the burn site in the Coyote Test Field (CTF), three 25,000-gallon tanks (one containing aviation fuel and two containing water) on an overlooking hill did not have any berms or dikes for spill control.

Of the 86 USTs, most contained fuel oil (39), dielectric oil (17), gasoline (8), diesel fuel (3), or waste oil (6). There are 2 neutralization tanks and 11 miscellaneous water/sludge tanks (some of which may hold radioactive material) (IT, 1987b). Tank levels are monitored at the motor pool, but currently there is no sitewide inspection program for the USTs and none is planned. Approximately 75 percent of the tanks are more than 20 years old and about 50 percent are more than 35 years old. Some tanks have been abandoned in place. One tank that was removed, which was approximately 20 years old, indicated no signs of leakage. The lack of a tank failure due to corrosion was attributed to a dry soil condition. There are no known leaking tanks at SNLA. A listing of the tanks, including location, contents, and capacity, is provided in Appendix F.

Current and former explosives storage bunkers (igloos) were inspected for unauthorized or improper storage of toxic chemicals and pesticides. The primary explosives storage location is the 6,000 Igloo Area. Secondary sites are located throughout the complex adjacent to testing and development sites and facilities in Technical Areas II, III, and the CTF (Doyle, 1987).

The explosives storage bunkers are metal tubes or concrete structures over which earth has been mounded so that only the face with the entrance door is exposed. The igloos range in floor size from 2 feet x 2 feet to 24 feet x 64 feet. Some of these igloos are no longer used for explosives storage and have been converted to test facilities and/or are used for storage of other materials. Because of this conversion, igloos were inspected to determine if there were any toxic chemicals or pesticides that were being stored in them or had been abandoned. Igloos in the 6,000 Igloo Area were clean and dry and contained only explosives, or were empty. In Technical Area III, the Gun Charge Assembly Facility, which contains a powder storage room and workroom, had small quantities (2 liter containers) of solvents, needed to prepare the assembly, stored in the work bench. Other than the above, none of the

igloos checked in the Technical Areas or in the CTF had any toxic chemicals or pesticides stored in them.

At SNLA, numerous chemicals (more than 4,000) are used at the facilities. Large quantities of sodium hydroxide and sulfuric acid are typically used for regeneration of ion exchange columns used to purify water. The development laboratories tend to use large quantities of a few chemicals whereas the research facilities (many of which are analytical chemistry laboratories) tend to use small quantities (gram to pound containers) of hundreds of different reagent chemicals. Most of the chemicals used in major quantities at SNLA fall into the category of inorganic acids and bases, solvents, and alcohols. The major chemicals and their annual usage are shown in Table 4-6.

At SNLA, storage of bulk toxic and flammable chemicals, other than the few chemical storage tanks mentioned above, consists of storage of 55-, 35-, 15- and 5-gallon containers of chemicals or solvents. As stated previously, there no longer is a central chemical storage building. After being received, the containers of chemicals are shipped to the ordering work units for storage. With few exceptions, none of the work units have chemical storage areas designed to prevent releases to the environment. One of these exceptions is at the Plastics Laboratory (Building 834W) where there is a chemical storage shed, which was specifically designed for this purpose. This shed has a grid bottom with sump for spill control and in addition, has a ventilation system, fire suppression system, and ground straps (which were in use on 55-gallon drums of acetone).

Quite often chemicals are stored outside without any protection from the effects of the environment and without any provisions to control potential spills or leaks. Examples of outdoor chemical storage areas at SNLA that pose a potential environmental problem are at Buildings 841, 983, and 805. In Technical Area I at Building 841, which is the Photo Fabrication (Printed Circuit) Laboratory, an uncovered loading dock is used as the normal storage area for drums of chemicals, including solvents. Five drums of solvents such as methylene chloride and trichloroethene were stored there. Two of the drums had bulged drum heads. Additional drums, one of which was bulged, were stored across from the loading dock by Building 842 on the asphalt area between the two buildings. There are

TABLE 4-6

MAJOR HAZARDOUS SUBSTANCES USED AT SANDIA NATIONAL LABORATORIES - ALBUQUERQUE

Chemical	Annual Purchases (lb)
Sodium Hydroxide Solution	408,360
Sulfuric Acid	157,864
Hydrogen Peroxide 30%	25,248
Buffered Oxide Etchant (Fluorides)	19,760
Acetone	16,634
Propanol	26,000
Hydrofluoric Acid	12,114
Nophenol-992, Stripping Solution	12,000
Genesolv D/Freon TF	10,220
Buffered Oxide Etchant 20:1 (Fluorides)	9,760
Phosphoric Acid	9,483
Ammonium Fluoride (40.0%)	7,744
Sodium Hydroxide	4,750
1,1,1-Trichloroethane	2,752
Methylene Chloride	2,608
Hydrochloric Acid	2,374
Methanol	2,352
Polysilicon Etchant (Fluorides)	2,320
Trichloroethylene	2,101
Nitric Acid	1,787
Toluene	1,778
Hydrogen Chloride	1,320
Phosphine 1% in Argon	1,120
Ethylene Glycol	676

TABLE 4-6

MAJOR HAZARDOUS SUBSTANCES USED AT SANDIA NATIONAL LABORATORIES - ALBUQUERQUE (Continued)

Chemical	Annual Purchases (lb)
1,1,2-Trichloro-1,2,2-trifluoroethane	640
Xylenes	507
Acetic Acid, Glacial	475
Tetrahydrofuran	342
Formaldehyde	232
Sodium Acetate	198
Methyl Ethyl Ketone	170
Carbon Tetrachloride	105
N,N-Dimethylformamide	72
Chloroform	55
Acetonitrile	43
Ethyl Acetate	36
Dioxane	33
Chlorobenzene Mono	28
Lithium Hydroxide	26
Benzene	23
Formic Acid	16
Amyl Acetate	10

Source: Extracted from chemical purchase data, 1987

two storm drains in this asphalt within 10-15 feet of the drums. Plastic drums (~15 gallons) of ferric chloride on the Building 841 loading dock had rust-color stains on the outside; there were stains on the concrete and across the asphalt toward one of the drains. Whether the stains on the concrete and asphalt were due to the ferric chloride or the exposed rebar in the concrete loading dock that was rusting could not be determined. The problems with this area are that it is heavily exposed to the sun (causing pressurization of volatile drums), there is no spill control, and there are two storm drains in the area which will immediately carry away any spills.

In Technical Area IV at Building 983, which is the Particle Beam Fusion Laboratory, thirty-five 55-gallon drums of Freon solvent were stored outside near the southeast corner of the building. The drums were stacked two-high on the asphalt, in the sun, and at least five of them had badly bulged tops, indicating pressurization. No spill control measures were provided. There are many other areas where a few drums are stored outside in similar conditions.

In Technical Area I, at Building 805, which is a three-story building with many research and standards laboratories (including chemistry laboratories), the chemical storage area is located on the covered loading dock. Twelve 6-foot-tall metal cabinets are used to store small containers of chemicals and small gas cylinders for the various laboratories in the building. These cabinets, although out of the sun, are not protected from the weather. This was indicated by water damage to 9 cardboard boxes of acetone and methanol (12x1 liter per box) stacked up outside the cabinets. There is no spill control for this area. No drains were observed nearby.

Some buildings have separate rooms for storage of chemicals but none of these rooms were designed for such use. They do not have any berms or other spill containment measures and may even have floor drains in the room. An example of the latter case is in Building 834W. The chemical storage room (approximately 8 feet x 24 feet long) had shelving on the two long walls filled with chemicals. Various solvents, including methyl ethyl ketone and methylene chloride, were present and at least 5 boxes containing gallon containers of toluene diisocyanate were stacked on the floor. The floor was sloped to two floor drains connected to the sewer. In the event of a spill, the chemical would go to the KAFB system and eventually the City of Albuquerque publicly-owned treatment works (POTW).

At SNLA, storage of small quantities of toxic and flammable chemicals at various buildings throughout the facility at the work units varies widely. In general, small quantities of toxic materials are stored in their original containers and flammable materials are stored in their original containers or 1- to 5-gallon metal safety cans in metal or approved flammable cabinets designed for this purpose. However, many of these cabinets are stored outside, where they and the chemicals they contain, especially volatiles, can be affected by lack of protection from the environment. The hot summer sun can elevate temperatures inside the cabinets, which may affect the chemicals, causing expansion and resulting leakage. At some buildings, personnel have tried to mitigate the consequences of outside storage by placing the cabinets in alcove areas, under building overhangs, or in shady areas.

Additional chemical storage problems come about because of orphaned chemicals. These are chemicals that have been left in a building or area and for which no one claims ownership or responsibility. This may result because people and/or programs are transferred or terminated and process chemicals are left unattended (essentially abandoned), sometimes for years. There is a potential for these chemicals and their containers to deteriorate, with possible leakage to surface soil and water.

An example of orphaned chemicals is seen in Technical Area III behind Building 6730, which is listed as the Mechanical Test Facility. There are 14 drums containing oil and 50 percent caustic soda in the central yard of the complex that are rusting and/or showing crystal growth indicating caustic leakage. Along the fence at the rear of this complex, behind Building 6732, there are 16 drums containing oil, 50 percent caustic soda, and Freon, and other unmarked drums. Most of the drums are rusting, one is damaged, and two are leaking what appears to be crude oil. The bungs were missing, the tops of the drums were full of oil, and there was a puddle of oil on the ground. The program in which these chemicals were used was terminated approximately 5 years ago.

Additional orphaned chemicals can be found in Technical Area I in Building 895, the former Chemical Storage Building. There are two small (approximately 6 feet x 8 feet) storage rooms on the south end of the building. In the room in the southeast corner were 2 one-gallon pails of an arsenic compound and 20-30 lecture bottles of various compressed gases. In the room in the southwest corner, there were 12 cases (4 gal/case) of methanol and toluene and 30-40 lecture bottles of various

compressed gases. There was trash in both of these rooms and everything was covered with a heavy layer of dust. It appeared the chemicals had not been checked for a year or more.

At the CTA, few toxic materials are used or stored. The CTA uses and stores small quantities of ammunition, tear gas, pyrotechnics, gun cleaning solvents, paint, gasoline, diesel fuel, and motor oil to support maintenance and operation of the Live Fire Ranges. The ammunition and related items are stored in Bunker #3 and flammables are stored in metal cabinets. Disposal of the weapon cleaning solvent bath is handled by SNLA Division 3314 Waste Disposal personnel.

The TSD has an even smaller facility consisting of an administration trailer and a gunsmithing trailer at the small pistol range. They use and store items similar to CTA to support this range.

At SNLA, information is extracted from MSDSs and included in Safe Operating Procedures prepared by operating units. The original MSDSs (over 4,000) are kept on file by Industrial Hygiene in Building 869; they also have a computerized list of the MSDS file. At least annually, a notice is placed in the SNLA bulletin, which goes to all employees, informing them of the location and availability of this information.

Polychlorinated Biphenyls

The labeling, use, storage, and disposal of PCB oils and PCB-containing equipment were assessed at SNLA by the review of procedures, and inventory and shipping records; the inspection of currently operating equipment for leaks; and the interviewing of personnel at each facility who had responsibilities related to PCBs. CTA and TSD receive their electrical power from distribution systems under the jurisdiction of SNLA or KAFB and therefore, have no PCB-containing electrical equipment or PCB oils.

SNLA does have PCB-containing electrical equipment in use and in storage. They have a PCB program which is discussed in SOP 85300 8605, "Safe Operating Procedure for the Identification, Removal, Storage and Disposal of Polychlorinated Biphenyls (PCB's)" which was revised in May 1986 (SNLA, 1986d). According to the

SOP, user organizations are responsible for identification (conducting sampling where necessary) labeling of PCB and non-PCB equipment with appropriate labels, and inspections of PCB equipment. Industrial Hygiene and Toxicology (Division 3311) is responsible for providing analyses of PCB samples, and Environmental Protection and Hazardous Waste Management (Division 3314) is responsible for storage, disposal, and spill cleanup coordination. Division 3314 also provides overall coordination for PCBs.

Plant Utility Systems (Division 7811) is responsible for PCB-containing transformers and capacitors used in the power distribution system to the various SNLA buildings. They identified, labeled, and initiated inspections of this equipment in 1981. The inventory, inspection due dates, inspection history, and other equipment details are kept on a personal computer system the division uses. At the time of the quarterly inspection, an inspection form for each piece of equipment is printed out and given to an electrician to perform. When the forms are returned to the division supervisor, any deficiencies noted are corrected by initiating a Work Order (WO). The WO numbers are noted on the bottom of the inspection forms and the WOs are tracked to close out the item. Hard copies of inspection forms are on file back to 1981. Typically, there are about four minor corrective actions required per quarter on the 100 plus items that are inspected.

The PCB labeling system used at SNLA for the power distribution equipment is as follows:

- PCB equipment (more than 500 ppm PCB) - has PCB labels and a maintenance inspection Yellow Tag number (such as S00002) indicating it is part of a preventive maintenance inspection program.
- PCB-contaminated equipment (50-500 ppm PCB) - has PCB labels only and is not part of the inspection program.
- Non-PCB equipment (less than 50 ppm PCB) - has a non-PCB label or is unlabeled.

In general, non-PCB power distribution equipment is unlabeled, contrary to the SOP, which specifies that it will have a non-PCB label. This would not be a problem

except that an assessment to identify and label all PCB-containing equipment used in other than the main power distribution system (i.e., in R&D systems) has not been performed. Therefore, a transformer or capacitor with no label does not necessarily mean it is non-PCB.

The power distribution transformers and capacitors with PCBs were inspected. Approximately 40 percent of the equipment is in the interior of buildings, mostly in Technical Area I. All the equipment looked in good condition and in the few cases where there had been weeps from drain valves, sample points or tap changers which could not be tightened, there were drip containers. There are no spill control berms and in a few cases, there are either drains or sumps nearby. The equipment outside is generally located on a cement pad with crushed rock around the pad usually enclosed by a fence. (Small, totally enclosed transformers with underground cables did not have fences.) The outside equipment also has no spill control measures to contain the PCB fluid in the event of a spill or leak. Although the equipment itself is labeled, in most cases warning labels are not posted on the hallways, doors, or gates in fences leading to the equipment to warn firemen. However, the KAFB Fire Department has been notified via letter of the location of the PCB transformers to allow fire preplanning to prevent or minimize the effects of PCB releases during a fire (Kirson, 1987).

A statement of work (SNLA, 1987a) has been prepared to retrofill eighteen 100-percent-PCB transformers (all of which are interior transformers) and process 21 lower concentration PCB transformers to reclassify them as non-PCB status. At the time of the Survey, the statement had not been sent out to obtain bids.

If organizations have equipment that potentially contains PCB oils and they wish to dispose of the equipment, they are supposed to notify Division 3314 (SNLA, 1986d). Prior to disposal, sampling is performed by Division 3314 personnel or one of their contract technicians and the samples are analyzed on-site in the Environmental Laboratory (Division 3311) or off-site by a contractor (IT), depending upon the urgency.

In the past, some PCB-containing equipment has been turned in to reclamation and was sold. This equipment was later reclaimed and steps taken to prevent a recurrence. Now any transformers or large capacitors turned in are held for

Division 3314, who sample and/or dispose of them as PCB equipment, as appropriate, via U.S. Environmental Protection Agency (EPA)-approved PCB disposal vendors.

There is a PCB storage facility in Technical Area II in Building 920, which is controlled by Division 3314. The storage area has 8-inch berms, no drains, and an impervious concrete floor, and meets the other requirements of 10 CFR 761. A number of drums and large capacitors were in storage at the time of the inspection. No leakage was observed and the area was clean and dry.

PCB waste disposal records were computerized starting in 1985 and appear to be in good condition, with a specific inventory number assigned to each item for inspection and tracking purposes. A review of the shipping records disclosed complete shipping papers and signed certificates of destruction for all PCBs shipped. PCBs are shipped by RIN Chemical Company of Albuquerque and disposed of at sites operated by Rollins Environmental and U.S. Pollution Control, Inc.

Pesticides

Pesticides are used to control insects, rodents, and weeds. SNLA has a Pesticide Program, but BAO, CTA, and TSD, because of their limited facilities, do not have a program and rely on the host organization (SNLA or KAFB) for any applications that are necessary.

At SNLA no insecticides or rodenticides are being applied by site personnel. The site does not have licensed applicators/operators and therefore does not apply or store insecticides. An outside contractor, A-1 Quality Pest Control, performs these services with licensed applicators. They use commonly available chemicals (which have been approved by Division 3311) on a weekly basis for the control of indoor pests such as silverfish, roaches, ants, spiders, and scorpions. The indoor pests are treated with Diazinon, flies in the garbage collection and storage area are treated with Dursban, and rats and mice are exterminated with Diptacinone. Lawns and shrubs are also treated for cutworms and other pests using chloropyrifus (SNLA, 1987c). These chemicals are not on the Federal Restricted Use List.

The pesticide contract at SNLA is administered by Plant Engineering Operations (Division 7862). Service requests from various organizations are received and accumulated at Plant Engineering headquarters (Building 887). The requests are called in on Wednesdays and the contractor performs the work on Thursdays (and Fridays if necessary). A covered pickup truck is used to bring small hand sprayers and 5- to 10-gallon containers of premixed solution. The sprayers are filled on-site but are not rinsed on-site. A copy of the contractor's procedure was not on file.

At SNLA, an outside contractor, Aspen Landscaping and Tree Service, performs weed control and ground sterilization with herbicides applied by licensed applicators. They used commonly available chemicals (which have been approved by Division 3311) on an as-needed basis. They use Hyvar-X, Krovar and Oust (SNLA, 1986e). These chemicals are not on the Federal Restricted Use List.

The herbicide contract at SNLA is also administered by Plant Engineering Operations, but most of the time service requests are called in to the contractor through area delegates. The contractor performs specific job assignments on an as-needed basis rather than on a routine basis. Hand sprayers are used for hard-to-reach areas and a truck-mounted sprayer for larger areas. A copy of the contractor's procedure was not on file.

Up until approximately 2 years ago, herbicides were applied (at least in some areas) by laborers in Technical Area III using 250-gallon spray trailers. The foreman and four laborers attended a one-day school conducted by DuPont, but no records were available showing attendance. There also were no approved procedures available for handling, application, and storage of the herbicides.

Previously, the laborers performed 10-15 days a year of spraying and used approximately 50 pounds of Hyvar-X and 100 gallons of 2,4D. Currently, if the contractor cannot respond fast enough, these same laborers are still used to spray. This may only occur 3 times a year requiring approximately 10 gallons of 2,4D. The last time the laborers were used to spray was approximately a month before the Survey near Building 6525. There are a number of peach trees in the center of this complex and about 30 percent of their foliage was dead, indicating that overspray had occurred. The equipment and chemicals that were used were stored outside west of Building 6501 in an open field.

Asbestos

In the past, asbestos was widely used at SNLA in many of the old buildings for pipe and boiler insulation. The insulation primarily used now is a non-asbestos silica-based material. Asbestos wastes were formerly disposed of in the active KAFB Sanitary Landfill (DOE-AL, 1987).

SNLA had been requested in 1986 to perform an asbestos assessment to assist in compliance with EPA regulations and recommendations. Because of lack of funding/manpower it has not been accomplished yet; therefore, SNLA does not know which buildings contain friable-asbestos-containing material (ACM), making it difficult to predict how much ACM will be removed during the year and if it is necessary to notify the EPA.

Currently, SNLA is trying to use a contractor to comply with asbestos regulations. Plant Engineering (Division 7862) administers a contract for asbestos removal performed by a qualified asbestos abatement contractor, Keers Environmental, Inc. (whose work practices were verified by Division 3311 (IH)). If notification of the EPA is required, Plant Engineering notifies Industrial Hygiene and they perform the notification.

Under the current situation, if ACM is suspected or encountered during renovation, Division 3311 is notified so that they can sample and perform a qualitative analysis to determine if the material contains asbestos. If the material is ACM, the abatement contractor is used to remove and dispose of the asbestos. The contractor accumulates the material in a locked trailer east of Building 887 in a fenced contractor yard. When the trailer is full, the ACM is disposed of by Keers at their own EPA approved landfill.

SNLA has no written guidelines or procedures for the removal of asbestos or the disposal of asbestos waste nor does it have a copy of the contractor's procedures. No notifications have been made to the EPA nor were there any records available indicating the total volume of ACM removed.

CTA and TSD rely on SNLA for asbestos abatement.

4.2.1.2 Bendix Albuquerque Operations

Toxics Management

Bendix Albuquerque Operations (BAO), which is also known as the Center for Radiation-Hardened Microelectronics (CRM), is operated by the Bendix Corporation, whose main DOE facility is in Kansas City. Approximately 2 years ago, Bendix took over the production of integrated circuits at the Building 870 Complex in Technical Area I from SNLA, and approximately a year ago took over environmental responsibilities for the facility.

Bendix Kansas City (BKC) Safety Department and Environmental Services Department reviews plans and advises management at BAO. The BAO Health, Safety and Environmental Protection (HSEP) staff, which consists of one professional and one technician, are responsible for most of the HSEP programs at BAO. SNLA ES&H personnel provide some surveys on an annual basis and others on an as-needed basis. They also include BAO's discharges to the sanitary and storm sewers in their DOE site plan and conduct environmental monitoring accordingly. KAFB's Hazardous Material (HAZMAT) Response Team provides support when a major health, safety, or environmental hazard is evident.

Chemicals are procured at BAO via a Purchase Requisition. Quality Control provides any specifications, labeling requirements, and storage requirements. Formal approval from the BAO Environmental Protection Specialist (or his designate) is required before any chemical not defined by BAO Material Specification or in the BAO Stores/Material Procurement System is purchased or received at Building 870. The specialist requests an MSDS on the purchase request and/or calls directly to the supplier to obtain one. Material Planning and Control sends the PR to BKC who issues a Purchase Order to the supplier.

Chemicals are received at RIN Chemical Company, Inc., in Albuquerque, which has a temperature-controlled warehouse. This is done since many of the process chemicals are temperature sensitive and, if received at SNLA Building 957, might sit in an uncontrolled environment for a number of days. Quantities of the chemicals as needed are delivered to BAO and stored in a temperature-controlled 16-foot x

20-foot metal storage building on a cement slab east of Building 870. A list of the typical process chemicals is shown in Table 4-7. Most of these chemicals are obtained in cases of relatively small bottles such as gallon, liter, and a few pint bottles. Cases of acids, bases, and solvents are all stacked together in proximity, with insufficient room for inspection of containers and no segregation of incompatible materials. There is no berm and there are no other spill control measures for the storage building, and a 2-foot x 4-foot storm drain is located in the yard approximately 7 feet from the building door.

Bottles of chemicals from the storage building are brought into Building 870 and placed into two chemical storage rooms, one for each clean room. Chemicals are stocked on the shelves from the rear through one door and are removed for use from the front via sliding glass doors. Only small quantities were neatly stored there. The floor drains had been plugged and there was a stainless steel drip pan covering the entire floor.

Bulk chemicals for the Elementary Neutralization Unit (ENU) are stored in new tanks north of Building 870. There are a 4,000-gallon hydrochloric acid tank and an 8,000-gallon sodium hydroxide tank. Both of these tanks have large dikes, the transfer pumps are within the dikes to contain leaks or spills, and the drain system is set up so that any chemicals can be neutralized in the ENU prior to discharge. The ENU contains 3 neutralization tanks in a below-grade concrete vault.

Originally, the bulk acid and caustic tanks at BAO also supplied chemicals to day tanks for regeneration of the water treatment demineralizers in the northeast corner of Building 870. Because of equipment problems and replacement of the bulk storage tanks, the day tanks were removed and regeneration chemicals are supplied from 55-gallon drums using barrel pumps, connected via plastic tubing to the suction of the original day tank pumps. Two to three 55-gallon drums of 50 percent caustic are offloaded from a pickup and placed on the concrete floor of the demineralized-water room. There are three drains in the room going to the sewer. Etch rings in the floor indicate there have been at least minor spills, which may have entered the drains. A concentrated hydrochloric acid drum is placed on the soil next to the building and pumped through the wall. There are no spill control measures. This temporary setup requiring manual handling and transfer of chemicals every 2 weeks has been used since August 1984.

TABLE 4-7

MAJOR PRODUCTION CHEMICALS USED AT BENDIX ALBUQUERQUE OPERATIONS

Chemical	Annual Purchases (gal)
Ammonium Hydroxide	230
Sulfuric Acid	6,900
Acetic Acid-Glacial	60
Nitric Acid	130
Hydrofluoric Acid	1,200
Hydrogen Peroxide	3,150
Phosphoric Acid	720
Buffered Oxide Etchant	250
Polysilicon Etchant	60
Ammonium Fluoride	970
Pass, Glass Etch	140
Xylene	40
Hydrochloric Acid	190
Acetone	780
Isopropanol	1,050
Nophenol-922, Stripping Solution	250
Methanol	25
Hexamethyldisilazane	30
Developer, Pos. Resist	5,000
Thinner, Photoresist	100
Kodak Positive Photoresist	440
Tetraethylorthosilicate	20
Electronic Liq. (Fluorinert)	200
Stripper, Photoresist	30
Triton X-100 Surfactant	2
Wright Etchant	8
Microposit	-
Microposit Primer	-
Genesolv D/Freon PCA	1,460

Source: Extracted from Ferryman, 1987

At BAO, MSDSs for the chemicals used at this facility are stored in a three-ring binder prominently displayed in Building 870 (the main building where the bulk of the personnel work) in a break area likely to be visited by most personnel.

Polychlorinated Biphenyls

BAO has only one large power transformer at the Building 870 complex that is filled with a non-PCB fluid. BAO has no other PCB-containing equipment.

Pesticides

BAO, because of its limited facilities, does not have a pesticide program. It relies on SNLA to furnish pesticide control when needed.

Asbestos

BAO personnel indicated they did not have any asbestos program since they believed they had removed all asbestos. (Asbestos gloves and fire blankets had been removed.) If a renovation occurs where a material is suspected to be ACM, a sample is sent to the Division 1800 or Division 1311 laboratory for analysis. The only likely place where there still would be asbestos would be the maintenance shop and boiler room, which are operated by SNLA personnel. These areas were inspected; most of the insulation was non-asbestos and the insulation that may have been asbestos was properly wrapped and in good condition.

4.2.1.3 Inhalation Toxicology Research Institute

Toxics Management

At the Inhalation Toxicology Research Institute (ITRI), a number of radioactive, toxic, and known or suspected carcinogens are used in animal inhalation studies to determine the effects of these pollutants. The quantities of these particular materials are relatively small. Health Protection Operations (HPO) is responsible for the ITRI environmental, safety and health protection (ES&H) efforts, and consists of two professionals and three technicians.

To procure a new chemical item, an experimenter discusses how the chemical will be used and its effects in an experimental protocol writeup and submits it to HPO. If this protocol has not been prepared yet, the requester has the option of preparing a Chemical Hazards Evaluation Form (HP-026) and submitting it to HPO for evaluation. The requester then fills out a purchase requisition, obtains his supervisor's approval, and submits it to HPO. HPO approves it and requests an MSDS if one is not on file; the Laboratory Director then approves the purchase and Purchasing orders the material.

Materials are received directly at ITRI (they do not go through SNLA receiving at Building 957) at the receiving area in Building 9217. About the only chemical which is received in bulk via tank truck is No. 2 diesel fuel oil which provides fuel for the generators and boilers. The oil is stored in underground storage tanks (USTs). Any bulk stock chemicals (i.e., liter to gallon-size bottles of acids, bases, and solvents) are placed in the chemical storerooms in Building 9217. Chemicals that are nonregulated (by HPO) are delivered directly to the person who requested them at the requestor's laboratory. Any material that is radioactive material, a carcinogen, or any chemical specified on the purchase order "to be delivered to HPO" is turned over to HPO. Radioactive material and carcinogens are stored in Building 9200, Room 210. National Toxicology Program (NTP) test chemicals, which are required to be kept separate (as part of NTP quality assurance), are stored in Building 9217 in the Controlled Chemical Storeroom.

Bulk liquids (i.e., diesel fuel oil) are stored at ITRI in 7 USTs. The total capacity of these tanks is 82,000 gallons. These tanks connect to 5 small (ranging from 18-70 gallons) day tanks located inside buildings 9262 and 9201. Overflows from these small tanks would go to either surface drainage or the sanitary sewer. The USTs are either coated or are cathodically protected to minimize corrosion. A recent inspection report states these tanks are in excellent condition. The material balance monitoring and oil level gauge indicate there are no leaks in the tanks or supply system. Visual inspections of the aboveground piping are conducted weekly and inspections of the UST locations and underground pipeline rights-of-way are conducted at 6-month intervals (ITRI, 1987b). A listing of the tanks, including location and capacity, is provided in Appendix F, Table F-3.

The major chemical storage areas for the facility are in Building 9217 in the northeast corner in rooms specifically designed for the storage of chemicals. One is the Flammables Storage Room, which is approximately 15 feet x 24 feet. The concrete floor is recessed 4 inches below the floor of the main building and has a drain to an outside sump filled with crushed rock to contain and control any major spills. Metal cabinets and open shelves are used to store various solvents and flammable chemicals. The area contains a fan in the outside wall for ventilation, fusible links on ventilation louvers, explosion-proof lighting, and a fire suppression system. Most of the containers stored here are gallon to liter-size bottles.

The Corrosives Storage Room, which is about 18 feet x 24 feet, is located next to the Flammables Storage Room, and is similarly constructed. The shelves are open and are used to store mostly gallon to liter-size bottles of acids and bases, which are stored in their original cardboard or foam shipping containers. Two 55-gallon drums of acid are stored on stands for dispensing in the large open center area. Plastic was taped to the floor to protect the concrete from any drips that might occur; there was no sign of leakage on the concrete floor.

The ITRI storerooms were in good order and, in the Corrosives Storage Room, incompatible items were generally well separated. (A box containing bottles of sulfuric acid was stacked on top of boxes of ammonium hydroxide, but when discovered was immediately corrected.)

The radioactive materials, carcinogens, and other toxic materials used at ITRI as the pollutant in experiments are typically received on a one-time basis and may vary from approximately 10 pounds to 1 gram of the substance, depending upon the toxicity of the material and the size of the experiment, with most materials received being in the 10- to 100-gram range.

The bulk of the hazardous materials received at ITRI are used for the dissolution and/or preparation of animal tissues for study and consist mainly of acids, bases, and solvents. These chemicals are listed in Table 4-8.

At ITRI, MSDSs for the materials used at this facility are stored in the main building (Building 9200) in a set of six three-ring binders prominently displayed on a central

TABLE 4-8

MAJOR PROCESS CHEMICALS USED AT INHALATION TOXICOLOGY RESEARCH INSTITUTE

Chemical Name	Estimated Annual Usage (lb)
Acetaldehyde	<0.1
Acetic Acid	<10
Acrylonitrile	<200
Ammonia	<10
Benzene	<10
Bromine	<0.1
1,3-Butadiene	<10
Carbon Disulfide	<1
Carbon Tetrachloride	<1
Chloroflurocarbons (CFC113)	<100
Chloroform	<10
Di (2-Ethylhexyl) Phthalate	<0.1
Dioxane	<1
Ethyl Acetate	<30
Ethylene Oxide	<10
Ethanol	<4,000
Formaldehyde	<100
Hexane	<30
Hydrochloric Acid	<10
Hydrofluoric Acid	<5,000-6,000
Hydrogen Sulfide	<100
Methylene Chloride	<100
Methyl Ethyl Ketone	<10
Methyl Isobutyl Ketone	<1
Nitric Acid	8,000-9,000
Phenol	<0.1
Polycyclic Organic Compounds	<10
Sulfuric Acid	<10
Tetrahydrofuran	<100
Toluene	<100
Xylene (all isomers)	<100
CFC 113	<100
Methyl Chloride	<1

Source: McClellan, 1987

table in the library where personnel come to do research or for a break. In some cases, MSDSs for particular chemicals were posted in plastic inserts on laboratory doors.

Polychlorinated Biphenyls

ITRI has three large PCB power transformers at its complex, two of which are in Building 9201. They do have a PCB program which is discussed in ITRI SOP NO: IH-27 (ITRI, 1986d). The Head of Health Protection Operations is responsible for overall implementation and the Facility Engineer is responsible for inspection and maintenance of the transformers and the records associated with these activities. These records were checked, indicating that the quarterly inspections were performed. The transformers were inspected. All were in good condition and had proper labeling including the gates and doors leading to them to warn firemen. The KAFB Fire Department has been notified of the location of the three transformers (McClellan, 1985) to allow fire preplanning to prevent or minimize the effects of PCB releases during a fire. There are no spill control berms around the transformers and, in the case of the transformers in Building 9201, there are drains nearby which would carry off any major spills to the lagoons. ITRI has budgeted for fiscal year (FY) 89 to retrofill these three transformers to reclassify them as non-PCB. Since the transformers are the only known PCB equipment, there is no on-site PCB storage area and no PCB equipment has been shipped off-site.

Pesticides

At ITRI they have two procedures, SOP 0569 (ITRI, 1985a) and IH-16 (ITRI, 1985b), covering pesticide control. An outside licensed contractor, Rose Exterminator Company, is used for control of insects and rodents. They use seven different insecticides, two rodenticides, and live catch traps for rats and mice (Lyons, 1985). The different materials are used very selectively and under the supervision of HPO personnel or the Chief Animal Technologist, since improper application might affect the animal studies being performed at ITRI. The contractor comes on a monthly basis unless called sooner because of need. Contractor personnel bring their own chemicals and do not store any on-site nor rinse containers on-site.

No herbicides are currently approved for routine use at ITRI. In certain fenced areas (i.e., the lagoon area), goats are used for vegetation control (ITRI, 1985a).

Asbestos

At ITRI an asbestos assessment was conducted in January 1986 by taking samples in various locations throughout the facility. These samples were sent to Hager Laboratories, Inc. in Denver, Colorado, for analysis. Most of the institute buildings are newer than 1973 and do not contain asbestos. In the older buildings, the asbestos was concentrated mostly in the boiler rooms and equipment rooms on the boilers and on pipe elbows. The straight runs of insulation were fiberglass. The ACM areas have been labeled with stickers and appeared to be in good condition. There are no plans to remove any of this material. ITRI personnel have removed a small amount of insulation but only to work on the pipe. There is no written procedure for this activity, since it is so infrequent; removal was performed by HPO personnel or maintenance personnel under the direction of HPO. They either wet the ACM or used glove bags. Personnel used Tyvek coveralls and respirators and the material was double-wrapped for disposal at the KAFB Sanitary Landfill. In the two instances where ITRI did dispose of ACM, the KAFB Civil Engineer was notified. He met them at the landfill, specified where to place the asbestos and immediately had it covered.

4.2.2 Findings and Observations

4.2.2.1 Category I

None

4.2.2.2 Category II

1. Orphaned chemicals at SNLA. Chemicals which have been orphaned (or abandoned) have been allowed to accumulate at SNLA in inadequate storage areas, and due to their age and lack of inspection, may leak or have leaked to the environment. This may result in the contamination of soil and surface water.

RELEASED

Examples of orphaned chemicals include:

- In Technical Area III behind Building 6730, there are 14 drums of oil and 50 percent caustic soda in the central yard of the complex that are rusting and/or showing crystal growth indicating caustic leakage.

- In Technical Area III behind Building 6732, there are 16 drums of oil, 50 percent caustic soda, Freon, and other unmarked drums of chemicals. Most of the drums are rusting, one is damaged, and two are leaking what appears to be crude oil. There is a puddle of oil on the ground. The programs in the 6730/6732 complex were terminated approximately 5 years ago.

- In Technical Area I, Building 895, there are two rooms with assorted hazardous and flammable chemicals. Trash, a heavy layer of dust, and other evidence indicate the chemicals have not been used or checked for at least a year.

2. Improper storage and application of herbicides by unlicensed SNLA personnel. Herbicide (2,4D) may leak to the environment and may contaminate surface soil, surface water, and possibly groundwater due to improper storage in the environment and lack of spill control.

   Excessive application of herbicides with resulting damage to vegetation and foliage may occur (or has occurred) as a result of application of herbicides by unlicensed personnel who do not have written procedures and who may not have had adequate training.

   Herbicides used by the SNLA maintenance personnel were improperly stored in Technical Area III west of Building 6501 in an open field. There were three full drums of 2,4D on a pallet; one full drum with a dispensing valve on a stand; one unlabeled, unknown full chemical drum; and four empty herbicide drums. All these drums were stored outside in an open area, without protection from the elements and without any spill control measures. Two spray trailers, which were stored next to the dispensing drum, were undoubtedly loaded in this area. There was no vegetation in the area, but

whether this was due to spills, to spraying of the area, or to natural conditions (it was a sandy area) could not be ascertained.

Approximately a month before the Survey, the personnel sprayed herbicide in the vicinity of Building 6526 where there are five mature peach trees in a cluster. After the spraying, approximately 30 percent of the foliage died, indicating that there was improper application or that too concentrated a solution was used. Since personnel in the buildings nearby eat these peaches, improper applications of herbicides may affect not only the vegetation, but also personnel in the area.

4.2.2.3 Category III

1. Incomplete control of PCBs at SNLA. PCBs may inadvertently be released to the environment since no assessment to locate, sample, mark, and inspect transformers and capacitors that are being used for research and development (R&D) has been performed yet. This has been done for power distribution equipment.

The known PCB power distribution transformers and capacitors (over 100) do not have any containment for spill control. Any leaks or spills may contaminate surface soil, surface water, and/or the building if the transformers are located inside. In a number of cases (Buildings 841, 865, and 894 were the worst offenders) flammable material was stored within 5 meters adjacent to or within barriers around PCB transformers; this could result in a fire and release of PCBs. Although the transformers were marked, in most cases labels to warn firemen are not posted on the hallways, doors, or gates in fences leading to PCB equipment. Therefore, PCB-contaminated fire suppression water may be inadvertently released to the environment.

It should be noted that a work statement had been prepared (but not issued) to retrofill eighteen 100 percent-PCB transformers and process 21 lower concentration PCB transformers to reclassify them as non-PCB. A status form had been prepared to document potential PCB equipment used in R&D and a cost estimate for a contractor to perform the work had been prepared, but a contract had not been let at the time.

2. Lack of UST inspection program, abandoned-tank removal program, and spill control. With the exception of gasoline tanks at the motor pool, there is no program for the inspection of underground storage tanks (USTs) to determine leakage, nor is there a program for the removal of abandoned or inactive USTs. There are no spill control measures provided for an above ground storage tank (AST) of aviation fuel at the CTF burn site. There is a potential for leakage from the USTs to contaminate soil and groundwater, and from the AST of aviation fuel to contaminate soil and surface water.

A large proportion of USTs at SNLA are old - approximately 75 percent are more than 20 years old and about 50 percent are more than 35 years old. Installation of many of those tanks was probably poor - inadequate backfill, packing, etc. - based on interviews with SNLA personnel. Most tanks at SNLA are not coated. The above information suggests that there is a strong potential for leaking tanks at SNLA. These tanks contain diesel fuel, coolant oil, and fuel oil. There are also a few waste oil and wastewater tanks. Purchasing records cannot be used to track potential tank losses due to SNLA's distribution system.

All known abandoned tanks are underground. There are 17 abandoned USTs known to SNLA. The potential exists for the reuse of inactive or abandoned tanks with substances that would react with tank residues, increasing the waste hazard and potentially increasing tank leakage. The tanks contained tritiated water, dielectric oil, gasoline, fuel oil, and washwaster. Removal of abandoned tanks provides a method of detecting and remediating leaks from USTs. There are no plans to replace or remove these tanks.

A 25,000-gallon AST of aviation fuel situated on a hill overlooking the burn site at the CTF has no berm or other spill control measures. If a leak should occur, soil would be contaminated and the fuel would flow to the nearby arroyo and would eventually make its way to the Rio Grande. If a major leak or spill occurred when a burn test was being conducted, the test area could be engulfed in flames.

As part of the followup Sampling and Analysis program, a number of the USTs will be leak-tested to determine if any leakage is occurring.

3. No spill control around PCB transformers at ITRI. Three PCB transformers at ITRI have no spill control to prevent releases to the environment and possible contamination of soil and surface water in the event of leakage.

   Two of the transformers, located in Building 9201, have drains nearby which would carry major spills to the lagoons. Leakage from the third transformer, which is outside, would contaminate the soil and might ultimately go to the lagoons.

   ITRI has budgeted for FY89 to retrofill all three transformers to reclassify them as non-PCB.

4.2.2.4 Category IV

1. Outdoor storage of chemicals at SNLA. In several areas of SNLA, process chemicals are stored outdoors in an unprotected manner that may potentially lead to ruptures or leaking containers and releases to storm drains and/or to the air.

   The lack of protection from the elements may result in some containers becoming overpressurized from exposure to the sun or rusted from exposure to rain and snow, thus failing and releasing chemicals. Since there is no spill control at any of the outdoor chemical storage areas, chemicals have the potential to contaminate soil, surface water, ambient air, and groundwater.

   Examples of improper storage include:

   - In Technical Area I at Building 841, the chemical storage area is located on an uncovered loading dock with no spill control. Five drums of solvents, such as methylene chloride and trichloroethene, were stored there and two had bulged heads. Additional drums, one of which was bulged, were stored across from the loading dock on the asphalt by

Building 842. There are two storm drains in the asphalt within 10-15 feet of the drums. Stains indicate there may have been leakage.

- In Technical Area IV at Building 983, thirty-five 55-gallon drums of Freon solvent were stored outside near the southeast corner of the building. The drums were stacked two high on the asphalt, in the sun, and at least five drums had badly bulged tops indicating overpressurization. No spill control measures were provided.

2. Potential asbestos mismanagement at SNLA. The lack of a comprehensive asbestos management program at SNLA may lead to inadequate identification of ACM at SNLA and subsequently to improper handling and disposal of these materials.

   Identification of ACM locations at SNLA has not been performed. ACM is not marked and may be improperly removed by untrained unprotected personnel and improperly packaged and disposed of with normal waste. This may result in inhalation of asbestos fibers by removal personnel, and possible contamination of the building, transporting vehicle, and disposal area (i.e. KAFB Sanitary Landfill).

   No ACM removal reports have been made to the EPA. Since the quantities of ACM to be removed, and the amounts actually removed, have not been properly documented, it is probable that threshold reporting limits have been exceeded.

3. Inadequate storage of chemicals at BAO. Chemicals stored at BAO are stored without segregation, with no protection from the environment, and/or the storage areas lack spill control measures.

   If a leak or spill occurs, chemicals may be released, thus contaminating surface soils in the area and/or stormwater drains.

Examples of improper storage include:

- In Building 870A, the Chemical Storage building east of Building 870, cases containing pint- to gallon-size bottles of acids, bases, solvents, and other hazardous chemicals are stacked together in a 16-foot x 20-foot metal building with insufficient room to inspect containers, no segregation of incompatible materials, and no spill control. A 2-foot x 4-foot storm sewer is located 7 feet from the building door.

- Eighteen 55-gallon drums of ethylene glycol are stored outdoors by the cooling tower without protection from the environment. Seven drums have rusty tops as a result of water collecting in the tops.

A new chemical storage building has been built at BAO, but had not been put in service.

4. Potential spills from regeneration system at BAO. As the result of a temporary regeneration system in the deionized water room in Building 870 and lack of spill controls, spills may occur, releasing hydrochloric acid or sodium hydroxide to surface soil and/or the sewer.

A "temporary system" has been used for approximately the last 3 years to regenerate the demineralizers because the day tanks were removed and never replaced. Every 2 weeks the contractor who operates the water treatment system brings in approximately two 55-gallon drums of sodium hydroxide (which is offloaded onto the water treatment room floor) and a drum of hydrochloric acid (which is placed on the soil outside the building). The drums are connected via barrel pumps and plastic tubing to the suctions of the original regeneration pumps. There are three floor drains that go to the sanitary sewer in the room close to the area where the caustic drums are placed. Etch rings in the concrete indicate at least minor spillage has occurred in the past. There are no spill control measures and because of all the physical handling, there is a potential for more significant spills or leaks to occur.

4.3 Radiation

This section (1) identifies the sources of off-site radiation exposure resulting from operation of facilities at the Sandia National Laboratories complex in Albuquerque, New Mexico; (2) reviews the methods used to measure and monitor the impacts of those exposures; (3) compares the estimated and measured impacts against established standards and limits; and (4) presents findings regarding problems and deficiencies. These topics are addressed in the context of relevant U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) requirements. The requirements themselves are described in detail in Appendix G.

A variety of radioactive materials has been and is being used at these facilities. The Sandia National Laboratories - Albuquerque (SNLA) weapons development activities involve primarily the use of tritium, uranium, and plutonium. Experimental and research programs in nuclear energy and high-energy particle acceleration involve and/or produce special nuclear materials, mixed fission products, activation products, and tritium, and result in the generation of ionizing radiation fields.

The Inhalation Toxicology Research Institute (ITRI), in its research directed toward elucidating the biological consequences of inhaling toxic substances, uses an even broader range of radioactive substances. Among the materials that have been studied are tritium, fission products, and transuranic elements that might be encountered in the nuclear fuel cycle.

4.3.1 Background Environmental Information

Background radiation is radiation arising from radioactive material or radiation sources other than the ones directly under consideration (which in this case are direct radiation fields and radionuclides in environmental media, resulting from activities at facilities in the Sandia complex). Background radiation is always present and consists of two major components, cosmic radiation and terrestrial radiation. The cosmic component is produced by interactions of high-energy radiation from outer space with the earth's atmosphere and varies depending upon the altitude above sea level. Background radiation levels from the cosmic radiation component vary in the U.S. from 26 mrem/yr at sea level to 125 mrem/yr in Colorado

(NCRP, 1975). Throughout the Albuquerque area the contribution of cosmic radiation is approximately 49 mrem/yr (EPA, 1981).

The terrestrial radiation component of background radiation is due to over 50 naturally occurring radionuclides, mainly potassium-40 (K-40) and members of the uranium-238 (U-238) and thorium-232 (Th-232) decay series, in the earth's crust. This terrestrial component will vary in intensity, depending upon such factors as local geologic formations and ground moisture. Since World War II, there is a third source of background radiation caused by man-made radionuclides, such as cesium-137 (Cs-137) and strontium-90 (Sr-90), which have been distributed throughout the world as fallout from atmospheric nuclear detonations. This source, which has been decreasing from about 10-15 mrad/yr since aboveground testing stopped in the United States, is usually included in the terrestrial component and presently constitutes a few mrad/yr. The terrestrial component of background radiation in the United States generally varies by region from 15 mrad/yr along the Atlantic and Gulf coastal plains to 140 mrad/yr in the Colorado area (NCRP, 1975). In the Albuquerque area the terrestrial background radiation level is approximately 70 mrem/yr (EPA, 1981).

The total dose equivalent from natural background radiation in the Albuquerque area is thus about 119 mrem/yr. The external direct radiation component of this total is likely closely approximated by the direct measurements conducted by SNLA at the facility perimeter and in nearby communities. In 1986, the average annual doses from these measurements were 92 mrem (perimeter) and 89 mrem (communities) (Millard et al., 1987). Background levels of radionuclides in various environmental media such as air and water are routinely measured by EPA. SNLA measurements in samples of soil and vegetation from nearby communities are also considered as representative of the background levels in these media. Table 4-9 presents data on background levels in environmental media.

TABLE 4-9

BACKGROUND CONCENTRATIONS IN ENVIRONMENTAL MEDIA FROM THE ALBUQUERQUE AREA

MEDIUM	RADIONUCLIDE CONCENTRATION							
	Gross Alpha	Gross Beta	Tritium	Pu-238	Pu-239	U-234	U-235	U-238
Air ($pCi/m^3 \pm 2\sigma$)	ND[a]	0.20[b]	ND	0.7 ± 0.7[b] ($X10^{-6}$)	27.0 ± 3.5[b] ($X10^{-6}$)	112.0 ± 16.6[b] ($X10^{-6}$)	7.1 ± 3.2[b] ($X10^{-6}$)	74.6 ± 12.5[b] ($X10^{-6}$)
Surface Water ($pCi/l \pm 2\sigma$)	3.1 ± 0.6[c]	5 ± 6[c]	<0.45[c]	ND	ND	ND	ND	1.3 ± 1.3[c]
Drinking Water ($pCi/l \pm 2\sigma$)	5.0 ± 1.0[b]	6.0 ± 0.8[b]	0.1 ± 0.2[b]	0.016 ± 0.010[b]	0.003 ± 0.004[b]	4.095 ± 0.377	0.230 ± 0.039[b]	3.572 ± 0.332[b]
Soil (pCi/g)	ND	ND	3.6 ± 1.2[c]	ND	ND	ND	ND	0.7 ± 0.5[c]
Vegetation (pCi/ml water)	ND	ND	4.1 ± 0.8[c]	ND	ND	ND	ND	ND

[a]ND = not determined
[b]Source = EPA, 1981
[c]Source = Millard et al., 1987

4.3.2 General Description of Pollution Sources and Controls

4.3.2.1 Sandia National Laboratories-Albuquerque

Five Technical Areas and several environmental test areas comprise SNLA. A brief description of the activities in each area having a potential for emitting direct radiation and releasing radioactive effluents follows.

Technical Area I

Technical Area I is dedicated primarily to the design, research, and development of weapon systems and limited production of weapon system components. Administrative offices, laboratories, and shops are also located in this area. Facilities in Technical Area I having a potential for airborne releases of radioactive effluents are the Toxic Metals Machine Shop in Building 869, the neutron generator (accelerator) facilities in Buildings 805 and 807, and the Neutron Generator (explosive devices) Testing Laboratory in Building 891. The Toxic Metals Machine Shop, which performs machining operations on depleted uranium (in addition to other toxic metals), is described in detail in Section 3.2.2.1. Machining operations in this facility are performed wet and the local exhaust ventilation system contains roughing and high-efficiency particulate air (HEPA) filtration for removal of particulates. Monitoring of this exhaust is not performed.

The accelerator-type neutron generators utilize tritium targets for the production of 14 MeV neutrons. Small fractions of the tritium are released during accelerator operation and from stored targets and contaminated components. At the time of the Survey, one of the accelerators was not in routine use and the other was being used for a study involving a nonradioactive target. The facilities and target/component storage and handling areas are exhausted; stack discharges are not sampled or monitored for tritium concentrations.

Tritium-containing neutron generator devices are tested under negative pressure in Building 891 to determine aging effects on the tritium foils. Up to several curies of tritium may be on the test apparatus at one time and testing of a group of devices may continue for a few years. Health Physics and facility operating personnel believe that tritium losses to the vacuum system and exhaust ventilation system are

negligible; however, the discharge is not treated to remove tritium and is not monitored.

No sources of potential radionuclide contamination in liquid effluents from Technical Area I were identified during the Survey.

Sources of potential direct radiation include the Instrument Calibration Facility, X-ray machines, and two neutron-generating accelerators. Each of these sources is provided with shielding to protect the staff in adjacent areas; this shielding also provides protection for the off-site environment.

Technical Area II

Technical Area II is a relatively small area, used primarily for small-scale explosive testing. Building 935, the Neutron Generator Test Facility, is the only facility in this area with a potential for airborne releases of radioactive material. This facility conducts destructive and nondestructive tests on small devices containing foils with 10 to 50 mCi of tritium. The destructive test apparatus is exhausted, without filtration or monitoring, to the atmosphere through a roof-mounted ventilation system. A one-time monitoring study, conducted in 1985, indicated approximately 4.8 μCi of tritium was released in testing one device (Abbott, 1985); between 50 and 100 such devices are tested annually.

An inactive low-level waste disposal (burial) site is located on the east side of Technical Area II. This facility has not been used since 1959. The trenches have been backfilled with 3 feet of soil and covered with concrete caps.

There are no significant sources of radionuclide-contaminated liquid effluents or direct radiation currently operational at this Technical Area.

Technical Area III

South of Technical Area I is a group of approximately 20 development and testing facilities and areas, known collectively as Technical Area III. No radioactive effluents are released through normal operations in these facilities and areas. The site, currently in use for burial of low-level radioactive waste, is also located in this

Technical Area. This disposal site includes one section which has been used since 1959 for burial in trenches. Five trenches are no longer in use and have been filled and covered with dirt. Another section of the site has been used for disposal of classified low-level waste in 35 pits. Thirty-four of these pits have been filled and covered with a concrete cap. One pit is currently being used. The low-level radioactive waste consists primarily of tritium-contaminated materials. Three additional pits located in the classified waste disposal area are used exclusively for natural and depleted uranium waste disposal. This site is described in more detail in Section 4.1.2. Measurements and calculations conducted in 1982 indicated that from 3 to 43 Ci of tritium may be released to the atmosphere annually from the classified burial site (Millard, unpublished data). Elevated concentrations of tritium were also present in soil moisture in the vicinity of the burial site.

Some of the test areas contain small pieces of depleted uranium shrapnel from destructive tests; however, direct radiation levels from this material are negligible as are the potentials for contamination of surface or groundwater by uranium from this shrapnel.

Technical Area IV

Technical Area IV is a relatively new facility, designed for inertial confinement fusion research and pulsed power research. A large accelerator, the Particle Beam Fusion Accelerator-II (PBFA-II), was completed in 1985. Gaseous tritium effluents (primarily HT) may be generated when this accelerator becomes fully operational. A large accelerator facility (STL) is currently under construction. It will house seven pulsed power accelerators - HERMES III, RLA, TROLL, STF, SPEED, HYDROMITE, and PROTO II. Several of these accelerators are being transferred from Technical Area V. A new accelerator facility, SATURN, is under construction. These accelerators are heavily shielded to protect the site staff, thus ensuring low radiation levels in the environment. Accelerator operation also produces very short-half-life radionuclides, such as nitrogen-13 (N-13), which may be released to the atmosphere. Decay and dilution between the generator and the area boundary reduce the concentrations of these sources to very low levels. No potential sources of radionuclides in liquid effluents were identified.

Technical Area V

Technical Area V houses several large electron beam accelerators, three research reactors in two facilities, a gamma [cobalt-60 (Co-60) and cesium-137 (Cs-137)] irradiator facility, and a hot-cell facility. Tritium may be released from some accelerators during operation for fusion research; however, these accelerators are presently being relocated to Technical Area IV and no tritium releases have occurred for the past several years.

The reactors are used for testing of reactor and weapons components under conditions of pulsed high-radiation fields. The facilities are quite different: the Sandia Pulsed Reactor (SPR) is an unreflected, unmoderated assembly of enriched uranium; the Annular Core Research Reactor (ACRR) is an annular core of 226 fuel elements in an open water tank. Both the SPR and ACRR air exhaust systems are equipped with HEPA filtration; filter banks are monitored for direct radiation to identify abnormal releases or control system malfunctions. Airborne releases from both facilities are primarily argon-41 (Ar-41) from activation of the air within the experimental chamber.

The reported amount of Ar-41, released from both reactor areas, is computed from reactor operating parameters. The reported release from both reactors during 1986 was 7.49 Ci (Millard et al., 1987). Sampling to measure actual air releases of Ar-41 or other radionuclides is not performed.

Operations in the Hot-Cell Facility commenced in mid-1987. This facility consists of a series of glove boxes and shielded, remote-handling cells for the purpose of destructive investigations of irradiated and non-irradiated reactor fuel elements. The exhaust ventilation from various components of this facility pass through multiple (2 to 4) stages of HEPA filtration and charcoal filters. Operating procedures limit radioactivity in samples to 6,000 Ci of mixed fission/activation products and 5 kg of fissile material (SNLA, 1986f). Sampling of the stack discharge is for particulates only. The stack is equipped with a direct radiation monitor to identify gross releases; this monitor does not have recording or integrating capabilities. In addition to the filtration, airborne releases are further reduced by natural radioactive decay and/or dilution between generating point and the site boundary.

Neither the reactors nor the Hot-Cell Facility have liquid effluent releases under normal operating conditions. Capabilities exist for releasing the ACRR and gamma irradiator water pools into underground storage tanks outside the 6850 Building. Floor drains and hand sinks in Building 6850 also go to these storage tanks. Tank contents are sampled and analyzed before release to two small surface basins, north of the Technical Area perimeter fence.

Accelerators, reactors, the Hot-Cell Facility, and the Gamma Irradiation Facility are also sources of direct radiation exposure. These facilities are heavily shielded to protect the operating staff, thus reducing direct radiation in the environment to low levels.

Other Areas

SNLA also has environmental test areas outside the five Technical Areas. These areas are located south of Technical Area III and in canyons on the west side of the Manzano Mountains. Tests in these areas may disperse small quantities of depleted uranium into the atmosphere and contaminate the surrounding soil with uranium dust and pieces of shrapnel. The test areas are surveyed following each test and contaminated materials are collected and disposed of. Environmental monitoring is done as considered necessary by the SNLA. Operations in these areas are, in addition, administratively controlled to avoid uranium contamination in public areas beyond the confines of Kirtland Air Force Base (KAFB). Small pieces of depleted uranium shrapnel remain in the soil at some of these test areas; however, associated direct radiation levels are negligible. SNLA also stores special nuclear material, irradiated fuel elements, and sealed radioactive sources in underground bunkers on the Manzano Base. Individual source shielding, shielding from the bunker material, and strict access control limit direct radiation levels in the environment to negligible levels.

4.3.2.2 Bendix Albuquerque Operations

The Bendix Albuquerque Operations (BAO) involves no radioactive materials or other radiation sources which present a potential for elevated direct radiation levels or radionuclide contamination of the environment.

4.3.2.3 Inhalation Toxicology Research Institute

The Inhalation Toxicology Research Institute (ITRI) conducts studies to evaluate factors influencing the toxicity of inhaled radionuclides and other pollutants. Facilities include a central laboratory and office buildings, exposure chambers, animal housing and care areas, a material receiving and storage building, and waste storage and processing areas. A wide variety of radionuclides are used at ITRI; during 1985 and 1986 major radionuclides under study included americium-241 (Am-241), plutonium-238 (Pu-238), plutonium-239 (Pu-239), thorium-228 (Th-228), curium-244 (Cm-244), uranium-232 (U-232), cesium-134 (Cs-134), carbon-14 (C-14), ytterbium-169 (Yb-169), strontium-90 (Sr-90), cerium-144 (Ce-144), promethium-147 (Pm-147), phosphorus-32 (P-32), and tritium.

Work with alpha-emitting radionuclides is performed in Building 9202, which contains four exposure rooms, eight radiochemistry laboratories, an electron microscope room, and a room equipped with muffle furnaces.

All laboratory operations involving radionuclides that emit only beta-gamma radiation are conducted in the Inhalation Exposure Complex (Building 9200), which also houses the shielded radioisotope storage vault for all beta- and gamma-emitting radionuclides. Operations in this complex include radiochemical preparations, beta-gamma inhalation exposures, aerosol test generations, and decontamination. Building 9200 also contains radiochemistry, biochemistry, and aerosol physics laboratories.

Ventilation systems from radionuclides operations are equipped with one or more (depending upon the radionuclides and quantities in use) stages of HEPA filtration. Effluents from all ventilation systems handling radioactive material are continuously sampled for particulates. Total atmospheric releases reported for 1986 were 134 mCi of tritium and 8.5 mCi of lead-212 (Pb-212) (Thompson, 1987a). The value for tritium was calculated, because the particulate samplers do not collect this material in gas or vapor form.

Liquid wastes, which may contain radionuclide levels exceeding recommended concentration limits for release to unrestricted areas, are collected for processing. All other liquid wastes from ITRI operations are released to a series of five lagoons.

Approximately 30,000 gallons per day are released into these lagoons; this is also the calculated evaporation rate for these bodies of water.

Long-term use of these lagoons has resulted in concentration of the radionuclides in the bottom sediments. A sixth lagoon was removed from service, due to contamination of sediments as a result of a Cs-137 release. Until a few years ago, liquid wastes not acceptable for discharge to the lagoons were placed in two "hot ponds" and permitted to concentrate by evaporation. Although this practice has been discontinued, the ponds still contain contaminated liquids and sediments. Tables 4-10 and 4-11 summarize the radionuclide levels in "hot-pond" liquids and sludges (sediments) for the years 1983-1986. The integrity of the liners on the ponds and lagoons is in question. Sections 3.4 and 4.5 discuss these systems in greater detail.

Sources of direct radiation are the radionuclide storage vault, waste processing and storage buildings (9221 and 9222), and the liquid waste "hot ponds". Shielding for protection of the ITRI staff ensures control of the direct radiation levels in areas accessible by the general public.

4.3.3 Environmental Monitoring Program

This section describes the methods, practices, and results of the programs used by the SNLA complex in evaluating the environmental impacts from the use of radioactive materials and radiation-producing equipment.

4.3.3.1 Sandia National Laboratories-Albuquerque

SNLA conducts a program for routinely monitoring direct radiation and concentrations of radionuclides in vegetation, soil, and water samples from the environs of their activities. Monitoring locations are identified on Figures 4-3 and 4-4 and Table 4-12.

TABLE 4-10

RADIONUCLIDE CONCENTRATIONS[a] IN "HOT POND" LIQUIDS

Radionuclide	1983	1984	1985	1986
NORTH POND				
Pu-238	4.5 ± 1.0 E-02	28 ± 1	2.0 ± 0.4 E-03	6.0 ± 0.1 E-02
Pu-239	8 ± 4 E-03	6 ± 1	1.1 ± 0.3 E-03	2.7 ± 0.1 E-02
Am-241	1.1 ± 0.5 E-01	10 ± 1	1 ± 1 E-03	1.9 ± 0.3 E-03
Cm-243,244	0 ± 2 E-02	6 ± 1	0 ± 1 E-03	0 ± 1 E-04
Sr-90	6.7 ± 0.1 E + 01	880 ± 10	5.2 ± 0.2 E-01	7.4 ± 0.1
Cs-137	1.0 ± 0.1 E + 03	10,000 ± 1,000	3.0 ± 0.1	1.6 ± 0.1 E + 01
SOUTH POND				
Pu-238	15 ± 1	1.5 ± 0.3	2.6 ± 0.1 E-02	3.1 ± 0 E-01
Pu-239	8.8 ± 0.1	0.3 ± 0.1	6.8 ± 0.1 E-02	9.1 ± 0.3 E-02
Am-241	0.7 ± 0.1	0.2 ± 0.1	6.1 ± 0.1 E-02	3.0 ± 0.1 E-02
Cm-243,244	2.2 ± 0.1	0.0 ± 0.1	2.5 ± 0.1 E-02	8.7 ± 0.3 E-03
Sr-90	3.2 ± 0.1 E + 02	9 ± 1	7.2 ± 0.1	5.6 ± 0.1
Cs-137	8.8 ± 0.1 E + 02	2,400 ± 100	7.7 ± 0.1	5.5 ± 0.1 E + 01

Source: Thompson, 1987d

[a] In pCi/mL

DRAFT

TABLE 4-11

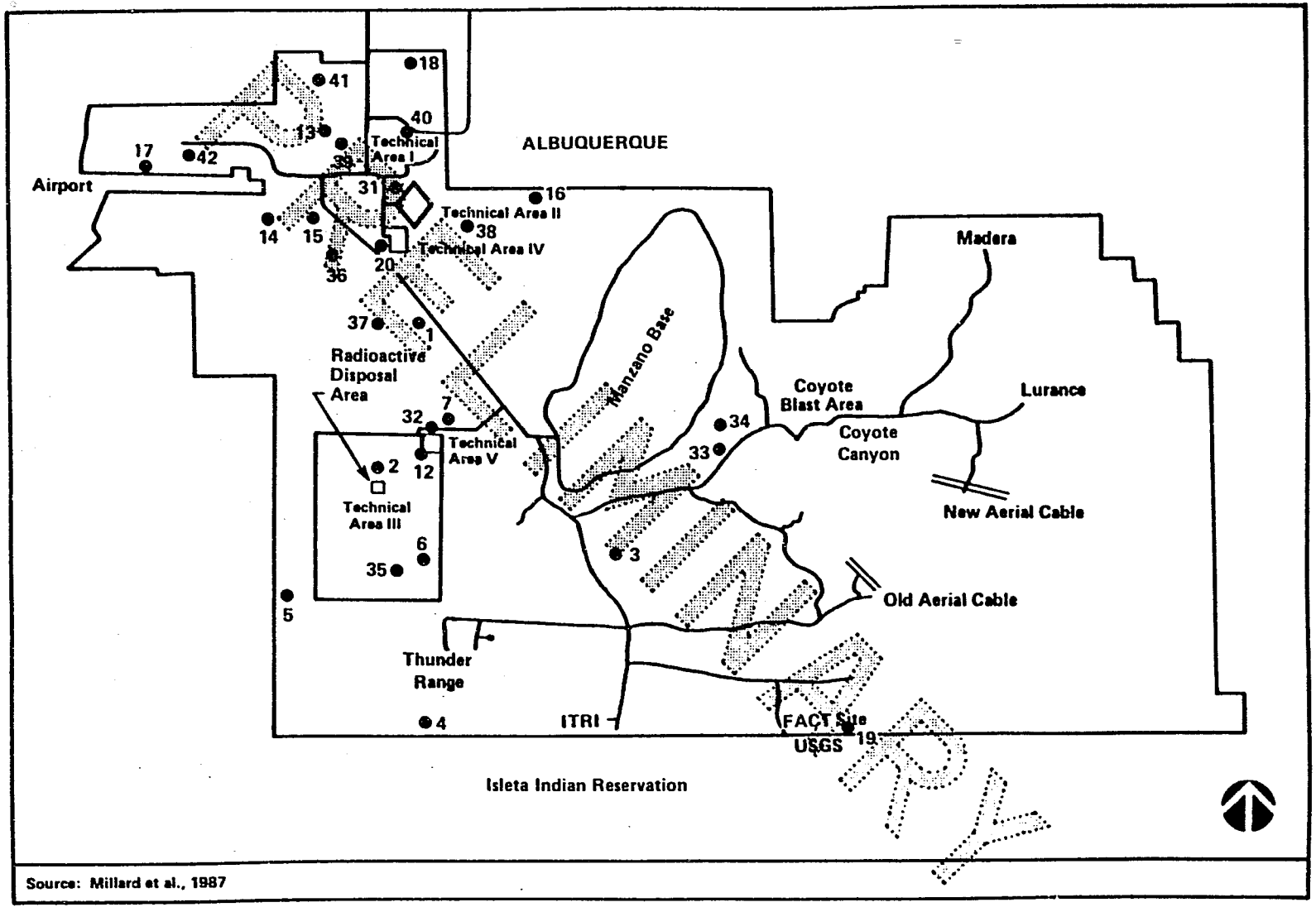
RADIONUCLIDE CONCENTRATIONS[a] IN "HOT POND" SLUDGES

Radionuclide	1983	1984	1985
NORTH POND			
Pu-238	26 ± 1	170 ± 10	1.0 ± 0.1
Pu-239	15 ± 1	120 ± 10	3.8 ± 0.3 E-01
Am-241	2.1 ± 0.1 E + 02	210 ± 10	8.2 ± 0.2 E-01
Cm-243,244	6 ± 1	16 ± 2	0 ± 1 E-03
Sr-90	5.1 ± 0.1 E + 05	62,000 ± 1,000	4.7 ± 0.1 E + 03
Cs-137	4.2 ± 0.1 E + 05	150,000 ± 10,000	4.4 ± 0.1 E + 02
SOUTH POND			
Pu-238	1.4 ± 0.1 E + 04	51,000 ± 1,000	1.0 ± 0.1 E + 02
Pu-239	2.8 ± 0.1 E + 03	27,000 ± 1,000	2.7 ± 0.1 E + 01
Am-241	1.2 ± 0.1 E + 02	10 ± 1	2.6 ± 0.1
Cm-243,244	1.9 ± 0.1 E + 01	240 ± 10	1.9 ± 0.3 E-04
Sr-90	1.7 ± 0.1 E + 04	46,000 ± 1,000	2.7 ± 0.1 E + 02
Cs-137	9.9 ± 0.1 E + 05	270,000 ± 10,000	8.0 ± 0.1 E + 02

Source: Thompson, 1987d

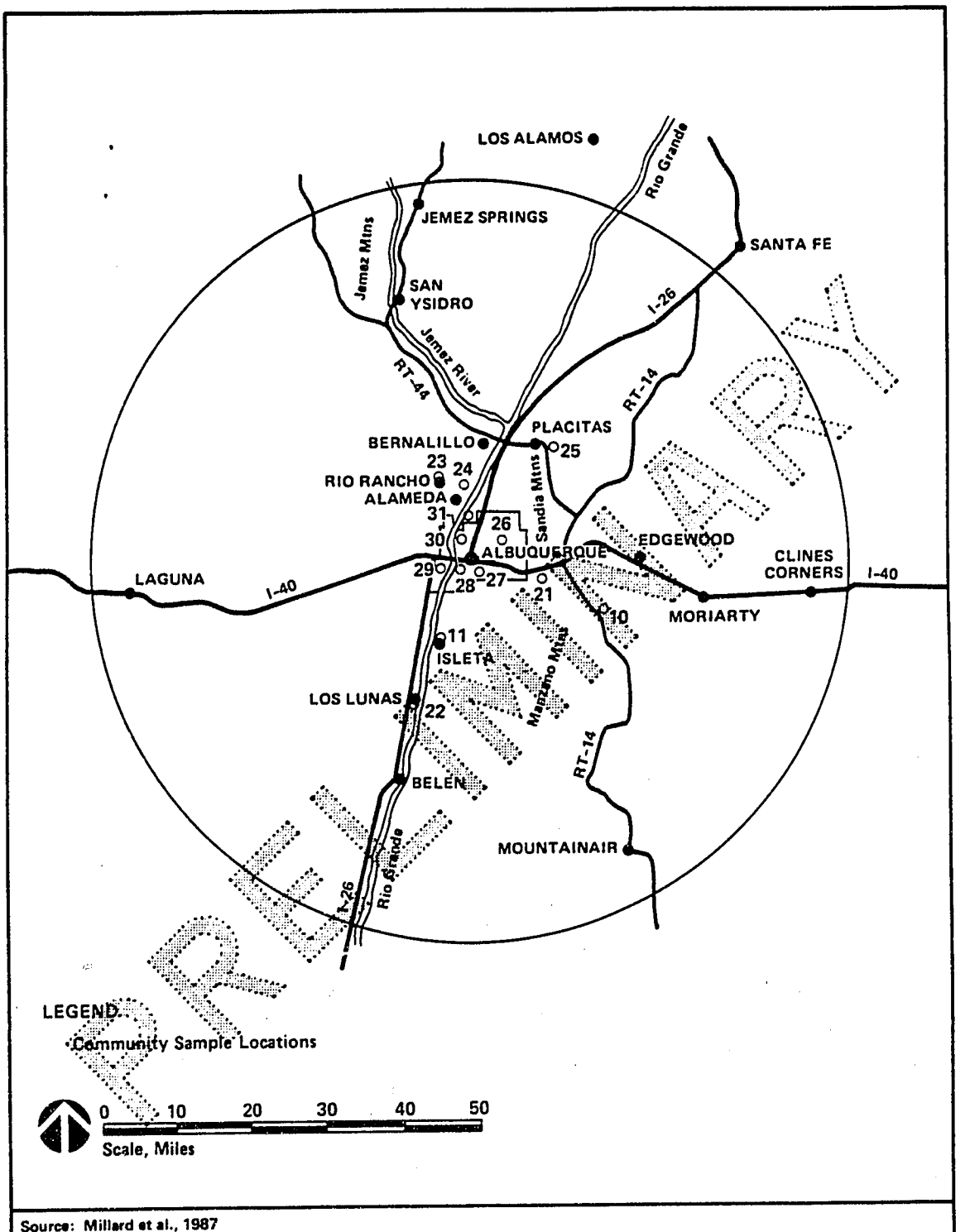
a In pCi/g

PRELIMINARY



Source: Millard et al., 1987

LOCATIONS OF SNLA ON-SITE AND PERIMETER TLD MONITORING STATIONS FIGURE 4-3



Source: Millard et al., 1987

LOCATIONS OF SNLA COMMUNITY (OFF-SITE) TLD MONITORING STATIONS

FIGURE 4-4

TABLE 4-12

SNLA ENVIRONMENTAL MONITORING LOCATIONS

Location Number	Location Name	Description*	Sample Type**
1	Pennsylvania Ave.	S	V,S,T
2	Radioactive Waste Disposal Site NW	S	V,S,T
2 NE	Radioactive Waste Disposal Site NE	S	V,S
2 SE	Radioactive Waste Disposal Site SE	S	V,S
2 E	Radioactive Waste DisposalSite E	S	V,S
3	Coyote Canyon Control	S	V,S,T
4	Isleta Reservation Gate	P	V,S,T
5	McCormick Gate	P	V,S,T
6	Technical Area III, SE	S	V,S,T
7	Arroyo, N Technical Area III	S	V,S,T
8	Corrales Bridge	C	V,S,W
9	Sedillo Hill, I-40 E of Albuquerque	C	V, S
10	Oak Flats	C	V,S, T
11	Isleta Pueblo, Rio Grande	C	V,S,T, W
12	Technical Area III Well	S	W
13	Base Well 1	S	W
14	Base Well 2	S	W
15	Base Well 7	S	W
16	Four Hills	P	V, S, T
17	Base Well 14	S	W
18	North Perimeter Rd.	P	T
19	Seismic Center Gate	P	V, S, T
20	Technical Area IV, SW	S	V,S,T
21	Bernalillo Fire Station 10, Tijeras	C	T
22	Los Lunas Fire Station	C	T
23	Rio Rancho Fire Station, 19th Street	C	T
24	Corrales Fire Station	C	T
25	Placitas Fire Station	C	V,S,T
26	Alb. Fire Station 9, Menaul NE	C	T
27	Alb. Fire Station 11, Southern SE	C	T
28	Alb. Fire Station 2, High SE	C	T
29	Alb. Fire Station 7, 47th NW	C	T
30	Alb. Fire Station 6, Griegos NW	C	T
31	Technical Area II Guard Gate	S	T

TABLE 4-12

SNLA ENVIRONMENTAL MONITORING LOCATIONS (Continued)

Location Number	Location Name	Description*	Sample Type**
32	Technical Area V, SW Corner	S	T
33	Coyote Springs	S	V,S,W
34	Lurance Canyon	S	S
35	Chemical Waste Disposal Site	S	V,S
36	Base Well 4	S	W
37	Base Well 8	S	W
38	Base Well 11	S	W
39	NW DOE Complex	P	T
40	Technical Area I NE by 852	P	T
41	Base Well 3	S	W
42	Base Well 12	S	W

Source: Millard et al., 1987
* S = Sandia, P = Perimeter of Sandia, C = Community
**V = Vegetation, S = Soil, W = Water, T = TLD (Thermoluminescent Dosimeters)

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Vegetation Sampling

Samples of native vegetation are collected in late summer from a 9-square-meter area at each of 20 locations on and off SNLA as listed on Table 4-12. Each sample receives a tritium and gamma spectrum analysis. The results are grouped and reported as shown in the following table of calendar year (CY) 1987 results (Table 4-13). No statistically significant differences exist between samples collected from on-site, at the site perimeter, and in surrounding communities. The values reported for CY 1986 are consistent with those reported during the years 1972 through 1985.

Soil Sampling

Samples of soil are collected annually at 21 locations (see Table 4-12). The samples are collected randomly from the same 9-square-meter area from which vegetation samples are obtained. Each sample is analyzed for uranium, Cs-137, and tritium. Results from CY 1986, summarized in Table 4-14, were comparable to background levels and results reported for previous years.

Water Sampling

SNLA samples Rio Grande water once each year, upstream and downstream of the SNLA facilities. Also, groundwater samples are collected from wells in use at the time of sample collection. Samples are analyzed for gross α and β, cesium-137, tritium, and uranium. Results for CY 1986 are summarized in Table 4-15.

Concentrations in these samples are comparable to background levels.

Penetrating Radiation

SNLA maintains a network of 27 thermoluminescent dosimeters (TLDs) at the following locations for monitoring gamma radiation levels in the environs of its facilities.

- Eight locations in the vicinity of SNLA facilities on the KAFB (Figure 4-3).

TABLE 4-13

MEAN CONCENTRATIONS OF TRITIUM AND CESIUM-137 IN VEGETATION FOR CALENDAR YEAR 1986)

Nuclide	Location	Sample Size	Concentration		
			$\overline{x}$	s	Range
^{3}H	SNLA	12	4.2	0.3	3.7 to 4.7
pCi/mL	Perimeter	4	4.1	0.4	3.8 to 4.7
	Community	6	4.1	0.5	3.3 to 4.6
Total		22	4.1	0.4	3.3 to 4.7
^{137}Cs	SNLA	12	0.03	0.02	<0.01 to 0.08
pCi/g	Perimeter	4	0.023	0.008	<0.02 to <0.03
	Community	6	0.02	0.02	<0.01 to <0.05
Total		22	0.03*	0.02	<0.01 to 0.08

Source: Millard et al., 1987

$\overline{x}$ = mean, s = standard deviation.

^{137}Cs < Minimum Detectable Level (<MDL) values were used in calculations of $\overline{x}$.

* Only three locations have ^{137}Cs > MDL.

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TABLE 4-14

MEAN CONCENTRATIONS OF URANIUM, CESIUM-137, AND TRITIUM IN SOIL SAMPLES FOR CALENDAR YEAR 1986

Nuclide	Location	Sample Size	Concentration		
			$\bar{x}$	s	Range
Uranium (µg/g)	SNLA	12	2.6	0.3	2.1 to 3.0
	Perimeter	4	2.4	0.3	2.2 to 2.9
	Community	6	2.2	0.7	0.9 to 2.7
Total		22	2.4	0.4	0.9 to 3.0
^{137}Cs (pCi/g)	SNLA	12	0.15	0.06	0.09 to 0.27
	Perimeter	4	0.19	0.13	0.02 to 0.33
	Community	6	0.15	0.12	0.02 to 0.32
Total		22	0.15	0.09	0.02 to 0.33
^{3}H	SNLA	12	3.7	0.7	2.6 to 4.9
(pCi/mL)	Perimeter	4	3.7	0.8	2.6 to 4.4
	Community	6	3.6	0.6	3.0 to 4.7
Total		22	3.7	0.7	2.6 to 4.7

Source: Millard et al., 1987.

$\bar{x}$ = mean, s = standard deviation.

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TABLE 4-15

MEAN CONCENTRATIONS OF GROSS ALPHA, GROSS BETA, URANIUM, CESIUM-137, AND TRITIUM IN WATER FOR CALENDAR YEAR 1986

Location	Sample Size	Sample Type	Gross α 10^{-9} µCi/mL	Gross β- 10^{-9} µCi/mL	Uranium 10^{-3} µg/mL	^{137}Cs 10^{-9} µCi/mL	^{3}H 10^{-6} µCi/mL
Surface Water (Streams)	3	Total	3.1 ± 0.6	5 ± 3	4 ± 2	<MDL	<MDL
		Filtered	2.4 ± 0.5	5 ± 3	4 ± 2	<MDL	<MDL
		Suspended Solids	<MDL	<MDL	-	-	-
Ground-water (Wells)	10	Total	4 ± 5*	2.1 ± 0.7*	1.4 ± 0.4	<MDL	<MDL
		Filtered	3 ± 1*	4 ± 2	1.4 ± 0.4	<MDL	<MDL
		Suspended Solids	1.83*	<MDL	-	-	-

Source: Milllard et al., 1987

* Includes <MDL values. No error term is given if >50% of the values are <MDL

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- Seven locations on the KAFB perimeter (Figure 4-3).
- Twelve off-site locations in communities within 80 km of the SNLA facilities (Figure 4-4).

The SNLA Environmental Report (Millard et al., 1987) summarizes and provides detailed tables of the radiation levels measured by this network of TLDs during 1986. These data are presented in Table 4-16. As would be expected, the on-site measurements were higher than those on the perimeter or in off-site communities. The highest measurement was 168 mR/yr at the southwest corner of Technical Area V, near the SPR and HERMES-II facilities; in 1985 this same location had an annual exposure level of 160 mR/yr (Millard et al., 1986). Other on-site locations ranged from 88 to 153 mR/yr in 1986 - an increase over the 1985 measurements, which ranged from 83 to 110 mr/yr.

At the perimeter monitoring locations, the exposure levels ranged from 77 to 106 mR/yr during 1986. The highest levels were at the Four Hills and Seismic Center Gate locations. SNLA personnel have no explanation for the slightly higher levels at these two locations. Except for these locations, the exposure levels at the perimeter stations are in the range of background levels for this area. By comparison, the levels at the perimeter stations were 77 to 103 mR/yr during 1985.

Gamma exposure levels in nearby communities ranged from 77 to 99 mR/yr during 1986. These levels are typical of naturally occurring background radiation levels in the Albuquerque area. The levels measured during 1986 were slightly lower than the levels measured during 1985, i.e., 76-116 mR/yr.

Determination of Radiation Doses

Doses received by off-site personnel as a consequence of airborne releases from SNLA operations are calculated using the AIRDOS-EPA computer code. The calculations for 1986 were based on a total airborne emission of 7.5 Ci of Ar-41 and the nearest member of the public being at 2.8 km from the release point (Technical Area V). The effective whole-body dose equivalent determined was 3.1×10^{-4} mrem (Burnett, 1987). Because SNLA environmental monitoring indicated that direct radiation levels and radionuclide concentrations in water, soil, and vegetation were

TABLE 4-16

SNLA THERMOLUMINESCENT DOSIMETER MEASUREMENTS[a]

Location Number	Description	Annual Exposure (mR)[c]
1	On-Site-Pennsylvania Avenue	153
2	On-Site-Rad Waste Disposal	88
3	On-Site-Coyote Canyon Control	131
6	On-Site-Technical Area III, SE	84
7	On-Site-Arroyo, N Technical Area III	110
00	On-Site-Control	73
00	On-Site-Control	95
20	On-Site-Technical Area IV, SW	95
31	On-Site-Technical Area II Guard Gate	99
32	On-Site-Technical Area V, SW Corner	168
4	Perimeter-Isleta Reservation Gate	95
5	Perimeter-McCormick Gate	77
16	Perimeter-Four Hills	106
18	Perimeter-North Perimeter Road	91
19	Perimeter-Seismic Center Gate	106
39	Perimeter-NW DOE Complex	84
40	Perimeter-Technical Area I NE by 852	84
10	Community-Oak Flats	99
11	Community-Isleta Pueblo, Rio Grande	77
21	Community-Bernalillo Fire Station #10	84
22	Community-Los Lunas Fire Station	80
23	Community-Rio Rancho Fire Station	84
24	Community-Corrales Fire Station	88
25	Community-Placitas Fire Station	99
26	Community-Albuquerque Fire Station #9	99
27	Community-Albuquerque Fire Station #11	95
28	Community-Albuquerque Fire Station #2	88
29	Community-Albuquerque Fire Station #7	80
30	Community-Albuquerque Fire Station #6	95

a Source: Millard et al., 1987

b Refer to Figures 4-3 and 4-4

c Data rounded to nearest whole number

not significantly different than normal background levels, other pathways would contribute an extremely small percentage of the DOE Order 5480.1 and National Emission Standards for Hazardous Air Pollutants (NESHAP) dose guideline values and can therefore be considered insignificant.

4.3.3.2 Bendix Albuquerque Operations

Because no direct radiation fields or effluents containing radionuclides are generated by BAO activities, this facility does not perform any radiological monitoring or sampling of the environment.

4.3.3.3 Inhalation Toxicology Research Institute

ITRI conducts routine sampling and measurements to evaluate the radiological impact of its operation on the environment.

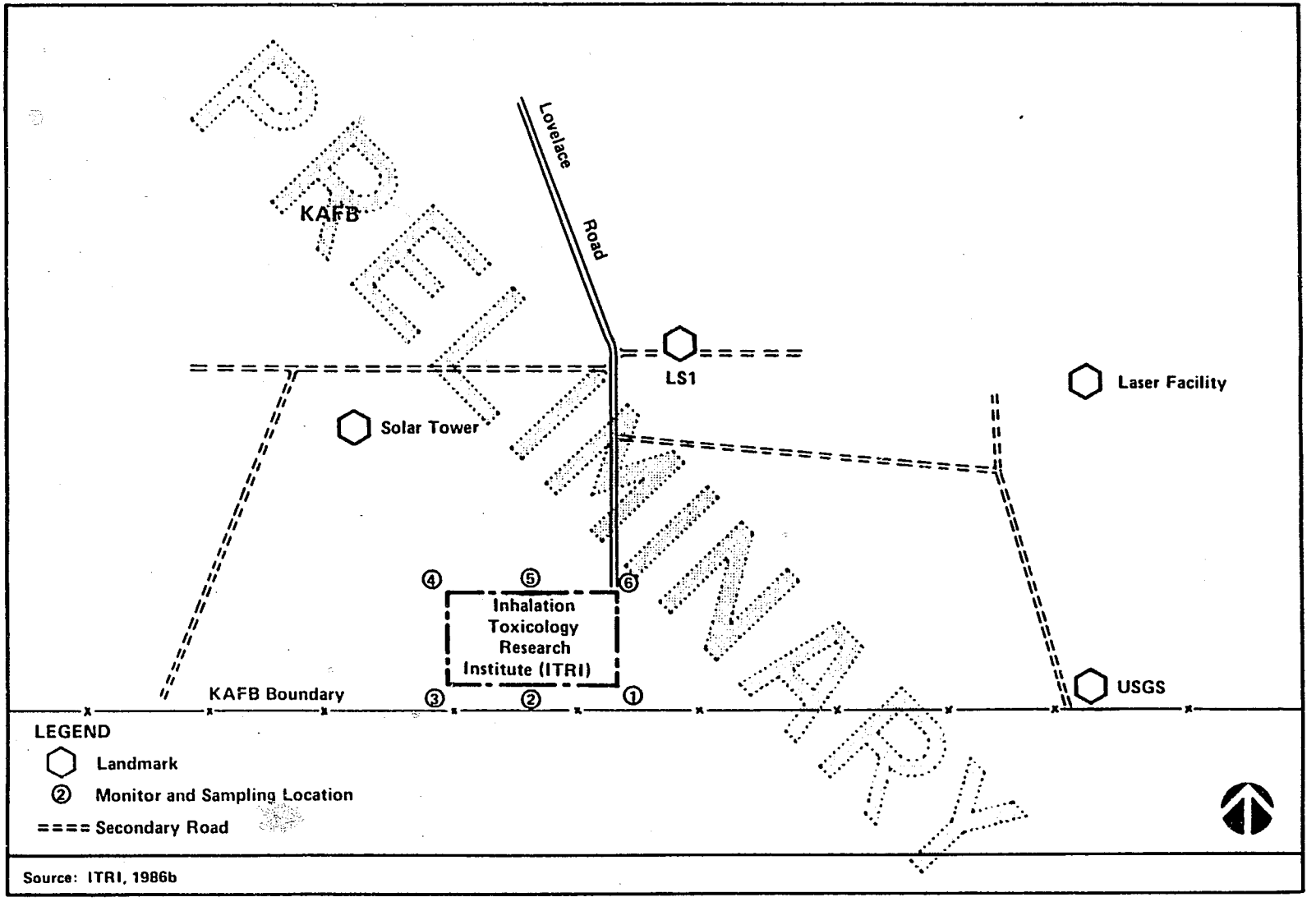
Soil Sampling

Soil samples are collected annually from six locations around the perimeter of the facility (see Figure 4-5) and analyzed for Pu-238, Pu-239, Am-241, Cm-244, Sr-90, and Cs-137. Results for 1986, summarized in Table 4-17, indicate that alpha-emitting radionuclides were not detectable, while Sr-90 and Cs-137 ranged from 0.13 to 0.58 pCi/g and from 0.5 to 1.6 pCi/g, respectively. These data are consistent with results from previous years. The Sr-90 values are slightly higher than typical background concentrations.

Penetrating Radiation

ITRI utilizes a network of six TLD stations to monitor direct radiation levels at the perimeter of the site. These stations are indicated on Figure 4-5. Results for 1986, summarized in Table 4-18, indicate that radiation levels at the perimeter ranged from 94 to 110 mrem/yr. The highest level was at station number 6 on the north side of the site. The level is approximately 11 mrem higher than in 1985 (Thompson, 1986) and is believed by site personnel to be the result of exposure to beta radiation from the soil, because the dosimeter had fallen from its holder and was in direct

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TLD ENVIRONMENTAL MONITORING AND SOIL SAMPLING LOCATIONS AT ITRI

FIGURE 4-5

TABLE 4-17

RADIONUCLIDE CONCENTRATIONS IN ITRI ON-SITE SOIL SAMPLES FOR CALENDAR YEAR 1986

Sample Location	Soil Concentration (pCi/g dry weight)					
	Pu-238	Pu-239	Am-241	Sr-90	Cm-244	Cs-137
1.SE Corner	0.00 ± 0.05	0.00 ± 0.01	0.0 ± 0.1	0.28 ± 0.05	0.0 ± 0.1	0.5 ± 0.1
2.S Side	0.00 ± 0.03	0.03 ± 0.03	0.0 ± 0.01	0.15 ± 0.04	0.0 ± 0.2	0.9 ± 0.1
3.W Corner	0.00 ± 0.05	0.00 ± 0.04	0.0 ± 0.2	0.13 ± 0.03	0.0 ± 0.3	1.1 ± 0.1
4.NW Corner	0.00 ± 0.11	0.00 ± 0.05	0.0 ± 0.2	0.55 ± 0.06	0.0 ± 0.3	0.7 ± 0.1
5.N Side	0.00 ± 0.04	0.00 ± 0.03	0.0 ± 0.1	0.58 ± 0.10	0.0 ± 0.3	1.4 ± 0.1
6.NE Corner	0.00 ± 0.06	0.00 ± 0.05	0.0 ± 0.2	0.38 ± 0.06	0.0 ± 0.5	1.6 ± 0.1
7.USCGS Site*	0.00 ± 0.04	0.00 ± 0.03	0.0 ± 0.3	0.08 ± 0.03	0.0 ± 0.7	0.5 ± 0.1

Source: Thompson, 1987a
* US Coast and Geodetic Survey Site near ITRI on KAFB, considered to be a representative background location.

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TABLE 4-18

ITRI THERMOLUMINESCENT DOSIMETER MEASUREMENTS DURING 1986

Location Number[a]	Description	Annual Level (mrem)
1	SE corner	99 ± 12
2	S side	94 ± 10
3	SW corner	94 ± 11
4	NW corner	94 ± 11
5	N side	110 ± 16
6	NE corner	100 ± 5
	control	95 ± 11

Source: Thompson, 1987a
[a] Refer to Figure 4-5

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contact with the ground for approximately 8 months of the year. Other monitoring locations were not significantly different in 1986 and 1985 and were at the upper bound of typical background levels for this area.

Other Environmental Monitoring

ITRI does not have a routine environmental sampling program for groundwater and vegetation. Four air samplers are operated continuously and the particulate filters changed monthly. These air samplers provide an indication of elevated air concentrations, which might identify an unusual occurrence or a change in trends; however, the samplers have not been placed based on meteorological modeling and therefore are not considered useful for assessing environmental and off-site impacts due to airborne releases.

Determination of Radiation Dose

Radiation doses received by persons off-site as a consequence of ITRI activities are calculated using AIRDOS-EPA, based on airborne releases from the facility. During 1986, the whole-body dose equivalent was calculated as 5.3×10^{-7} mrem/yr. This calculation assumed an air release of 134 mCi of tritium and 8.5 mCi of Pb-212. Tissue dose equivalents for this same time period were: red marrow, 2.1×10^{-5} mrem/yr; lung, 1.3 x 10-4 mrem/yr; bone surface, 2.4×10^{-4} mrem/yr; and liver, 3.2×10^{-4} mrem/yr (McClellan, 1987a).

4.3.4 Findings and Observations

4.3.4.1 Category I

None.

4.3.4.2 Category II

1. Inadequate contamination control and monitoring practices. Contamination control and monitoring practices at SNLA do not ensure that radionuclide levels on materials and facilities, considered suitable for use or release without radiological control restrictions, satisfy certain guideline levels recommended

by the NRC or DOE. Land areas, facilities, items of equipment, and materials with radionuclide concentrations exceeding recommended levels, may be released to the environment and/or for eventual use by the public. In some circumstances, the resulting radiation doses to individual members of the public could exceed established Federal limits of 100 mrem/year.

The Nuclear Regulatory Commission (NRC) has established guidelines for residual contamination on facilities and equipment being released from licensing restrictions; DOE has adopted similar guidelines for formerly utilized sites and remedial action programs, and these guidelines have been prepared (DOE Order 5480.1B00 as amended by the August 5, 1985, W.A. Vaughan memorandum) for all equipment and facilities being released from DOE sites for unrestricted use by the public. SNLA does not have a documented policy concerning permissible contamination levels on surfaces or in media such as surface soil. The practice is to control contamination to levels which are not detectable above background. While this approach provides adequate control for most radionuclides, the monitoring methods in use at SNLA do not provide the sensitivity necessary to measure down to 100 dpm/100 cm^2, the recommended level of average surface contamination for "fixed" transuranics, radium-226, strontium-90, and several additional radionuclides. Cleanup procedures for Tonopah establish allowable residual contamination levels for plutonium; however, these levels are at least a factor of 2 greater than the recommended (NRC) or proposed (DOE) guidelines for that radionuclide (Tucker, 1986).

SNLA does not have a procedure requiring assessment and positive identification of contamination status on items being released from areas of potential contamination. Technical Area V has established a policy requiring health physics inspections of potentially contaminated items before release from controls (Stump, 1986). In other areas, it is the general practice to perform such monitoring.

Limited radiological monitoring by Survey team members identified two pieces of equipment (old aircraft gauges) at the Reclamation Yard in Technical Area I; the direct radiation level associated with one of these gauges was greater than 0.5 mR/hr. Materials at the Reclamation Yard are normally being

processed for off-site distribution, frequently to the public. The Survey team also identified several items of contaminated equipment and areas of ground surface contamination at the 9939 facility. These items and areas were previously believed to be free of contamination by both the facility personnel and the cognizant Health Physics representative.

2. Water infiltration into radioactive waste disposal areas at SNLA. Conditions and/or practices at the SNLA active and inactive radioactive waste burial areas permit the infiltration of water into the burial trenches. This increases the potential for migration of radionuclides into surrounding soil and, possibly, into groundwater. Section 4.1.2.2 discusses this finding in further detail.

4.3.4.3 Category III

None

4.3.4.4 Category IV

1. Identification of SNLA air emissions. Some sources of air emission are not being included in the Environmental Reports. Total activity released to the environment from SNLA and the resulting population doses are therefore being underestimated.

The 1986 SNLA Environmental Monitoring Report indicates that 7.5 Ci of Ar-41 was the only air emission from operations during the year (Millard et al., 1987). The sources of the Ar-41 releases were the reactor facilities in Technical Area V. Other operations and facilities had known or potential radiological air emissions, which were not addressed in the 1986 report. For example, 1982 measurements and calculations estimated that from 3 to 43 Ci of H-3 may be released to the atmosphere annually from wastes in the classified waste burial site in Technical Area III (Milliard, unpublished data). Also tests on neutron generators in Technical Areas I and II release small quantities of H-3. A measurement in 1985 indicated that approximately 4.8 μCi of tritium were released in testing an explosive neutron generator device in Technical Area II (Abbott, 1985). Between 50 and 100 such devices are tested yearly. No data are available concerning tritium releases from the accelerator Neutron

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Generator Facility of the explosive neutron generator testing operation in Technical Area I. Destructive testing of devices containing depleted uranium and, sometimes, tritium is conducted at various sites in Technical Area III and the remote areas. Some tests, such as those involving burning of the portion containing radionuclides, have a potential for airborne emissions. These tests are not routinely monitored or releases reported.

The off-site effective dose equivalent from Ar-41 released from SNLA in 1986 was estimated to be 3.1 x 10-4 mrem/yr (Burnett, 1987). This is a small fraction of the EPA guideline level of 25 mrem/yr.

Consideration of other air emissions in making the off-site dose calculation would result in an increase in the estimated population dose. However, because of the relatively small activity levels in the other releases and the dilution which will occur between the release point and the site perimeter, the additional dose contribution is still expected to be several orders of magnitude below the EPA guideline level.

2. Verification of Ar-41 reactor effluent calculation at SNLA. Ar-41 releases from reactors in SNLA Technical Area V are calculated; sampling has not been conducted to verify these calculations. Activities released through stack discharges and resulting off-site doses may not be accurately estimated.

Neutron activation of air surrounding the ACRR and SPR reactors produces Ar-41. The quantities produced are calculated, based on the power outputs of the reactors and the air volumes available for activation. The same parameters have been used for these calculations since 1974; however, these calculations have never been verified by actual sampling of the stack effluent or reactor air volumes. Quantities of Ar-41 produced and released may not be accurate. Resulting off-site population doses may also be inaccurate.

During 1986 it was calculated that 6.33 Ci of Ar-41 were released from the ACRR and 1.16 Ci were released from the SPR (Millard et al., 1987).

The calculated off-site effective dose equivalent resulting from these releases was estimated to be 3.1 x 10^{-4} mrem/yr (Burnett, 1987). This value is very small

in comparison with the EPA off-site guidelines of 25 mrem/yr; a very large error in the calculated release would be required to make the associated off-site dose equivalents a significant fraction of the guideline values. Although it is unlikely that the current calculational methods would be in error to such an extent, it is not possible to defend the current methodology unless the calculations are verified with actual sampling and/or measurement.

3. Failure to monitor for non-particulate emissions. The stack monitoring and sampling system for the Technical Area V Hot-Cell Facility is not capable of assessing releases of non-particulate radionuclides such as noble gases and iodines. If such releases were to occur, the resulting environmental impacts and population doses could not be accurately determined.

The Hot-Cell Facility exhaust ventilation is filtered through multiple stages (2-4, depending upon the specific portion of the facility) of HEPA filters and charcoal filters to remove airborne particulates and radioiodines, respectively. The administrative limits established for the facility restrict the total activity in any one operating section to 6,000 Ci of mixed fission products and 5 kg (300 Ci of Pu-239) of fissile material (SNLA, 1986f). In addition, anticipated delay times between irradiation and Hot Cell operations should result in decay of short-lived fission products, including I-131, to very small fractions of their initial activity content. This combination of administrative controls and effluent cleaning systems should be adequate to limit release of airborne contaminants to concentrations within the guidelines established by DOE. However, in the case of a breakdown of administrative controls on activity levels and decay times, higher levels of radioiodines and noble gases will be released into the ventilation system. Also, in an incident such as a fire, or in other occurrences which negate the effectiveness of the air filtration systems, radioiodines might be released to the atmosphere.

The present stack sampling system consists only of a particulate filter. This filter will not provide a representative sample for evaluation of gaseous or vapor discharges. A direct radiation monitor on the stack provides an indication of the relative radiation from materials in the stack. There is no calibration on this unit, which would permit determining concentrations or releases of specific radionuclides. In addition, the monitor only provides a

real-time readout; there are no recording or integrating capabilities on this system. In the event of a release of iodines, noble gases, or other non-particulate radionuclides, the present sampling and monitoring system would not be capable of assessing the total release. Estimates of population doses or other environmental impacts could not be adequately performed.

4. Identification of ITRI air emissions. Some sources of air emission are not being included in the Environmental Reports. Total activity released to the environment from ITRI and the resulting population doses are therefore being underestimated.

Air emissions reported for 1986 were 0.134 Ci of H-3 and 0.0085 Ci of Pb-212 (McClellan, 1987a). In addition to these radionuclides, between 0.050 and 0.150 Ci of Kr-85 was released from static-charge eliminator devices, but were not reported. Liquids in the lagoons and hot ponds may contain volatile forms of H-3 and C-14. It is estimated that approximately 30,000 gallons of liquid evaporate daily from these lagoons and ponds. Depending on the concentrations of volatile radionuclides in the liquids, the evaporation could be another source of air emissions which are not being considered by ITRI. Liquids from these ponds and lagoons have not been analyzed for concentrations of potentially volatile radionuclides.

The effective dose equivalent to the nearest off-site resident was estimated to be 5.3×10^{-7} mrem/yr, based on the H-3 and Pb-212 emissions listed above. This is much smaller than the DOE and EPA guidelines of 100 mrem/yr and 25 mrem/yr, respectively. Although consideration of the other air emissions sources will increase the estimated population dose, the doses are anticipated to still be several orders of magnitude less than the guideline levels.

Sampling and analyses will be conducted to determine the concentrations of H-3 and C-14 in pond and lagoon liquids.

5. Non-representative sampling of ITRI air emissions. The locations and flow rates of sampling equipment in the exhaust ventilation discharges from ITRI are such that samples collected may not be representative of the actual air

emissions. Releases to the environment and estimated population doses may therefore be inaccurate.

Probes for withdrawing samples of stack discharges from the ITRI exhaust ventilation system are located at bends, junctions, transitions, and other locations of disturbed airflow within the ductwork. At such locations, the concentrations and size distributions of particulates in the air are different than the average concentrations and distributions in the entire airstream. Also, sampling rates are not set to withdraw from the airstream at an isokinetic rate. This condition could result in collection of samples in which the particulate concentrations are not representative of the average concentrations in the entire airstream. Guidelines for the placement and operation of stack sampling probes are provided in ANSI N13.1-1969; the ITRI samplers are not consistent with these guidelines.

Exhaust discharges from radionuclide operations at ITRI pass through at least one stage of HEPA filters, depending upon the anticipated concentrations and the potential radiotoxicity of the radionuclides present. These filters are designed to remove more than 99.97 percent of the particulates larger than 0.3 μm in diameter from the airstream. In conditions of routine operation, the exhaust air should not contain significant particulate levels and therefore the location of the probes and the sampling rates will not affect the representativeness of the sample. However, in case of a filter failure, particles of larger sizes and in greater concentrations may be present. Under these circumstances, the sampling locations and rates would be important factors in ensuring that a sample is representative of the average in the discharged air.

4.4 Quality Assurance

This section of the report discusses the quality assurance (QA) aspects of SNLA and ITRI regarding environmental sampling and analysis, and procedures relating to environmental data management. The Central Training Academy (CTA), Transportation Safeguards Division (TSD), and Bendix Albuquerque Operations (BAO) rely on the Sandia National Laboratories-Albuquerque (SNLA) Environmental Monitoring Program. BAO does perform sanitary sewer sampling (as part of the SNLA sampling program). The Inhalation Toxicology Research Institute (ITRI) has a separate program to monitor its area. The major emphasis was on the ability to identify the quality of the data produced as a result of the environmental field sampling/monitoring and laboratory analytical programs.

During the Survey, the scope of the review included the following types of items related to sampling and analysis:

- Quality Assurance/Quality Control (QA/QC) plan
- Appropriate sampling and analysis methods
- Written approved procedures to implement the QA/QC plan and analytical methods
- Calibration and maintenance of equipment/records
- National Bureau of Standards (NBS) traceability for calibration/records
- Training of personnel/records
- Analytical techniques
- Analytical records preparation
- QC of analytical data
- Participation in QC programs
- Chain-of-custody procedures

A review of the QA plan, the sampling and analysis procedures, and the standards and calibration information for the analytical equipment was conducted. Sample collection was observed. Data handling and the results of the QC program participation were also reviewed.

4.4.1 General Description of Data Handling Procedures

4.4.1.1 Sandia National Laboratories - Albuquerque

Environmental Monitoring Program

Typically, environmental monitoring programs at U.S. Department of Energy (DOE) sites were established to monitor for radioactive materials and were expanded to include other parameters to meet National Pollutant Discharge Elimination System (NPDES) liquid discharge permit requirements or more recently to meet Resource Conservation and Recovery Act (RCRA) groundwater monitoring requirements because of hazardous waste burials.

SNLA has maintained an environmental monitoring program since February 1959. The objectives of this surveillance program are to detect the release and/or migration of radioactive material from SNLA operations and to determine the resulting population exposures above normal background radiation levels. The monitoring program also provides a check on the effectiveness of reactor radiological safety systems in effect at Technical Area V. Soil, vegetation, and water are monitored for radionuclides, primarily Cs-137 and H-3. Gross alpha (α) and gross beta (β) screening analysis is performed on water samples. Soil samples are analyzed for uranium to determine uranium concentrations resulting from explosive testing. Thermoluminescent dosimeters (TLDs) were added in 1981 to measure ambient levels of external penetrating radiation around each major facility. No air sampling is performed.

The SNLA environmental monitoring locations remain essentially the same from year to year although some monitoring locations have been changed to accommodate facility changes or discontinuance of operations. Groundwater samples for radiological analysis are collected from Kirtland Air Force Base (KAFB) wells in use at the time of sample collection and the sampled wells may differ from one year to the next.

The SNLA environmental monitoring locations, the type of sample collected (vegetation, water, soil) or presence of a TLD station for each location and the results are provided in figures and tables in Section 4.3, Radiation.

SNLA has about 15 miles of sewer lines which are interconnected with those of KAFB. Wastewater samples are collected at five process discharge monitoring manholes. Sampling locations and results are discussed in Section 3.3, Surface Water.

Samples are also collected from five RCRA groundwater monitoring wells around the old Chemical Waste Landfill. Locations and results are discussed in Section 3.4, Geohydrology.

At SNLA, environmental surveillance is performed by a number of SNLA organizations and by outside contractors. Table 4-19 shows the responsible organizations for sampling and analytical work for all the SNLA environmental monitoring efforts.

At SNLA there is no overall environmental monitoring QA program plan. There are, however, a number of documents that describe the procedures used and the QC elements of the monitoring program. The collection and analysis of environmental samples (surface water, soil, vegetation, and TLDs) for radioactive analysis is done according to procedures described in the SNLA Environmental Monitoring Manual (Millard et al., 1987) and in accordance with methods described in DOE/EP-0023 (DOE, 1981). The SNLA Environmental Monitoring Manual references SNLA, DOE, U.S. Environmental Protection Agency (EPA), and other documents where detailed procedures can be found and is therefore rather brief (approximately 9 pages).

Wastewater sampling (including analysis and QA) is performed by a contractor, International Technology (IT) Corporation, in accordance with the Wastewater Sampling Plan for SNLA (IT, 1987a). The IT wastewater sampling plan, which was being used, was in draft stage at the time of the Survey.

RCRA groundwater sampling at the Chemical Waste Landfill (including analysis and QA) is performed by IT Corporation in accordance with the RCRA Interim Status Groundwater Monitoring Plan (IT, 1985). At the time the monitoring plan was being revised to address the state's comments.

TABLE 4-19

RESPONSIBILITIES FOR ENVIRONMENTAL SURVEILLANCE PROGRAM AT SNLA

Type Sample/# of Sample Locations		Sampling			Analysis	
		Collector	Type	Frequency	Laboratory	Frequency
Surface Water	3	IT/3314	Grab	Annually	3311	Annually
Soil	18	IT/3314	Grab	Annually	3311	Annually
Vegetation	18	IT/3314	Grab	Annually	3311	Annually
Groundwater (wells)	10	IT/3314	Grab	Annually	3311	Annually
TLD	26	IT/3314	Continuous	Qtrly	3311	Qtrly
Wastewater	5	IT(4)/ BAO(1)	Time Prop.	4 days/month	IT	Monthly
Groundwater (RCRA Wells)	5	IT	Grab	Semi-annually	IT	Semi-annually

IT = International Technology Corporation
BAO = Bendix Albuquerque Operations
3314 = SNLA Div. 3314 - Environmental Protection and Hazardous Waste Management
3311 = SNLA Div. 3311 - Environmental Health Laboratory

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Collection of environmental samples for radioactive analysis was demonstrated during the Survey (samples are collected only once per year and sampling was not scheduled during the Survey). The samples were collected by a Division 3314 technician and an IT Corporation technician. The technician had a field logbook with directions she had written from the previous year on how to get to the sample locations. There is no official set of maps, directions, or sketches. Nor are there any signs or markers to indicate where the samples should be taken. The only indication that the sample location had been found was when the post used to house the TLDs was located.

Sample collection and in-situ handling were performed according to the Environmental Monitoring Manual. However, for the surface-water sample at the Rio Grande, two separate samples were collected rather than splitting one to obtain a filtered and unfiltered sample. Samples were acidified when appropriate and filtering apparatus was acid-cleaned between samples.

Data were recorded in the field logbook and/or sample analysis request forms. Sample bottles were labeled with a unique sample number and the number was recorded.

Soil and vegetation sampling were also observed. In some sample areas where grass is sparse, a mixture of grass and weeds may be collected which may affect the sample results. The samples are double-bagged in plastic bags and labeled.

Training of the Division 3314 technician was on-the-job training (OJT) by the IT technician who had performed the sampling in previous years.

Collection systems and the actual collection of wastewater samples from manholes in the sanitary sewer system were observed. Of the five sample locations, only one has a permanent sampling system which also includes a Parshall flume to determine flow rates. The flow measurement system did not work at this location. One of the other sites also had a flume, but there was no method to determine flow rates at the three remaining sample locations. Sampling of two manholes by IT personnel was observed. Portable Isco Samplers are used for 4 consecutive days to collect 24 time-proportional samples over an 8-hour period (based upon SNLA facilities operating on an 8-hour day) from 8 a.m. to 4 p.m. BAO collects samples from its

manhole during the same 4 consecutive days using a portable Isco Sampler, but collects 24 time-proportional samples over a 24-hour period (since BAO operates more than 8 hours per day) from 6 a.m. to 6 a.m. the next day.

The sample probes were inserted into specific sewer lines that emptied into the manhole, but were not re-strained. The flow in the pipe tended to move the sample probe into the general sump of the manhole. This situation, together with the fact that there is no weir to pool the sample from the particular sewer line to be sampled, may result in a diluted sample being taken and lower results being reported.

The portable sampling equipment was in good condition and was iced to keep samples cool. The chemist took temperature and pH measurements, was using good sampling techniques, and appeared to be following procedures which were on hand. Samples were placed in prelabeled sample bottles which had discrete sample numbers, appropriate data was logged on sample sheets and the samples placed in a portable cooler. The portable sampler was prepared for the next day by inserting a second set of clean sample containers and installing a charged battery. Ice would be added the next morning when the sampler was started.

After daily sample collection, the samples are taken by IT or BAO to the Division 3314 office trailer. Division 3314 stores the samples in a refrigerator. At the end of 4 days all the samples collected are packed in coolers, appropriate paperwork is prepared, including chain-of-custody forms, the coolers are sealed and IT transports them off-site to deliver and/or send them to the appropriate laboratories. There appears to be a break in the chain of custody in the transfer of samples from IT and BAO to SNLA and then back to IT since chain-of-custody forms are not filled out until the samples are shipped.

RCRA groundwater sampling was observed. In general the equipment was in good condition, procedures were followed, and data were recorded in logbooks and/or on sample forms. There were problems associated with well placement, construction, bailing equipment, and some of the techniques used by the sampling personnel, which resulted in a finding that the validity of the groundwater monitoring data at the Chemical Landfill is questionable because of the methods

used to collect the samples. Details are provided in Groundwater Section 3.4.4.1 Category IV 1.

SNLA Laboratory

The SNLA Environmental Health Laboratory is part of Division 3311 (Industrial Hygiene/Toxicology). The laboratory is located in Technical Area I in Building 869. On the first floor there is a small sample preparation laboratory (Room 16, General Chemistry/Radiochemistry) and next to it a chemistry laboratory (Room 20, Spectrochemistry/Bioassay) for wet chemistry and instrumental analyses, including liquid scintillation counting (for tritium). The laboratories are operated by one chemist who performs analyses for the environmental program, bioassay program (urine and blood), industrial hygiene program (asbestos, beryllium, lead, uranium, and other samples) and for the waste program [polychlorinated biphenyls (PCBs)]. For radioactivity analyses, samples are prepared in the sample preparation room and counted in the laboratory for tritium. For alpha, beta, or gamma counting, the prepared samples are sent to the counting room in the basement (Room B-29), which is operated by a second individual. Normal Health Physics samples are also counted in this counting room. The environmental TLDs are also read out here. Environmental analyses are a very small percentage of the work performed at these facilities.

SNLA laboratory QA regarding environmental samples analyzed at the Division 3311 Environmental Health Laboratory is very briefly discussed in the Environmental Monitoring Manual (Millard et al., 1987). This manual also discusses methods (references) to be used for chemical preparation and radiochemical analyses of the samples, one of which is SAND 75-0014.

SAND 75-0014, Manual of Analytical Methods for the Environmental Health Laboratory (Gray, 1975) is a bound report last issued in 1975, rather than a loose-leaf set of individual procedures which can be readily revised. The chemist had many revisions and insertions in his copy and was in the process of revising and reissuing the manual in anticipation of a second chemist being hired.

Sample tracking at the laboratory is performed as follows. When samples are transferred to the Chemistry Laboratory, an analytical request form is completed for

each type of analysis requested. Sample numbers are listed on each form. The chemistry staff then assigns a chemical analysis log number to each sample. All analytical data are reported using the log numbers as a reference. These log numbers are later entered into the environmental monitoring data bases which list sample numbers, sample locations, analytical log numbers, and associated data. No specific chain-of-custody forms are used.

Samples are analyzed according to the revised procedures in SAND 75-0014 (Gray, 1975) or other standard reference manual. For analysis of gamma-emitting nuclides, data are analyzed by computer software developed by Canberra Industries. Data are recorded on the sample analysis request form which is signed by the chemistry staff person and approved by the Division Supervisor. A copy of the form is sent to the requestor. A few forms were seen in the field with no approval signatures.

Instruments are calibrated using approved methods and NBS or NBS traceable standards. Spikes, blanks, and splits are used to check on analytical procedures. Replicate samples (such as samples of soil and vegetation) are collected and analyzed to obtain an estimate of variability including sampling, analytical, and counting errors.

Laboratory QA is achieved through successful participation in EPA (Environmental Monitoring Systems Laboratory) and DOE (Environmental Measurements Laboratory) intercomparison programs. Ratios comparing SNLA values to reference values provided by EPA and DOE laboratories for QA programs are included in the Annual Environmental Monitoring Report for SNLA (Millard et al., 1987).

For external penetrating radiation measurements, a minimum of five TLD chips of lithium fluoride are placed at each sample location in order to get an estimate of the variability of TLD response at a particular location. Transit controls are used to document additional exposure received during transit from SNLA to field locations. The TLD readout equipment is calibrated by exposing TLDs to 0, 10, 20, 30, and 50 mR of Cs-137 midway through each quarterly field cycle. Ten TLDs are exposed at each level (Millard et al., 1987). The calibration exposures are performed at the SNLA Gamma Radiation Standards Facility, which maintains calibration traceability to NBS through the use of NBS-certified R-chambers (SNLA, 1986g).

SNLA Contractor Laboratory

Groundwater and wastewater samples from SNLA are analyzed for EPA/RCRA-regulated substances by a contractor laboratory (IT).

IT has an overall corporate Laboratory QA Manual (IT, 1984). Each individual laboratory supplements the generic QA manual with a laboratory-specific QA manual to go with specific equipment. The manual for the Pittsburgh Laboratory (IT, 1987d), where SNLA's samples are normally sent, was reviewed. The various sample plans and manuals cover sampling, sample handling, trip and equipment blanks, splits, and spikes. For analysis, analytical methods described in EPA (1982) and EPA (1983) are used. If a method is not available in either of the above, an appropriate method from one of the standard references is used. Chain-of-custody procedures are also required from sampling through disposal of the samples.

Data management, instrument calibration, and laboratory QA are also discussed. Standard curves are verified at least daily, a blank is used with each extraction batch, and 10 percent of the samples are spiked. The QA program has been in operation for 14 years and satisfies EPA and Nuclear Regulatory Commission (NRC) requirements. The Pittsburgh Laboratory is EPA-certified for organics under its Contract Laboratory Program (CLP).

4.4.1.2 Bendix Albuquerque Operations

BAO performs sewer sampling as part of the SNLA Environmental Monitoring Program previously described.

4.4.1.3 Inhalation Toxicology Research Institute

ITRI has maintained an environmental monitoring program since at least 1973. The objective of the surveillance program is to detect the release and/or migration of radioactive or toxic materials from ITRI operations to the environment.

The ITRI Environmental Monitoring Program consists mainly of effluent air sampling and environmental air sampling. Air exhausted from controlled areas of the facility is sampled through fiberglass filters that are collected and analyzed for

radioactivity, as are the environmental air sample filters. Water and sediment are collected from the sewage lagoons and are analyzed for radioactivity. Soil and vegetation samples are also analyzed for radioactivity. Thermoluminescent dosimeters are placed at predetermined locations to monitor external radiation. Samples taken are counted at ITRI (for screening purposes) and/or are analyzed by an independent commercial laboratory.

Most radioactive sample locations are on the ITRI site. The locations remain fixed from year to year. More details on the radioactive monitoring program and results are provided in Section 4.3, Radiation.

Wastewater at ITRI is discharged to a sewage lagoon system. Monitoring of the lagoons and results is discussed in Surface Water, Section 3.3.3.3.

Groundwater sampling is not conducted at ITRI.

Environmental surveillance at ITRI is the responsibility of Health Protection Operations (HPO). HPO collects all samples. Analytical work is performed by Eberline Analytical in Albuquerque for radiological samples and Hager Laboratories, Inc., in Denver, Colorado, for nonradiological analysis (on the sewage lagoons).

The ITRI QA plan for environmental monitoring is covered in the HPO Quality Program Plan. Environmental monitoring procedures are covered in SOP-HP-11 (ITRI, 1986a).

Air samples are collected monthly by the HPO technician and counted for gross alpha and beta radiation as a screen. The 12 filters from each location are sent to Eberline for an annual composite radiochemical analysis.

TLDs are changed monthly by the HPO technician and sent to Eberline for reading.

Soil and vegetation samples are collected annually by the HPO technician and sent to Eberline for radiochemical analysis.

Samples of lagoon water and sediment are collected annually by the HPO technician, usually with assistance of a summer student. Spikes are prepared by one of the HPO professionals. A set of samples is sent to Eberline for radiochemical analyses and to Hager Laboratories for analysis of selected EPA/RCRA-regulated substances. Sampling and analyses data are recorded in bound laboratory notebooks.

The only major pieces of sampling equipment at ITRI are the air samplers. They consist of an open-faced filter, vacuum pump, critical orifice for flow control, and an hour meter. No integrating gas meter is used. The flows are checked once per year. The carbon vane pumps are run to failure rather than having scheduled preventive maintenance. Some data may be lost as a result of pump failure. Both the intake and discharge for the samplers are located within the sample enclosure, which may cause some recirculation and thus lower values. However, the normal values obtained are so low that any inaccuracies in the sampling system would have a negligible impact on the population dose (which is estimated to be 0.003 percent of the EPA limit of 25 mrem/year).

The HPO technician's training was OJT and he has no formal or documented training in environmental monitoring. However, he is certified by the National Registry of Radiological Protection Technologists, he assisted in writing the procedures, and he has been performing the job for at least 10 years.

ITRI Contractor Laboratories

Radiological samples and TLDs from ITRI are analyzed by a contractor laboratory (Eberline Analytical of Albuquerque, NM). Eberline has an extensive QA manual (Eberline, 1986) regarding sample analyses. However, one item the manual does not cover is chain of custody. Eberline uses calibration standards traceable to NBS, or if this is not possible, relies on other suppliers such as Amersham Searle, DOE, and EPA. Eberline participates in the National Voluntary Laboratory Accreditation Program (NVLAP), operated by NBS, and is certified to process TLDs. The laboratory was not visited.

Nonradioactive samples are analyzed by a contractor laboratory (Hager Laboratories, Inc., of Denver, Colorado). According to ITRI, Hager does have a QA

manual and is certified by both the EPA and the American Industrial Hygiene Association. However, ITRI did not have a copy of the manual available for review. The laboratory was not visited.

4.4.2 Findings and Observations

4.4.2.1 Category I

None

4.4.2.2 Category II

None

4.4.2.3 Category III

None

4.4.2.4 Category IV

1. Insufficiency of SNLA environmental monitoring program. The quantity and type of sampling performed and the parameters analyzed are not sufficient to characterize the environmental contamination, or lack of contamination, as a result of SNLA operations.

   Examples of this situation include:

   - In general, environmental samples for radioactive analysis are taken only once per year (see Sections 3.1 and 4.3).
   - For wastewater sampling, there are no flow measurements, and, because of the temporary sampling setup, low values may be obtained.
   - For groundwater sampling, well placement, construction, and sampling techniques make the data questionable (see Section 3.4).

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- No environmental air sampling is performed for analyses of radioactive or nonradioactive parameters (see Section 3.1).

2. Outdated laboratory analytical procedures manual. An outdated laboratory procedures manual used at the SNLA Environmental Laboratory may potentially lead to inaccuracies in some of the reported environmental data.

   The specific analytical methods used for some of the analyses are not properly documented because the procedures have not been officially revised since 1975. Thus the validity and accuracy of some of the data can be questioned.

3. Inadequate environmental sample transfer system at SNLA. Lack of chain-of-custody procedures, or non-use of them, creates the possibility of sample mixup. This situation makes it difficult to verify results by tracking the sample data reported to the sample collected, and therefore it would be difficult to legally defend the data reported by SNLA. Wastewater samples are transferred from IT to SNLA and back to IT before chain-of-custody forms are filled out.

4. Inadequate environmental sample transfer system at BAO. Lack of chain-of-custody procedures, or non-use of them, creates the possibility of sample mixup. This situation makes it difficult to verify results by tracing the sample data reported to the sample collected, and therefore it would be difficult to legally defend the data reported by SNLA for BAO discharges. When BAO personnel take wastewater samples and transfer the samples to SNLA, no chain-of-custody procedure is used.

5. Inadequate environmental sample transfer system at ITRI. Lack of chain-of-custody procedures, or non-use of them, creates the possibility of sample mixup. This situation makes it difficult to verify results by tracing the sample data reported to the sample collected, and therefore it would be difficult to legally defend the data reported by ITRI. No chain-of-custody procedures are used when transferring samples to contractor laboratories.

4.5 Inactive Waste Disposal and Contamination Sites

This section presents a description of possible and actual sources of environmental pollution as a result of inactive waste disposal and contamination sites at the Sandia National Laboratories-Albuquerque (SNLA), including the Central Training Academy (CTA), Transportation Safeguards Division (TSD), the Los Alamos National Laboratory (LANL) Life Sciences-1 (LS-1) Site, and Manzano Base. Also included in the Survey were Bendix Albuquerque Operations (BAO) and the Inhalation Toxicology Research Institute (ITRI).

On April 26, 1985, U.S. Department of Energy (DOE) Headquarters issued Order 5480.14 to provide instructions for implementing a program to identify and evaluate inactive waste disposal sites on DOE installations and to effect remedial actions where necessary to improve control of hazardous substance migration from these sites. The DOE Albuquerque Operations Office (AL) had initiated the Comprehensive Environmental Assessment and Response Program (CEARP) in mid-1984 to help fulfill the DOE commitment to operate under a policy of full compliance with applicable environmental regulations within the AL complex.

The CEARP Phase I, Assessment of the Installations, was carried out at the SNLA, and the Phase I: Installation Assessment Report (June 1987 Draft) was used as a basis for the Survey efforts. The Phase I Report identifies 85 potential Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at the SNLA, 13 of which have no planned future action under the DOE CEARP/CERCLA Order. In addition to these sites, the Survey efforts identified several potential inactive waste disposal and contamination areas at SNLA and at the facilities that were not included in the CEARP. These areas as well as the CEARP sites are described in the following section.

4.5.1 General Description of Pollution Sources and Controls

SNLA evolved as a result of the atomic bomb development work of the Manhattan Engineer District activities at Los Alamos during World War II. Thus, its history and mission are closely intertwined with those of Los Alamos and the early Army Air Corps installation known as Sandia Base. An abbreviated history of the SNLA is given below, as excerpted from the CEARP Phase I Report (DOE-AL, 1987) and the

History of Sandia Corporation (Alexander, 1963).

Operations at Kirtland Field (part of Sandia Base) began in 1945 with construction of a bomb-loading pit to load Los Alamos assembled bombs into military aircraft. Early in 1946, it was decided to separate the Sandia activities from Los Alamos and make Sandia responsible for assembly, field testing, stockpile operations, and surveillance work to improve weapon quality and reliability (DOE-AL, 1987).

In 1947, the Los Alamos Z-4 engineering group was transferred to Sandia, thereby consolidating the functions of the Z Division at Sandia (Alexander, 1963). In 1948, a new tech area (Tech Area II) was established 1/2 mile south of Tech Area I to be used for high explosives assembly.

The University of California which operated Los Alamos desired to divorce the production functions of Sandia from the University (DOE-AL, 1987). Therefore, on 1 November 1949, the Sandia Corporation (a subsidiary of AT&T Technologies, Inc., formerly known as Western Electric Company) assumed direction of Sandia Laboratory.

Sandia Laboratory established Area III in 1953 for full-scale environmental testing of weapons with and without explosives (Alexander, 1963). Blast effects testing was conducted on a small scale in the remote parts of Coyote Canyon and on a larger scale at the Nevada Test Site.

In 1979, Sandia Laboratory was renamed Sandia National Laboratories-Albuquerque (DOE-AL, 1987).

Today, SNLA is dedicated to the development of the non-nuclear portions of nuclear weapons. Located on the 52,223-acre Kirtland Air Force Base (KAFB), SNLA occupies 5 Technical Areas and some remote test areas to the east designated as Coyote Test Field (CTF). Coyote Test Field is partly owned by DOE, partly owned by the U.S. Air Force (USAF) and partly managed by the U.S. Forest Service (USFS) as National Forest system lands (withdrawn from the public domain for DOE or USAF use). SNLA

operational activities and experimental testing have been conducted over a widespread area in CTF that encompasses land in all three ownership categories.

The following discussion addresses potential pollution sources and controls for the inactive waste disposal and contamination sites identified during the Survey effort. These include sites at SNLA, BAO, and ITRI. Sites discovered during the Survey are described in detail in the text, while previously discovered sites (e.g., CEARP sites), as well as the newly discovered sites, are tabulated in Appendix H. This is not done to de-emphasize the importance of the CEARP sites, but rather to allow all information available on the newly discovered sites to be provided. Additional information discovered about the CEARP sites during the Survey is given in the "Comments" section for each site in Appendix H.

Appendix H also includes SNLA sites that were listed in the RCRA Facility Assessment Report (RFA Report) and the KAFB Installation Restoration Program Report. These sites were not all investigated by the Survey team, however, and thus may not be included in the Survey Findings. They are, however, included in the Appendix H tables for completeness.

Appendix H consists of two tables. Table H-1 includes only the inactive waste (CERCLA) sites, and is grouped according to test sites, disposal sites, and hazardous material handling and process sites. Within each of these categories, sites are arranged by location.

Table H-2 lists the inactive waste (CERCLA) sites as well as the active (RCRA) waste sites, and is arranged according to CEARP identification (ID) number and/or Survey ID letter designation. Sites which were not investigated by the Survey team (i.e., the RFA sites) have a "0" for their ID numbers.

4.5.1.1 Sandia National Laboratories - Albuquerque

Sandia National Laboratories-Albuquerque, including CTA, TSD, LS-1, and Manzano Base, has been used for a variety of operations since its inception in 1945. The Environmental Survey activities conducted at SNLA identified five general categories of potential or actual sources of environmental contamination for this facility as a result of past practices. These categories were developed based on

similarities in activities performed as well as similarities in environmental impacts from these activities. These five categories include test sites, disposal sites, hazardous material handling and process areas, off-site testing and disposal sites, and inactive underground storage tanks (USTs). These five activities are discussed categorically in the following sections.

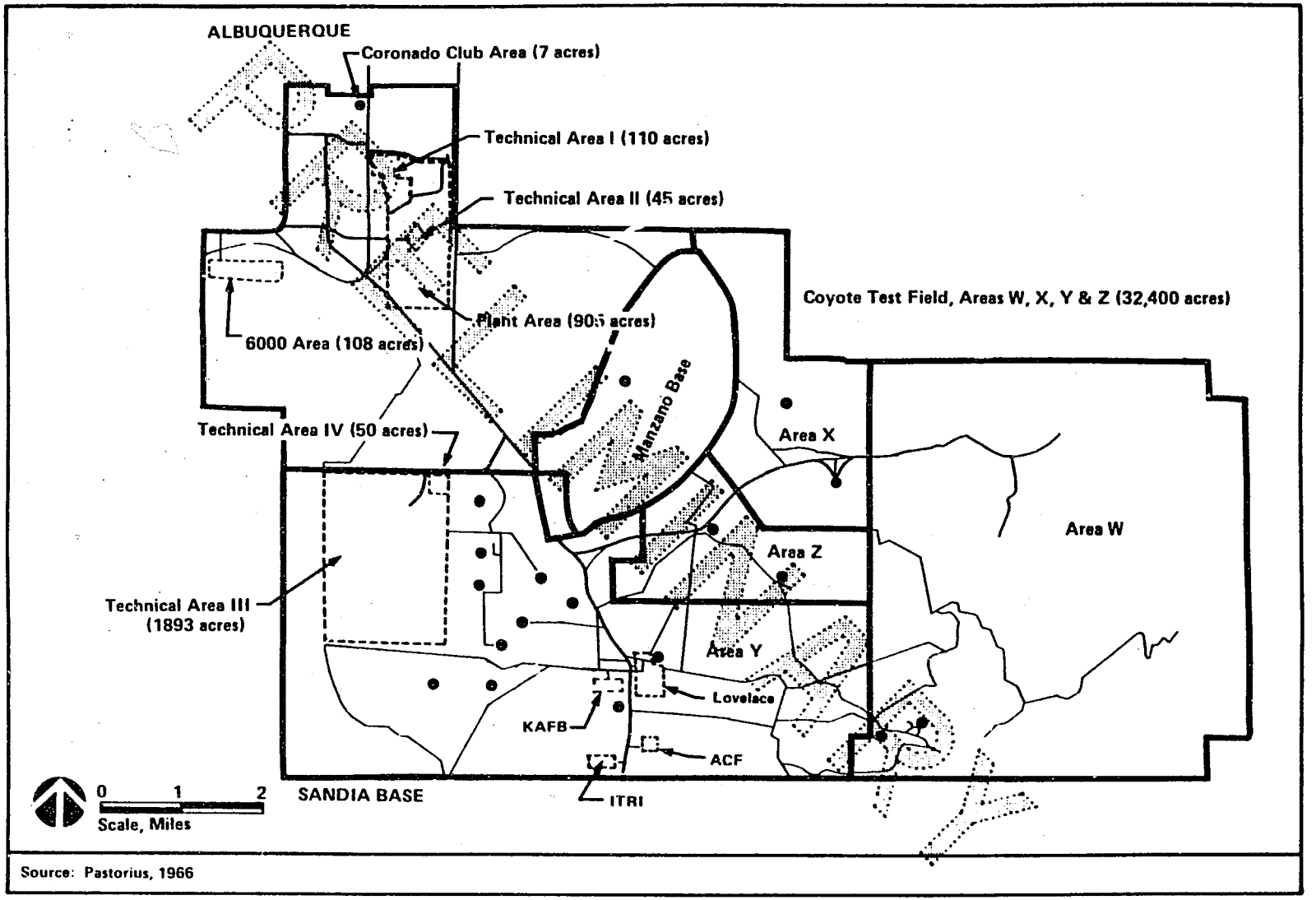
Test Sites

Testing activities have been conducted at SNLA since the mid-1940s. The main test areas have been Technical Area III and CTF, but activities have also occurred in or near Technical Areas II and V.

Coyote Test Field was divided into four areas in the early days: Areas W, X, Y, and Z, as shown in Figure 4-6. These four parcels, all used for high explosive (HE) tests, encompassed an area of 32,400 acres in 1966. It is not known what fraction of this area has been utilized by SNLA. The specific uses of these four parcels were as follows (Pastorius, 1966):

Area W	Miscellaneous HE tests
Area X	15,000-lb HE tests
Area Y	Fallout, seismic, and miscellaneous explosives tests
Area Z	250-lb HE tests

These areas were used extensively for explosive testing and weapons destruction tests using depleted uranium (DOE-AL, 1987). Other materials used at these test sites include beryllium, barium, lead, aluminum, HE, and TNT. These test sites include areas where materials have been dispersed on and beneath the ground surface, where they may cause potential soil, groundwater, and surface-water contamination. As more refined experiments were designed that required the construction of specialized facilities and equipment, these four general areas were divided into smaller test facilities. Today, SNLA owns and conducts activities on approximately 2,900 acres in the five Technical Areas, and utilizes approximately 5,300 acres in CTF (DOE-AL, 1987). Current SNLA and non-SNLA hazardous test areas are shown in Figure 2-2. Sites are currently monitored after each test by SNLA Environmental Health and Safety (EH&S) staff if there is an environmental concern, and Action Description Memorandums (ADMs) have been required for each test since 1985. This was not done in the past, however.



Source: Pastorius, 1966

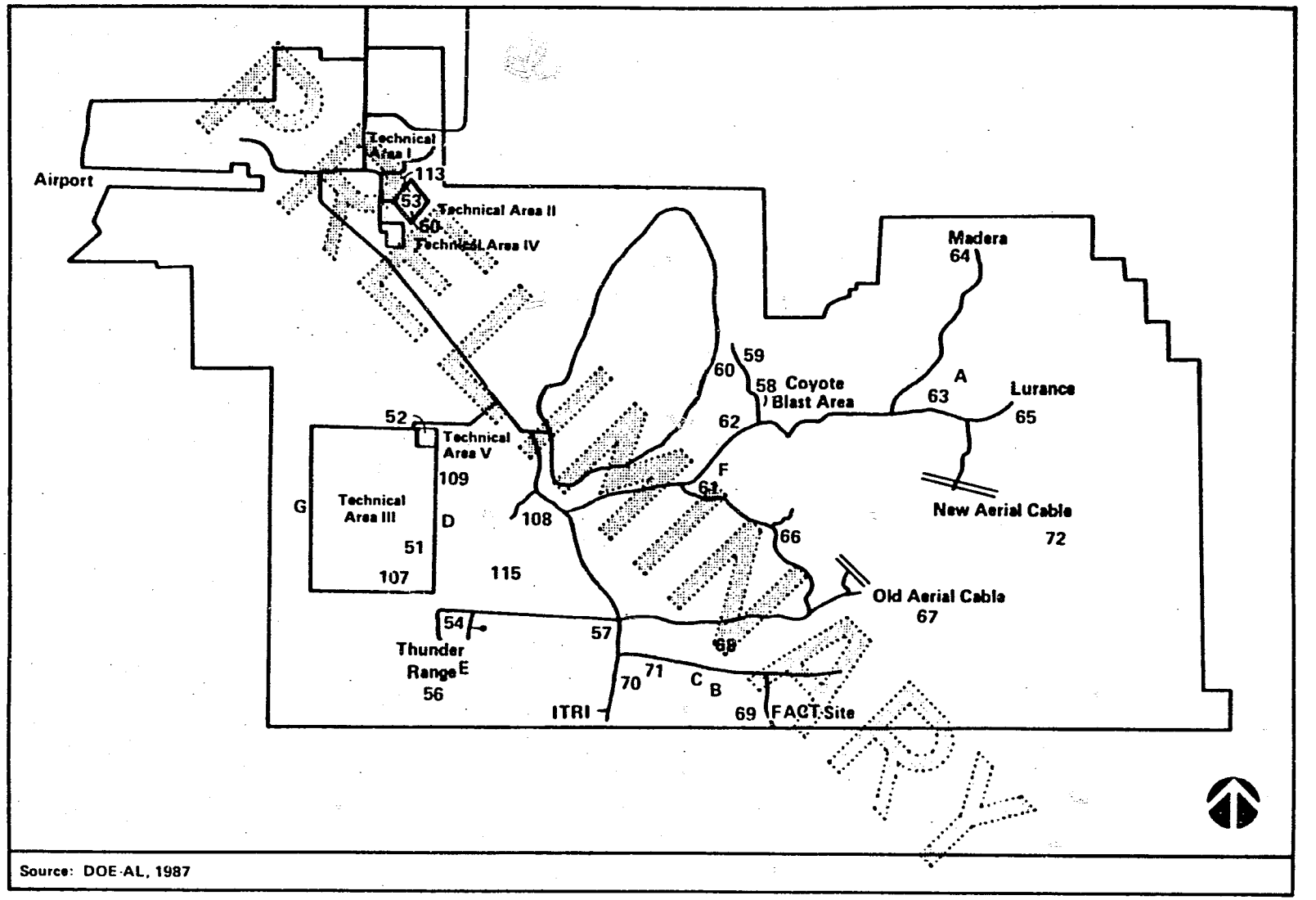
COYOTE TEST FIELD AND THE TECHNICAL AREAS IN THE EARLY DAYS FIGURE 4-6

5 OF 8

A compilation of known inactive test sites at SNLA is shown in Table H-1, and is grouped by location. A total of 27 inactive test sites were identified by the CEARP. Of these, however, five were dismissed by both the CEARP and the Survey team as not being potential environmental problems. An additional seven potential test areas were identified by the Survey team as requiring further investigation. The approximate locations of all test sites are shown in Figure 4-7. Numbers shown in the figure correspond to the sites' CEARP ID numbers, while letters correspond to the newly discovered sites described below. Information on dates used, waste types, facility type, media impacts, CEARP finding and action, and Resource Conservation and Recovery Act (RCRA) Facility Assessment ID Number, as well as other information, is shown for each site in the appendix when available. For a more complete description of testing activities at each CEARP site, the reader is referred to the CEARP Phase I Report (DOE-AL, 1987). The potential test sites discovered during the Survey effort are discussed below.

a) Site Northeast of Balloon Test Area (Site A, Figure 4-7)

An area northeast of the former Balloon Test area (CEARP Site Number 63) may be a former test area. This area is shown as site "A" on Figure 4-7. Two wooden crates (approximately 4 feet long x 2 feet wide x 2 feet deep) were found in the area, one of which was not nailed closed. This accessible box contained a cylinder (approximately 3 1/2 feet long x 3 inches in diameter) with the words "ionizing radiation," "microwave," and "contains beryllium oxide." A similar cylinder is suspected to be present in the other box. These cylinders are believed to be remnants of a 1978 test using high-power microwave radiation devices. Notified of the boxes, SNLA EH&S personnel indicated they would be removed. Three concrete manholes (one dated 9/7/83) were also near the boxes, which were west of the road leading from the Balloon Test area to an abandoned mineshaft. The abandoned mineshaft (pit) was approximately 10 feet in diameter and over 20 feet deep, and was adjacent to an abandoned green truck with DOE lettering. West of this mineshaft, north of the road that loops back toward the Balloon Test area, were some trenches filled with construction debris and tumbleweed. The origin of this debris is not known.



Source: DOE-AL, 1987

APPROXIMATE LOCATIONS OF INACTIVE TEST SITES

FIGURE 4-7

b) Site Southwest of Old Burn Site (Site B, Figure 4-7)

An area south of Target Road and west of the Old Burn Site (CEARP Site Number 68) appears to have been used for testing activities. At least two large metal platforms were found, one with a concrete platform on top and containing layers of insulating material beneath it. An empty covered wooden box (approximately 2 feet deep below the ground surface) is east of one of the platforms, and what appeared to be a mortar round was found nearby. The activities surrounding the use of this site are not known. However, one SNLA empoyee indicated it may be an area where the U.S. Navy performed work on the proximity fuse. Cleanup was initiated at the site but was halted when a workman was killed. It is not known whether this is associated with the Workman Site (Site Number 57) listed in the CEARP Phase I Report.

c) Site East of University of New Mexico Shock Tube (Site C, Figure 4-7)

A potential former test site exists east of the University of New Mexico (UNM) shock tube south of Target Road. This area is east of a telephone pole with electrical lines extending to the east, and contains a circle of concrete blocks, wire and wood debris, and a mound of soil with concrete and rebar protruding from it. This site may be associated with the UNM shock tube activities. No information is available concerning waste types produced from these activities.

d) Buildings 9920/9964 Beryllium Test Pits (Sites D and E, Figure 4-7)

In the early 1960s, beryllium tests were conducted in a pit west of the metal plate in front of Building 9920. Five to six tests were performed where 100-gram metal disks were explosively driven into the pit, which was approximately 4 feet deep and 6 feet in diameter with tapered sides. It was covered with approximately 6 inches of soil between tests, and the area is now completely backfilled.

Beryllium "shots" were reportedly conducted at a distance from Building 9964 in the late 1970s. It is not known whether the tests performed were similar to those at Building 9920.

e) Site Between Schoolhouse Mesa and Coyote Springs Road (Site F, Figure 4-7)

Evidence of past testing activities exists along the road north of Schoolhouse Mesa and south of Coyote Springs Road. A concrete circular pad (approximately 6 feet in diameter), which appears to have sustained blasting activities, is along the north side of the road. Charred wood, 2-inch-diameter piping, firing cables, and bottoms of tin cans were found nearby. Pieces of rusted metal, possibly drums, were found in the arroyo to the north, and old car parts and an old riveted drum were to the northeast. Numerous roads that appeared not to have been used for years (as evidenced by vegetation) criss-crossed the area. On the south side of the road from this site were concrete rubble, pails, gasoline cans (DuPont brand), and washtubs in and near an arroyo to the south.

To the west were two wooden house frames that appear to have been erected recently. Shells, campfire rings, soda cans, and a can of rubber cement with a 1986 expiration date on it, as well as piles of sandbags south of the wooden structures, indicate that this area may currently be in use as a practice firing site.

East and north of the above areas, mineshafts and/or evidence of surface mining were noted.

f) Disturbed Areas West of Technical Area III (Site G, Figure 4-7)

Various disturbed areas were noted west of the Technical Area III fence during a helicopter flyover of the facility. These areas were later inspected and the following observations noted.

An area somewhat cleared of vegetation was noted at the end of an old road extending west of Technical Area III. No debris or radiation levels above background were noted.

Further south was a fenced-in area where samples of paint are left out to dry in the environment. The CEARP Report listed a Burial Site (CEARP Site Number 26) in Technical Area III near the west fence. It is not known whether this area may have been within the fenced area listed above.

A barren area was noted west of the road outside the Technical Area III fence across from the old sled track. A concrete pad on a hill lies between the road and the fence.

At the southern portion of the old sled track was a road extending west to another clearing. Some firing cable was found in this area, and a metal cylinder (2 inches long x 1 inch in diameter) labeled "flammable" was found on a bank of mounded soil along an arroyo.

No information is available concerning any activities that may have occurred in these areas.

Disposal Sites

Disposal of radioactive and/or chemical wastes has been occurring on-site at SNLA since it began operation in the 1940s. Disposal activities have occurred in or near all five Technical Areas as well as in the remote areas of KAFB (Coyote Test Field). These sites, grouped into four subcategories, include landfills, surface disposal areas, surface impoundments, and septic tanks/drainfields. These four sub-categories of pollution sources are as follows.

Landfills - This subcategory includes trenches, pits, mounds, and mineshafts/adits, as well as traditional landfills. In most of these cases, wastes were disposed of in an unengineered manner (i.e., without any methods of waste containment). In some cases, wastes were placed without regard to segregation of waste types (radioactive versus chemical), and simply backfilled with soil. In other cases, waste segregation was practiced, and waste sites were capped with concrete (e.g., Radioactive Burial Site, CEARP Site Number 1). Both solid and liquid waste types have been disposed of in this manner. Sites where liquid wastes were disposed of and which are located in the eastern portion of KAFB (where groundwater is more shallow) have the greatest potential for groundwater contamination, whereas sites where solids were disposed of in the western portion of KAFB have the least potential for groundwater contamination. Soil and surface-water contamination is likely, the latter much more so at sites located in or near the arroyos. The suspected impact to each medium (groundwater, surface water, soil, and air) for each site is shown in the tables in Appendix H.

Surface Disposal Areas - This subcategory includes arroyos, scrap yards, and open dumps, where wastes are discarded on the land surface. These areas contain abandoned drums and tanks, contaminated soil, surplus equipment, building/construction rubble, shrapnel, depleted uranium, and HE, among other wastes. Some of this disposal is a direct result of testing activities in the area. This appears to be true to a greater extent in the remote areas of CTF, where many of the arroyos contain debris of various types. At least one dump located in an arroyo (Landfill and Open Dump, Tijeras Arroyo, CEARP Site Number 24) is believed to have been washed away during a flash flood which occurred in the 1970s. The potential for surface-water contamination from these sites in or near the arroyos is high. These sites also pose a threat of soil contamination and, to a lesser extent, groundwater contamination. The potential impacts to each medium are shown for each site in Appendix H.

Surface Impoundments - Surface impoundments are used in conjunction with some of the testing and operational practices at SNLA. These impoundments have received liquids containing radioactive and/or chemical wastes, and may or may not be lined. Much of the waste is ultimately disposed of by evaporation and/or infiltration. Because of the increased hydraulic pressure caused by the standing liquid in the impoundment, the potential for groundwater contamination via infiltration is high for the unlined sites and for those having liners of questionable integrity. This is of more concern in the areas of KAFB where groundwater is shallow (i.e., less than 100 feet below the ground surface). Surface waters and soils are also expected to be impacted from these impoundments. The expected impact to each medium from each site is given in the tables in Appendix H.

Septic Tanks/Drainfields - SNLA Technical Areas II, III, and V as well as CTF are connected to septic tanks and drainfields rather than to a wastewater treatment system. These systems may include sanitary and/or industrial wastes, and are potentially contaminated with radioactive and/or chemical wastes. Suspected waste types include cesium-137, cobalt-60, solvents [methanol, trichloroethylene (TCE), toluene], HE, and silver. The industrial septic systems are equipped to filter out and contain particles, such as HE, with the filters periodically being replaced.

These filter systems often failed, however, allowing the release of this debris into the drainfields. Continued use of these systems may potentially wash these contaminants into the soil and groundwater. At least one system was observed to have an outfall to a nearby arroyo, posing some surface-water contamination concerns. The expected impacts to each medium for each site are given in the tables in Appendix H.

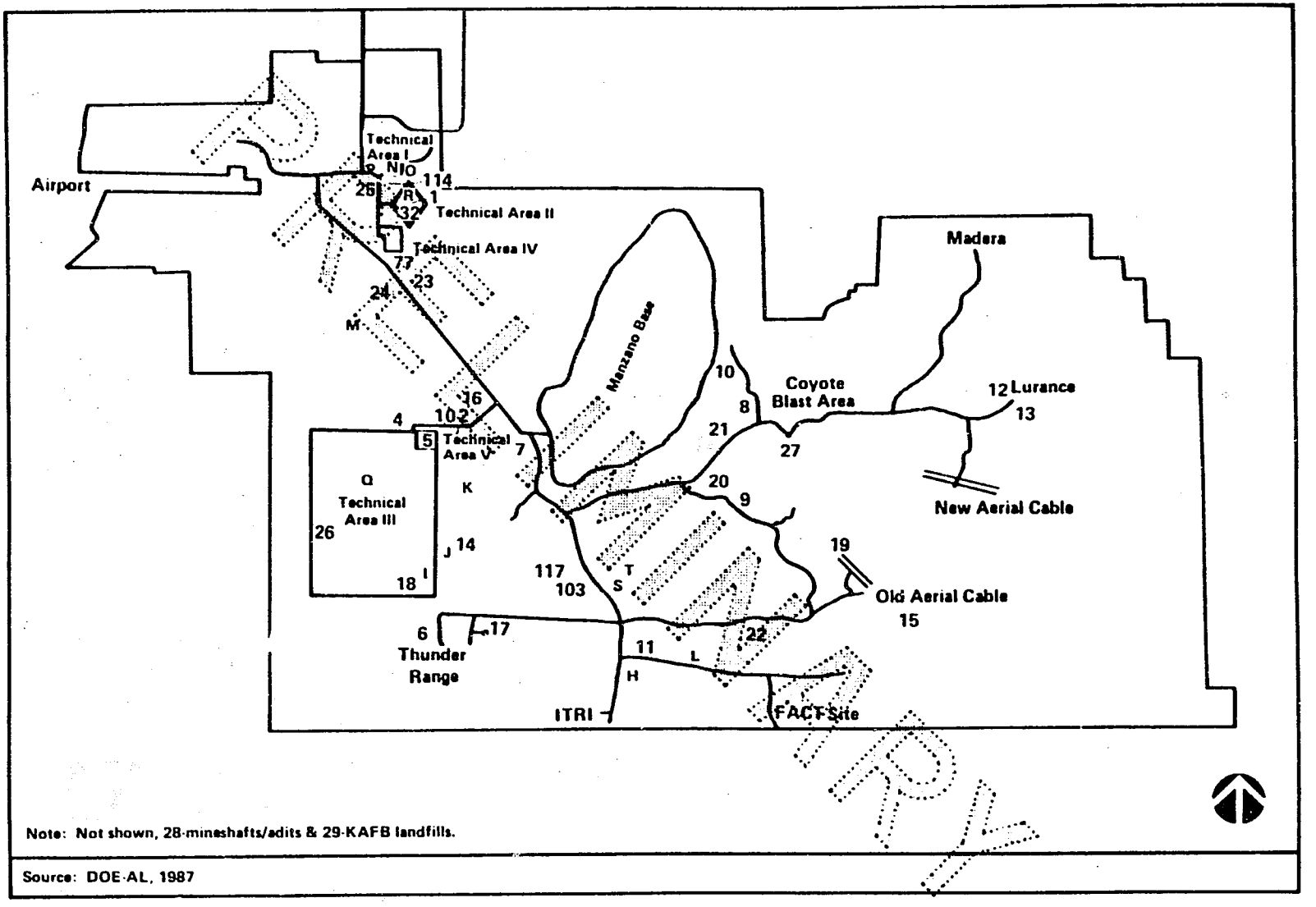
All disposal sites listed in the CEARP Phase I Report as well as those identified during the Survey activities are given by location in Table H-1. The approximate locations of these disposal sites are shown in Figure 4-8. A total of 34 inactive disposal sites were identified in the CEARP. Of these, one site was dismissed by CEARP but retained by the Survey effort for further investigation. An additional 13 potential disposal areas were identified by the Survey team as requiring further investigation. Pertinent information for each site is listed in the table in the appendix for the CEARP sites. Available information for the remaining sites is given below.

a) Black-Lined Pit Northwest of Explosives Test Pit (Site H, Figure 4-8)

South of Target Road and east of the water towers along Lovelace Road, a pit surrounded by a broken-down fence was located. The pit (approximately 20 feet x 20 feet) contained remnants of a black plastic liner in and around it. This area is south of the red and white tower along Target Road and northwest of the Explosives Test Pit (CEARP Site Number 70). No information is available concerning the past use of this area.

b) Technical Area III Surface Impoundment (Site I, Figure 4-8)

A large surface impoundment containing water is located in the southeastern portion of Technical Area III. The impoundment had an inlet pipe that appeared to originate on the other side of a nearby road and run underneath it into the impoundment. Some firing shells were found around the impoundment during the Survey. Whether the impoundment was ever used for anything more than surface runoff collection is unknown.



APPROXIMATE LOCATIONS OF INACTIVE DISPOSAL SITES

FIGURE 4-8

c) Abandoned Drums (Sites J, K, L, M, Figure 4-8)

Numerous abandoned drums were scattered throughout the facility, lying either in open spaces, arroyos, or salvage yards. Some drums were empty while others were not. Abandoned drums not associated with other identified sites were found in the following areas:

West of Building 9920 (2 drums of Degreasol, a few inches of liquid remaining) (Site J)
West of Building 9950 (4 drums, all empty) (Site K)
North of Target Road, East of UNM Shock Tube (2 drums, contents unknown) (Site L)
Southwest of Golf Course, South of Arroyo del Coyote (possibly USAF drums) (more than 75 drums, contents unknown) (Site M)

d) Disturbed Areas noted in Aerial Photographs (Sites N, O, P, Q, R, Figure 4-8)

Five areas were identified during the review of aerial photographs from the 1950s-1960s where waste disposal or other operations involving hazardous substances may have occurred. No information is available concerning past activities at these areas, and no activities are presently occurring. These areas include:

- Ponds (5) in the southeast corner of Technical Area I, near the intersection of Gibson and Eubank (possibly USAF use; approximately 1950 photograph) (Site N)
- Metal scrap and trash yard south of the above area (Site O)
- Stained area in the southwestern portion of Technical Area I (Site P)
- Igloos in Technical Area III (approximately 1962 photograph) (Site Q)
- Disturbed area south of center road in eastern portion of Technical Area II (possibly Chemical Disposal Pit-CEARP Site Number 3) (Site R)

e) Life Sciences - 1 Sites (Sites S and T, Figure 4-8)

Since the late 1950s, the Life Sciences-1 (LS-1) facility located on KAFB east of Lovelace Road has been used for biomedical research (blast overpressure tests) on animals. The DOE has operated the 30-acre facility since the 1960s; it has been run by Los Alamos National Laboratory (LANL) for the past 3 years. Prior to LANL, the Lovelace Foundation operated the facility as its Biodynamics Laboratory (approximately 1955-1985) as a satellite of its facility located 1 mile to the south (the ITRI). The three primary functions of LS-1 were to conduct:

1) Blast overpressure tests - placing animals at the impact end of a shock tube to assess the effects of shock waves which simulate nuclear weapons blasts,

2) Shrapnel studies - assessing the effects of shrapnel on styrofoam dummies using 1/8 lb - 24 lb of TNT, and

3) Translation studies - assessing the effects of targets impacting upon animals.

The LS-1 facility has reportedly not used any radioisotopes in the past 10-12 years. Prior to that time, neutron and gamma exposure occurred from the Sandia Pulsed Power Reactor, resulting in short-term activation. In the past 10 years or so, only formaldehyde and glutaraldehyde have been used, which are stored in the necropsy laboratory. High explosives used include C-4, primacord, and occasionally TNT and pentalite. Wastes produced from these substances include carbon dioxide, water, and small quantities of toxic gases, as well as waste formaldehyde.

Lake Christian, a 20-foot-deep polyvinyl-lined impoundment, is used to study shockwave propagation under water. Explosives are detonated in and under water and the shock waves are measured via instrumentation. The liner of the impoundment is said to be deteriorated. Carp, channel catfish, and bluegill reportedly live in the water.

Current activities involve approximately 35 sheep at the facility, where tests are conducted in bunkers to assess the effects of shock waves on the ear. Past tests have reportedly involved the effects on the lung and respiratory tract. The carcasses of the animals are disposed of in 6-foot-deep trenches at the facility, which are backfilled when full. Domestic wastes reportedly drain to a septic system.

In the 1940s, this area was used for proximity fuse testing for World War II by the U.S. Navy. Facility personnel report that live shells, which were fired from the current office site toward Laser Hill, remain in the field. Airplane debris was abandoned in this area over 20 years ago, and an old military landfill was discovered by facility personnel while disposing of animal carcasses in ditches. During the Survey, four large 1940 U.S. Army gas cylinders (Site S) were located near Lake Christian. Ash/cinder piles (approximately 20 feet x 10 feet x 30 feet) (Site T) containing burned metal parts were also located near an arroyo northeast of the facility.

The LS-1 site is tied in to the main KAFB water supply, but has two wells in the area: KAFB wells 29055 and 29056. One well reportedly has water in it, while the other has a pump with zero pressure. One person interviewed believed that the wells had not been used since the late 1960s, and that they are 54 feet deep. The wells on KAFB are discussed further in Section 3.4.

Hazardous Material Handling and Process Sites

Hazardous materials have been involved in SNLA operations since the early days. These materials, including radioactive and/or hazardous chemicals, have been used in all five Technical Areas as well as in the remote areas, including Tijeras Arroyo, the 9800 and 9900 series buildings, the canyon areas, and the northwest and southern portions of KAFB. The operations involving the use of these materials are described in Section 2.0.

Most of the inactive waste sites associated with these operations involve spills or past liquid discharges to the surface (e.g., via outfalls) or subsurface (e.g., via drains/leachfields) environment. Substances spilled include various oils, mercury, and acids. The 19 spill areas identified during the Survey effort are shown in Table

4-20. Other releases include radioactively contaminated liquids, acidic wastewater, HE, solvents, and other unidentified substances. These spills and releases may result in potential soil, surface-water, and/or groundwater contamination.

A compilation of all inactive hazardous material handling and process sites is given in Table H-1 by location for areas identified in the CEARP Phase I Report as well as areas discovered during the Survey effort. A total of 27 inactive sites associated with hazardous materials areas were listed in the CEARP. Six of these areas were dismissed by the CEARP as not posing any potential environmental concerns, but one of these sites was retained by the Survey team as requiring further investigation. An additional two hazardous materials areas were identified by the Survey team as requiring further investigation in addition to the 19 spill areas. The approximate locations of all of these sites are shown in Figure 4-9. Information pertaining to the CEARP sites is listed in Appendix H. Available information for the remaining two non-spill sites is discussed below.

a) Building 841 Outfall (Site U, Figure 4-9)

Building 841 in Technical Area I contains the printed circuits laboratory, photofabrication laboratory, and plating operations. Wastewater from this building exits via a pipe in the rear of the building and discharges onto the concrete and soil. The wastewater is believed to contain ferric chloride, and possibly methylene chloride and TCE. Discharge from Technical Area I used to go to an old (now abandoned) acid line that ends in the Technical Area IV parking lot. This is believed to be related to the old acid waste line outfall described in the CEARP Phase I Report (Site Number 46).

b) Arch-Type Aircraft Shelter (Site V, Figure 4-9)

On the eastern side of Madera Canyon Road is a USAF arch-type aircraft shelter constructed of concrete with metal arches. The shelter was lettered "Air Force Weapons Lab, SEQ, June 30, 1975." Three drums of hydraulic oil and one empty drum were found near the rear entrance, and spills (possibly oil) were evident in

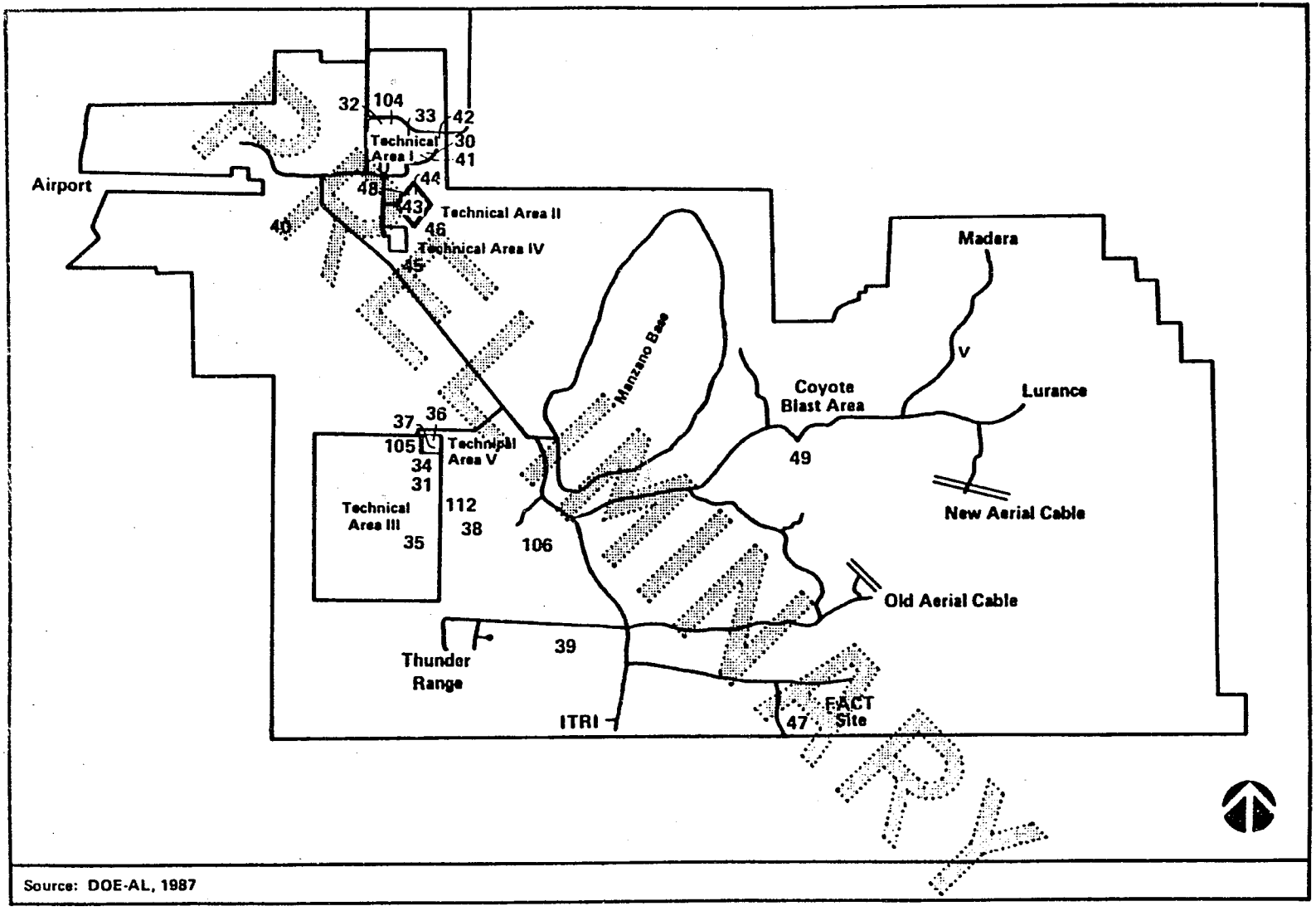
TABLE 4-20

SPILL AREAS AT SNLA AND ITRI IDENTIFIED DURING THE ENVIRONMENTAL SURVEY

	Location	Material	Quantity	Date
1	ITRI	Diesel fuel	2,000 gal	5/7/83
2.	NW end of old aerial cable	Crankcase oil under machinery	Unknown	Current*
3.	New aerial cable	Diesel fuel - up to 27 refilling areas	Unknown	Current
4.	KAFB arch-type aircraft shelter	Oil	Unknown	Current
5.	Steam plant drum	Waste oil at pump	Unknown	Current
6.	Tank farm	Fuel oil-refilling station	Unknown	Current
7.	Motor oil reclamation area	Potential spills in past	Unknown	1979 - 5/87
8.	Buildings 6505 & 6710 (from Ft. Wyndgate flatbed)	Transformer oil	Unknown	Current
9.	Centrifuge facility	Lube/hydraulic oil	>300 gal	Current
10.	Vibration facility	Hydraulic oil	Unknown	(?) - 1984
11.	HERMES (Building 6596)	Fuel oil - refilling station	Unknown	Current
12.	PROTO (Building 6597) UST field	Transformer oil	Unknown	Current
13.	Motor pool	Diesel fuel - refilling station	Unknown	- 1979
14.	Building 887	PCB oil	Unknown	Unknown
15.	Solar facility	Diesel fuel Ethylene glycol Heat transfer oil	Unknown	Current
16.	PROTO (Building 6597)	Freon TF Solvent - possibly leaking drums	Unknown	Current
17.	CTA UST (Building 30132)	Diesel fuel - overfilling/UST removed	Unknown	(?) - 4/30/87
18.	Building 841 (Printed circuits lab)	Ferric chloride, TCE, methylene chloride wastewater	Unknown	Current
19.	Building 9930	Unknown substance spilled	Unknown (20-30 ft^2 area)	Current

Source: Observations by Survey team.

* As of August 1987.



APPROXIMATE LOCATIONS OF INACTIVE HAZARDOUS MATERIAL HANDLING AND PROCESS SITES

FIGURE 4-9

front of the structure. An arroyo behind the shelter had concrete, debris, and cables in it, and wires were in a concrete bunker to the north. This site is believed to be abandoned by the USAF.

Off-Site Testing and Disposal Sites

SNLA has been involved with off-site nuclear weapons component testing and/or disposal operations since its inception in 1945. Los Alamos personnel from both Los Alamos and Sandia Base were involved in the first full nuclear test at the Trinity Site on July 16, 1945. When B-29 aircraft returned from Tinian in the South Pacific, the Airborne Testing group was also moved from Los Alamos to Sandia Base, and a practice bombing range was located about 25 miles south of the base on the Isleta Indian Reservation. A program of telemetering bomb-drop data was initiated to develop reliable statistical data on the performance of each weapon component, and air drops were conducted at the sea-level bombing range at Salton Sea, California, which was acquired from the Navy.

SNLA also became involved in various weapons testing programs including atmospheric, underwater, and underground nuclear detonations at the Trinity Site, Bikini Atoll, Eniwetok, the Nevada Test Site (NTS), and off the coast of southern California.

Nonnuclear weapons components testing was conducted at Los Lunas, New Mexico; the Salton Sea, California; Tonopah, Nevada; Bemidji, Minnesota; and Cold Bay, Alaska. In addition, various military installations in Arizona, California, Florida, Maryland, Nevada, New Mexico, Texas, Virginia, and Washington were used for ballistic testing. Blast effects testing was conducted on a larger scale at the NTS.

Peacetime applications included the feasibility of using thermonuclear devices for major land or sea earth-moving projects and recovery of heat from underground detonations. SNLA participated in nuclear experiments at various locations including a detonation in the salt formations near Carlsbad, and explosive cratering experiments at Dugway Proving Ground (Utah), Waterways Experiment Station

(Mississippi), Aberdeen Proving Ground (Maryland), Camp Cooke (California), NTS (Nevada), the Panama Canal Zone, and London, England (DOE-AL, 1987).

As can be seen, off-site tests, some using nuclear materials, were an integral part of development activities at SNLA. Available information on the locations, test names, and dates of these off-site testing activities is summarized in Appendix L. Overall, off-site testing as part of SNLA activities has been performed in over 50 locations worldwide.

Off-site disposal (i.e., disposal on property other than that under SNLA's control) of hazardous materials has also occurred through the years. SNLA operates a number of salvage/scrap yards throughout the Technical Areas and the remote areas where surplus equipment is sold to off-site vendors. Tight control of inventory, notably that containing potentially hazardous materials, has not always been maintained.

Since 1943 SNLA has utilized a network of five KAFB on-site landfills and four open dumps for the disposal of sanitary wastes. Landfill 1 and possibly landfills 2 and 3 are believed to have received some hazardous materials which may be the partial responsibility of SNLA (USAF, 1981). These landfills and open dumps are discussed further in Section 4.1.

Inactive Underground Storage Tanks

A compilation of 34 inactive underground storage tanks (USTs) at the SNLA Technical Areas, CTF, and ITRI is presented in Table 4-21. These tanks have been used for various substances, including both waste and raw material. Of these 34 USTs, only 9 are known to have been removed. The remainder may have been abandoned in place. It is not known what residual materials remain in the tanks. Neither SNLA nor ITRI currently has a formal program to remove inactive USTs.

4.5.1.2 Bendix Albuquerque Operations

Bendix Albuquerque Operations (BAO) is responsible, under a joint Memorandum of Understanding with SNLA, for production and development of Very Large Scale

TABLE 4-21

INACTIVE UNDERGROUND STORAGE TANKS * (AS OF 04/17/87)

Technical Area	Bldg.	Tank Size (gal)	Age (yrs)	Content	Status
I	844	150	20	Tritiated Water	Abandoned
I	874	8,000	0	Fuel Oil	Removed, 1984
I	893	25,000	6	Transformer Oil	Inactive/Full
II	900**	120	37	Gasoline	Inactive
II	901**	120	Unk	Gasoline	Unk
II	910	120	37	Gasoline	Inactive
II	911	120	37	Gasoline	Inactive
II	912	120	37	Gasoline	Inactive
III	6509	1,000	0	Fuel Oil	May Not Exist
III	6531	100	17	Fuel Oil	Abandoned
III	6536	10,000	30	Deionized Water	Out of Use
III	6555	550	0	Fuel Oil	Abandoned
III	6560	1,000	0	Fuel Oil	Removed, 1986
III	6570/1	300	0	Fuel Oil	Removed
III	6610	500	27	Fuel Oil	Abandoned
III	6712	600	0	Fuel Oil	Removed
III	6715	500	0	Fuel Oil	Abandoned
III	6730/1	500	0	Fuel Oil	Removed
III	6741	1,500	0	Fuel Oil	Removed
III	6743	1,000	0	Fuel Oil	Abandoned
V	6580	5,000	0	Fuel Oil	Removed
V	6580	6,500	Unk	Oil	Abandoned
V	6580	12,000	0	Washwater	Porous Drain Tube/Abandoned
V	6590/1	560	0	Fuel Oil	Removed
V	6597	25,000	Unk	Deionized Water	Abandoned
V	6597	25,000	Unk	Deionized Water	Abandoned
CTF	9800/1	Unk	0	Fuel Oil	Abandoned
CTF	9925	5,000	0	Fuel Oil	Abandoned
CTF	9925	500	Unk	Fuel Oil	Abandoned
CTF	9939	2,000	20	Waste Holding/Washwater	Deactivated 5/80
CTF	9956	500	0	Fuel Oil	May Not Exist
CTF	9982	4,000	Unk	Wastewater (Solar Facility)	Removed in approx. 1983
ITRI	9251	10,000	25	Fuel Oil	Abandoned
ITRI	9251	6,000	25	Fuel Oil	Abandoned

Sources: Millard et al., 1987; IT, 1987b; Knott, 1985

Notes: *Some tanks may contain residual material
** May be the same tank
CTF = Coyote Test Field.

Integrated Circuits (VLSIC) in Building 870 within Technical Area I. BAO, also known as the Center for Radiation-Hardened Microelectronics (CRM), began in 1982, and production has occurred since late 1985. The building was originally built as a warehouse, which was converted into a development laboratory and later a production area.

An incinerator used to destroy classified documents was located where the addition to Building 870 was built. Scrubber water from the incinerator was discharged to the storm drains. This incinerator was reportedly not used for hazardous materials, and was removed in approximately 1984.

Acids and caustics used for the Technical Area I water treatment facility have spilled in the past. One incident (believed to be CEARP Site Number 42) involved a spill of approximately 1,000 gallons of hydrochloric acid due to a tank rupture north of the building on January 9, 1984. The acid flowed down the street and entered a storm drain. A second incident involved a spill of approximately 600 gallons of sodium hydroxide on the ground surface when a day tank overflowed on November 4, 1984. There have also been reports of acids in the BAO sewer system, indicating leaks in Building 870. Both spill areas have been disturbed ("dug up") since the incidents occurred. None of these incidents, however, are believed to have any environmental consequences, because of the natural buffering action of the soil. Bendix Albuquerque Operations is not of concern from the standpoint of inactive waste disposal and contamination in the context of the Survey. The above is provided only for completeness in light of the CEARP information.

4.5.1.3 Inhalation Toxicology Research Institute

The 144-acre ITRI is part of the Lovelace Biomedical and Environmental Research Institute. With its origins in radionuclide inhalation toxicology dating back to 1960 through 1977, ITRI expanded to coal, diesel, and solar energy research from 1977-1981, and eventually became involved in the mechanisms of the inhalation of toxic substances. ITRI presently performs less than 50 percent of its research with nuclear materials, the majority involving chemical substances. Beagle dogs comprise the majority of research animals used at the facility, although other animals have also been used.

Lagoons

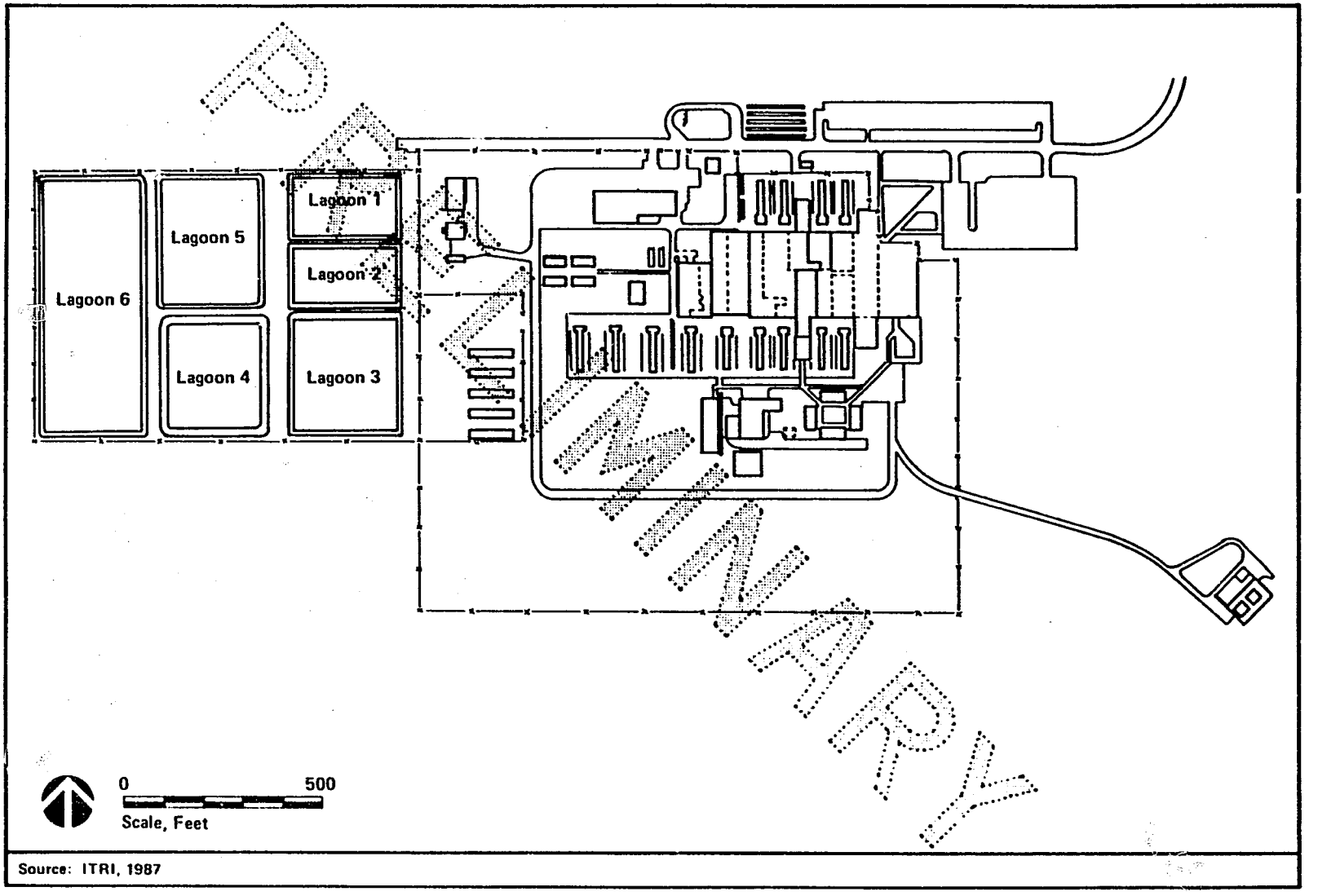
A series of 6 lagoons covering a total of 10 acres is present at ITRI west of the laboratories, as shown in Figure 4-10. The lagoons have processed up to 30,000 gpd of domestic sewage and laboratory effluent since the first lagoon was constructed in 1962. Prior to construction of the "hot ponds" (see below), low-level radioactive waste (LLW) liquids may have been disposed of in Lagoon 1.

Lagoon 1 has been inactive since 1970. It was closed after it was found to contain 150 mCi of cesium-137, probably due to a study in the mid-1960s involving the injection of the substance directly into the bloodstream of animals whose excreta were discharged to the lagoons. The lagoon has been covered with approximately 1 foot of soil.

Soil core sampling to depths of 25 to 60 feet was performed in 1983 west and south of the lagoons, along the southern border of the site, and at the hot ponds, as well as in the northeast corner (background sample). Monitoring wells were also placed between the lagoons at depths to 12 feet below the bottoms of the lagoons to detect any migration from the lagoons. Periodic sampling of water and sediment from the lagoons has occurred since 1967 and 1973, respectively. The active lagoons are further discussed in Section 3.3.3.3.

Hot Ponds

Two concrete- and polyethylene-lined surface impoundments (each 20 feet x 20 feet x 5 feet deep) were constructed in 1966 for receiving LLW liquids from ITRI. The "hot ponds" ceased being used for disposal of LLW liquids in August 1986, but the surrounding area is used for storage of drummed waste, lead pigs, piping, bricks, etc. with low-level radioactive contamination. The hot ponds are further discussed in Section 4.1.



Source: ITRI, 1987

LOVELACE ITRI SITE PLAN

FIGURE 4-10

Pathological-Waste Disposal

Three pathological-waste incinerators have been used at ITRI, all of which had two primary combustion chambers and two afterburners. The first incinerator was used from 1962 to 1971/1972 and was built on a concrete pad that would now be under Building 9202E. The second incinerator operated from the mid-to-late-1960s until August 1973, and was built as part of a large steel shed on "the hill," presumably near the hot ponds. Neither of these incinerators had any effluent treatment.

The current incinerator is a package incinerator housed in Building 9221. It was purchased in approximately 1981 but was not used until a year later. The effluent from this incinerator passes through a spray dryer, bag filter, and a high-efficiency particulate air (HEPA) filter. The ash from the incinerators was shipped as LLW to Beatty, Nevada, until 1981, when a DOE policy change required that it be shipped to NTS.

Between 1973 and 1982, ITRI wastes were disposed of as follows. From the 1973-1974 time period, laboratory wastes were compacted on the hill, drummed, and sent to Nevada. This included 95 percent burnable waste, dead laboratory rats, etc. In the later 1970s to approximately 1983, most dead rats were buried in three trenches (6 feet wide x 6 feet deep x 50 - 100 feet long) on the hill. One trench is approximately 30 feet south of the hot ponds, parallel to the southern fence of ITRI. The remaining two trenches are parallel to the border fence of the Isleta Indian Reservation. The rats buried on the site were excess rats resulting from overbreeding, and no toxics were ever associated with them. The trenches reportedly also contained many tumbleweeds, which were simply covered with soil rather than removed. Currently, rat carcasses are stored in a freezer to be incinerated later. Some rats from overbreeding have been disposed of at the KAFB Sanitary Landfill.

Underground Storage Tanks/Spills

ITRI reportedly has two inactive USTs that contained fuel oil, as listed in Table 4-21.

A spill of 2,000 gallons of diesel fuel occurred on May 7, 1983, as listed in Table 4-20. The spill occurred when a gasket on a fuel oil filter inside Building 9262 failed and spewed oil from the filter housing. Some oil overflowed from a sump outside the building to the ground, and several hundred gallons entered a floor drain inside the building which discharged into the lagoons.

Approximately 500 gallons of oil was collected from the ground surface and drummed, and the area was flushed with water for 1 to 2 days. Some of the oil/water mixture was washed into a ditch along an on-site road. No oil was reported to have left the ITRI site.

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

4.5.2.3 Category III

1. Potential for contamination from SNLA inactive test areas. A total of 29 areas are recognized by the Survey team as having been used in the past for testing activities that resulted in dispersal of chemical and/or radiological debris with the potential for soil, groundwater, and surface-water contamination. This total includes 22 test areas identified in the CEARP Phase I Report as well as 7 areas identified during the Survey as potential test areas.

   Some of the dispersed debris, which reportedly was of a particle size too small to be picked up, may be currently leaching to the soil column or washing into surface waters as a result of precipitation; larger debris, which was not removed, may degrade and leach less quickly and thus pose less of an

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immediate threat to the environment. Constituents of concern include depleted uranium, beryllium, barium, lead, aluminum, high explosives, and TNT residuals. Sites where testing debris (firing cables, scrap metal, aluminum and lead fragments, propellant fragments, etc.) was found or where testing was reported are listed in Table H-1.

Selected test sites are described below. These sites represent tests where contaminants have been deposited beneath the ground surface (i.e., liquid discharges) as well as on the ground surface (i.e., explosive dispersal tests). Sites where sampling and analysis is to be performed are also included. Examples of sites with high/medium potential for groundwater contamination are described in Section 3.4.2.1.

a) Old Burn Site (CEARP Site Number 68, Figure 4-7)

The Old Burn Site located north of Target Road was used for studying the effects of fire on weapons components. Past activities have resulted in known contamination of the area with depleted uranium, lead, and thorium based on knowledge of site use and later cleanup activities. The site had an unlined pit approximately 25 feet x 25 feet in area (later, plastic lining was used), where oil was burned during testing activities. Although radioactively contaminated soil at the site was removed in the 1970s, no records exist to verify the extent of cleanup. In addition, no attempt was made to identify other (chemical) contamination. Burning activities were done in a subsurface pit, with water (and any contaminants) subsequently discharged to a trench and a 30-foot-diameter surface impoundment. Although the exact period of use of the site is not known, it is believed that the site was used prior to the construction of the current burn site in the 1970s.

Data obtained as a result of sampling and analysis will be used to determine (1) whether testing activities have resulted in soil contamination of the area with chemical and/or radiological substances and (2) whether cleanup of radioactively contaminated soil was adequate.

b) Building 6924 Pad, Tank, and Pit (CEARP Site Number 51, Figure 4-7)

Building 6924, located in Technical Area III, was used for HE synthesis from approximately 1969 to 1971. Solvents contaminated with HE were discharged to a concrete-lined ditch and then to a corrugated metal tank where they were ignited. The tank overflowed to an unlined 20-foot x 20-foot surface impoundment via an underground pipe. The volume of liquid received is not known. Some rocket propellant research may also have been conducted at the site.

Data obtained as a result of soil sampling from the tank and surface impoundment will be used to determine whether any residual HE, solvent, or other wastes are present in the environment as a result of previous site activities.

c) Building 9940 Firing Site (CEARP Site Number 108, Figure 4-7)

Building 9940 was used for a number of years for explosive shots involving corium thermite (a mixture of depleted uranium, chromium oxide, nickel oxide, zirconium oxide, iron, and molybdenum) and possibly other materials. From 1979 to 1982, the failure of 10 to 12 experiments possibly resulted in the spread of more than 10 kilograms of depleted uranium, beryllium, and other heavy metals to the soil. These failures resulted from tests which pre-ignited in the air above a tank of water rather than inside it as designed. Debris was spread over an approximately 50-foot area around the test pad, now covered by a 10-foot x 10-foot x 40-foot-high metal building atop a hill 100 feet north of Building 9940. The practice at the time was to wash small particles of corium into the ground with a hose around the pad to remove surface depleted uranium activity.

Sampling and analysis is designed to determine whether any residual contamination remains in approximately the upper 1 foot of soil that could be further wind-eroded or carried away by surface waters.

d) Schoolhouse Mesa Uranium Burn Site (CEARP Site Number 20, Figure 4-8), Burial Site/Open Dump (CEARP Site Number 9, Figure 4-8), and Test Site (CEARP Site Number 61, Figure 4-7)

The Schoolhouse Mesa was used for burning depleted uranium, for detonation of HE, and for surface and subsurface disposal of wastes in a nearby arroyo during the late 1950s and early 1960s. The schoolhouse itself was used as the headquarters for various testing activities. The area contains pits, firing cables, and charred material; drums, rocket casings, and a gas cylinder, possibly related to these activities, are present in the nearby arroyo.

The area was examined by personnel from the KAFB Explosive Ordnance Division (EOD), and scattered ordnance, HE, and propellant were removed.

Data from soil sampling will be used to determine whether any hazardous materials remain as a result of previous testing and surface disposal practices, and to verify the extent of cleanup.

e) Sites Identified by the Survey Team

In addition to the selected CEARP test sites described above, seven potential test areas were identified by the Survey team. These test areas include those listed in Table 4-22 and described in Section 4.5.1.1. Note that the identification of these areas was based on a review of aerial photographs from the 1950s/1960s, an aerial review of the facility by helicopter during the Survey, and/or Survey surface reconnaissance activities. The ability for these areas to be further researched varies, as does their degree of severity. The areas are included, however, for further investigation, as available information does not warrant dismissal from consideration as potential sources of environmental contamination.

2. Potential for contamination from SNLA inactive disposal areas. A total of 47 areas are recognized by the Survey team as having been used for surface or subsurface disposal of waste, resulting in potential soil, surface water, and/or

TABLE 4-22

POTENTIAL CONTAMINATION SOURCES AT SNLA IDENTIFIED DURING THE ENVIRONMENTAL SURVEY *

Test Areas
A. Site northeast of Balloon Test Area
B. Site southwest of Old Burn Site
C. Site east of University of New Mexico Shock Tube
D/E. Buildings 9920/9964 Beryllium Test Pits
F. Site between Schoolhouse Mesa and Coyote Springs Road
G. Disturbed areas west of Technical Area III
Disposal Areas
H. Black-lined pit northwest of Explosives Test Pit
I. Technical Area III Surface Impoundment
Abandoned drums
J. West of Building 9920 K. West of Building 9950 L. North of Target Road, east of University of New Mexico Shock Tube M. Southwest of Golf Course, south of Arroyo del Coyote (possibly USAF drums)
Disturbed areas noted in aerial photographs (no longer existing)
N. Ponds in southeast corner of Technical Area I (possibly USAF) O. Metal scrap and trash yard south of the above area P. Stained area in the southwestern portion of Technical Area I Q. Igloos in Technical Area III R. Disturbed area south of center road in eastern portion of Technical Area II
Life Sciences-1 (LS-1) Site
S. Abandoned gas cylinders T. Ash/cinder piles
Hazardous Material Handling and Process Areas
U. Building 841 outfall
V. Arch-type aircraft shelter (USAF)

Source: Observations by Survey team

* Letters indicate site locations on Figures 4-7, 4-8, and 4-9.

groundwater contamination with chemical and/or radiological substances. This includes 34 disposal areas identified in the CEARP Phase I Report as well as 13 areas identified during the Survey as potential disposal areas.

Waste disposal directly to the environment may result in soil and/or groundwater contamination, the latter being much more likely from unlined surface impoundments. Disposal in or near the arroyos may result in surface-water contamination during high-precipitation events and possibly the migration of wastes off the site. Wastes disposed of include depleted uranium, tritium, radium, cobalt-60, cesium-137, beryllium, plutonium, nickel-63, neutron-activated materials, lead, mercury, barium, HE, and TNT. Some of the radioactive substances have likely decayed and may represent less of a hazard than at the time of burial; other materials have retained their toxicity. Sites where suspected/documented land disposal occurred are listed in Table H-1.

Selected disposal sites are described below. These sites were selected to illustrate unique disposal methods (i.e., mines), as well as subsurface disposal areas (e.g., landfills) where sampling and analysis is to be performed. Surface and subsurface disposal is included in the Schoolhouse Mesa sites in Finding 1. In addition to surface and landfill disposal, the two other disposal subcategories (surface impoundments and septic tanks/drainfields) are addressed in Section 3.4.4.3, Finding 1, in Category III. Examples of sites with high/medium potential for groundwater contamination are described in Section 3.4.2.1.

a) Classified-Waste Disposal Trenches (CEARP Site Number 2, Figure 4-8)

The Classified-Waste Disposal Trenches in Technical Area II have been used for subsurface disposal of wastes. Although the trenches are currently used for nonradiological waste disposal, past use for disposal of radiological and/or chemical waste is uncertain. The area has been used since approximately 1947, and no disposal records exist. All trenches are unlined, and some have metal pipes at the ends for markers. It is believed that trenches were used in the northern portion of the site while pits were used in the southern portion.

Data obtained as a result of sampling and analysis will be used to determine whether any hazardous materials have been disposed of at this site, and their general locations.

b) Mines (CEARP Site Number 28)

Numerous abandoned mine explorations are present in CTF in which unknown quantities of wastes, munitions, and debris have reportedly been disposed of. Cavin (1984) identified the following:

17 open shafts (4 off-base)
12 tunnels /adits
7 trenches
± 60 pits
4 explosive/radioactive materials disposal areas
8 mines (containing excavations of all types)

A radiometric study was conducted by SNLA personnel as a result of a 1981 helicopter aerial inspection by EG&G Energy Measurements Group. Eleven mineshafts identified as suspicious in the KAFB Installation Restoration Program report were scanned, and soil/debris samples collected as appropriate. No surface radiation levels significantly above background were detected. No entry was made into the mineshafts, however, and no attempt was made to determine the presence of any chemical contaminants.

c) Sites Identified by the Survey Team

In addition to the selected CEARP disposal sites described above, 13 potential disposal areas were identified by the Survey team. These disposal areas include those listed in Table 4-22 and described in Section 4.5.1.1. Note that the identification of these areas was based on a review of aerial photographs from the 1950s/1960s, an aerial review of the facility by helicopter during the Survey, and/or Survey surface reconnaissance activities. The ability for these areas to be further researched varies, as does their degree of severity. The

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areas are included, however, for further investigation, as available information does not warrant dismissal from consideration as potential sources of environmental contamination.

3. Potential for contamination from SNLA and ITRI inactive hazardous material handling and process areas. A total of 43 areas are recognized by the Survey team as having discharged hazardous materials to the environment, resulting in potential soil, surface-water, and/or groundwater contamination with chemical and/or radiological substances. This includes 22 areas identified in the CEARP Phase I Report as well as 21 areas identified during the Survey as potential hazardous material handling and process areas.

   The CEARP areas include 10 spill areas and 12 areas where hazardous materials have been discharged to the environment as a direct result of daily operations, as listed in Table H-1. An additional 19 spill areas were identified during the Survey, one of which is at ITRI. These areas are described in Table 4-20. Substances spilled include various oils [polychlorinated biphenyl (PCB), diesel, hydraulic, waste, mineral, etc.] as well as mercury and acids. Many of the additional spill areas seem to be a result of poor management practices during fuel oil tank refilling (i.e., tanks have overflowed or valves have leaked and contaminated the surrounding soils). Other substances possibly discharged to the environment include radioactively contaminated runoff/decontamination fluid, acidic wastewater, HE, solvents, and other unidentified substances. Representative CEARP hazardous material discharge areas (e.g., CEARP Sites Number 46 and 48), which have high/medium potential for groundwater contamination, are discussed in Section 3.4.2.1. The two additional hazardous material handling and process areas discovered during the Survey are listed in Table 4-22 and described in Section 4.5.1.1.

4. Potential for contamination from SNLA sites dismissed from further investigation by CEARP. Various areas of potential environmental contamination exist which will not be further examined by the CEARP program as potential environmental problems. The lack of examination of these areas will allow the continued presence of these potential environmental hazards and may pose a threat to soil, groundwater, and/or

surface water. Sites not being further examined by the CEARP program include (1) Lurance Canyon Burn Site Surface Impoundment and (2) Explosive-Contaminated Drains. These sites are described as follows.

a) Lurance Canyon Burn Site Surface Impoundment (CEARP Site Number 13, Figure 4-8)

The Lurance Canyon Burn Site Surface Impoundment was used presumably from the site's construction in the 1970s until 1985 to receive wastewater containing fuel (JP-4) from the burn site. During testing, weapons components were tested by subjecting them to fire from the ignited JP-4, which was floated on water. At the completion of testing, this water/fuel mixture was discharged to the unlined impoundment south of the road to evaporate and/or leach into the ground. This area is known to be in an area of shallow groundwater (depth to groundwater approximately 70 feet).

Sampling and analysis will be performed in this area as part of the surface-water Survey activities (see Section 3.3).

b) Explosive-Contaminated Drains (Buildings 9939, 9960, 9965, and 9967) (CEARP Site Number 106, Figure 4-9)

Buildings 9939, 9960, 9965, and 9967 have been involved with HE work as follows:

9939 - HE Machining
9960 - HE Machining
9965 - HE Assembly
9967 - Primacord construction, HE assembly

All four buildings are on septic tank systems. During the Survey, Building 9967 personnel stated that in the past, the inside walls and floor were washed down every 3-4 weeks into the septic tank system, a process that took 30-45 minutes at 6-10 gpm of water. This washwater may have contained residual HE contamination. At that time, three to four "shots" (tests) were performed per

week in that area. The building has not been washed down for the past 4-5 years. It is equipped with a floor drain that discharges into a concrete trough and then to the septic system. It is not known whether similar practices, and thus similar potential for environmental contamination, existed at the other facilities.

Building 9939 now performs tests using molten uranium oxide (70 percent depleted uranium oxide, 30 percent zirconium oxide) to assess its effects on eroding concrete. Tests using sodium have also been conducted to assess the effects of sodium on concrete. Broken crucibles, concrete, and firebrick are disposed of in three open trenches (3 feet wide x 20 feet long) on the site. The sodium tests were performed from approximately 1977 to 1983.

Building 9960 has been used exclusively for machining of explosives for approximately 27 years. Explosives are machined remotely under a cover of tempered water, which, along with explosive debris, is discharged directly to an explosive septic system. The septic tank is equipped with a bag for capturing explosive debris, and the bag is changed every 6 to 12 months. Interviews with facility employees indicate that the cotton bags (used prior to 1980) often failed, allowing debris to escape to the seepage pits. Building 9960 is located in an area near the Hubble Springs Fault, where groundwater may be found at less than 100 feet.

Sampling and analysis will determine the quantity of explosive materials within the seepage pits and in the soil column to a depth of 30 feet.

5. Potential for contamination from SNLA and ITRI inactive underground storage tanks. Thirty-four inactive USTs have been identified at SNLA (32) and ITRI (2) that have the potential to contaminate subsurface soils and/or groundwater. Of the 34 USTs, only 9 are known to have been removed. The remainder may be abandoned in place and may contain residual materials, including tritiated water, transformer oil, fuel oil, gasoline, wastes, washwater, and/or deionized water. The known capacities of these tanks range from 100 to 25,000 gallons, with some tanks being nearly 40 years old. No testing was ever performed to determine whether the tanks have leaked, and the integrity of the tanks (especially the older ones) is doubtful. No program is currently in place to

remove inactive USTs at SNLA or ITRI. These inactive USTs are described further in Table 4-21.

6. Potential for contamination from SNLA off-site testing and disposal. Testing and disposal by SNLA at off-site locations may result in the development of potential environmental problems (e.g., soil and/or groundwater contamination) at these locations. Lack of adequate control practices for off-site testing and disposal locations may result in SNLA becoming partially liable for environmental contamination from these facilities.

   SNLA has performed off-site testing since the 1940s at over 50 locations worldwide using hazardous chemical and/or radioactive materials. The extent of any environmental control measures and cleanup activities at these areas is not documented. Available information on off-site testing activities is compiled as Appendix L.

   SNLA may have contributed to potential environmental problems due to off-site disposal (i.e., disposal on property not under the control of SNLA). This includes potential disposal of hazardous material at three of KAFB's sanitary landfills (CEARP Site Number 29) as well as ultimate off-site disposal of equipment obtained from SNLA's salvage and scrap yards.

   During the Survey, a deficiency in screening of potentially hazardous and/or radiological substances from the on-site reclamation yards was evidenced by the presence of drums in the Technical Area III yards, and two old aircraft gauges containing radioisotopes in a Technical Area I yard. In addition, SNLA was recently named as a potentially responsible party (PRP) in a 104E notification letter requesting information regarding SNLA PCB transformer and capacitor reclamation/disposal associated with the Pagano Reclamation Yard.

7. Potential for contamination from ITRI inactive Lagoon 1. Past disposal of radioactively contaminated fecal matter from experimental animals and of possibly hazardous substances via laboratory drains at ITRI to (inactive) Lagoon 1 has resulted in potential subsurface soil and/or groundwater contamination.

Although the lagoon was lined with a synthetic liner, the integrity of the liner is questionable. The inactive lagoon may leach radioactive and/or toxic substances to the subsurface soils and /or groundwater, and possibly off the site to water supply wells.

An unknown quantity of liquid radioactive wastes was released into Lagoon 1 from 1962 until the construction of the hot ponds in 1966. After construction of the hot ponds, the lagoon was removed from service and covered with a layer of soil (approximately 1 foot). It has been inactive since 1970. Hazardous chemical wastes may also have been discharged to the lagoon over the years from the ITRI laboratories via sinks and drains, as separation of chemical and sanitary wastes was not performed. It is possible that detectable levels of hazardous chemical compounds may be present in the lagoon from laboratory drain discharge.

The types of wastes currently produced at ITRI are discussed in Section 4.1.1.3. No abnormal levels of radioactivity were found with a micro-R-meter over the soil cover layer on the lagoon during survey activities. However, the lagoon was closed and backfilled due to the detection of up to 150 mCi of cesium-137. Other radionuclides used at ITRI, which may be present in the lagoon, include plutonium-238 and 239, strontium-90, and americium-241. ITRI currently has no plans to further investigate or remediate this lagoon.

Data obtained from soil and vegetation sampling will be used to determine the presence/type of radionuclides in the soil column with a potential for subsequent groundwater contamination, and the presence of any hazardous chemical compounds in the lagoon.

4.5.2.4 Category IV

1. Noncompliance with DOE Order 5480. 14 of April 26, 1985. SNLA did not submit a Phase I Installation Assessment in compliance with DOE Headquarters Order 5480.14.

This DOE Order requires that a Phase I Installation Assessment be performed by April 26, 1986 "to evaluate site history and records, (and) to locate and

identify those inactive hazardous wastes disposal sites that may pose a risk to health, safety and the environment as a result of migration of hazardous substances." The Phase I Installation Assessment format is spelled out in detail and includes a physical inspection, the rating of nonradioactive sites with the CERCLA Hazard Ranking System (HRS), and the rating of radioactive sites with DOE's Modified Hazard Ranking System (MHRS). Failure to perform this assessment may result in the lack of identification of all potential inactive sites of environmental concern, such as the additional sites identified during the Survey effort. This lack of identification and subsequent investigation of these sites may result in unforeseen environmental damage as a result of past activities performed at SNLA.

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4. Interim Status Closure Plan, Post Closure Plan and Financial Requirements, September 1986, IT Corporation.
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6. Map - DOE and SNLA Permitted Sites at KAFB and Listing of permit numbers.
7. ENV Test Facilities, SNL, 1983.
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9. NV/AL MOU for TTR, KTF and NTS.
10. Groundwater Monitoring Waiver Request - Volumes I, II and III.
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16. Most recent RCRA Part A (4/22/87).
17. Emergency diesel generator air permit.
18. Open-burning air permits.
19. Enclosed-burning, visible emission variances.
20. Hammermill permit for visible emissions.
21. Documentations of NRC notification on >RQ releases.
22. 24" X 30" color photograph of Technical Area I.
23. 24" X 30" color photograph of Technical Area II.
24. 24" X 30" color photograph of Technical Area III and V.
25. 24" X 30" color photograph of Technical Area IV.
26. 24" X 30" color photograph of Technical Area V.
27. 24" X 30" color photograph of Solar Research Test Facility.
28. Index to Real Estate Permits.
29. Index to Albuquerque Operations Office (AL) Real Estate Related files
30. Index to Sandia National Laboratories Albuquerque Leases and Agreements.
31. Index to Tonopah Test Range Leases and Agreements.
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35. Buffer Zone Agreement DE-AC04-79AL100323 Modification #2, DOE/AL and Pueblo of Isleta.
36. Kirtland Air Force Base building under Permit to DOE.
37. SNLA Major and Minor Building Directory by ascending area/building.
38. SNLA directory storage buildings/structures/igloos (other than 6000 Igloo Area).
39. Large Scale Map showing building locations in Technical Areas I, II, and IV.
40. Large Scale Map showing building locations in Technical Area III.
41. Large Scale Map showing building locations in Technical Area V.
42. Memorandum on explosives storage bunkers and locations.
43. Post-Closure permit application (RCRA Landfill).
44. Tonopah Test Range Maps showing building locations, utilities and sewer lines.
45. Space Analsis Drawings showing floor plans and room utilizations of all Sandia - Albuquerque buildings.
46. SPCC Plan (FINAL).
47. Sanitized CEARP interview notes.
48. Rough draft SNLA Phase I Appendix describing SNLA facilities.
49. 7.5 Minute Topo Map of Los Griego Quadrangle.
50. 7.5 Minute Topo Map of Alameda Quadrangle.
51. 7.5 Minute Topo Map of Sandia Crest Quadrangle.
52. 7.5 Minute Topo Map of Sandia Park Quadrangle.
53. 7.5 Minute Topo Map of Albuquerque East Quadrangle (Contains Technical Area I and Technical Area II).
54. 7.5 Minute Topo Map of Albuquerque West Quadrangle.
55. 7.5 Minute Topo Map of Tijeras Quadrangle (Contains Lurance Canyon Site).
56. 7.5 Minute Topo Map of Sedillo Quadrangle.
57. 7.5 Minute Topo Map of Isleta Quadrangle.
58. 7.5 Minute Topo Map of Hubbell Spring Quadrangle (Contains Technical Areas III and V).
59. 7.5 Minute Topo Map of Mound Washington Quadrangle (Contains Coyote Canyon Site).
60. 7.5 Minute Topo Map of Escabosa Quadrangle.

61. Sanitary Sewer Maps of Technical Areas I, II, and IV.
62. Storm Sewer Maps of Technical Areas I, II, and IV.
63. Sanitary Sewer Maps of Technical Areas III, V, and Coyote Test Facility.
64. Remaining Sanitized CEARP Interview Notes.
65. CEARP Handwritten Notes from Review of SNLA UOR's.
66. Sanitary Sewer Maps of Live Fire Range and Security Force Experimentation Area (TSA).
67. Partial set of Exhaust Ventilation Systems drawings for stacks identified in Stack Survey.
68. Exhaust Ventilation Performance Survey (Hood Survey).
69. SNLA Wastewater Monitoring results submittal (to City to Albuquerque) (March-Map 1987).
70. SNLA Sanitary Sewer Analysis (June 1987).

Bendix Albuquerque Operations (BAO)

1. BOA Mechanical Drawings of Stacks and Vents.
2. SNLA Stack Survey.
3. BAO Unusual Occurrence Report.
4. Consolidated Utilities Diagram.

Inhalation Toxicology Research Institute

1. Analytical data for nonradioactive water pollutants for the lagoons, 1983-86. Analytical data for radionuclides in both water and sediment for the lagoons are given in the annual ITRI Environmental Reports, a copy of which was included in the original ITRI submittal.
2. Analytical data (Eberline lab reports) for radioactivity in the "hot ponds" for 1983-86.
3. Blueprints of site utilities:
   - Chilled Water Systems
   - Hot Water Heating Systems (2 sheets)
   - Compressed Air Piping (2 sheets)
   - LPG Systems (2 sheets)

   Blueprints describing the sewer systems, water distribution systems, and fuel oil distribution systems have already been provided in the original package.

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4. Listing of all exhausters at ITRI.
5. Blueprint of rooftop exhausters (not totally up-to-date).
6. Inventory of radionculides (receipts up-to-date, but use, physical decay, and discard are not up-to-date).
7. Design Analysis for Proposed New Sewage Lagoons (1974), describing design of existing lagoons 5 and 6.

PRELIMINARY

APPENDIX A

SURVEY PARTICIPANTS

PRELIMINARY

SANDIA NATIONAL LABORATORIES ALBUQUERQUE
SURVEY PARTICIPANTS
AUGUST 17 - SEPTEMBER 4, 1987

DOE

Team Leader	Vincent Fayne
Assistant Team Leader	Mark Smith

CONTRACT PERSONNEL

Coordinator	Kevin Walter (NUS Corporation)
Air	Robert Lanza (ICF Technology)
Radiation	Craig Roberts (NUS Corporation)
	James Berger (Oak Ridge Associated Universities)
QA/Toxics	John Connelly (NUS Corporation)
Surface Water	Kevin Walter (NUS Corporation)
	Vincent Fitzpatrick (Pacific Northwest Laboratories)
Waste Management	George Gartseff (NUS Corporation)
	Kim Green (ICF Technology)
Inactive Waste Sites	Mara Hlavacik (NUS Corporation)
Hydrogeology	Doug Riddle (NUS Corporation)
	Peter Feldhausen (NUS Corporation)

PRELIMINARY

APPENDIX C

SURVEY PLAN

PRELIMINARY

ENVIRONMENTAL SURVEY
SANDIA NATIONAL LABORATORIES
August 17 through September 4, 1987
Albuquerque, New Mexico

1.0 INTRODUCTION

The Environmental Survey is a one time baseline inventory of existing environmental information and environmental problems and risks at DOE operating facilities. The Survey will be conducted in accordance with the principles and procedures contained in the DOE Environmental Survey Manual.

The Survey is an internal management tool to aid the Secretary and Under Secretary in allocating resources for maintaining aggressive environmental programs and for mitigating environmental problems at DOE facilities.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey at the Sandia National Laboratories - Albuquerque (SNLA) will be managed by DOE Team Leader Vincent Fayne and Assistant Team Leader Mark Smith. John Cochran will serve as the Albuquerque Operations Office (AL) representative on the Survey team. Technical support will be provided by contractor personnel as follows:

Radiation:	Craig Roberts, NUS Corporation Jim Berger, Oak Ridge Associated Universities (ORAU)
Surface Water/ Drinking Water:	Kevin Walter, NUS Corporation Vincent Fitzpatrick, Pacific Northwest Laboratories (PNL)
Waste Management:	George Gartseff, NUS Corporation (Additional person to be named later)
Inactive Waste Sites/ Releases:	Mara Hlavacik, NUS Corporation

Hydrogeology:	Douglas Riddle, NUS Corporation Peter Feldhausen, NUS Corporation
QA/Toxic & Chemical Materials:	John Connelly, NUS Corporation
Air:	Robert Lanza, ICF Technology

2.1 Pre-Survey Activities

Survey team members began reviewing SNLA, Inhalation Toxicology & Research Institute (ITRI), Bendix Albuquerque Operations (BAO), and Tonopah Test Range (TTR) general environmental documents and reports in June 1987. Messrs. Fayne, Smith, Walter, Roberts, Lanza, and Ms. Hlavacik conducted a pre-Survey site visit on July 7-10 to gain a familiarization with key DOE staff and contractor personnel. The facility was toured, a cursory review of documents was completed, and data that were generated in response to an information request letter of June 9, 1987 was discussed. The letter proposed the Survey schedule and listed environmental information of interest to the Survey team for planning purposes.

A meeting was held with the City of Albuquerque Environmental Health Department; State of New Mexico Environmental Improvement Division, Health and Environment Department; U.S. Forest Service representatives; and Kirtland Air Force Base environmental staff on July 9, 1987 to review environmental issues and explain the purpose and scope of the Survey. These discussions identified issues of State and Federal governmental concern on which the Survey team will focus.

This Survey Plan will be transmitted to the Albuquerque Operations Office prior to the Survey.

2.2 On-Site Activities

The Survey will be conducted from August 17 through September 4, 1987 at SNLA, ITRI, BAO, and TTR. The agenda will be as shown in Table 1, with modifications as

appropriate to minimize disruption of site activities and to enhance the efficiency and effectiveness of the Survey.

At the end of Table 1, a listing of specific areas that each Survey team member will evaluate has been provided. This list is intended to assist AL and their contractors in identifying the most appropriate technical contacts who should be matched with individual Survey team members.

Interviews and consultations will be conducted with environmental, safety, operations, waste management, purchasing, and warehousing personnel, among others, in the course of the Survey. Also, the Survey team will continue their review of records and other documentation during the Survey. These records are identified in the "Records Required" sections of this plan. The Survey team has already reviewed some of these documents, so copies need not be made of documents previously submitted by AL and their contractors. However, the original documents should be readily available for reference during the on-site activities.

Tonopah Test Range (TTR) will be included in the facilities inspected during the on-site activities. TTR will be visited by four Survey team members on August 26 and 27. Those members visiting will cover multiple specialty areas as listed below.

Mark Smith:	Assistant Team Leader
Kevin Walter:	Surface Water
	Waste Management
	Toxic Substances/ Quality Assurance
Craig Roberts:	Radiation
	Air
Douglas Riddle:	Hydrogeology
	Inactive Waste Sites

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These team members will visit all the major buildings located on the range and tour the range by vehicle. Particular attention will be given to present operations as well as past testing activities.

2.3 Sampling and Analysis

Based on available site environmental information and the results of the on-site Survey activities, the sampling and analysis (S&A) phase of the Survey process will be implemented approximately 13 weeks after completion of the Survey. This effort will have a 8-12 week duration and will be conducted by the Idaho National Engineering Laboratory (INEL). Results of the S&A effort will be transmitted to the Survey Team Leader for incorporation into the Interim Report. If data are determined to be reportable pursuant to regulatory requirements, they will be immediately provided to AL.

2.4 Conclusions and Reporting on the Survey

A closeout briefing will be conducted during the third week of the Survey to describe the general conclusions of the on-site activities. Within 10-12 weeks of the on-site Survey team visit, an Environmental Survey Preliminary Report will be developed for SNLA. Within 10 weeks of the availability of the analytical results from the sampling and analysis phase of the Survey, an Interim Report will be completed.

PRELIMINARY

Table 1
SNLA On-Site Survey Agenda*

	Air	Radiation
Week 1 (8/17/87)		
Monday	All Day - Site Briefing/Tour	All Day - Site Briefing/Tour
Tuesday	(am) Site Tour (continued) (pm) Tech Area I - Steam Plant Emergency Power Generators (Bldg. 862) Plastic Shop (Bldg. 834) Glass Shop (Bldg. 864)	(am) Site Tour (continued) (pm) 1. & 2. Tech Area V-Radiation Facilities Effluent Monitoring & Control Waste Management Off-site Dose Calculations
Wednesday	All Day - Bendix Albuquerque Degreasing Operations Etching Operations Toxic Gases Use and Storage (arsine) Scrubbers, Solvent Capture System	(am) 1. Tech Area IV Particle Beam Fusion Facility Hermes III Saturn (pm) Strategic Defense Facility
Thursday	All Day - ITRI Plutonium Laboratories Beta Radionuclide Laboratories Toxic Metals (e.g., Be, Li)/Toxic Organics (e.g., benzene) Control Systems (HEPA Filters)	(am) 1.&2. ITRI-Inhalation Chambers Hot Cells Hot Ponds Solid Waste Treatment and Packaging Waste Lagoons Historic Record of Radioactive Material Receipts (pm) 1. Tech Area I - Hazardous Waste Repackaging and Storage facility and procedures (with Waste Management) 2. ITRI Stack Monitors and Sampling/Dose Calculation Methodology
Friday	(am) ITRI - Combustion Equipment (Boilers, Diesel Engines, Pathological Incinerator) (pm) Tech Area II - Explosive Test Laboratories Environmental Testing Lab (Bldg. 904) Safety Chemical Labs (Bldg. 906) Explosives Application Facility (Bldg. 907) Explosives Development Lab (Bldg. 915) Explosive Devices Building and Lab (Bldgs. 919, 922) Various Explosive Testing, Decontamination, Reclamation and Storage Facilities	All Day - 1. & 2. Tech Area I, Bldgs. 805, 819, 869, 891 Begin Survey of Contaminated Remote Areas

Table 1
SNLA On-Site Survey Agenda* (continued)

	Air	Radiation
Week 2 (8/24/87)		
Monday	All Day - Coyote Test Field Open Burn Areas Explosive Test Areas, Cable Facility Rocket/Missile Engine Tests Surface Contamination (depleted U) (Pb, Be)	All Day - 1. Tech Area III - LLW Disposal Facility On-Site Environmental Monitoring Stations 2. Manzano
Tuesday	All Day - Tech Area I - Microelectronics (Bldg. 870) Ceramics Lab (Bldg. 840) Painting/Coating Shop (Bldg. 841) Photofabrication Lab (Bldg. 841B) Foundry (Bldg. 841)	All Day - 1. Off-Site Environmental Monitoring Stations 2. Tech Area I - Stack Monitors
Wednesday	All Day - Tech Area I - Toxic Metal Machine Shop (Bldg. 869) Filter Cleaning Shop (Bldg. 877) High Bay Laboratory and Machine Shop (Bldg. 809) Solvent Spray Booths Process Development Labs Miscellaneous Laboratories and Shops	All Day - 1. Tonopah Test Range
Thursday	All Day - Tech Area III - Environmental Test Facility Explosive Test Facilities Open Burn Areas, Shock Tubes Thermal Treatment Facility Incinerator/Hammermill Rocket Engine Sled Tests Surface Contamination (Depleted U) (Pb, Be) Hydrazine Facility Sodium Facility Various Explosive Testing & Storage Facilities	All Day - 1. Tonopah Test Range
Friday	All Day - Miscellaneous Remote Areas, Tech Areas II & III, Coyote Test Field and Live Firing Range	All Day - 1.&2. ES&H Staff Background Dose Estimation Dose Modeling Methodology and Inputs

Table 1
SNLA On-Site Survey Agenda* (continued)

	Air	Radiation
Week 3 (8/31/87)		
Monday	All Day - Document Review, Follow up Areas	(am) 1.&2. Document Review (pm) 1.&2. Assistance in Survey of Media
Tuesday	All Day - Document Review, Follow up Areas, Sampling and Analysis Request Preparation	1.&2. Revisit Tech Areas as Needed
Wednesday	All Day - Sampling and Analysis Meeting	All Day - Sampling and Analysis Meeting
Thursday	All Day - Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders	All Day - 1.&2. Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders
Friday	Closeout Meeting	Closeout Meeting

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Table 1
SNLA On-Site Survey Agenda* (continued)

	Surface Water/Drinking Water	Waste Management
Week 1 (8/17/87)		
Monday	All Day - Site Briefing/Tour	All Day - Site Briefing/Tour
Tuesday	(am) Site Tour (continued) (pm) 1. Bendix (Bldg. 870) and Associated Wastewater Treatment Plant 2. Tech Area I-Steam Plant, Plastics, and Glass Shops	(am) Site Tour (continued) (pm) 1. Bendix (Bldg. 870) - Points of waste generation (with Surface Water). 2. Tech Area I - Steam Plant, Plastic and Glass Shops (with Air)
Wednesday	All Day - 1. ITRI - Points of Wastewater Generation, Disposal Lagoons, Hot Pond 2. ITRI - Points of Wastewater Generation, Disposal Lagoons, Hot Pond	(am) 1. ITRI - Points of Waste Generation, Disposal Lagoons, Hot Ponds (with Surface Water) 2. Tech Area I - Environmental Monitoring Overview (with QA/TSCA) (pm) 1. ITRI - Continuation of a.m. site visit 2. Tech Area I - Stores Management, Toxics Tracking (with QA/TSCA)
Thursday	All Day - 1.&2. Same as CERCLA; Madera Canyon, Lurance Canyon, New Aerial Cable Site, Operation Beaver Site, Coyote Spring and Picnic Area, & selected 9000 series buildings.	(am) 1 Eastern area test sites, including Coyote Blast Area, Madera Canyon, Lurance Canyon, and New Aerial Cable 2. Non-Hazardous Solid Waste Disposal Procedures (pm) 1. Continuation of a.m. eastern area test sites 2. Tech Area I - Hazardous Waste Repackaging and Storage facility and procedures (with Radiation)
Friday	(am) 1.&2. Same as CERCLA; sites south of Coyote Springs Road including the old aerial cable area and the storage and burn area, Life Sciences 1 Site, & selected 9000 series buildings. (pm) 1.&2. Tech Area II with Waste Management, including Buildings 904, 906, 907, 909A, 913, 915, 922, 935, and 942	(am) 1. Site south of Coyote Survey Road, including the Old Aerial Cable area and Bldg. 9990 2. Thunder Range Testing Sites (pm) 1. Tech Area II - Explosives Test Lab; Nonradioactive Classified Waste Disposal 2. Document Review

Table 1
SNLA On-Site Survey Agenda* (continued)

	Surface Water/Drinking Water	Waste Management
Week 2 (8/24/87)		
Monday	All Day - 1. Manzano Base (with Waste Management 1) 2. Coyote Test Field, including open burn areas, explosives test areas, rocket/missile engines, and Central Training Academy (with Waste Management 2)	All Day - 1. Manzano Base 2. Coyote Test Field, including open burn areas, explosives test areas, rocket/missile engines, and Central Training Academy
Tuesday	(am) 1.&2. Tech Area III, including Chemical Landfill, Bldgs. 6520, 6529, 6530, 6536, 6542, 6560, 6583, 6584, 6587, 6620, 6635, and 6734 (pm) 1. Document review 2. Tech Area IV - Bldgs. 6580, 6585, 6591, 6592, 6595, 6588, and 6590	(am) 1. Tech Area I - including Ceramics Lab, Painting/Coating Shop, Photofabrication Lab, Foundry (with Air) 2. Tech Area III - Chemical Waste Landfill, Thermal Treatment, Radioactive Waste Burial, and other points of waste generation (pm) 1. Tech Area I - continuation of a.m. site visits 2. Tech Area IV - including Bldgs. 6580, 6585, 6591, 6592, 6595, 6588, and 6590
Wednesday	All Day - 1. Tonopah Test Range 2. Tech Area I western area buildings that discharge directly to Tijeras sanitary waste line to Albuquerque POTW, sources of wastewater generation	All Day - 1. Document Review 2. Tech Area I - Western area bldgs. and points of waste generation
Thursday	All Day - 1. Tonopah Test Range 2. Tech Area I - Eastern area buildings, sources of wastewater generation	All Day - 2. Tech Area I - Eastern area bldgs. and points of waste generation
Friday	(am) 1.&2. Kirtland Air Force Base (KAFB) wastewater treatment plant, Tijeras Arroyo Golf Course irrigation system, KAFB water supply wells (pm) 1.&2. Tech Area IV Bldgs. 961, 981, 983, 983P, and 986	(am) 2. KAFB sanitary landfills (pm) 2. Tech Area IV - including Bldgs. 961, 981, 983, 983P, and 98

Table 1
SNLA On-Site Survey Agenda* (continued)

	Surface Water/Drinking Water	Waste Management
Week 3 (8/31/87)		
Monday	(am) 1.&2. Document Review (pm) Review storm drainage facilities, Tech Areas I, II, IV, driving/walking tour of outfalls into Tijeras Arroyo.	All Day - 2. Document Review and follow-up site visits
Tuesday	(am) 1.&2. Surface water sampling, review procedures and observe sampling wastewater discharges (pm) 1.&2. Followup inspections Tech Area I	(am) 2. Document Review and follow-up (pm) 2. Sampling and Analysis Request Preparation
Wednesday	All Day - 1.&2. Sampling and Analysis Meeting	All Day - 2. Sampling and Analysis Meeting
Thursday	All Day - 1. Coordination with Sampling Team Pre-Closeout Meetings with Survey Team Leaders (am) 2. Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders (pm) 2. Document Review	All Day - 2. Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders
Friday	Closeout Meeting	Closeout Meeting

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Table 1
SNLA On-Site Survey Agenda* (continued)

	Inactive Waste Sites/Releases (CERCLA)		Hydrogeology	
Week 1 (8/17/87)				
Monday	All Day -	Site Briefing/Tour	All Day -	Site Briefing/Tour
Tuesday	(am) (pm)	Site Briefing/Tour (continued) Bendix and Tech Area I (emphasis on historic disposal practices, spills, etc.)	(am) (pm)	Site Briefing/Tour (continued) 1. Bendix & Tech Area I (emphasis on historic disposal practices, spills, etc.) 2. Tour Chemical Waste Landfill and associated areas. Inspect monitoring wells and discuss results.
Wednesday	All Day -	Test Sites, etc. along Coyote Springs Road north to and including Coyote Blast Area, Test Site Road, CTA/LFR and LS-1.	All Day - (am) (pm)	1. Inspect inactive waste sites - Coyote Springs Road north to and including Coyote Blast Area, Test Site Road, CTA/LFR and LS-1. 2. Visit active disposal areas, e.g., sanitary landfills. Continue Chemical Waste Landfill inspections, as necessary. 2. Inspect, obtain construction, location and pumping history on municipal, site and domestic water supply wells.
Thursday	All Day -	TSA, Madera and Lurance Canyon Test sites, New Aerial Cable area and Operation Beaver site	All Day - All Day -	1. Inspect inactive waste sites - TSA, Madera Canyon Sites, Lurance Canyon sites, New Aerial Cable area and Operation Beaver site. 2. Visit Kirtland AFB - inspect inactive and active waste sites, review and obtain groundwater and hydrogeologic data
Friday	All Day -	Test & Disposal Sites south of Coyote Springs Road leading to and including the Old Aerial Cable area and the Storage and Burn area (west of the Laser Hill Fence)	All Day - All Day -	1. Inspect inactive waste sites - sites south of Coyote Springs Road leading to and including the Old Aerial Cable area and the Storage and Burn area (west of the Laser Hill Fence). 2 Document review, record searches.

Table 1
SNLA On-Site Survey Agenda* (continued)

	Inactive Waste Sites/Releases (CERCLA)	Hydrogeology
Week 2 (8/24/87)		
Monday	All Day - ITRI Inactive Sewage Lagoon, Hot Ponds, other inactive waste sites; & Thunder Range	All Day - 1. Inspection of all waste sites associated with Manzano Base. All Day - 2. Inspection of all disposal areas at ITRI & Thunder Range.
Tuesday	All Day - Continuation of Monday inspections, Target Rd Test sites, etc. 1Pm - review aerial photos	All Day - 1. Document review, record searches All Day - 2. Continue to inspect inactive waste sites at ITRI & Thunder Range; plus Target Road sites
Wednesday	All Day - Additional Tech Area I inspections; Tech Area II sites (Radioactive Burial Site, Disposal Trenches & Pits, Firing Sites, etc.) & sites outside of Tech Area IV (Disposal Trenches, Landfill/Open Dump, Oil Surface Impoundments, etc.)	All Day - 1. Tonopah Test Range All Day - 2. Continue to inspect inactive waste sites in Tech Area I plus Tech Area II and the sites outside of Tech Area IV
Thursday	All Day - Sites along Pennsylvania Ave. south to and including Tech Areas III (Spill Areas, Storage & Salvage Yards, Explosive Test Area, etc.) and V (Spill Areas, Radioactive Surface Impoundments and Drainfield, etc.)	All Day - 1. Tonopah Test Range All Day - 2. Inspect inactive wastes sites along Pennsylvania Ave. south to and including Tech Areas III and V
Friday	All Day - Continuation of Thursday inspections, plus sites west of Lovelace Road (Bldgs. 9920, 9940, etc.)	All Day - 1. Inspect inactive waste sites - continuation of Thursday inspections, plus sites west of Lovelace Road. All Day - 2. Observe sampling of monitoring and drinking water wells.

Table 1
SNLA On-Site Survey Agenda* (continued)

	Inactive Waste Sites/Releases (CERCLA)	Hydrogeology
Week 3 (8/31/87)		
Monday	All Day - Document and historical aerial photograph review	All Day - 1. Perimeter inspections, adjacent lands, arroyos, etc. (am) 2. Document review (pm) 2. Review of local well records
Tuesday	(am) Follow up inspections and interviews (pm) Sampling and Analysis Request Preparation	All Day - 1. &2. Sampling and Analysis Request Preparation
Wednesday	All Day - Sampling and Analysis Meeting	All Day - 1. & 2. Sampling and Analysis Meeting
Thursday	All Day - Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders Follow-up inspections as required	All Day - 1. & 2. Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders Follow-up inspections as required
Friday	Closeout Meeting	Closeout Meeting

PRELIMINARY

Table 1
SNLA On-Site Survey Agenda* (continued)

			QA/TSCA
Week 1 (8/17/87)			
Monday	All Day -	1.	Site Briefing/Tour
Tuesday	(am)		Site Tour (continued)
	(pm)	1.	Tech Area I, EH&S Office - Chemical and toxic material overview specialist meeting (including PCBs, asbestos, pesticides). Discussion with EH&S staff on policies, procedures, locations, users, and contacts. Obtain copies. Quality Assurance (QA) overview (regarding environmental program, sampling, analysis, data handling, and report preparation). Sampling schedule and contacts. Obtain copies of QA plans for sampling plus on-site and off-site labs.
Wednesday	(am)	1.	Tech Area I, Bldg. 860, 869 - Environmental Laboratory Overview. Obtain copies of procedures and QA manuals.
	(pm)	1.	Tech Area I, Bldg. 894, 879 - Discussion with Stores Management. Overview of tracking of toxics (requisition, purchasing, receiving, storage, issue, and disposal).
	All Day -	2.	Tech Area V, Bldgs. 6594, 6586, 6593A, B, C; storage bldgs. - Inspect chemical storage areas, PCB equipment. Check on asbestos and pesticide use. Check on effluent/env. sampling. Obtain copy of lab QA plan and procedures.
Thursday	(am)	1.	Tech Area I, Bldg. 870 (BAO) - Review toxic chemical, PCB, asbestos, pesticide use at BAO. Review env. monitoring (wastewater). Obtain copies of policies and related procedures. Inspect chemical storage areas (shed and bulk storage at effluent neutralization unit).
	(pm)	1.	Bldgs. 9200, 9217 (ITRI) - Review toxic chemical, PCB, asbestos, pesticide use at ITRI. Review env. monitoring. Obtain copies of policies and related procedures. Inspect chemical storage areas (9200, 9217) and PCB transformers.
Friday	All Day -	1.	Tech Area I, Bldg. 834, 835, 839, 840, 841, 844, 845, 846, 848, 894, 879 - Inspect chemical storage areas, PCB equipment. Check on asbestos removal/condition, pesticide use.

Table 1
SNLA On-Site Survey Agenda* (continued)

			QA/TSCA
Week 2 (8/24/87)			
Monday	All Day -	1.	Tech Area I, Bldg. 860, 869 - Inspect Environmental Labs. Discuss procedures. Observe operations. Tech Area II, Bldgs. 920, 904, 906, 921, 942, 907, 919, 940 - Inspect chemical storage areas, PCB equipment. Check on asbestos and pesticide use.
		2.	Manzano
Tuesday	All Day -	1.	Tech Area III, Bldgs. 6587, 6501, 6502,6505, 6540, 6542, 6721, 6715, 6750, 6753, 6924, 6630, 6930, 6932; chemical dump - Inspect chemical storage areas, PCB equipment. Check on asbestos and pesticide use.
Wednesday	(am)	1.	Tech Area IV, Bldg. 960, 961, 970, 980 - Inspect chemical storage areas, PCB equipment. Check on asbestos condition/removal and pesticide use.
		2.	Tech Area V, Bldg. 6586 - Inspect low-level counting lab. Observe operations. Follow up on any chemical, PCB, asbestos or pesticide items in Area V.
	(pm)	1.	Followup/document review
		2.	Followup/document review
Thursday	(am)	1.	Various Areas - Observe any environmental sampling (this period can be switched as necessary).
	(pm)	1.	Tech Area I, Bldgs. 860, 869 - Discuss and observe operation in environmental lab.
	All Day -	2.	Various Remote Areas - Coyote Canyon, Madera Canyon, Lurance Canyon; New Aerial Cable, Old Aerial Cable, Fact sites; Thunder Range - Check for chemical storage, PCBs and asbestos.
Friday	All Day -	1.	Tech Area I - Inspect Transformers - other PCB equipment

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Table 1
SNLA On-Site Survey Agenda* (continued)

	QA/TSCA
Week 3 (8/31/87)	
Monday	(am) 1. Document review 2. Document review (pm) 1. Tech Area I, Bldg. 802, 805, 806, 807, 808, 828, 893 Inspect Chemical Storage Areas 2. Various Areas - Followup
Tuesday	(am) 1. Various Areas - Followup (pm) 1. Sampling and Analysis Request Preparation. All Day - 2. Various Areas - Followup on env. monitoring/counting labs and TSCA QA items. Document review/assist in preparation of S&A requests.
Wednesday	All Day - 1. Sampling and Analysis Meeting.
Thursday	All Day - 1. Coordination with Sampling Team Pre-Closeout Meeting with Survey Team Leaders Various Areas - Followup inspection and records review.
Friday	Closeout Meeting

*Note: The following specialists are uncleared: QA/TSCA #1, Hydrogeology #2, Waste Management #2, and the Inactive Waste Sites specialist. All others are Q-cleared.

UNAPPROVED

TABLE 1 (Continued)

SANDIA NATIONAL LABORATORIES ON-SITE SURVEY AREAS OF INTEREST FOR TECHNICAL SPECIALISTS

WASTE MANAGEMENT	
G. Gartseff (Additional person to be named later)	Hazardous Waste Non-Hazardous Solid Waste Underground Storage Tanks RCRA/Solid Waste Permits Mixed Waste
RADIATION	
C. Roberts J. Berger	Radioactive Emissions and Effluents Source Controls and Monitoring Environmental Monitoring - Rad Laboratory Analysis - Rad Radioactive Waste
AIR	
R. Lanza	Meteorology Local Air Quality Data Emission Sources, Controls and Monitoring Environmental Monitoring - Air Air Permits and Air Emissions Inventory Fugitive Airborne Emissions Accidental Releases to Air
SURFACE WATER	
K. Walter V. Fitzpatrick	Effluent Sources Wastewater (Process and Sanitary Treatment Facilities) Cooling Water System Drinking Water Distribution Stormwater Management Spill Prevention, Control and Countermeasure Plan
HYDROGEOLOGY	
D. Riddle P. Feldhausen	Waste Storage and Disposal Sites (Past and Active) Spill/Accident Locations Regional Geology and Groundwater Well Inventory and Construction Groundwater Monitoring Program and Studies
INACTIVE WASTE SITES	
M. Hlavacik D. Riddle	Characterization Studies Remediation Work Past Waste Site Locations Spill/Accident Locations Former Production Locations Former Test Site Locations
QUALITY ASSURANCE	
J. Connelly J. Berger	Environmental Sampling Program Environmental Analytical Program Data Management and Handling QA Program Overview
TOXIC AND CHEMICALS MATERIALS	
J. Connelly	Process Chemicals and Substances Inventory Asbestos Removal and Disposal PCBs In-Service, Storage, and Disposal Pesticide Use, Storage, and Disposal Warehousing and Storage Tanks for Process Chemicals Warehousing and Storage of Explosives/Reactive Materials

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3.0 AIR

3.1 Issue Identification

The radioactive and toxic and criteria pollutant air-related Survey activities involve an assessment of the facility-wide air emissions, emissions controls and monitoring equipment, and the acquisition and processing of ambient air monitoring data. Areas of investigation will include process and laboratory emissions of radionuclides including plutonium, uranium, tritium, iodine, krypton-85, carbon-14, and argon-41. Emissions of criteria pollutants (e.g., lead, volatile hydrocarbons (VOCs), nitrogen oxides and sulfur dioxide), toxic metals (e.g., arsenic, beryllium), gases (e.g., arsine), and organics (e.g., benzene), explosive materials from processes and laboratories, and emissions from fuel burning equipment will also be investigated. Operational and procedural practices associated with emission controls and monitoring equipment will be evaluated. Fugitive sources of radioactive and toxic and criteria pollutant particulate and gaseous emissions, including emissions of fugitive dust from areas of surface contamination and emissions of criteria and toxic air pollutants from explosive field tests, chemical and waste storage/handling areas, open burning, and rocket motor firing will be investigated.

The general approach to the Survey will involve a review of existing environmental reports, chemical and radionuclide inventories, operating procedures, ventilation diagrams, stack monitoring reports, radioactive effluent reports, and other relevant documents to identify significant process, laboratory and fugitive sources of air emissions. Following the document review will be the physical inspection of major processes, control and monitoring equipment, and potential fugitive sources. The Survey will identify potential and actual air contaminant emissions from major processes, laboratories and fugitive sources at the facility, identify and evaluate the existing control equipment for the air contaminants, and assess the potential for environmental problems from the emissions.

The radiological air monitoring system assessment will involve inspection of the ambient air samplers and stack monitors, and review of data acquisition, documentation and procedures, calibration procedures, data validation, and processing. The primary emphasis of the monitoring program review will be to

determine the environmental impact of plant operations and to evaluate the collected data.

Several areas for specific investigation have been identified during a review of available documentation:

- Process, laboratory and fugitive airborne releases of plutonium, uranium, tritium, iodine, krypton-85, argon-41 and carbon-14 from Sandia, ITRI, and Bendix facilities in Tech Areas I, IV, and V, and other areas, including potential for accidental releases and evaporation from storage/disposal areas;

- Potential emissions of explosive materials from the explosive test facility (Tech Area II), explosives storage areas (site wide) and other areas, including both laboratory and fugitive emissions;

- Emissions of toxic metals, gases and organics from Sandia, ITRI, and Bendix facilities in Tech Areas I and II and other areas, including process and laboratory emissions;

- Fugitive emissions of toxic metals, radionuclides, criteria pollutants and/or toxic gases from rocket motor firings, explosive field tests and areas of surface contamination in Tech Area III, the Coyote Test Field, and other remote areas.

- Potential/actual emissions of toxic and criteria air pollutants from unpermitted and/or characterized sources.

3.2 Records Required

The following records should be available for on-site review:

- Source and emissions inventories for both radiological and criteria and toxic air pollutant process, laboratory, and fugitive emission sources and chemical inventory lists;

- Types and quantities of explosive materials presently and historically used at the facility;

- Types and quantities of rocket engines presently and historically used at the facility;

- Tritium, plutonium-238/239, krypton-85, iodine and carbon-14 emissions monitoring data, and handling/control system descriptions;

- Local ambient air quality data for radionuclides;

- Identification of significant fugitive/accidental airborne releases of radionuclides and toxic and criteria air pollutants;

- Reports on accidental releases/unusual occurrences relating to radiological and criteria and toxic airborne releases;

- Ambient air dispersion calculations and dose calculations;

- Descriptive documentation on existing and proposed add-on emission controls;

- Descriptive documentation on existing and proposed ventilation systems;

- Operating, testing, and maintenance procedures for control equipment;

- Correspondence between Albuquerque Operations Office and regulatory agencies related to air/radiological issues;

- Radiological ambient air monitoring program procedures/documentation;

  - Sample collection procedures.
  - Calibration procedures and records.
  - Laboratory procedures and quality assurance.
  - Ambient air monitoring data.

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- Radiological stack monitoring/sampling program procedures/ documentation; and

  - Calibration procedures and records.
  - Stack monitoring/sampling data.
  - Laboratory procedures and quality assurance.

- Action description memoranda, regulatory variances, etc. for activities (e.g., open burning, sled tests) which release radiological, criteria or toxic emissions to the air.

4.0 RADIATION

4.1 Issue Identification

The radiation related Survey activities involve an assessment of the facility-wide sources of exposure of persons residing in the environs. The activities include identification of all such sources, and examination of the measures in place to measure and control radiation doses. Areas of investigation will include the process and laboratory emissions of radionuclides, the resuspension of soil contamination, and the migration into the groundwater of radioactive materials from previous waste disposal operations. The reliability and confidence level of the estimates of the radiation dose received by persons off-site will be examined with particular attention being given to the exposure pathways and the cumulative effect of multiple facilities and sources.

Several specific areas of investigation have been identified during a review of available documentation. These include:

- Control and measurement of airborne radioactive materials at the radiation facilities in Tech Area V;

- Control and measurement of tritium at the accelerator, fusion and strategic defense facilities in Tech Area IV;

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- Control and measurement of various radionuclides used in animal experiments at the Inhalation Toxicology and Research Institute (ITRI) and in the processes carried out in Tech Area I;

- Current and past waste management practices at ITRI;

- Identification of soil contaminated primarily with depleted uranium;

- Impact of practices for the disposal of low-level radioactive solid waste with special attention given to the migration of radionuclides from the disposal facilities in Tech Area III;

- Environmental monitoring activities including examination of on-site and off-site monitoring locations; and

- Review of dose modeling and input parameters.

4.2 Records Required

The following records should be available in addition to those already supplied.

- List of stacks and vents from which radioactive materials can be released.

- Description of stack monitors.

- Dose calculations for each Tech Area or release point (e.g., ITRI and BAO).

- Legible (preferably original) copy of E.G.&G. Aerial Radiation Measurements.

- Inventory of radioactive materials received during the last five to ten years. (Amounts of classified materials need not be specified; the intent is to determine what kind of radioactive materials have been received by the various facilities).

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5.0 SURFACE WATER/DRINKING WATER

5.1 Issue Identification

The Survey will concentrate on areas of acknowledged concern including three separate subgroups of wastewater disposal. These subgroups include: discharge of sanitary and industrial process wastewater to the Kirtland Air Force Base (KAFB) wastewater treatment plant and ultimately the City of Albuquerque publicly owned treatment works (POTW); discharge of sanitary and possibly industrial wastewaters to the ground via septic tank and tile field disposal systems; and discharge to Tijeras Arroyo (and other surface drainage courses) of stormwater which potentially is contaminated by overland flow through areas of known or unknown toxic contamination or by admixture of industrial process discharge into stormwater disposal drains.

The first subgroup of wastewater disposal to one or both of the treatment plants includes Tech Areas I and IV. Related areas to be investigated include the disposal of sludge from the city POTW on the mesa south of KAFB. The second subgroup of wastewater disposal to a septic system includes the more remote areas of SNLA; Tech Areas II, III, & V; Coyote Test Field; and the eastern portions of KAFB on which Sandia conducts operations. The final subgroup of stormwater disposal involves all areas of SNLA, but of special concern are any portions of Tech Areas I, II and IV that drain into Tijeras Arroyo. In reviewing all of these subgroups of wastewater disposal, emphasis will be placed on current, as well as historical, sources of wastewater generated to evaluate toxic and radiologic contaminants discharged and their fate.

In addition the Survey will review the effect of prior operations on naturally occurring surface waters (springs & seeps) such as Coyote Springs, Sol se Mete Spring, and Lurance Canyon Springs. These evaluations will be performed in conjunction with the inactive wastes sites and hydrogeology portions of the Survey.

Another area of investigation will be the adequacy of spill prevention, control, and countermeasure procedures for above ground storage of petroleum products and hazardous substances that have the potential to enter surface water (directly or via sewers) if spills or tank rupture occur.

Several areas for specific investigation have been identified during a review of available documents:

- KAFB wastewater treatment sludge; potential for containing toxic substances from SNLA, sludge analyses and ultimate handling.

- Cross connections between industrial, sanitary, and stormwater sewer systems, specifically discharge of industrial wastewater into stormwater discharges leading to Tijeras Arroyo.

- Inadvertant current or past discharge of toxic or hazardous materials to subsurface disposal systems, including septic tank and tile fields.

- Release of biocides to wastewater systems via cooling tower blowdown.

- Discharge of toxic and hazardous materials, including radionuclides, into the lagoons and hot ponds at the Inhalation Toxicology Research Institute (ITRI).

5.2 Records Required

Records that should be available during the visit to obtain information include:

- Water distribution and sewer plans (current and historical) for all areas.

- Information submitted to the city POTW and KAFB regarding wastewater, specifically including sampling and analysis data.

- Analytical data on influent process water in all areas and on any wells, springs or seeps on SNLA property that is available.

- Past wastewater treatability or characterization studies.

- Spill prevention, control, and countermeasure (SPCC) plans, data used in their preparation, and any notifications or reports on past spills.

- Wastewater sampling data for ITRI.
- Water balance calculations and drawings, and records of water consumption.
- Accidental release or unusual occurrence reports that may relate to potential past discharges to the wastewater systems or stormwater system.
- List and drawings of current and abandoned septic tanks and tile fields.
- Operational procedures for Bldg. 870 (current and prior to installation of the solvent waste tank).
- Summary of major building missions over time. Current missions do not necessarily reflect activities conducted in the 1950s, 1960s and 1970s.
- History of modifications to Bldgs. 840 and 841.
- Drawing on Classified Waste Incinerator.
- Detailed topographic maps of all firing and test areas.
- Historical overview of water treatment for steam plant.
- Identification of soil sample locations in the Tijeras Arroyo drainage area.
- History of Coyote Springs water analysis.

6.0 WASTE MANAGEMENT

6.1 Issue Identification

The waste management review will place emphasis on the identification of hazardous/non-hazardous waste management activities that have potential for an adverse environmental effect. The June 1987 Draft Phase I CEARP Report identified 32 potential RCRA hazardous waste sites. Of these, 10 were found to be "positive" for the presence of RCRA hazardous wastes, and 19 were labelled "uncertain." Of

general concern are waste process chemicals from the various laboratories and technical support shops, waste chemicals from the research laboratories, and scrap materials and byproducts from test and evaluation activities. The greatest quantities of hazardous wastes are generated from the development laboratories and support shops in Tech Area I, including the Bendix Albuquerque Operations. Other areas of interest include the labs, explosives testing areas, and waste disposal areas in Tech Area II; the chemical landfill and thermal treatment facility in Tech Area III; and the possible presence of hazardous wastes (including toxic metals) and mixed wastes in Tech Areas IV, V, and the Coyote Test Field. The Survey will assess whether the SNLA hazardous/non-hazardous waste management activities are conducted to prevent unauthorized releases to the environment. Appropriate sections of the Part B application will be reviewed for completeness. In addition, any operating and permitting issues for hazardous waste treatment, storage, and disposal (TSD) units will be identified. Solid waste management units (SWMUs) will also be identified and assessed as appropriate.

The waste management review will be coordinated with the air, toxic and chemical materials, and the surface water/drinking water investigations to help identify possible releases. The SNLA facilities will be examined to determine hazardous/non-hazardous waste generation points, and to characterize current and past waste disposal practices.

Several general areas for investigation have been identified during a review of available documentation:

- Underground storage tanks;
- Waste oil management practices;
- Chemical and sanitary landfill operations;
- Hazardous waste disposal procedures and documentation;
- Solid waste disposal procedures and waste segregation practices;
- Storage and disposition of scrap/salvage materials;

- Photographic processing laboratories waste handling;
- Motor pool facilities waste storage and disposal; and
- Waste accumulation times at control and satellite collection points.

6.2 Records Required

The following records should be available for on-site review;

- Part B permit application (records and documentation);
- Inspection documentation (State and Federal);
- Groundwater monitoring, sampling, and analytical documentation relating to RCRA;
- Waste inventory documentation, and reports on waste generation;
- Enforcement action documentation; and
- Internal documentation relating to waste TSD or generation inspection.

7.0 INACTIVE WASTE SITES/RELEASES

7.1 Issue Identification

The inactive waste sites/releases specialty area review will identify environmental problems associated with the historical handling, storage and disposal of hazardous and radioactive substances at the site. The Survey will focus on current and future environmental problems related to past land use and disposal practices, and past spills/releases. The review will evaluate information developed in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) regulations.

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Information on potential or documented disposal sites will be examined to better assess environmental contamination from inactive waste sites. Since groundwater contamination is often a result of buried waste, the CERCLA portion of the Survey effort will be closely coordinated with the hydrogeological portion of the Survey to document these waste sources. Furthermore, past wastewater treatment activities at the site will be evaluated to aid in determining the source(s) of any present or potential environmental contamination. Information pertaining to stormwater and surface drainage or unknown/unpermitted subsurface disposal of waste that may form a migration pathway will be obtained. A determination will also be made of the influence of past handling and disposal of hazardous and mixed chemicals/wastes with regard to the existence of undocumented inactive waste sites/releases.

Several areas of concern have been identified during a review of available documentation. Major areas of investigation include:

- Radioactive Burial Site (Tech Area II)
- Radioactive Surface Impoundments (Tech Area V)
- Radioactive Drainfield (Tech Area V)
- Gas Cylinder Disposal Pit (Building 9966)
- Gas Cylinder Disposal Pit (Arroyo del Coyote)
- Open Dump (Coyote Canyon Blast Area)
- Burial Mounds (North of Pendulum Site)
- Burial Site/Open Dump (Lurance Canyon)
- Burial Site (Building 9920)
- Scrap Yards/Open Dumps (Thunder Range)

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- Spill Areas
- Potentially Contaminated Test Areas (Firing Site, Bldg. 9956; Coyote Canyon Blast Area; Bunker Area, Pendulum Site)
- Chemical Pits (old landfill and lagoon, Tech Area III)
- ITRI Inactive Sewage Lagoon
- Life Sciences Division Site (Sheep Research Lab, LS-1)
- Manzano Base
- Tonopah Test Range, NV

Other possible areas of investigation include:

- Existing and former facilities that have handled hazardous, mixed, and low-level radioactive wastes;
- Areas where past undocumented disposal and/or weapons testing may have occurred;
- Areas where leaks, spills, or inadvertent disposal may have created ongoing sources of contamination of traceable plumes of surface or subsurface contamination; and
- Additional past waste disposal areas not previously identified.

Information reviewed in the Comprehensive Environmental Assessment and Response Program (CEARP) Draft Phase I Report for the site indicated that facility activities were conducted at numerous off-site locations (test areas, etc.). Information on these facilities should be made available to ensure that any potential CERCLA issues are addressed for these locations.

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7.2 Records Required

The following records should be available for on-site review:

- Phase I Installation Assessment Report for SNLA as per DOE CERCLA Order 5480.14, as well as any addenda prepared as a result of newly discovered sites, and the documentation used to prepare these reports;
- Past and ongoing CERCLA related studies and remediation reports;
- Records of historical production facilities, locations, operations, processes and substances used, and methods of materials and waste handling and disposal;
- Historical files on past site operations and processes, substances used, and methods of handling and disposal;
- Description and location maps of all inactive waste management facilities, including buried tanks (USTs and septic) and structures;
- Descriptions and notifications (as per CERCLA Section 103) of inactive waste sites and potential areas of contamination;
- Listing of inactive areas used for hazardous substances use, storage, receiving and shipping, and disposal;
- Descriptions of corrective actions;
- Historical standard operating procedures (SOPs) regarding management of hazardous substances, disposal areas, and storage areas;
- Hazardous substances inventories;
- Waste generation reports and characterization studies;
- Waste management plans (past and current);

- Files on past off-site waste handling and disposal (period of use, waste types and quantities, etc.);

- Historical aerial photographs and site plans that may provide clues to undocumented disposal;

- Descriptions and notification of spills/releases (Unusual Occurrence Reports and Minor Release Reports); and

- Records of facility expansion and building rubble disposal.

8.0 HYDROGEOLOGY

8.1 Issue Identification

The preliminary review of documentation on the SNLA area indicates that little monitoring of groundwater occurs in relation to waste sites. This fact is of particular concern in areas east of the Hubble Spring Fault, where the groundwater is at relatively shallow depths (50 to 100 feet deep). Routine monitoring of wells associated with the Chemical Disposal Area has only been active for the last few years. Significant levels of contaminants have been discovered in the soil beneath this facility. Additional inactive waste sites have the potential to contaminate groundwater. This is especially true where liquid wastes have been discharged to the ground.

Of additional concern for the Survey is the relationship between the SNLA area and adjacent drinking water wells. The City of Albuquerque has major pumping centers nearby. Kirtland Air Force Base also derives drinking water from wells.

Preliminary data has also been reviewed for the Tonopah Test Range. These data also indicate potential for groundwater contamination as a result of TTR activities.

A general review of data collection efforts that have taken place will be required to determine the usefulness, for the purposes of the Survey, of existing information. This will include a review of sampling procedures, chain-of-custody and quality assurance/quality control procedures and compatibility of data from various

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sources. The reliability, construction, and placement of wells used for groundwater monitoring will be examined, and interviews with site personnel will be conducted.

Several specific areas of investigation have been identified during a review of available documentation. These include:

- Inactive waste sites, in particular those where groundwater is at a shallow depth;
- Areas of current and historic liquid discharges to the ground surface;
- Groundwater use in the vicinity of the site; and
- Current status of groundwater monitoring at the Chemical Waste Landfill.

8.2 Records Required

The following documents should be available for on-site review:

- New and recent data and reports on groundwater quality;
- Off-site well inventories which include location, depth, size and owner of the well;
- Well sampling procedures;
- Well installation reports, boring logs and as-built drawings;
- Groundwater work plans; and
- Historic memos, aerial photographs, topographic maps, etc.

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9.0 QUALITY ASSURANCE (QA)

9.1 Issue Identification

The quality assurance portion of the environmental program will involve an evaluation of environmental sampling and analytical capabilities at SNLA, BAO, and ITRI in order to determine the degree to which site environmental data can be utilized by the Survey. This review will also influence decisions on the environmental data gaps and where the Survey will conduct sampling and analysis. The QA aspects of the environmental sampling program performed by the Environmental Health and Safety (EH&S) personnel will be evaluated. QA programs for on-site environmental laboratories (and off-site laboratories) will be reviewed.

The intent of this review will be to identify the quality assurance procedures for obtaining process effluent and environmental samples, performing the analytical work to identify pollutants, and the handling and reporting of data. All aspects of the QA program relating to environmental monitoring and analysis at SNLA, BAO, and ITRI will be reviewed.

The environmental sampling performed by the EH&S personnel will be evaluated by reviewing procedures, data handling, records, and logbooks. Field techniques will be observed to determine actual sampling practices.

The analytical laboratories will be reviewed through an evaluation of procedures and records, and observation of laboratory operations. Off-site laboratories will be evaluated by reviewing documents. No visits to off-site laboratories are anticipated for these operations.

Several areas for specific investigation have been identified during a review of available documentation:

- Operator and technician training;
- Equipment and instrument calibration /maintenance;
- Precision and accuracy studies;

- Blank, split, and spiked sample analyses;
- Sample handling and chain-of-custody procedures;
- Data reduction and validation;
- Data reporting and documentation; and
- Calculation and logbook reviews.

9.2 Records Required

The following records should be available for on-site review:

- Analytical laboratory and environmental sampling quality assurance plans and manuals;
- QA audits of laboratory and sampling programs;
- Reports for precision and accuracy;
- External performance standard results (e.g., DOE Environmental Measurements Laboratory and other outside agencies);
- Laboratory and sampling procedures manuals;
- Operator and technician training records (laboratory and sampling);
- Instrument maintenance and calibration records (laboratory and sampling); and
- Laboratory and sampling calculations, workbooks, and standard data reporting forms.

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10.0 TOXIC AND CHEMICAL MATERIALS-TSCA

10.1 Issue Identification

The toxic and chemical materials review will address the raw materials and process chemicals used at SNLA. The use, handling, and disposal of Polychlorinated Biphenyls (PCBs), asbestos, and pesticides will also be within the scope of this effort.

Several areas for specific investigation have been identified during a review of available documentation:

- All toxic materials purchased, used, or manufactured, and the tracking, control, and management of these substances;
- Records of toxic materials usage to assess the potential for entering effluent streams;
- An inventory of PCB-contaminated electrical equipment in use;
- The condition of PCB equipment, its potential for leakage, and the quantity of contaminated fluids;
- Obsolete or used PCB items and contaminated items in storage for proper packaging, adequate storage protection requirements, and inventory controls;
- Procedures to be used to remove and dispose of the transformers with PCBs;
- Procedures for PCB analysis, removal, handling,and disposal;
- Disposal practices for current and past inventories to determine the method(s) of disposal and location(s) of disposal sites;
- The presence of asbestos building materials and insulation at the site, and specifications, plans, and procedures for removal, handling and disposal projects;

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- Training and certification of asbestos workers; and
- The usage of pesticides on the site, as well as personnel training, application records, and storage and disposal practices.

10.2 Records Required

The following records should be available for on-site review:

- Inventory of toxic materials and purchasing records;
- Toxic materials labeling and tracking system;
- Procedures for handling, control, and management of toxic materials;
- Annual PCB status reports;
- Inventory of in-service PCB-contaminated equipment and fluids;
- PCB handling, storage, and disposal procedures;
- Storage records of PCB items;
- Disposal records for PCB items;
- Asbestos handling, removal, and disposal procedures;
- Locations of buildings containing asbestos;
- Asbestos disposal records, including method and location of disposal;
- Inventory of pesticides;

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- Standard operating procedures and disposal records for the handling and storage of pesticides; and

- Records of training for personnel handling/applying pesticides.

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APPENDIX D

CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

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LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

α	Alpha particles (radiation)
AAQS	Ambient Air Quality Standard
ACRR	Annular Core Research Reactor
AIHA	American Industrial Hygiene Association
Alox	aluminum oxide
β	Beta particles (radiation)
BAO	Bendix Albuquerque Operations
BOD	Biochemical Oxygen Demand
Btu	British thermal units
C	Degrees centigrade
$CaCrO_4$	calcium chromate
cc	cubic centimeters
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
cfm	cubic feet per minute
Ci	curie
cf	cubic feet
CO	carbon monoxide
cpm	counts per minute
CTA	Central Training Academy
CTBN	trade name resin product
cy	cubic yards
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
AL	U.S. Department of Energy, Albuquerque Operations Office
dpm	disintegrations per minute
EP	Extraction procedure

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LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

EPA	U.S. Environmental Protection Agency
F°	degrees Fahrenheit
ft^2	square feet
ft^3/yr	cubic feet per year
g	gram
gal	gallon
GIF	Gamma Irradiation Facility
gpd	gallon per day
gph	gallon per hour
gpm	gallon per minute
ha	hectare
HEPA	high-efficiency particulate air (filter)
HP	Health Physics
hp	horsepower
HW	hazardous waste
IH	Industrial Hygiene
ILW	intermediate-level waste
ITRI	Inhalation Toxicology Research Institute
k	kilo (1000)
KAFB	Kirtland Air Force Base
kg	kilogram
km	kilometer
L	liter
LANL	Los Alamos National Laboratory
lb	pound
LLW	low-level waste
LS-1	Life Sciences Facility
m	milli (1/1000)

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LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

µ	micro (10^{-6})
mCi	millicurie (1/1000 curie)
µCi	microcurie (10^{-6} curie)
µCi/g	microcurie per gram
mg	milligram (1/1000 gram)
mgd	million gallons per day
µg	microgram (10^{-6} gram)
mL	mililiter
mR	milliroentgen (1/1000 roentgen)
mrem	millirem (1/1000 rem)
µR -	microroentgen (10^{-6} roentgen)
mCi/L	millicurie per liter
M^3	cubic meter
MCL	maximum contaminant level
MDA	Minimum Detectable Activity
mph	mile per hour
MSDS	Material Safety Data Sheet
MW	mixed waste
NBS	U.S. National Bureau of Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
EID	New Mexico Environmental Improvement Division
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
O&G	oil and grease
OSHA	U.S. Occupational Safety and Health Administration
p	pico (10^{-12})
PBFA	Particle Beam Fusion Accelerator
PbO	lead oxide
pCi	picocurie (10^{-12} curie)
pCi/g	picocurie per gram
pCi/L	picocurie per liter
PCB	polychlorinated biphenyl

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LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

POTW	Publicly Owned Treatment Works
ppb	part per billion
ppm	part per million
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
R	roentgen
R&D	research and development
RCRA	Resource Conservation and Recovery Act of 1976
RTG	radioactive thermal generator
Si/Ge	silicon/germanium
SNLA	Sandia National Laboratories-Albuquerque
SNLL	Sandia National Laboratories-Livermore
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure Plan
SPR	Sandia Pulse Reactor
STL	Simulation Technology Laboratory
T	temperature
TCA	trichloroethane
TCE	trichloroethylene
TLD	thermoluminescent dosimeter
TOC	total organic carbon
TOH	total organic halogens
TRU	transuranic
TSCA	Toxic Substances Control Act
TSD	Transportation Safeguards Division
TSP	total suspended particulates
TSS	total suspended solids
USFS	United States Forest Service
USGS	United States Geological Survey
UST	underground storage tank

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LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

VOC	volatile organic compound
WWTP	wastewater treatment plant

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APPENDIX E

TONOPAH TEST RANGE

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E1.0 INTRODUCTION

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E1.0 INTRODUCTION

The purpose of this appendix is to present the preliminary findings made during the Environmental Survey, conducted on August 26 and 27, 1987, at the United States Department of Energy (DOE) Tonopah Test Range (TTR). As a Preliminary Report, the contents are subject to revisions, which will be made in a forthcoming Interim Report, based on Albuquerque Operations Office (AL) review and comments on technical accuracy, the results of the sampling and analyses, and other information that may come to the Survey team's attention prior to issuance of the Interim Report. TTR is currently operated for DOE by Sandia National Laboratories.

The TTR Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The TTR Environmental Survey was conducted by an interdisciplinary team of technical specialists headed and managed by an Assistant Team Leader from the DOE Office of Environmental Audit. The TTR Survey team consisted of the following members:

Mark Smith	-	DOE; Assistant Survey Team Leader and Air Specialist
Kevin Walter	-	NUS Corporation; surface water, waste management, toxic substances/quality assurance specialist
Doug Riddle	-	NUS Corporation; hydrogeology and inactive waste site specialist
Craig Roberts	-	NUS Corporation; Radiation Specialist

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols in the DOE Environmental Survey Manual. Substantial use of existing information and of interviews with knowledgeable field office and site contractor personnel accounted for a large part of the on-site effort.

The preliminary Survey findings, in the form of existing and potential environmental problems, are presented in Sections E3.0 and E4.0 of this appendix. Section E3.0 includes those findings that pertain to a specific environmental medium (e.g., air or soil, surface water, and groundwater), whereas Section E4.0 includes those that are non-media-specific (e.g., waste management, direct radiation, and quality assurance). Because the findings are highly varied in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections E3.0 and E4.0.

The criteria for placing a finding into one or more of the four categories are as follows:

Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental, Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.

Category II findings encompass one or more of the following situations:

- Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human

population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.

- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the timeframe of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other environmental management practices.

- Noncompliance with significant regulatory procedures, i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits.

Category II findings include those environmental problems where the risk is high but the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, more discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.

- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this category, the range of alternatives available for response, and the corresponding timeframes for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases as well as multiyear budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a concentration that presents a concern for local populations or the environment that is sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations, even though below those established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to the health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term "environmental problem" is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I-III. Such findings can be based upon any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate Program Office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another between media categories is not appropriate or valid. The categorization and listing of findings in order of significance within each media category in this report is only the first step in a multistep iterative process to prioritize DOE problems.

The next portion of the TTR Survey is the Sampling and Analysis (S&A) phase. Idaho National Engineering Laboratory (INEL), the S&A team for TTR, will begin taking samples in spring 1988. Prior to sampling, an S&A Plan will be prepared by DOE and INEL in accordance with the protocols in the DOE Environmental Survey Manual. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey, and to fill existing data gaps or weaknesses.

An Interim Report will be prepared 6 to 8 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve as the site-specific source for information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems. Information in this Preliminary Report will assist AL in the planning of these near-term responses.

It is clear that certain findings and observations contained in this report, especially those in Category II, can and should be addressed in the near term (i.e., prior to the DOE-wide prioritization effort). It is also clear that the findings and observations in this report are highly varied in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective action.

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E2.0 GENERAL SITE INFORMATION

PRELIMINARY

E2.0 GENERAL SITE INFORMATION

This section will provide background information on the environmental setting, climate, operations, and facilities of Tonopah Test Range (TTR).

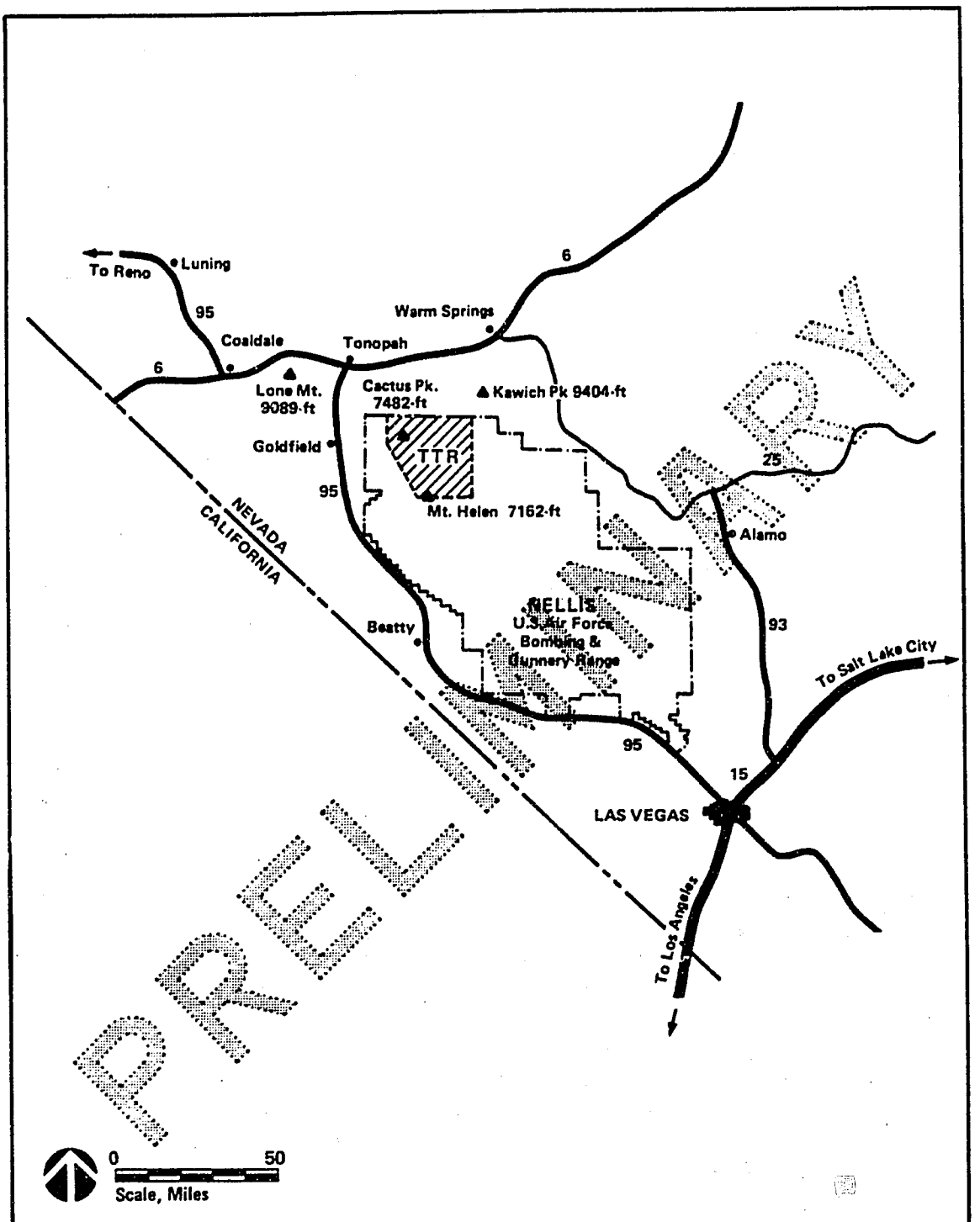
E2.1 Site Setting

TTR is in Nye County, Nevada, on the northern portion of the U.S Air Force Nellis Bombing and Gunnery Range. It is identified on Strategic Air Command charts as Cactus Flats and on aeronautical sectional charts as R-4809. It is about 140 miles northwest of Las Vegas, Nevada, by air, and 39 miles southeast of Tonopah, Nevada, by road.

TTR is bounded on three sides by the Nellis Bombing and Gunnery Range and on the north by sparsely populated public land administrated by the Bureau of Land Management and the U.S. Forest Service. The TTR site occupies 624 square miles of military land, used by permit and operating agreement with the U.S Air Force. The general location of TTR within Nevada is shown in Figure E2-1. The nearest town, Goldfield, is 26 air miles west of the Range Control Point Area 3.

The TTR has an irregular but nearly square shape about 24 miles wide and 26 miles long. The main target areas for testing are a north-south string of dry lakebeds or playas at an elevation of approximately 5,400 feet. Along the west side of TTR is the Cactus Range, a series of low rocky mountains with the highest peak 7,500 feet above mean sea level (MSL). Along the eastern boundary is the Kawich Range, whose peaks range from 6,500 to 9,400 feet MSL. The main area of the Range is a broad, high desert valley known as Cactus Flats, which lies between the Cactus and Kawich Ranges.

The climate is hot in the summer and cold in the winter. The valley floor is sparsely covered with range grasses and low bushes such as budsage and shadscale. The fauna of the valley consists of such animals as kangaroo rats, coyotes, lizards, wild horses, occasional wayward cattle, and a variety of birds. The vegetation grades into larger bushes, Joshua trees, and juniper as one ascends the slopes at the sides of the valley and into the low mountains. There are no perennial streams and only a



Source: SNLA, 1984

TONOPAH TEST RANGE REGIONAL SETTING FIGURE E2-1

few permanent springs, the water from which evaporates or percolates back underground within a few hundred feet. Average temperatures range from 29°F in the winter to 71°F in the summer, with average minimum of 14°F in January and maximum of 89°F in July. Winds are frequent and generally come from the south, southeast, or northwest. Relative humidity ranges from 26 to 59 percent. Precipitation averages about 5 inches/year. Minimum cloud cover and generally good visibility (about 60 miles) in this dry, moderate climate provide TTR with over 300 days per year of good testing conditions. The Sierra Nevada to the west blocks most Pacific-originated storms, and the intervening desert exhausts moisture from storms arising in that area. When storms reach TTR from the west, they generally deposit little moisture but cause a high cloud cover that is usually of short duration. The few storms that deposit much moisture and remain in the area for some time usually come from the southwest.

E2.2 Overview of Major Site Operations

The prime mission of the TTR is to provide research and development test support for nuclear ordnance programs for the U.S. Department of Energy (DOE). Test support for other government agencies is also provided on a reimbursible, non-interference basis. Activity at the TTR includes air drops, artillery projectile firings, ground-launched rockets, air-launched rockets, explosion effects tests, earth penetrator tests, cruise missile flights, and many miscellaneous activities requiring a remote range for safety or security reasons. Personnel in support of Sandia National Laboratories-Albuquerque (SNLA) operations at Tonopah usually number about 200 staff members (SNLA, 1987).

SNLA's first test range, where drops were conducted in late 1945, was near Los Lunas, New Mexico, 25 miles southwest of Sandia Base at 5,000 feet MSL. A range nearer sea level was needed, however, and in 1946 one was established at Salton Sea, California. This area, known as Sandy Beach, had been used by the Manhattan Project for ballistic and other testing of the first weapon shapes.

By the mid-1950s, the atmosphere around Salton Sea had become hazy, limiting visibility and hampering photography. In addition, the population of the neighboring Imperial Valley began to increase. A new public highway and commercial airways over the area complicated bombing approaches, and the

number of programs requiring ballistic and operational testing continued to multiply.

After several years of searching and evaluating, a site in the northwestern corner of the Las Vegas Bombing and Gunnery Range was selected. The site had been surveyed by the Naval Air Special Weapons Facility at Kirtland Air Force Base (KAFB) and recommended in a report dated February 27, 1956, which noted that any of a string of dry lakebeds in the vicinity would be satisfactory for high- and low-level bombing operations. This area eventually became the TTR. The Salton Sea Range was deactivated in July 1961.

Construction at TTR started in 1956 and the first test was conducted on February 4, 1957. In 1958, the range was made a permanent facility. The Air Force has issued three extensions to the permit covering SNLA use of the area, the latest to March 31, 1989 (SNLA, 1984).

E2.3 Site Facilities

There are about 50 buildings or major structures on the TTR of approximately 100,000 ft^2 total floor space. There are two main centers of activity, Area 3 and Area 9, and numerous smaller ones.

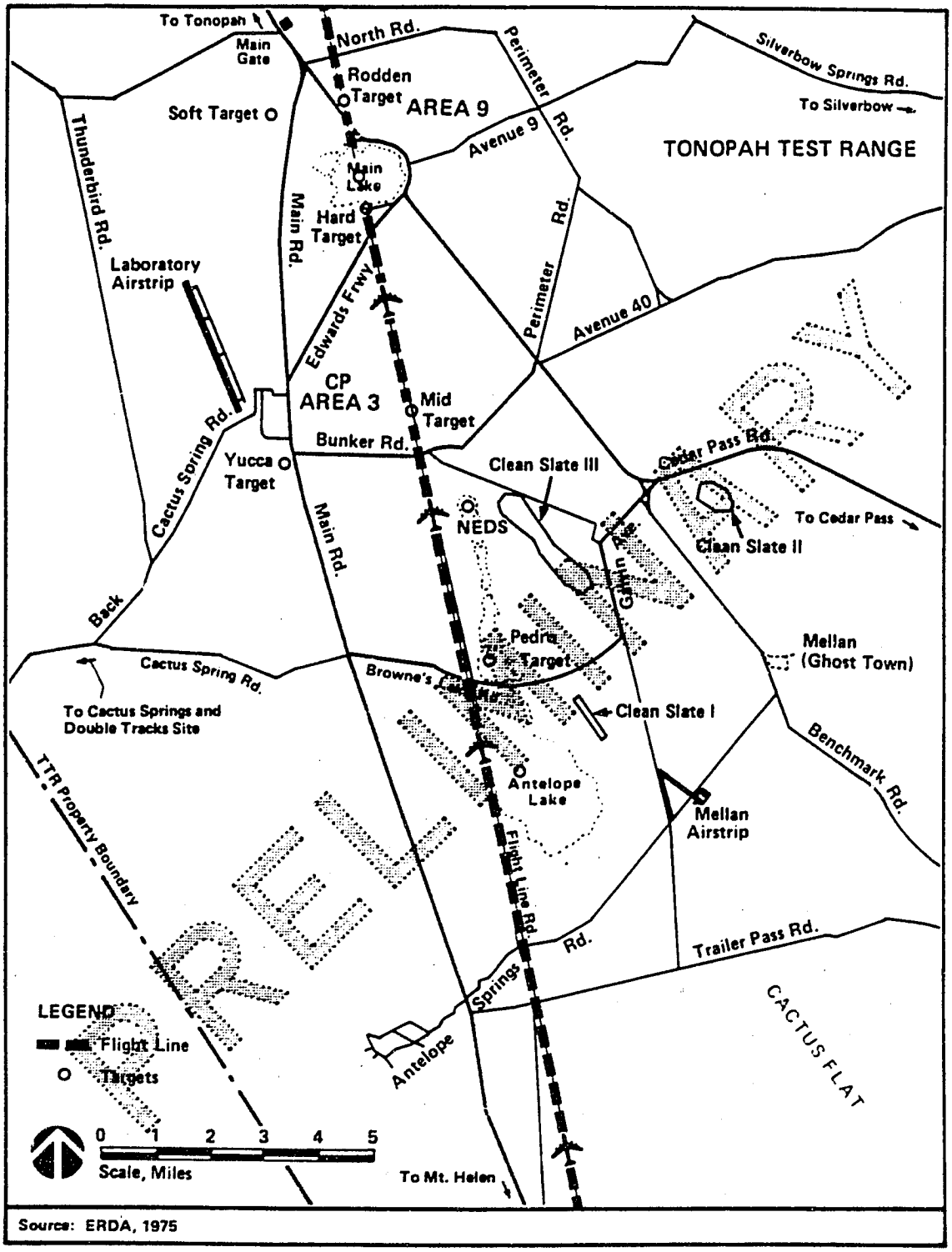
Area 3 is the Control Point Area, which contains the buildings and staff necessary for administration, operational control, a computer, telemetry playback equipment, and maintenance. Area 9 is a center for rocket and gun firings, with impact areas to the southeast.

A series of targets in the dry lakes is used for air drops of ballistic shapes. A rocket static test stand (the C4 site) has been built for the Navy on the east side of the valley, but the test program for which it was constructed is in abeyance. Tests are carried out on one of the smaller dry lakes in a program for the design of shipping containers that will retain the shrapnel and gaseous products such as might be produced by the planned demolition of a nuclear weapon. Earth penetrator experiments are carried out wherever the proper ground or rock conditions can be found.

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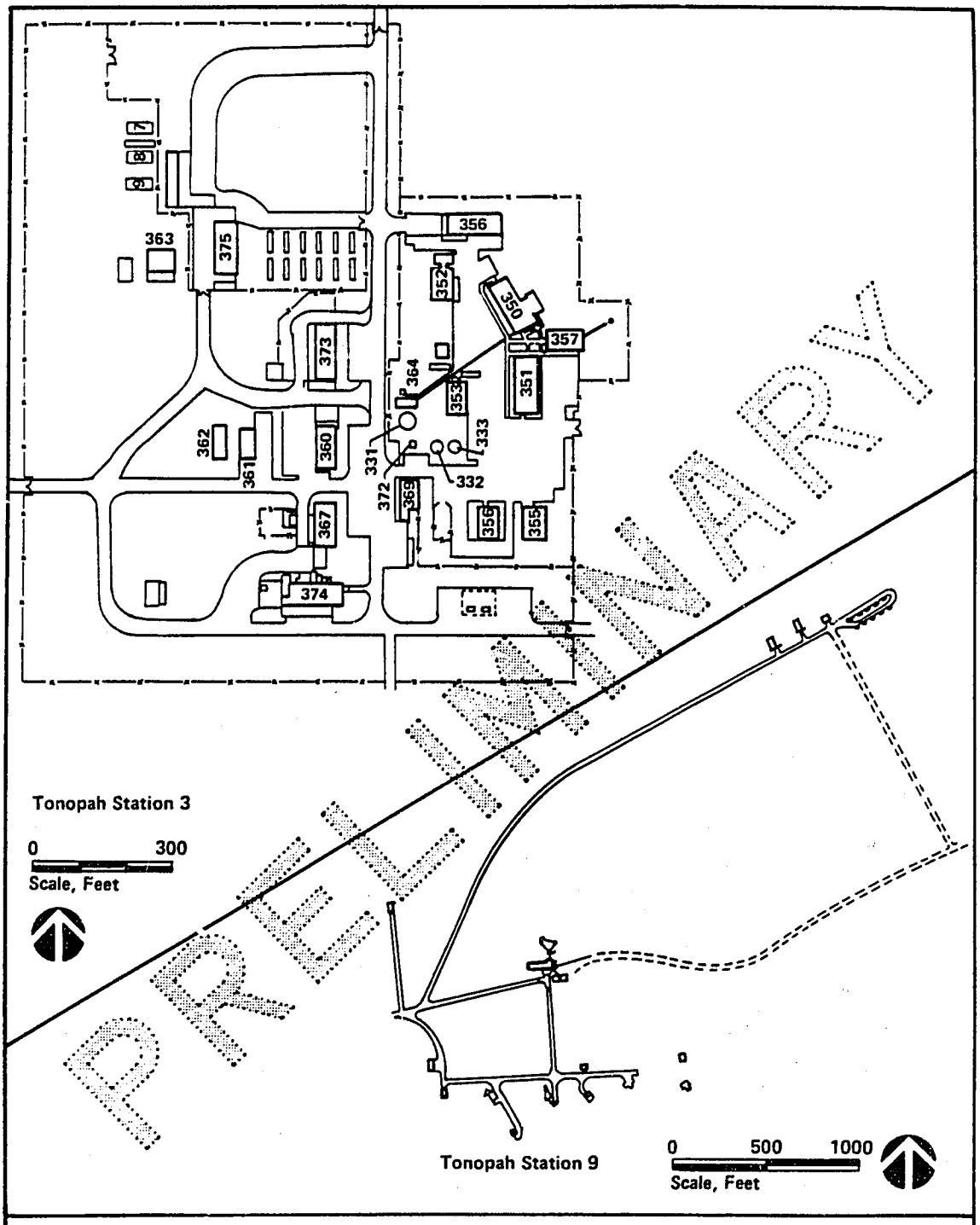
On either side of the valley are many stations for fixed and portable radars, telescopes, and phototheodolites. Figure E2-2 shows some of those facilities and roads and Figure E2-3 shows the major structures in Areas 3 and 9.

PRELIMINARY



Source: ERDA, 1975

MAP OF TONOPAH TEST RANGE AND ITS FACILITIES FIGURE E2-2



Source: SNLA, 1984

TONOPAH STATIONS 3 & 9 FIGURE E2-3

E3.0 MEDIA-SPECIFIC SURVEY FINDINGS

PRELIMINARY

E3.1 Air

The air emission sources on the Tonopah Test Range (TTR) are small-scale industrial sources, including diesel-fuel-powered generators. None of the operations emit regulated quantities of toxic or criteria pollutants nor, with the exception of periodic tests, do they emit quantities of materials that would be regulated under the National Emission Standard for Hazardous Air Pollutants (NESHAP). Those periodic tests have involved the infrequent dispersal of beryllium, depleted uranium, or plutonium.

E3.1.1 General Description of Pollution Sources and Controls

E3.1.1.1 Dispersal Tests

Infrequently over the history of the TTR, there have been tests of weapons systems that have resulted in the dispersal of beryllium or radionuclides on the range. These tests were:

Roller Coaster/Clean Slate (see Section E4.3, Radiation)
W79-60 test
W82 test
Colimbo test
Non-Violent Dispersal burn tests

The W79-60 test was conducted below ground level, in a trench, and was enclosed by sandbags during the test, resulting in minimal release of material to the atmosphere.

The W82 test conducted in mid-1987 was a ballistic test conducted on Antelope Lake to determine the extent of air and ground dispersal of depleted uranium and beryllium. During the test, collectors were distributed along a 1,000-meter by 500-meter grid at 100-meter spacing. The test was arranged so that the dispersal of material would be across this grid. Following the test, some slight elevation of gamma radiation levels was noted close to the blast point, with levels being indistinguishable from background farther out. The final test results were not available at the time of the Survey, but preliminary indication was that this type of

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test did not result in a source of airborne pollutants except for a short time during the blast and at very short distances.

The Colimbo test was conducted at Pedro Lake and involved the in-air detonation of a missile. It is expected that this test also resulted in a very short-term source of air emissions in the immediate vicinity of the test.

The Non-Violent Dispersal test was a burning test conducted in an ill-defined region on one of the lakebeds. Limited information was available to assess the potential emissions from these tests.

The result of these dispersal tests was to leave several regions of surface contamination of certain radionuclides and beryllium. The potential for resuspension of these materials creates the possibility of a source of airborne contaminants. However, due to the relatively large particle sizes involved, the distance from any inhabited area, and the concentration of surface contaminants, the likelihood of resuspension being a significant source is remote.

E3.1.1.2 Diesel Generators

There are five diesel generators located in Area 3, all of which are used for backup or emergency power supplies. In Building 03-53, three generators of 350 kW, 160 kW, and 200 kW provide the emergency power supply for Area 3 operations. These are operated approximately once per month either for testing purposes or during power outages. In Building 03-58, two 65-kW generators provide the uninterruptible power supply for the computer operations. These are also used approximately once per month, turning on during even brief power outages to maintain electrical supply to computers.

There is also a diesel backup generator in Building 09-58 in Area 9. This has a capacity of 185 kW and serves as the emergency power supply for the Area.

E3.1.1.3 Miscellaneous Area 3 Sources

Several operations in Area 3 serve as low-level sources of organic material or metals. Some examples of these, all below regulatory levels, are:

- Vehicle repair shops have dip tanks containing solvents.

- Building 03-73 contains a painting chamber which vents to the outside, a plumbing shop with a bench-top grinder vented to the outside, and a carpentry shop with vents for removal of sawdust.

- Some uncovered barrels of waste oils are stored in the area.

E3.1.2 Ambient Air Monitoring

A continuous air sampling station is operated as part of the EPA Air Surveillance Network. The network is located in Area 3 between Building 03-67 and the 1034 trailer, approximately 12 feet in front of a concrete block retaining wall. The station provides the only information available regarding the airborne concentrations of radioactive materials at the TTR Control Point. Particulate fiber filters and charcoal canisters are exchanged three times per week and analyzed by gamma spectrometry. A summary of relevant surveillance network calendar year (CY) 1986 results is shown in the following table.

SUMMARY OF 1986 EPA AIR SURVEILLANCE NETWORK RESULTS

Sample Location	1986 Quarter	Days Sampled	Average Concentration (pCi/m³)**						
			^{7}Be	^{103}Ru	^{131}I	^{132}Te	^{134}Cs	^{137}Cs	^{140}La
TTR, NV	1	74.8	0.071(35)	0.057(27)	0.15(28)	0.008(4.3)	0.019(15)	0.036(27)	0.023(4.3)
	2	87.8	0.074(26)						
	3	77.7	0.044(33)						
	4	87.9	0.072(34)						
	Year	328.2	0.065(32)						
Goldfield, NV	1	*		0.045(15)	0.21(19)	0.004(1.1)	0.010(4.5)	0.033(15)	--
	2	90.8	0.037(10)						
	3	90.8	0.029(9)						
	4	89.1	0.044(9)						
	Year	270.7	0.037(9)						
Tonopah, NV	1	*		0.044(14)	0.19(16)	0.004(1)	0.013(8.6)	0.021(7.7)	--
	2	91.1	0.009(3.1)						
	3	90.1	0.03(10)						
	4	91.0	0.041(12)						
	Year	273.0	0.027(8.4)						

Source: SNLA, 1987

* Negligible gamma spectra.

** Values are concentrations with % days detected reported in parenthesis.

E3.1.3 Findings and Observations

E3.1.3.1 Category I

None

E3.1.3.2 Category II

None

E3.1.3.3 Category III

None

E3.1.3.4 Category IV

1. Nonrepresentative location of ambient air monitoring station. The location of the ambient air sampling station in Area 3 does not provide representative information of actual ambient conditions.

   The results of the U.S. Environmental Protection Agency (EPA) monitoring station located in Area 3 are used to identify any abnormalities in airborne radioactive materials in Area 3 and the Control Point. The current location of the station in a narrow alleyway causes it to be subject to localized airborne transport and deposition patterns that are not indicative of Area 3 in general. Therefore the results of the sampling station are of questionable value.

PRELIMINARY

E3.2 Soil

In this section, background information on the surficial soils of the area will be provided along with a description of the sources of pollution to those soils.

E3.2.1 Background Environmental Information

The Cactus Flat Basin, lying between the Cactus and Kawich Mountain Ranges, ranges in elevation from 5,300 to 5,600 feet above mean sea level (MSL). All of the flat is of 0-10 percent slope, with up to and over 25 percent slope existing in the transition zone between the flat and the mountain ranges bordering the Tonopah Test Range (TTR).

Across Cactus Flat, a series of playas (dry lakes) extend from the Main Playa on the north to Antelope Playa on the south (see Figure E2-2). The relief of the mountains surrounding the enclosed basin ranges from 1,000 to 3,000 feet above the playa surface. During the last glacial period, 10,000 to 20,000 years ago, the playas were part of an interconnecting series of lakes that occupied much of the Basin and Range Province. Sedimentary rock underlies Cactus Flat and the playas, and many of these rocks weather to clay minerals or zeolites which readily take on and expel water during dry climatic cycles. As a result of low rainfall or a declining water table, giant polygons can form when the playa desiccates beyond the "normal shrinkage" limit.

Over half of the TTR is blanketed by alluvium and colluvium of Quarternary and Tertiary age. This alluvial material is thickest in the major basins such as Cactus Flat, but the actual thicknesses there are unknown.

E3.2.2 General Description of Pollution Sources and Controls

Sources of pollution to the soils of TTR can be grouped into three categories. First is localized contamination of soils by toxic or hazardous substance spills and leaks. The majority of this type of soil contamination is found at Areas 3 and 9 described in Sections E4.1 and E4.2. Second, subsurface contamination of soils occurs due to wastewater discharges to septic systems and leaching pits. These sources are described in Section E3.3 - Surface Water. The third source of contamination of soils

at TTR is caused by intentional dispersal tests or routine explosive tests which spread pollutants over small or in some cases moderately large areas. This contaminated soil is then subject to resuspension by wind.

Four intentional dispersion tests, entitled the Roller Coaster series, were conducted in 1963 to study plutonium dispersal from accidental non-nuclear explosions of plutonium-bearing weapons. These tests resulted in three contaminated-soil areas on TTR called "Clean Slate 1, 2, and 3" (see Figure E2-2) and a contaminated area of the Nellis Bombing and Gunnery Range west of Cactus Spring called "double track". These areas were subsequently fenced.

The total plutonium estimated to be in the three Clean Slate test areas is 64 curies. The area involved is approximately 2.4 square kilometers (see Table E4-2 for a summary of information on these tests). Soil sampling and ground and aerial radiologic studies were performed on the area in the 1970s. The fencing was last placed in 1973. The last aerial study was performed in 1977. Since 1978 no measurements or soil samples have been obtained to assess migration of the plutonium. The only surface stabilization performed involved the covering of hot spots with soil. A total of 453,000 cubic meters of soil has been estimated to be contaminated (SNLA, 1987).

Routine testing operations at TTR that may result in soil contamination due to explosive tests may be grouped into seven general categories (ERDA, 1975):

1. Air Drops -- TTR range instrumentation is configured to cover the trajectories of simulated bombs or weapons aimed at several designated targets along the chain of dry lakes running through the center of the TTR. Units containing beryllium and/or high explosives (HE) are sometimes included. The average number of air drops per year has been approximately 130. In the past, up to 30-35 of the air drops per year have involved units with beryllium or HE.

2. Gun Firings -- TTR conducts as many as 150 gun firings (155 mm and 8 inch) per year. A few (less than 10) of the projectiles have contained radioactive or toxic materials (depleted uranium, plutonium, or beryllium) or HE, but not both in the same unit. The impacts are

generally 7,000 feet (2,100 m) distant at an azimuth of 147 degrees true from their firing points in Area 9. Another impact area is about 40,000 feet (12,200 m) in that direction. Many rounds have parachute recovery systems. Wind measurements are taken before each firing of such rounds to ensure that they will land on the TTR in places easily accessible for recovery.

3. Ground-Launched Rockets -- Rockets of the antiaircraft type are launched from Area 9, most containing scientific instruments or test objects for aeroballistic or materials properties measurements. A few prior to 1970 contained as much as 5 pounds of explosives used to disperse sodium or barium compounds into the upper atmosphere for the purpose of mapping the earth's magnetic field or high-altitude winds. The latter reach altitudes of 300,000 feet or more; the former, altitudes of not over 70,000 feet. In such launches there have been as many as three rocket stages plus the payload, all of which impact at various locations on TTR, generally toward or beyond the ghost town of Mellan.

4. Air-Launched Rockets -- Up to several times a year, as a service to the military, TTR is used for the launching of rockets from aircraft. These are medium-altitude releases, generally about 6,000 feet above the terrain. Flight paths and launches may be either from the south or from the north (not from the east or west because of wind and terrain limitations), releasing over the TTR for impact on Nellis land to the south, or vice versa. A very few releases are from the north, with their release points outside the range and with trajectories to impact on or past the TTR.

5. Explosion Effects -- A series of tests (the NEDS tests) is being carried out in a program for the design of shipping and storage containers that will retain the shrapnel, radioactive and toxic debris, and gaseous products such as might be produced in the planned demolition of a nuclear weapon. In 1963, a series called the Roller Coaster tests was carried out to study the spread of plutonium from the nonnuclear detonation of nuclear weapons; Roller Coaster-type tests are not expected to be conducted again.

6. Static Rocket Tests -- As an assist to the Navy in developing the Trident submarine program, the TTR constructed a static rocket motor test pad and is holding the facility on a standby basis.

7. Earth Penetrator Tests -- The TTR conducts several tests a year for the Sandia Terradynamics Program, a pioneering study of earth surfaces using high-velocity penetrators. Earth or rock penetrating shapes are dropped from aircraft, sometimes with rocket boosters to increase their impact velocities, or fired vertically downward from guns. The pattern of their deceleration in the ground or rock is diagnostic of the hardness and layering of these surfaces.

E3.2.3 Environmental Monitoring Program

No regular monitoring of soil is performed on TTR. An aerial radiological study was conducted by EG&G in 1977 of the three Clean Slate test sites and the double-track test site. Fences were previously built in 1970 to include the 100 $\mu g/m^2$ contamination contours (= 0.3 $\mu Ci/g$ if all in the top centimeter of soil) as a result of a ground FIDLER (field instrument for detection of low-energy radiation) study. The aerial study, however, showed contamination above that level outside the fenced areas. In the case of Clean Slate 2, only half of the contamination pattern was enclosed by the fence.

After some explosive tests, selected soil samples are taken to indicate soil contamination by beryllium. Soil samples collected after a total of 18 NEDS tests indicate that beryllium levels in the soil at the point of detonation and up to 100 feet downwind are less than the limit of detection (5 mg Be/g soil), presumably because of the very small size of particles formed (ERDA, 1975).

A recent series of soil analyses was conducted on samples taken from Antelope Lake in 1987 after a ballistic test (see Section E3.1.1).

E3.2.4 Findings and Observations

E3.2.4.1 Category I

None

E3.2.4.2 Category II

None

E3.2.4.3 Category III

1. Undetermined spread of radionuclide contamination in soil from dispersal test sites. The status of soil contamination by radionuclides resulting from dispersal tests, especially the Roller Coaster series of dispersal tests, is not being determined, updated, and reported. This may result in an overassessed exposure to animals or people on-site.

   The contamination pattern of the Clean Slate and double track test areas has not been determined since 1979. The EG&G aerial assessment performed at that time indicated that measurable concentrations of plutonium-238 existed outside the fenced areas around the sites. Additionally, the current potential for soil, vegetation, and groundwater contamination from other explosive tests, such as the Colimbo test at Pedro Lake, cannot be assessed without soil sampling and analysis.

E3.2.4.4 Category IV

None

DRAFT

E3.3 Surface Water

This section will evaluate the effect of surface and subsurface disposal of wastewaters on the site environment. Surface-water runoff will also be discussed.

E3.3.1 Background Environmental Information

All the streams in and near Tonopah Test Range (TTR) are intermittent and end in closed basins. The TTR is almost coincident with the Cactus Flat drainage area, although in the northwest the TTR laps over into the Stone Cabin Valley drainage area, in the west to the Stonewall Flat drainage area, and in the southeast into the Gold Flat drainage area (see Figure E3-4).

All the working areas of the TTR lie in about 400 square miles (1,000 square kilometers). Along the axis of the valley lies a string of playas (dry lakebeds), conspicuous by their light-colored surface sediments, high content of soluble minerals, and lack of vegetation. Except for a few days each year after rain in the nearby mountains, these playas are dry.

There are three springs within the TTR: Cactus and Antelope Springs in the central and southern Cactus Range, and Silverbow Springs in the northeastern corner of the TTR in the northern Kawich Range. Water from these springs does not travel far; it disappears rapidly through evaporation and infiltration, and its effect on the landscape is purely local. Water used in the TTR facilities comes from wells tapping the underlying groundwater in alluvium derived from the surrounding mountains. Depth to water varies from 90 to 150 feet (see Section E3.4).

The precipitation pattern in Nevada is principally related to topography, stations at higher elevations generally receiving more precipitation than those at lower elevations. On the valley floors, where precipitation is light (about 5 inches/year), little precipitation infiltrates into the groundwater reservoirs. The greater precipitation in the mountains provides most of the recharge. Water reaches the groundwater reservoirs by seepage loss from streams on the alluvial apron and by underflow from the consolidated rocks. Most of the precipitation is evaporated before infiltration, though some temporarily adds to soil moisture at shallow depths. A water budget for the Sarcobatus Flat groundwater system indicates a

possible annual recharge and discharge of 3,000 acre-feet, 600 of which comes from the Cactus Flat drainage system. In this estimate, only 0.5 percent of the precipitation falling on the drainage area was presumed to have gotten to the groundwater reservoir (ERDA, 1975).

E3.3.2 General Description of Pollution Sources and Controls

Sanitary wastewater and a small amount of industrial wastewater are generated by the maintenance, plumbing, photographic development, painting, and carpentry activities at TTR. Most of this wastewater is produced in Area 3 (see Figures E2-2 and E2-3) although Area 9 has a small amount. All of this wastewater is disposed of in septic tanks and tile fields or subsurface leaching pits generally constructed of large-diameter corrugated metal or concrete pipe placed vertically into the ground with stones at the bottom. Privies or portable toilets are used at the remote locations. In the past, every few years the septic tanks were pumped out and the sludge and scum buried in a nearby hole 1 meter in diameter and 15 meters deep, then backfilled.

Specific sources of industrial wastewater in Area 3 being disposed of to subsurface systems as above-described include:

1. Building 03-74 heavy equipment garage - wastewater containing waste oils and carryover Stoddard solvent from engine degreasing is disposed of in a dry well west of this building. It receives water from two internal floor drains in the truck repair bays and from an outside grate over which engines and parts are steam-cleaned.

2. Building 03-55 - Photographic Laboratory - Continuous overflow of black and white film development chemicals occurs from several motion picture and still photograph negative and print automatic developing machines. Additional batch dumping of chemicals occurs. All of this wastewater is collected and conveyed to a grease trap and then to a leach pit approximately 100 feet south of the building, at the southeastern side of the vehicle gas station. The leaching pit consists of a

vertical, approximately 4-foot-diameter corrugated metal pipe placed about 10 feet into the ground. The bottom of the pipe is lined with large gravel.

3. Other shops had sinks which may have received small quantities of cutting oils, cleaning solutions and paint solvents, and which discharge to septic tanks. Although staff in these buildings are currently segregating and containerizing this liquid waste as hazardous wastes for separate disposal (see Section E4.1), some of these building septic tanks may have in the past received these types of industrial wastewater. The buildings include:

Building 03-60	-	Light-vehicle maintenance garage
Building 03-70	-	Paint shop, plumber's shop, carpentry shop
Building 03-60	-	Tire shop

Area 9 had one source of industrial wastewater that involved a small mobile X-ray developing laboratory, which discharged presumably to a leaching pit. This laboratory is operated infrequently, recently for short periods of several days every 2 months.

E3.3.3 Environmental Monitoring Program

No regular monitoring of sanitary or industrial wastewater is conducted at TTR. A one-time sampling and analysis for silver was performed on the Building 03-55 discharge in May 1987 by Reynolds Electrical and Engineering Co., Inc. (REECo). An analysis of sludge from the grease trap detected 2.2 percent silver and an analysis of water in the leaching pit showed 2.47 ppm silver.

E3.3.4 Findings and Observations

E3.3.4.1 Category 1

None

E3.3.4.2 Category II

None

E3.3.4.3 Category III

1. Potential groundwater contamination. The groundwater has the potential to be contaminated as a result of industrial wastewater disposal to subsurface disposal systems in Areas 3 and 9. This has caused soil contamination and potential groundwater contamination.

   Discharges from the photoprocessing laboratory in Building 03-55, the heavy equipment garage, Building 03-74, and the mobile X-ray development trailer in Area 9 are contributing unmeasured quantities of pollutants to the soil underneath the subsurface disposal areas for these buildings. This adds to the potential for groundwater contamination described in Section E3.4.4.

E3.3.4.4 Category IV

None

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E3.4 Hydrogeology

E3.4.1 Background Environmental Information

E3.4.1.1 Geology

The Tonopah Test Range (TTR) lies within the Basin and Range Physiographic Province. The Basin and Range Province is aptly named after the topography of the region, which is comprised of north-south-trending mountain ranges separated by broad valleys or basins. TTR is located within a basin which contains a series of dry lakebeds. The basin is bounded on the east by the Kawich Range and on the west by the Cactus Range. Elevations range from approximately 5,300 feet above mean sea level (MSL) in the valley to 7,480 feet in the Cactus Range (ERDA, 1975).

TTR is underlain by complex series of rocks which range in age from Precambrian to Quaternary and Tertiary. Figure E3-1 presents a generalized stratigraphic column for the TTR. Specifics on the geology of TTR are not available and the stratigraphic column presented is derived from regional data (BLM, 1981). A rough surficial geologic map is included as Figure E3-2. As can be seen on this map, much of the TTR is immediately underlain by alluvial sediments interpreted to be greater than 1,000 feet thick. These sediments coincide with the basin and the area within the TTR known as Cactus Flats.

The Cactus Range to the west of the basin is composed primarily of highly faulted Tertiary volcanics and sedimentary rocks. The Kawich Range to the east is primarily comprised of Tertiary tuff and lava. A series of lava ridges and soft-tuff valleys also exists in the western portion of TTR and is known as the Mellan Hills (ERDA, 1975).

TTR lies within Seismic Risk Zone 3 at the eastern edge of the so-called Nevada Seismic Zone. The Nevada Seismic Zone has experienced some of the largest recorded earthquakes. A major fault/shear zone called the Walker Lane - Las Vegas Valley shear zone has been postulated to extend through TTR along the Cactus Range (see Figure E3-3). Numerous small earthquakes are expected to continue to occur west of TTR, with some occurring within the Cactus Range (ERDA, 1975).

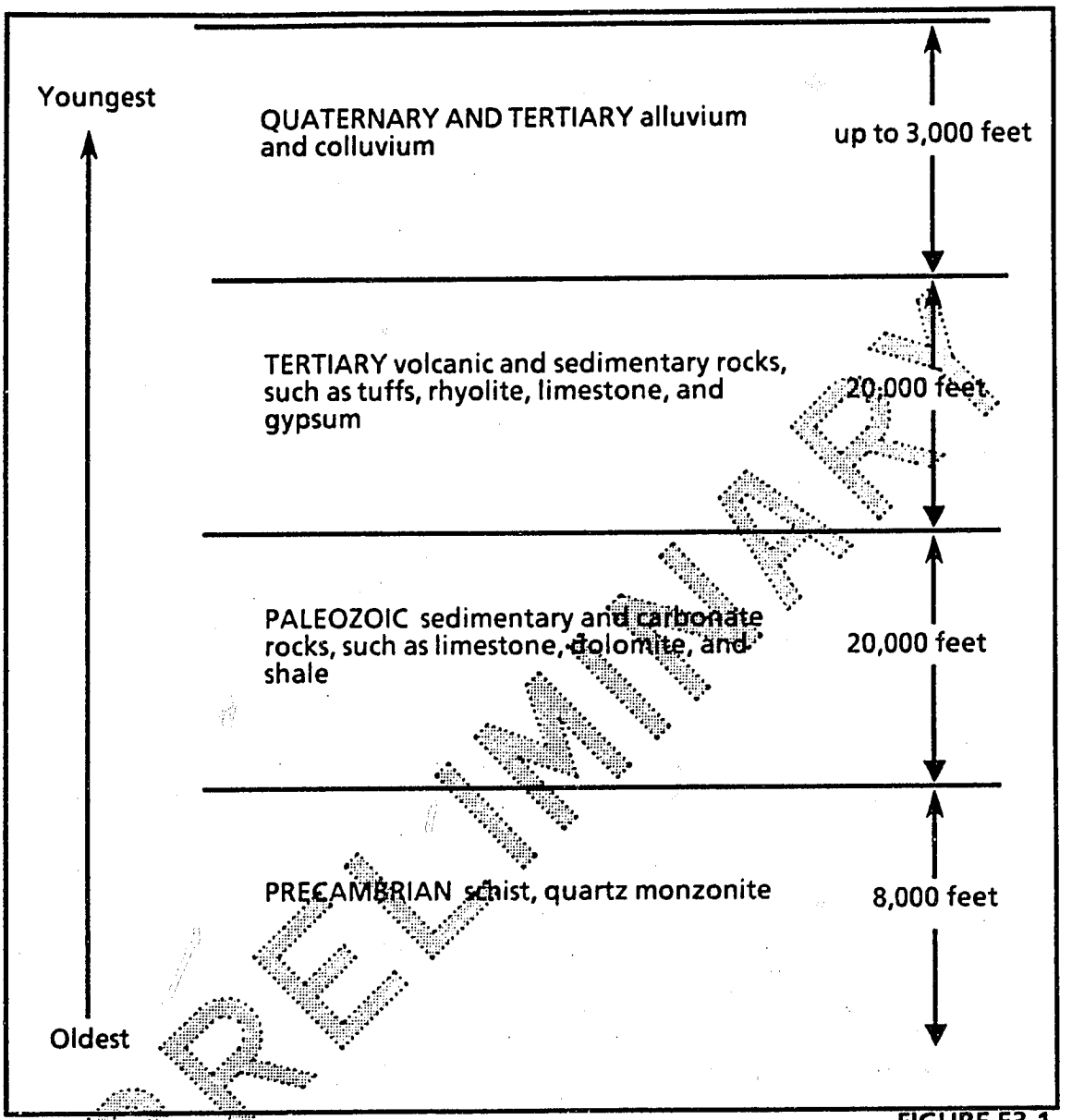
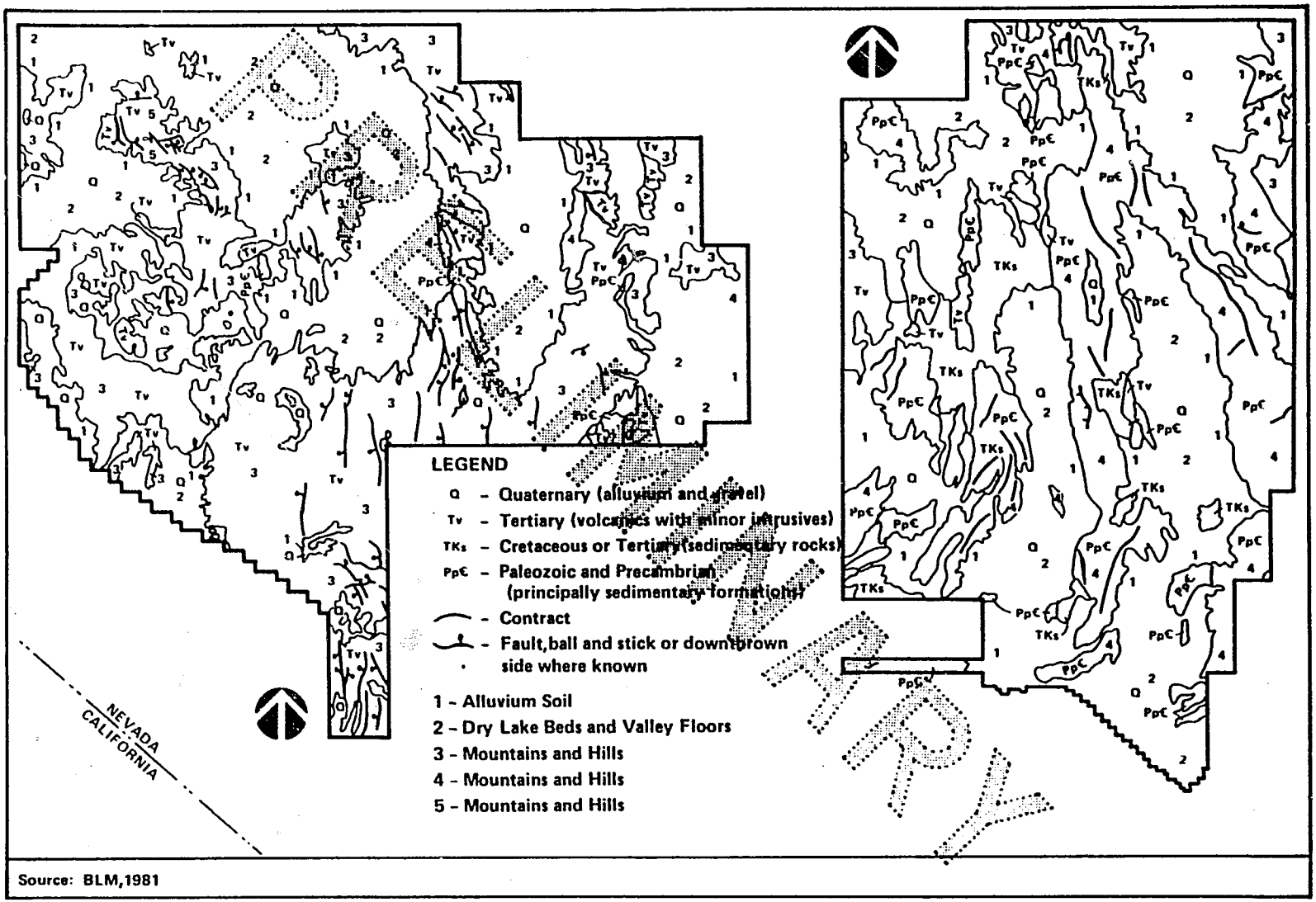


FIGURE E3-1

GENERALIZED STRATIGRAPHIC COLUMN OF TONOPAH TEST RANGE

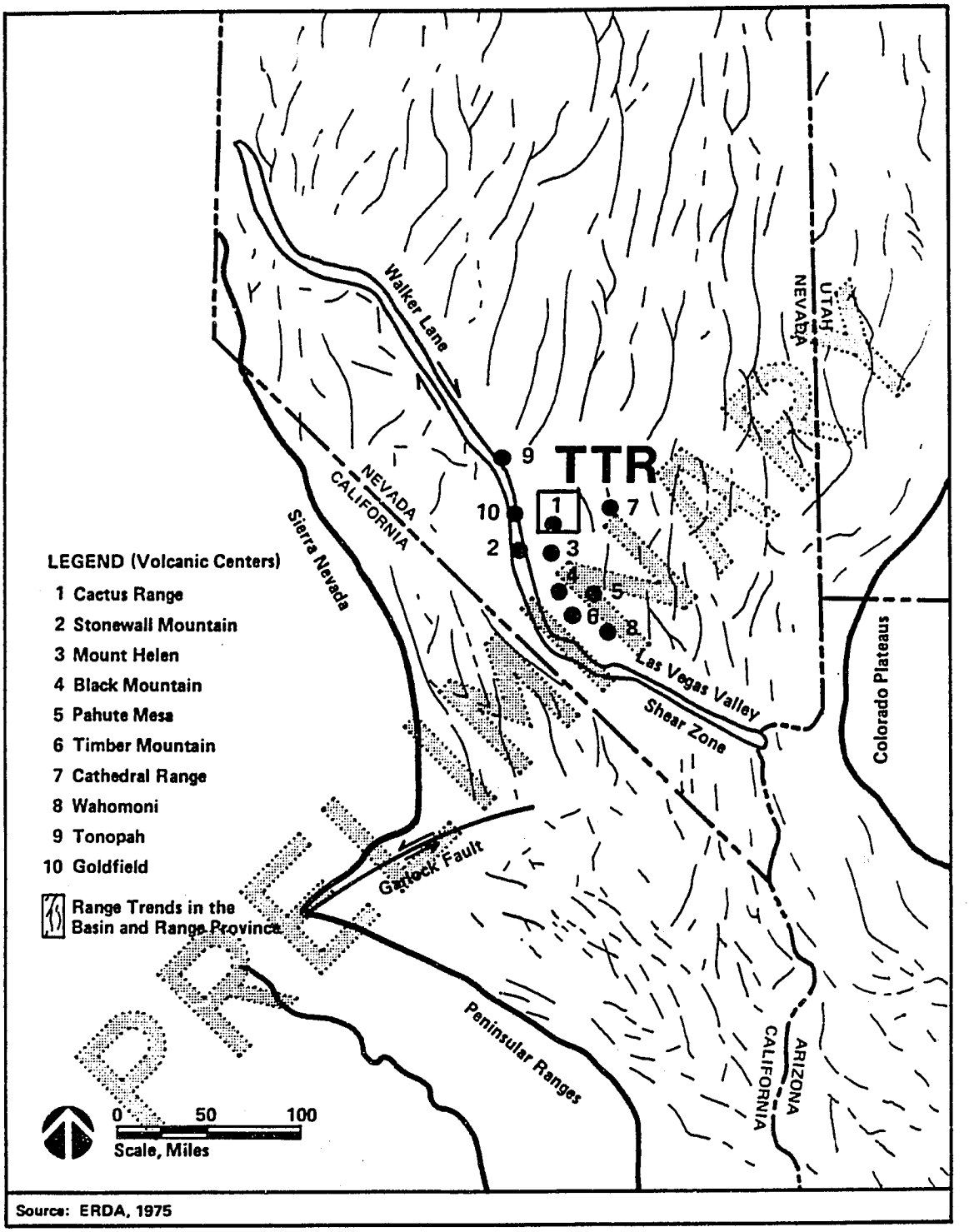
PRELIMINARY



Source: BLM, 1981

GENERAL SOILS - GEOLOGY MAP

FIGURE E3-2



Source: ERDA, 1975

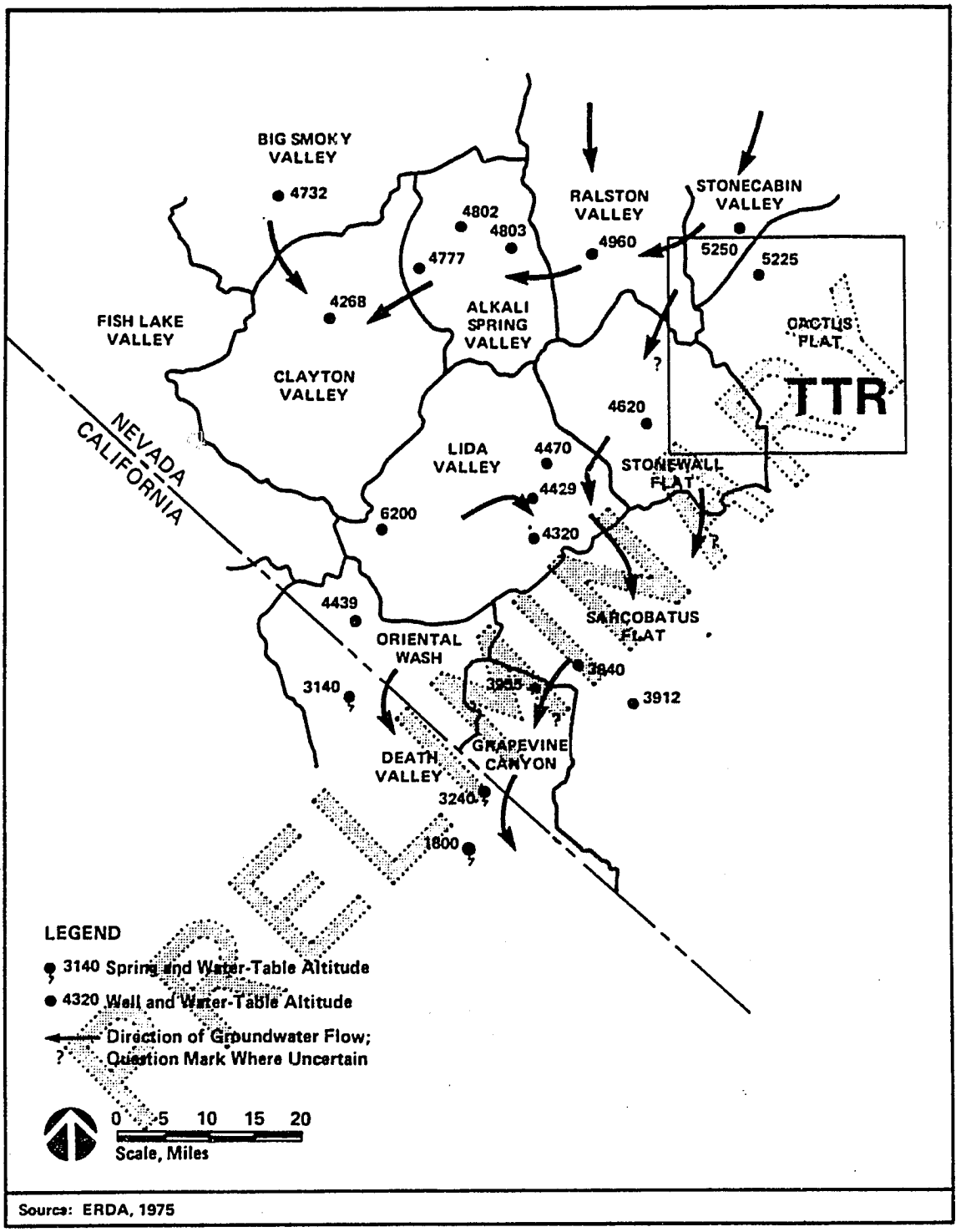
THE WALKER LANE-LAS VEGAS SHEAR ZONE FIGURE E3-3

E3.4.1.2 Hydrogeology

Data on both the regional and local aspects of TTR hydrogeologic conditions are extremely limited. On a regional basis the TTR is thought to be within the Cactus Flats groundwater drainage area (see Figure E3-4). Under one scenario, groundwater on a regional basis is interpreted to flow from the TTR area toward the southwest. It is postulated to be part of the groundwater system that discharges in Sarcobatus Flat northwest of Beatty, Nevada, along Highway 95 (ERDA, 1975). Because of the lack of groundwater elevation data, it is possible that the Cactus Flats drainage area is actually part of the Pahute Mesa groundwater system. Under this alternative scenario the groundwater would flow south and eventually discharge to the Amargosa Desert southeast of Beatty, Nevada. Estimates of Cactus Flats groundwater discharges have been made and range from 600 to 1,500 acre-feet/year (ERDA, 1975; BLM, 1981).

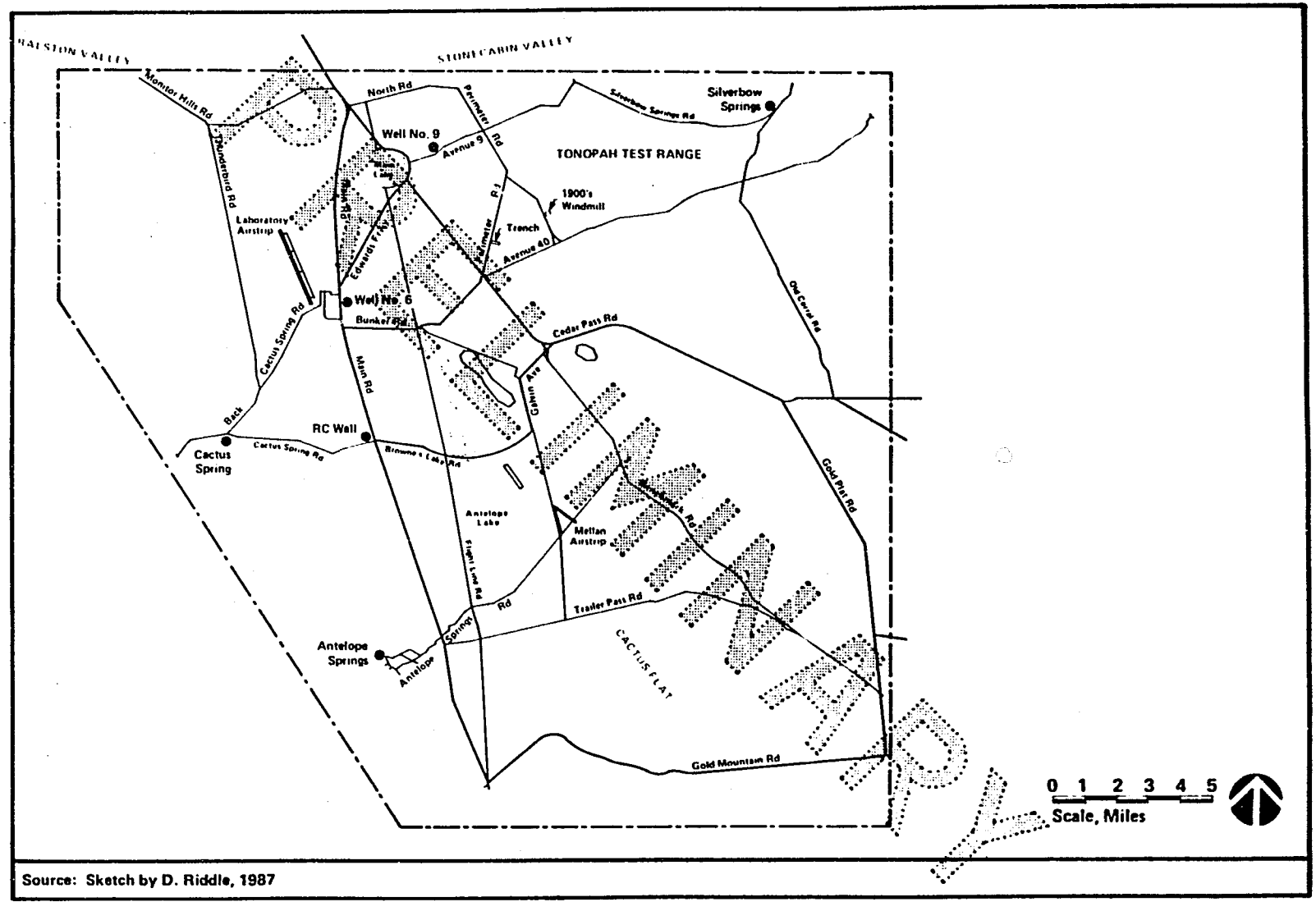
Recharge to the Cactus Flats groundwater system is derived principally from infiltration of precipitation at the higher elevations. Precipitation is higher in the mountain ranges that surround TTR. On the order of 12 inches/year of precipitation fall at the higher elevations, while approximately 5 inches/year fall in the valley at TTR (BLM, 1981) (SNLA, 1987). The recharging water reaches the groundwater systems in the basins through seepage losses from streams at the edges of the basin and through flow from the adjacent consolidated rocks (ERDA, 1975).

No data exist regarding the flow regime within TTR or the Cactus Flats system area. Three springs are known to occur within TTR. All the springs are located in the mountain ranges. Cactus and Antelope Springs in the Cactus Range, and Silverbow Springs in the Kawich Range. The locations of these springs and also site wells are shown on Figure E3-5. Water discharged from the springs is reported to flow only a short distance before evaporating and/or infiltrating into the ground. Within the Cactus Flats Basin, the groundwater closest to the surface occurs within the alluvium. Depth to groundwater has been reported to vary from 90 to 150 feet (ERDA, 1975). However, measurements taken from Sandia National Laboratories-Albuquerque (SNLA) Well No. 6 indicate that the depth to groundwater is much



GENERALIZED MAP OF INTER-VALLEY GROUNDWATER FLOW AS INTERPRETED FROM WATER-LEVEL DATA

FIGURE E3-4



Source: Sketch by D. Riddle, 1987

LOCATIONS OF WELLS AND SPRINGS **FIGURE E3-5**

deeper than that reported in the 1975 ERDA report. On-site interviews indicate that depth to water is on the order of 350 feet in SNLA Well No. 6. In fact, in 1981 the depth to water in the well was reported at 426 feet (SNLA, 1987).

E3.4.1.3 Groundwater Use

Water supply at TTR is provided by groundwater wells installed in the alluvial sediments. Three wells are utilized by TTR for water supply. The locations of these wells are shown on Figure E3-5. Specific information about these wells was not available during the record review. According to one site document (SNLA, 1987), SNLA Well No. 6 is 743 feet deep. The other two wells, Well No. 9 and the Roller Coaster (RC) Well, do not have any construction details. All three wells are currently in use. SNLA Well No. 6 is utilized as the main drinking water supply source for SNLA TTR activities. The RC Well is used for non-potable supply. Well No. 9 supplied potable water to Area 9 until 1985 and is now used intermittently for non-potable supply.

Withdrawal rates from the wells were estimated (in 1975) to be 3.65 million gallons/year. Approximately 3 million gallons is used for dust control and concrete mixing. The remaining volume is used for drinking and sanitation (ERDA, 1975).

E3.4.2 General Description of Pollution Sources and Controls

There are no known sources of groundwater contamination at TTR. However, there are a number of activities, both past and present, that have introduced chemical and radioactive contaminants to the soil. These have the potential to act as sources of groundwater contamination. The activities can be divided into three types; they are

1. test activities, such as air drops, tests of ground- and air-launched rockets, artillery projectile firings, explosion effects tests, cruise missile flights, and earth penetrator tests;

2. waste disposal activity areas, such as landfills, lagoons and septic tanks; and

3. other miscellaneous activity areas, such as scrap and waste oil storage yards.

Most of the activities noted above take place within the Cactus Flats Basin. The notable advantage to this location is the low annual precipitation and deep groundwater. This results in a reduced potential for contaminant migration from the soil to the groundwater.

The greatest potential impact to groundwater results from the introduction of liquids (historically and currently) to the soil via septic tanks and lagoons. Another area where the impact could be greater is at Cactus Spring where it is reported that animals subjected to plutonium-contaminated forage were housed. The groundwater is at the ground surface near the spring.

The areas, therefore, that are anticipated to have the greatest potential impact to groundwater include:

1. Cactus Spring;

2. the Roller Coaster lagoons, where sanitary and possibly radioactive decontamination effluents were discharged to the ground; and

3. septic tanks, in particular those that have accepted chemical discharges, such as the large-vehicle maintenance shop.

Other areas of contamination that could act as sources of groundwater contamination are discussed in Section E4.5 of this report. Typically these areas involve the contamination of soil by plutonium, uranium, and beryllium. However, it is suspected that old landfills may have received liquid chemical wastes, and there is evidence of oil spillage at the scrap storage area.

E3.4.3 Environmental Monitoring Program and Data

E3.4.3.1 Monitoring Programs

There are two routine groundwater monitoring programs conducted at TTR. The first is associated with the U.S. Environmental Protection Agency's (EPA) Long Term Hydrologic Monitoring Program (LTHMP). The second is conducted by Reynolds Electrical and Engineering Co. (REECo).

The EPA groundwater monitoring program (LTHMP) monitors groundwater "...in areas where nuclear tests have been conducted (and surrounding communities) to monitor the presence of nuclear test-related radioactivity if any occurs" (SNLA, 1987). In the case of TTR, Well No. 6 is part of this program. Samples are collected monthly and are analyzed for

- suspended solids,
- temperature,
- pH,
- conductivity, and
- gamma spectral analysis.

Semiannual analyses are performed on the samples from Well No. 6 for tritium.

The REECo sampling of groundwater involves a number of wells. SNLA Well No. 6 is included in this sampling. The sampling schedule includes

1. monthly sampling for bacteriological analysis;
2. quarterly sampling for:
   - tritium
   - gross alpha
   - gross beta
   - plutonium-239
   - strontium-90

DRAFT

3. sampling once every 3 years for an extended list of parameters (priority pollutants).

No other wells are monitored that are part of SNLA. No wells exist near other sources of contamination.

E3.4.3.2 Monitoring Data

The data base available for review was extremely limited. Although historical records exist from both monitoring programs, these records were not made available for this investigation. The only records available are for 1986 and are included in Tables E3-1 and E3-2.

The data suggest no apparent radiological impacts on the groundwater (obtained in the samples at Well No. 6) when compared to samples taken from other wells in the area. The plutonium-239 results indicated in Table E3-2 are reported to be in error as noted on the table.

E3.4.4 Findings and Observations

E3.4.4.1 Category I

None

E3.4.4.2 Category II

None

E3.4.4.3 Category III

1. Potential groundwater contamination. The groundwater has the potential to be contaminated as a result of areas of known and suspected soil contamination. This contamination could conceivably impact the water supply wells on the site. Known and suspected soil contamination has occurred as a result of site activities. These activities include

PRELIMINARY

TABLE E3-1

SUMMARY OF 1986 ANALYTICAL RESULTS FOR THE EPA LONG-TERM HYDROLOGICAL MONITORING PROGRAM*

Sample Location	1986 Quarter Report	Tritium* pCi/L Value ± 2σ	Percent Conc. Guide
Clark St., NV Well 6 TTR	1 2 3 4	*** -1.7 ± 12.5** *** -46 ± 250**	<0.01 <0.01
Tonopah, NV City Well	1 2 3 4	*** -6.8 ± 13** *** -120 ± 350**	<0.01
Las Vegas, NV Well 28 Water District	1 2 3 4	-9.3 ± 280** 2.7 ± 11.2 *** ***	<0.01 <0.01 <0.01

Source: SNLA, 1987

* Data from EPA, 1986 and personal communication (5-11-87).

** Concentration less than MDC (Minimum Detectable Concentration)

*** Gamma Spectrum Analysis only; No Radioactivity Detected

PRELIMINARY

TABLE E3-2

TONOPAH TEST RANGE SUPPLY WELLS SUBJECT TO THE SAFE DRINKING WATER ACT - ANALYSIS RESULTS

Location	Date	Analysis (value ± 2σ error)*					
		^{3}H (pCi/mL)	Alpha (10^{-3} pCi/mL)	Beta (10^{-3} pCi/mL)	Gamma (pCi/mL)	^{90}Sr (10^{-3} pCi/mL)	^{239}Pu** (10^{-3} pCi/mL)
Well 6 (SNLA)	3/31/86	<0.73	3.83 ± 0.92	7.37 ± 0.94	<MDL	<0.43	1.77 ± 0.31
	6/11/86	<0.63	4.79 ± 1.17	10.1 ± 1.01	<MDL	<0.28	<0.052
Well 3A	3/31/86	<0.73	4.26 ± 0.95	4.90 ± 1.09	<MDL	<0.36	0.71 ± 0.14
	6/11/86	<0.63	5.52 ± 1.08	9.01 ± 0.97	<MDL	<0.34	<0.052
Well BLM	3/31/86	<0.73	1.52 ± 0.63	6.83 ± 0.92	<MDL	--	--
	6/11/86	<0.63	2.36 ± 0.85	11.1 ± 1.00	<MDL	<0.37	<0.069
Well AF	3/31/86	<0.73	1.84 ± 0.68	8.52 ± 0.95	<MDL	<0.39	1.29 ± 0.22
	6/11/86	<0.63	2.35 ± 0.74	10.3 ± 0.85	<MDL	<0.33	0.315 ± 0.132 (low recovery)

Source: SNLA, 1987

* Screening level standard for gross alpha is 5×10^{-3} pCi/mL and for gross beta is 1.5×10^{-2} pCi/mL. Maximum contaminant levels for ^{3}H and ^{90}Sr are 20 pCi/mL and 8×10^{-3} pCi/mL respectively.

** Positive Pu-239 values reported for March 1986 have been determined to be anomalous and may have resulted from sample contamination. Subsequent sampling (June 1986) at the same locations gave no indication of Pu-239 above minimum detectable levels. Plutonium has never been detected in TTR well waters.

PREVIEW

a. test areas where plutonium, uranium, beryllium, and possibly other contaminants have been dispersed;

b. waste disposal areas where solid and liquid wastes have been disposed of; and

c. other areas where potential contaminants (such as waste oil) have been used or stored.

Soil contamination has the potential to contribute to groundwater contamination as a result of infiltration from precipitation. The potential for this to occur, however, appears to be low due to the low annual precipitation (5 inches/year) and the reported depth to groundwater (300 + feet).

A greater potential for groundwater contamination exists as a result of liquid effluent discharges to the ground and where contamination may be present where the groundwater is shallow. There are a number of areas where these conditions occur. Examples are listed below.

1. Roller Coaster Lagoons - These lagoons were utilized during the Roller Coaster tests during 1963. Discharges of sanitary effluent and possibly radioactive decontamination effluents occurred. These lagoons are currently filled with debris and literally hundreds of empty 55-gallon drums.

2. Septic Systems - All effluents at TTR are discharged to the ground via septic systems. These systems receive or have received wastes from both sanitary and chemical discharges. Examples of these sources include the photo laboratory and the large-vehicle maintenance area.

3. Cactus Spring - Animals subjected to radiation from forage obtained from the Roller Coaster tests were reportedly housed at Cactus Spring. These contaminants could have entered the shallow groundwater in this area.

4. Other Liquid Discharges - Spent solvents and other waste chemical liquids were historically disposed of in the old landfill.

2. Lack of characterization of hydrogeologic regime. The regional and local hydrogeologic regime has not been characterized. Sites where soil contamination exists or is suspected are not monitored. As a result, contamination could go undetected.

Groundwater flow rates, directions, and hydraulic conductivities have not been defined at TTR. Local depth to groundwater has been defined only at a small number of locations. Details of the regional flow regime are sketchy at best. It is not known whether the groundwater in the Cactus Flats Basin flows to the west or the south.

Depth to groundwater (and hence elevations of groundwater) are only determined at Well No. 6. It is unknown whether there are areas of shallow groundwater that could pose a potential problem with regard to contamination. An interview with a former site worker suggests that a rocket that impacted north of the main target lake impacted deep enough so that groundwater was encountered during the recovery of the rocket. Additionally, in the past, large tension cracks (on the order of thousands of feet long) developed on the lakebeds. It was reported that these cracks drained a lake of water in one instance. This occurrence could have carried contaminants to the groundwater if they were present.

E3.4.4.4 Category IV

None

E4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

PRELIMINARY

E4.1 Waste Management

E4.1.1 General Description of Pollution Sources and Controls

Until approximately 2 years ago, all the solid, domestic, and hazardous wastes generated at Tonopah Test Range (TTR) were disposed of on the Range. Most of the waste is produced in Area 3 and a somewhat smaller amount in Area 9. The majority of this solid waste was disposed of in a landfill approximately 1,000 feet northwest of Area 3 (see Section E4.5). The area is now covered with an unknown thickness of soil (presumably 2 or 3 feet) and fenced. This inactive landfill area encompasses an estimated 1 acre.

Nonhazardous solid wastes are now disposed of using the sanitary landfill method in trenches southwest of Area 3. There are two disposal cells about 1,500 feet from Area 3. One is partially covered with a screen to control windblown paper. The other is for large objects such as boxes and crates. There also is one cell 2,000 feet (600 m) from Area 9 for large objects.

No radioactive liquid, solid, or gaseous wastes are normally generated as a result of present TTR operations. The exception is the NEDS tests. During fiscal year 1975, 66 kg (29 mCi) of depleted uranium was collected from them for burial, as well as 5.4 kg of beryllium. These wastes are buried at a Government-owned, approved burial facility at the Nevada Test Site (NTS).

Occasionally test units containing depleted uranium and/or beryllium are deliberately destroyed using specific safe operating procedures. All fragments and waste material are carefully collected, packaged, marked, and shipped to the test originator using current Department of Transportation regulations.

Whenever explosives have deteriorated or are obsolete or defective, they are disposed of at an open burn pad about 2,000 m from Area 9. These consist of high explosives (Comp C), gun or howitzer propellants, electric igniters, and solid-fuel rocket motors. Safe operating procedures based on Army Ordnance Command manuals are used by qualified personnel to burn off the explosive materials. The residue is inspected and disposed of in the sanitary landfill cell nearby.

A variety of liquid industrial and hazardous wastes are currently generated in Area 3. They include the following:

1. Building 03-60 - The light-vehicle maintenance garage generates an estimated 500 gallons/year of waste motor oil transmission fluid, and gear oil from the oil changing of a fleet of 100 trucks and cars. Waste Stoddard solvent from maintenance activities is also generated at an estimated 100 to 200-gallon-per-year rate.

2. Building 03-74 - The heavy equipment garage generates waste Stoddard solvent, waste motor oils and greases, and waste hydraulic oils at a rate estimated to be similar to Building 03-60.

3. Building 03-73 - The paint shop generates an estimated 5-10 drums per year of contaminated paint solvents including mineral spirits, acetone, methyl ethyl ketone, methylene chloride, and other common paint solvents and stripping solutions mixed with waste paints and varnishes.

4. Building 03-73 - The Plumber's shop generates waste cutting oils with metal shavings. These oils contain halogenated solvent additives.

5. Security forces training building - This building generates an estimated 20-50 gallons per year of gun-cleaning solutions and solvents.

These liquid wastes, several of which may be hazardous, are currently contained in 5-gallon cans or 55-gallon drums and stored at the point of generation. These wastes are collected for disposal off the site by Reynolds Electrical and Engineering Company (REECo); however, there is no collection schedule, no program or procedure to sample and analyze the wastes to determine which are hazardous, and no regular program of transportation of the wastes. As evidence to this lack of a disposal system, a drum accumulation area was noted inside a fenced area approximately 2,000 feet southwest of Area 3. Inside the area, about 70 drums were stored, some directly on the ground surface and some on pallets.

E4.1.2 Findings and Observations

E4.1.2.1 Category I

None

E4.1.2.2 Category II

1. Potential soil and groundwater contamination from leaking improperly stored drums of liquid waste. The waste oil accumulation site south of Area 3 contains approximately 70 drums of waste oil potentially contaminated with hazardous wastes. These drums are stored over open ground; some are leaking and have contaminated the soil and potentially the groundwater.

   Many of these drums are rusty, have open bungs or open tops, and the outside of the drums and surrounding soil are covered with their spilled contents. Although all wastes are oily, some have sheens or appear to be of a wide variety of color and viscosities, indicating the possibility of admixtures of waste oil and other wastes. None of the drums are marked as to their current contents nor are the accumulation dates shown or recorded anywhere. Site personnel said that the storage area had been there for about 2 years.

E4.1.2.3 Category III

None

E4.1.2.4 Category IV

1. Potential soil contamination as a result of lack of system for accumulation and removal of liquid wastes. Currently, there is no system for the satellite accumulation and removal for disposal of hazardous liquid waste, particularly in Area 3. This may result in improper handling or spills of such wastes and potential soil contamination.

   Although hazardous liquid wastes such as paint thinners, waste solvents, waste oils, and metal shavings contaminated with cutting oil are segregated

from regular trash, no system or staff procedures exist for dating containers with accumulation date, or for container pickup, control, storage, and ultimate disposal of these wastes.

E4.2 Toxic and Chemical Materials

E4.2.1 General Description of Pollution Sources and Controls

Given the few types of industrial operations conducted at TTR, only limited quantities of toxic chemical materials are stored.

Two pole-barn-type buildings with elevated wooden deck floors are used for the main storage for the range. These storage buildings are at the northwest corner of Area 3. Together, the buildings contain approximately 50-60 drums of oils, transmission fluids, Stoddard solvent, cleaners containing methylene chloride and petroleum distillates, lacquer thinner, ethylene glycol, and other oils and solvents. Although there is some evidence of minor spillage on the ground, and there is no spill containment in the wooden or metal grate floors directly over bare ground, there is no evidence that large spills have occurred in the past.

At satellite usage locations throughout Area 3 and to a lesser extent in Area 9, drums and chemicals are stored outside and without containment, generally on their side in cradles. These locations include:

1. Building 03-74 heavy-equipment garage - 5 drums stored south outside the building, including 55-gallon drums of Stoddard solvent, motor oil, hydraulic oil, and transmission fluid.

2. Building 03-60 light-vehicle maintenance garage - 4 drums stored outside including 55 gallons of Stoddard solvent, oils, and steam cleaner detergent solution.

3. In Building 03-55 there are 3 indoor tanks of photo-development chemicals, including 30 gallons of developer, fixer, and stop stored in the attic of the building without containment or spill control. These tanks are loosely covered plastic carboys stored directly above the general

chemical storage area. This general storage area contains several 5-gallon and smaller containers of development chemicals. The floor drains in this storage area are believed to connect to the building leaching pit.

No polychlorinated biphenyl (PCB) or PCB-contaminated transformers are known to be at TTR, although a comprehensive study has never been conducted.

The use of pesticides at TTR is generally limited to small containers of household-use type, with the exception of Area 9 where commercial application of atrazine is performed around bunkers. Six 25-lb bags of 85 percent atrazine were stored on the open ground under a pole barn in Area 9.

PRELIMINARY

E4.2.2 Findings and Observations

E4.2.2.1 Category I

None

E4.2.2.2 Category II

None

E4.2.2.3 Category III

None

E4.2.2.4 Category IV

1. Potential soil contamination from improper outdoor storage of chemicals. There is improper outdoor storage of oils, solvent chemicals, and cleaners in Area 3 and of film development chemicals in Building 03-55 (photo laboratory) which may result in soil contamination.

Leaks and spills from 55-gallon drums on horizontal dispensing racks have caused visible soil contamination at the large-vehicle repair shop (Building 03-74) and the small-vehicle repair shop (Building 03-69).

The chemicals stored include Stoddard solvent, motor oils, and transmission fluid in five drums at Building 03-74 and in four drums at Building 03-60. Also three 30-gallon plastic storage tanks for film development chemicals were constructed in the attic rafters of the photo laboratory without proper installation or containment. These tanks could easily be tipped over and spill their entire contents on any personnel in the developing area.

2. Potential soil contamination from improper storage and application of pesticides. Improper storage and application of pesticides is occurring at Area 9 and no formal program for pesticide application in other areas is in place. Improper storage and application of pesticides may potentially result in soil contamination by excessive application or by spillage.

Six 25-lb bags of 85 percent atrazine weed killer were being stored on the ground in an unnumbered storage building at Area 9. Although pesticides were reported to be applied by Area 9 staff and by Area 3 staff, no procedures and protocols or licensed applicators are in place and no contract exists for an outside contractor program.

PRELIMINARY

E4.3 Radiation

This section (1) identifies the sources of off-site radiation exposure resulting from the operation of the Tonopah Test Range (TTR); (2) reviews the methods used to measure and monitor the impacts of these exposures; (3) compares the estimated and measured impacts against established standards and limits; and (4) presents findings regarding problems and deficiencies.

Sandia National Laboratories-Albuquerque (SNLA) activities at the TTR include air-drops, artillery projectile firings, ground-launched rockets (both high and low altitude), air-launched rockets, explosion effects tests, earth penetrator tests, and cruise missile flights. Some of the activities involve the use of radioactive materials, principally depleted uranium, which are scattered over portions of the TTR.

The tests carried out at the TTR are designed and equipped at other locations, notably Albuquerque and Livermore, and brought to the TTR by visiting teams. Any monitoring is performed by the visiting teams and the results do not become a part of the records maintained by TTR operational personnel.

E4.3.1 Background Environmental Information

The average dose equivalent from natural background radiation in non-urban Nevada is 71.1 millirem/year (EPA, 1985). This dose rate includes 41.9 millirem/year caused by charged particles from extraterrestrial sources which, when entering the earth's atmosphere, have sufficiently high energies to generate secondary particles that penetrate to ground level (EPA, 1985). Throughout the United States, the average dose rate due to cosmic radiation is 28 millirem/year (NCRP, 1975). Naturally occurring terrestrial radionuclides contribute a dose rate of 29.2 millirem/year in non-urban Nevada (EPA, 1985) as compared with a national population-weighted average of 26 millirem/year (NCRP, 1975).

E4.3.2 General Description of Pollution Sources and Controls

Many hundreds of air drops and gun firings have been carried out at the TTR. Some of the missiles and projectiles have contained depleted uranium and plutonium. This pattern of activity continues. Normally any debris from the tests is removed by

a visiting test team and the missiles and projectiles are returned to the team's home base. In a few instances the missiles and projectiles are buried so deeply or damaged so badly that they are buried in place on the TTR.

Proposed tests that are deemed to have a potential for environmental impact and are not covered under the 1975 TTR Environmental Assessment are required to have an approved Action Description Memorandum (ADM) before the tests can take place. The ADMs are written by the organization responsible for the test and are reviewed by SNLA personnel for submission to DOE for review and approval.

A series of tests named "Roller Coaster" were carried out in 1963 to study the dispersal of plutonium from the accidental, non-nuclear explosion of plutonium-bearing weapons. Three large areas of the TTR were contaminated with plutonium as a result of the tests ("Clean Slate" 1, 2, and 3). The contaminated areas were fenced and posted. A field radiation study of the areas was performed in 1973 and an aerial study in 1977. The areas have not been monitored since that time.

During the Roller Coaster operation, a large workforce was housed at the intersection of the main north-south road and the Cactus Springs Road. The facilities included a decontamination station for people as well as equipment. The facilities have since been dismantled and only foundations, berms, and dry basins now exist.

E4.3.3 Environmental Monitoring Program

Since 1970, environmental monitoring at the Nevada Test Site (NTS), including the TTR, has been the responsibility of the U.S. Environmental Protection Agency (EPA). The objective of this surveillance program is to measure levels and trends of radioactivity in the environment surrounding the testing areas and to ascertain whether testing is in compliance with existing radiation protection standards. Off-site levels of radiation and radioactivity are assessed by sampling milk, water, and air; by deploying dosimeters; and by sampling food crops, soil, etc. Routine sampling results are reported quarterly to the Nevada Operations Office (NVO) of DOE, and SNLA receives copies of the results and reports on them annually.

On-site services, including environmental monitoring, at NTS and TTR are provided by the Reynolds Electrical and Engineering Company (REECo) under contract to NVO. At TTR, REECo. collects well water samples, performs radiological analyses, and obtains permits in compliance with EPA regulations. The radiological analysis results for TTR are published in the annual NTS environmental monitoring report. Starting in 1986, copies of these data have also been provided to SNLA and are reported in the TTR environmental monitoring report (SNLA, 1987).

Water Monitoring

At TTR, the one potable supply well (Well No. 6) is sampled once every 3 months for radiological analysis. Samples are analyzed for gross alpha, gross beta, tritium, strontium-90, and plutonium-239. Other wells in the vicinity are sampled under the aegis of NVO. The results of sampling and analyses in calendar year (CY) 1986 for all these wells are shown in Table E3-2. The results are consistent with values reported in the 1985 NTS Environmental Monitoring Report.

TTR is also included in EPA's Long-Term Hydrologic Monitoring Program (LTHMP). The LTHMP was established to monitor water sources in areas where nuclear tests have been conducted (and surrounding communities) to monitor the presence of nuclear test-related radioactivity if any occurs. Samples were collected on a semiannual basis until 1984 but are now collected monthly. Monthly sample analysis includes a gamma spectral analysis, suspended solids, pH, temperature, and conductivity. Tritium analysis is done semiannually. When the conventional analysis yields tritium concentrations $\leq$700 pCi/L, a reanalysis is done using a tritium enrichment analysis technique (Minimum detection concentration = 9 pCi/L). Gross alpha and gross beta analysis is not done on the routine samples. A detailed analysis including isotopic uranium and alpha count is performed only for initial samples at new sample locations. Two 3.8-liter (one-gallon) samples are collected monthly. One sample is filtered and acidified. Two 0.47-liter (one pint) samples are collected for the tritium analysis, one of which is stored for a year as a backup sample.

Tritium concentrations for TTR Well 6, as reported by EPA, are shown in Table E3-1 along with Las Vegas and Tonopah results. All tritium concentrations observed were consistent with previous years' data (SNLA, 1987).

Air Monitoring

A continuous particulate air monitoring station is operated as part of the EPA Air Surveillance Network. The station is located in Area 3 between two closely spaced buildings. The station provides the only information available regarding the airborne concentrations of radioactive materials at the TTR Control Point. Filters are exchanged three times per week and analyzed by gamma spectrometry. A summary of relevant surveillance network CY 1986 results is shown in Section E3.1.2.

Penetrating Radiation

Measurement of penetrating radiation is carried out by EPA as part of its NTS-wide responsibilities. Thermoluminescent dosimeters (TLDs) are collected quarterly. Results for TTR are consistent with those for surrounding areas as shown in Table E4-1 (SNLA, 1987).

PRELIMINARY

E4.3.4 Findings and Observations

E4.3.4.1 Category I

None

E4.3.4.2 Category II

None

E4.3.4.3 Category III

None.

E4.3.4.4 Category IV

1. Off-site radiation dose unevaluated. Historical evaluation of off-site radiation dose from radioactive materials released during testing activities has not been performed.

TABLE E4-1

SUMMARY OF 1986 EPA DOSIMETRY NETWORK EXPOSURES*

Sample Location	1986 Quarter	Average Exposure (μR/h) ± 1s	Environmental Background (μR/h) ± 1s	Net Exposure mR ± S.E.
Tonopah Test Range	1	12.3 ± 0.5	11.6 ± 2.1	0.0
	2	10.1 ± 0.5	11.9 ± 2.1	0.0
	3	12.5 ± 0.5	11.9 ± 2.2	0.0
	4	12.1 ± 0.6	12.4 ± 1.9	0.0
	year	11.7 ± 0.3	12.0 ± 1.0	0.0
Tonopah, NV	1	13.1 ± 0.2	12.5 ± 0.9	0.0
	2	12.3 ± 0.8	12.9 ± 0.8	0.0
	3	14.4 ± 0.5	12.8 ± 0.9	0.0
	4	12.9 ± 0.5	13.4 ± 0.9	0.0
	year	13.2 ± 0.2	13.1 ± 0.4	0.0
Clark Station, NV**	1	11.6 ± 0.6	12.1 ± 1.0	0.0
	2	11.5 ± 0.5	12.2 ± 0.9	0.0
	3	12.5 ± 0.3	12.3 ± 0.9	0.0
	4	12.4 ± 0.4	12.2 ± 0.8	0.0
	year	12.2 ± 0.2	12.2 ± 0.4	0.0
Goldfield, NV	1	9.96 ± 0.42	9.28 ± 0.49	0.0
	2	8.37 ± 0.29	9.42 ± 0.60	0.0
	3	10.9 ± 0.4	9.28 ± 0.78	0.0
	4	10.1 ± 0.4	9.79 ± 1.05	0.0
	year	9.56 ± 0.2	9.37 ± 0.33	0.0

Source: SNLA, 1987

* Data from EPA, 1986

** Clark Station is located immediately north of TTR

The doses received by persons outside the boundaries of the TTR might actually be greater than reported. However, the very few people who reside in the vicinity of the TTR are located many tens of miles from where the tests are carried out and the dose consequences to them of materials released as a result of the testing are not likely to be significant.

PRELIMINARY

E4.4 Quality Assurance

E4.4.1 General Description of Data Handling Procedures

The on-site support contractor for Sandia National Laboratories-Albuquerque, Reynolds Electrical and Engineering Company (REECo) conducts the environmental sampling that is performed at TTR. Analyses are performed by REECo at the Nevada Test Site (NTS) or at other outside laboratories by proper procedures. Sampling performed at TTR includes air particulate sampling and potable well sampling. There are no written procedures for this sampling nor is there any training program for such procedures.

E4.4.2 Findings and Observations

E4.4.2.1 Category I

None

E4.4.2.2 Category II

None

E4.4.2.3 Category III

None

E4.4.2.4 Category IV

None

PRELIMINARY

E4.5 Inactive Waste Disposal and Contamination Sites

E4.5.1 General Description of Pollution Sources and Controls

The Tonopah Test Range (TTR) provides research and development and quality assurance (QA) testing for the U.S. Department of Energy (DOE) nuclear ordnance programs. TTR has been in operation since 1957 performing various tests at the rate of approximately 200 per year. Prior to DOE use, the TTR was used as a bombing range by the U.S. Air Force. The majority of tests (77 percent) are performed for the DOE. However, other tests have been conducted by other Government agencies. Tests include the use of gravity bombs, rockets, cruise missiles, artillery, and other devices and activities.

Approximately 200 Sandia National Laboratories-Albuquerque (SNL-A) personnel make up the workforce at TTR. Waste generated by their activities is for the most part disposed of on-site. Solid wastes are typically disposed of in landfills or trenches. Liquid effluents are typically disposed of in septic systems and associated drainfields. Hazardous waste and spent oils are collected for off-site disposal.

A comprehensive review and inventory of contamination and inactive waste sites (such as those required by DOE Order 5480.14) has not been done at TTR. This program [Comprehensive Environmental Assessment and Response Program (CEARP)] is in the process of being implemented for TTR but the first phase of the program was not scheduled to begin until late 1987. Therefore, the information in this section should be considered preliminary in nature due to the lack of available data.

E4.5.1.1 TTR Activities Summary

For the purposes of this summary, the activities that have contaminated or have the potential to contaminate soil and/or groundwater at TTR have been divided into three categories. These are

1. test activities, such as air drops, ground- and air-launched rocket tests, artillery projectile firings, explosion effects tests, cruise missile flights, and earth penetrator tests;

2. waste disposal activities, such as landfills, disposal trenches, lagoons, and septic tanks; and

3. miscellaneous activity areas, such as waste oil and scrap storage yards, where spills have occurred or could occur.

The following sections of the report are divided into discussions of each of these activity areas and the associated contamination issues that arise from these activities. Where possible, each potential contamination site is noted on Figure E4-1.

It should be noted that the following information was obtained based on a number of separate sources. Since the data base at TTR on contaminant sites is incomplete, the following discussion relies heavily on:

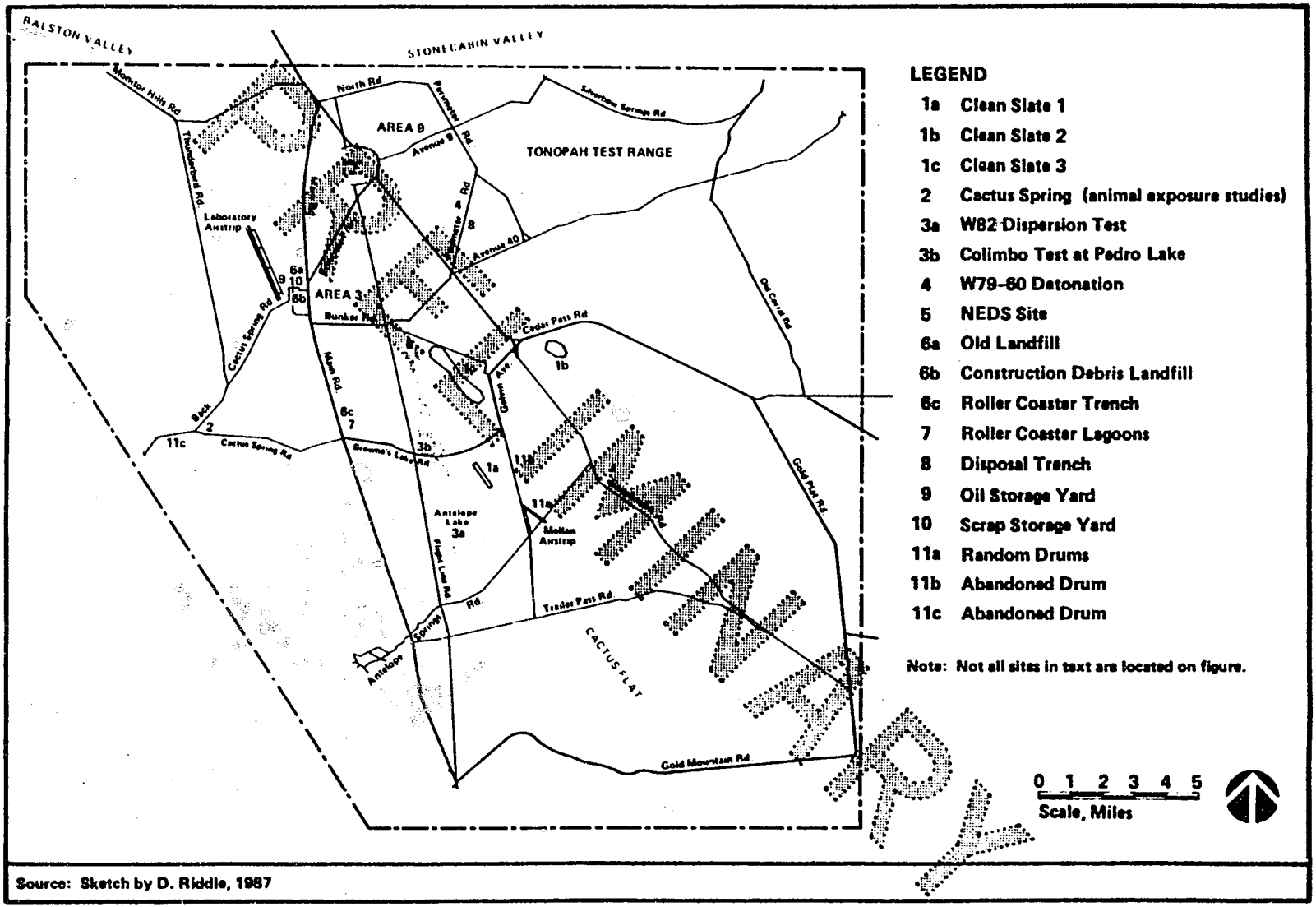
- interviews with site workers,
- TTR visual reconnaissance, and
- a cursory review of aerial photographs.

Additional valuable information was derived from all of the referenced documents for this section of the report.

E4.5.1.2 Testing Activities

Testing activities at TTR can and do result in the dispersal of radioactive and non-radioactive contaminants onto the ground. Typically these contaminants are beryllium and uranium-238, which are substitutes for fissionable materials in the weapons systems being tested. In most cases, the substitute materials are intended to remain intact within the weapon assembly; however, this is not always the case. In some recent and some historic tests, contaminants such as plutonium, uranium-238, and beryllium were deliberately dispersed into the environment. Live high explosives (HE) are also used at TTR. In some cases the weapons containing high explosives are detonated in place such that uranium-238 and beryllium could be introduced into the adjacent soil.

FINAL



Source: Sketch by D. Riddle, 1987

GENERAL LOCATIONS OF INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES FIGURE E4-1

The following discussion presents the individual activities or groups of activities that have or may have resulted in contamination at TTR.

Roller Coaster Tests - A series of four tests, three of which were conducted at TTR, were conducted in 1963. Known as Roller Coaster, these tests were performed to study plutonium-239 dispersal from accidental non-nuclear explosions of plutonium weapons. The three test areas at TTR are known as Clean Slate 1, 2, and 3. The tests resulted in three plutonium-contaminated areas at TTR which are currently fenced to prevent access (see Figure E4-1, Sites 1a, b, c).

The total plutonium estimated to be in the three Clean Slate test areas is on the order of 64 curies. The area involved is approximately 2.4 square kilometers (see Table E4-2 for a summary of information on these tests). Soil sampling and ground and aerial radiologic studies were performed in the 1970s. The fencing was last placed in 1973. The last study (aerial) was performed in 1977. Since 1978 no measurements or soil samples have been obtained to assess migration of the plutonium. The only surface stabilization performed involved the covering of hot spots with soil. A total of 453,000 cubic meters of soil has been estimated to be contaminated (SNLA, 1987).

Cactus Spring - According to site interviews, the Cactus Spring area served as an "animal camp" during the Roller Coaster tests. The animals were reportedly used for exposure studies. It has been reported that some animals (such as donkeys) were fed forage obtained from the plutonium-contaminated areas. Additionally it was mentioned that beagles were used at this animal camp.

It is possible that plutonium-contaminated materials and radiologically contaminated urine and feces could have contaminated the ground in the Cactus Spring area. Of additional concern is the proximity of groundwater to the ground surface at Cactus Spring. Since the spring flows at the ground surface, it is possible that contaminants could have entered the groundwater.

TABLE E4-2

ROLLER COASTER TEST INFORMATION*

Name	Clean Slate 1	Clean Slate 2	Clean Slate 3	Double Track
Date	25 May 1963	31 May 1963	9 June 1963	15 May 1963
Location	TTR	TTR	TTR	NELLIS
Plutonium Inventory (Ci)	5.2 ± 1.6	29 ± 6.2	30 ± 4.9	5.0 ± 1.4
Contaminated Area (km^2)	0.22	0.81	1.38	0.30
Inner Fence (km)	0.15	0.73	1.22	0.15
Outer Fence (km)	2.88	2.68	8.44	2.26

Source: SNLA, 1987

* Data from report provided by REECo Environmental Sciences Department/NTS, October 31, 1986.

PRELIMINARY

Penetration Tests - Projectiles are fired from a Davis gun into rock. The projectiles are usually inert, but may contain depleted uranium, plutonium, or high explosives. Approximately 150 shots are reported to have occurred at TTR since 1975. Twenty to thirty of these shots used depleted uranium. It is unknown whether case failures have occurred which could have dispersed contaminants into the environment. A worker indicated that he had never seen a case failure during the time he was involved with the tests.

W 82 Dispersion Test - In July of 1987 a cruise missile was detonated at Antelope Lake to evaluate dispersion of uranium-238. A sampling grid of 500 meters by 1,000 meters was used for monitoring with sticky plates. A soil sampling program with a 1,000-meter by 2,000-meter grid was also instituted as part of the monitoring program. According to TTR personnel, very little activity was detected at the detonation point. After a rainfall event, no activity was detected. Monitoring results from this test were not available during the site visit. It appears that there is a potential for soil contamination as a result of this test.

Additionally, a similar test with a cruise missile was conducted at Pedro Lake. Although the details of this test are unknown, it was reported that the test also involved the dispersal of depleted uranium. Similar contamination of soil could result.

In-situ Detonations - Almost all test units at TTR use depleted uranium and beryllium as substitutes for fissionable material. In addition, between 10 and 20 percent of the test drops use HE. Although it is usually not the intent to have a detonation, there may be a need to detonate these devices if they cannot be moved safely. In these cases they are detonated in place. This is accomplished by sandbagging atop the device to minimize dispersal. After detonation the surrounding soil is monitored for radiation and for the presence of beryllium. Contamination is left in the soil and the device is buried in place.

Other Dispersal Tests - Explosion effects tests (called the NEDS tests) were carried out in 1975 and possibly in later years. These tests were part of a program to provide design of shipping and storage containers that could retain the shrapnel, toxic debris, radioactive debris, and gaseous products produced from a demolition of a nuclear weapon. It is unknown how many of these tests were carried out;

however, in 1975 it was reported that 18 of these tests were completed (ERDA, 1975). According to this report, approximately 10 kilograms of depleted uranium and 1 kilogram of beryllium were used in each test.

These tests apparently involved the detonation of devices in both unconfined and confined configurations. Uranium and beryllium were dispersed as a result of the detonations. It is unclear whether any detailed studies of soil contamination from these tests were performed. There is a reference to soil samples having been taken that showed beryllium concentrations of less than the detection limit of 5 mg/g within 100 feet downwind of the detonation point.

There is an obscure reference (ERDA, 1975) to other tests at TTR where beryllium and depleted uranium were dispersed. No other information on the type of tests is given in the reference.

Debris - The various tests at TTR have resulted in miscellaneous debris scattered across the test area. This debris includes rocket motors, rockets, and shells. Reports of live and inert explosives left over from World War II also occur (ERDA, 1975). Two impacted rockets were observed during the site visit. It is unknown whether any contamination of soil has resulted from these impacts. Debris (concrete, vehicles, construction articles, etc.) was also observed during the site visit at the former NEDS test area.

E4.5.1.3 Waste Disposal Activities

Historically, all wastes generated at TTR were retained and disposed of on-site. At present, hazardous wastes and spent oil are collected for off-site disposal. Both liquid and solid wastes have been disposed of in the following areas:

- in landfills,
- in trenches,
- in lagoons,
- in septic tanks, and
- on the ground surface.

Both liquid and solid wastes continue to be disposed of in landfills and septic tanks. The following discussion reviews the various known waste disposal activities at TTR that may have resulted in contamination.

Landfills - The "old landfill" located near Area 3 was utilized between 1957 and 1985; it is currently inactive. It is reported to have received all wastes from TTR operations including spent solvents. It did not receive used motor oil, since the oil was used for dust control on dirt roads. Although little more is known about the landfill, it is suspected to have received potentially hazardous wastes (small quantities) since it operated over such a long period prior to hazardous waste regulations. Soils beneath the landfill may be contaminated. No monitoring has been performed at this landfill.

A construction debris landfill is currently operated near Area 3. It does not appear that this landfill has received contaminated substances. Most of the materials received by the landfill consist of wood, paper, and construction rubble. There is a possibility that the landfill could have received contaminated materials in the past, but this seems unlikely.

The Roller Coaster tests necessitated the construction of a camp to house the personnel required during the testing. The camp reportedly included decontamination facilities and a landfill. The location of this landfill is unknown. During the site visit, an open trench was discovered east of the Roller Coaster camp, which may have been the landfill. The trench contained debris including metal, tires, paper, cardboard drums and what appeared to be spent rockets. The trench was estimated to be 20 feet wide by 110 feet long. It is unknown whether any radioactive or hazardous materials would have been disposed of in this or any other landfill on the site. No monitoring is known to have been performed at this location.

Other areas, uncovered pits or trenches, that have received waste are dealt with in a separate discussion.

Liquid Waste Disposal Areas - Liquid wastes have been disposed of in lagoons and septic systems. In addition, waste oils have been spread on dirt roads for dust control. In general, all liquid sanitary wastes, with the exception of those from the

Roller Coaster camp, have been disposed of via septic systems and drainage fields. It appears that sanitary wastes from the Roller Coaster camp may have been discharged to two open lagoons east of the camp.

Septic Tanks - Septic tanks receive waste effluents from most occupied areas at TTR. While most of these discharges are likely to be sanitary wastes, some of the septic tanks have probably received chemical discharges. The areas where chemical discharges are suspected to occur include the photolab (which discharges photo rinsewaters) and the large-vehicle maintenance area (where historic discharges may have included solvents and petroleum products). It is likely that soils adjacent to the septic tanks and drainage fields have become contaminated over the years. There is also a greater potential for groundwater impacts from the septic tanks because of the ability of the liquids to act as a driving force for contaminant movement. No sampling data exist for either the effluents or the soils near the septic tanks or drainage fields.

Roller Coaster Lagoons - East of the former Roller Coaster camp are two dry lagoons that appear to have received wastewater from the camp. A series of manholes, along what is suspected to be a sewer line, originates within the camp and terminates as a pipe (discharge) into the lagoon closest to the camp. The lagoons are each approximately 65 feet wide and 130 feet long. There is no record of whether only sanitary wastes were discharged to the lagoons or if only radioactive decontamination water was discharged. It is possible that both types of effluents were discharged to the lagoons. The lagoons, during their lifespan, could have provided a driving force for contaminants to reach the groundwater if contaminants were present. No data on either the effluents or the lagoons exist.

Waste Oil - It was reported that waste oil derived from the vehicle maintenance shops was historically used on the dirt roadways of the site for dust control. This practice is no longer in use. Metals in the oil could have contaminated the soils in the roadways. No additional data are available.

Other Areas - There were liquid discharges as a result of decontamination facilities at the Roller Coaster camp. If these discharges did not go to the lagoons, they would have been discharged to another area of the site. Other decontamination

areas may have been used on the site for other tests; however, the existence and/or location of these areas is purely speculative.

Trench and Ditch Disposal Areas - A number of areas at TTR have been sites for the random disposal of debris. These areas include the trench at the Roller Coaster camp, which is filled with trash, and the Roller Coaster lagoons, which now contain hundreds of empty drums, metal, wood, paper, and other debris. A borrow pit east of station 28 and the perimeter road is filled with spent rockets from "honest john" and "nike" missiles. Also within this pit are drums, wood, and other miscellaneous debris. It is not known whether any of these pits have received chemical wastes, residues, or radioactive materials. No monitoring or sampling has been performed in these areas. Additionally, it is not known whether other trenches might exist at TTR.

E4.5.1.4 Other Activities

Other activities at TTR have the potential to result in soil contamination. These activities and areas are noted below.

Oil Storage Area - The waste oil storage area has 55-gallon drums of waste oil stored for off-site disposal. The ground in the area is stained from what appear to be oil spills.

Scrap Storage Yard - Historic aerial photographs reveal what appear to be significant numbers of drums stored in the scrap area west of Area 3. It is not known what, if anything, was in these drums or how long they had been stored in the area. It is possible that spills could have occurred if the drums contained any chemical products.

Random Drums and Debris - Nineteen empty drums were observed in the southern portion of the TTR along a roadway. Drums were observed in two other places along the roadside; along a road west of the Mellan Hills, and in the Cactus Range west of Cactus Spring. A large pile of bomb casings was observed near the Mellan Mines east of the dry lakebeds.

Old Mines - Prior to the establishment of the TTR, a number of mines operated within the TTR boundary. The Mellan Mines were visited during the site visit. No evidence of recent dumping was observed near the mine. However, an empty barrel of cyanide was discovered (likely used for minor ore processing at the mine). There may be some contamination as a result of these old mining activities.

E4.5.2 Findings and Observations

E4.5.2.1 Category I

None

E4.5.2.2 Category II

None

E4.5.2.3 Category III

1. Actual and potential soil contamination from site activities. Soil contamination has occurred and may have occurred as a result of historic and current site activities. This contamination has the potential to reach the groundwater.

   Activities that have contaminated or may have contaminated the soil consist of

   a. testing activities where plutonium, depleted uranium, and beryllium have been used;

   b. discharges of liquid effluents to the ground via septic systems, lagoons, and/or spills; and

   c. disposal of solid and/or liquid wastes (e.g., in landfills and trenches).

   Specific examples of the activities listed above and associated data are as follows:

PRELIMINARY

a. Testing areas: Clean Slate tests 1, 2 and 3 involved the dispersal of plutonium-bearing weapons. The areas of known plutonium contamination from these tests extend over 2 miles in length (Clean Slate 3). Other tests have included the use of depleted uranium and beryllium, which in some cases have been dispersed into the environment (e.g., W-82 test of July 1987). These tests may have contaminated soil.

b. Liquid effluent discharges: liquid effluent discharges to soil occur via septic systems at the facility. Of particular concern are discharges from the photo lab and large-vehicle maintenance shop. Historic discharges of sanitary and radioactive liquid effluents may have contaminated soil at the Roller Coaster sewage lagoons.

c. Solid and liquid waste disposal: solid and possibly liquid wastes have been disposed of in landfills at TTR, potentially resulting in soil contamination. Examples include the old landfill utilized between 1957 and 1985; the Roller Coaster sanitary lagoons which have been filled with debris and empty drums; and miscellaneous disposal areas.

The majority of these sites have not been investigated and no monitoring has been performed.

E4.5.2.4 Category IV

None

PRELIM

APPENDIX E REFERENCES

BLM (Bureau of Land Management, U.S. Department of the Interior and the Department of the Air Force), 1981. "Environmental Impact Analysis Process, Department of the Interior Final Environmental Statement. Proposed Public Land Withdrawal, Nellis Air Force Bombing Range, Nye, Clark and Lincoln Counties, Nevada," 736-335/1251 Revision No. 3-II, U.S. Government Printing Office, Washington, D.C.

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ERDA (U.S. Energy Research and Development Administration), 1975. Environmental Assessment - Tonopah Test Range, December.

Manhart, R., 1982. Technical Manual Tonopah Test Range Capabilities, SAND81-1871, Sandia National Laboratories-Albuquerque, Albuquerque, New Mexico.

NCRP (National Council on Radiation Protection and Measurements), 1975. National Background Radiation in the United States, Report 45, Washington, D.C., November.

SNLA (Sandia National Laboratories-Albuquerque), 1984. Site Development Plan, April.

SNLA (Sandia National Laboratories-Albuquerque), 1987. Environmental Monitoring Report, Tonopah Test Range, April.

PRELIMINARY

APPENDIX F

STORAGE TANK SUMMARY

PRELIMINARY

TABLE F-1

CHARACTERISTICS OF ABOVEGROUND TANKS AT SNLA: 1987

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
983-5	Acid	TA(1) IV	6,000
Burn Site-1	Aviation Fuel	CTF(2)	25,000
Burn Site-2	Aviation Fuel	CTF	600
Burn Site-3	Aviation Fuel	CTF	250
Burn Site-4	Aviation Fuel	CTF	500
Burn Site-5	Aviation Fuel	CTF	400
Burn Site-6	Aviation Fuel	CTF	2,000
983-6	Caustic Material	TA IV	6,000
970-2	Dielectric Oil	TA IV	250,000
970-4	Dielectric Oil	TA IV	250,000
981-1	Dielectric Oil	TA IV	250,000
983-1	Dielectric Oil	TA IV	250,000
983-2	Dielectric Oil	TA IV	250,000
983-3	Dielectric Oil	TA IV	250,000
983-4	Dielectric Oil	TA IV	250,000
605-1	Fuel Oil	TA I	216,000
605-2	Fuel Oil	TA I	45,500
605-3	Fuel Oil	TA I	45,500
605-4	Fuel Oil	TA I	216,000
605-5	Fuel Oil	TA I	508,000
605-6	Fuel Oil	TA I	1,024,000
9990-1	Fuel Oil	CTF	600

TABLE F-1

CHARACTERISTICS OF ABOVEGROUND TANKS AT SNLA: 1987 (Continued)

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
6596-1	Mineral Oil	TA V	8,500
6596-2	Mineral Oil	TA V	8,500
6596-3	Mineral Oil	TA V	8,500
6596-4	Mineral Oil	TA V	8,500
865-1	Waste Oil	TA I	200
898-1	Waste Oil	TA I	500
6597-9	Water	TA V	17,000

Source: IT, 1987

(1) TA = Technical Area
(2) CTF = Coyote Test Facility

PRELIMINARY

TABLE F-2

CHARACTERISTICS OF UNDERGROUND TANKS AT SNLA: 1987

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
888-3	Dielectric Oil	TA(1) I	20,000
888-4	Dielectric Oil	TA I	20,000
888-5	Dielectric Oil	TA I	20,000
888-6	Dielectric Oil	TA I	20,000
893-1	Dielectric Oil	TA I	25,000
6595-1	Dielectric Oil	TA V	34,120
6595-2	Dielectric Oil	TA V	34,120
6595-3	Dielectric Oil	TA V	34,120
6595-4	Dielectric Oil	TA V	34,120
6595-5	Dielectric Oil	TA V	34,120
6597-2	Dielectric Oil	TA V	25,000
6597-3	Dielectric Oil	TA V	25,000
6597-4	Dielectric Oil	TA V	25,000
6597-5	Dielectric Oil	TA V	25,000
6597-6	Dielectric Oil	TA V	25,000
6597-7	Dielectric Oil	TA V	25,000
6597-8	Dielectric Oil	TA V	25,000
876-3	Diesel Fuel	TA I	12,000
6587-3	Diesel Fuel	TA III	6,000
9925-2	Diesel Fuel	CTF(2)	6,000
605-7	Fuel Oil	TA I	1,000
605-8	Fuel Oil	TA I	12,000
605-9	Fuel Oil	TA I	12,000
605-10	Fuel Oil	TA I	12,000
605-11	Fuel Oil	TA I	12,000

TABLE F-2

CHARACTERISTICS OF UNDERGROUND TANKS AT SNLA: 1987 (Continued)

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
862-1	Fuel Oil	TA I	11,700
6020-1	Fuel Oil	TA IGLOO	300
6503-1	Fuel Oil	TA III	600
6505-1	Fuel Oil	TA III	300
6525-1	Fuel Oil	TA III	500
6527-1	Fuel Oil	TA III	2,360
6531-1	Fuel Oil	TA III	100
6536-1	Fuel Oil	TA III	25,000
6540/1-1	Fuel Oil	TA III	500
6555-1	Fuel Oil	TA III	550
6560/1-1	Fuel Oil	TA III	300
6610-1	Fuel Oil	TA III	500
6620-1	Fuel Oil	TA III	600
6630-1	Fuel Oil	TA III	560
6631-1	Fuel Oil	TA III	550
6640-1	Fuel Oil	TA III	1,000
6650-1	Fuel Oil	TA III	1,000
6715-1	Fuel Oil	TA III	500
6720/1-1	Fuel Oil	TA III	500
6743-1	Fuel Oil	TA III	1,000
9800-1	Fuel Oil	CTF	unk
9832-1	Fuel Oil	CTF	650
9925-3	Fuel Oil	CTF	5,000
9926-1	Fuel Oil	CTF	5,000
9940-1	Fuel Oil	CTF	500
9970-1	Fuel Oil	CTF	500

TABLE F-2

CHARACTERISTICS OF UNDERGROUND TANKS AT SNLA: 1987 (Continued)

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
9980-1	Fuel Oil	CTF	6,000
970-1	Fuel Oil	TA IV	1,000
6500-1	Fuel Oil	TA V	600
6580-5	Fuel Oil	TA V	5,000
6581-1	Fuel Oil	TA V	5,000
6588-1	Fuel Oil	TA V	5,000
6596-5	Fuel Oil	TA V	1,000
6597-1	Fuel Oil	TA V	4,000
876-2	Gasoline	TA I	12,000
901-1	Gasoline	TA II	120
910-1	Gasoline	TA II	120
911-1	Gasoline	TA II	120
912-1	Gasoline	TA II	120
6028-1	Gasoline	TA IGLOO	5,000
6587-2	Gasoline	TA III	10,000
9925-1	Gasoline	CTF	6,000
867-1	Neutralization Tank	TA I	4,000
983-7	Neutralization Tank	TA IV	20,000
876-1	Waste Oil	TA I	1,000
888-1	Waste Oil	TA I	550
888-2	Waste Oil	TA I	550
6587-1	Waste Oil	TA III	1,000
970-3	Waste Oil	TA IV	1,000
983-9	Waste Oil	TA IV	2,000

TABLE F-2

CHARACTERISTICS OF UNDERGROUND TANKS AT SNLA: 1987 (Continued)

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
831-1	Emergency washwater	TA I	1,000
839-1	Washwater sludge	TA I	unk
840-1	Water/waste coolant	TA I	500
844-1	Tritiated water	TA I	150
6536-2	Deionized water	TA III	10,000
9939-1	Washwater	CTF	2,000
983-8	Water/bromine	TA IV	60,000
6580-1	Washwater	TA V	2,000
6580-2	Washwater	TA V	6,000
6580-3	Washwater, porous drain tube(3)	TA V	12,000
6580-4	Washwater	TA V	30,000

Source: IT, 1987

(1) TA = Technical Area
(2) CTF = Coyote Test Facility
(3) Not included in calculation of total number and volume of tanks.

PRELIMINARY

TABLE F-3

CHARACTERISTICS OF UNDERGROUND TANKS AT ITRI: 1987

Tank ID	Tank Contents	Tank Location	Capacity (gallons)
TF-001	No. 2 Diesel	E of Bldg. 9217	10,000
TF-002	No. 2 Diesel	E of Bldg. 9217	6,000
TF-003	No. 2 Diesel	N of Bldg. 9262	30,000
TF-004	No. 2 Diesel	N of Bldg. 9262	30,000
TF-006	No. 2 Diesel	SE of Bldg. 9211	2,000
TF-007	No. 2 Diesel	SE of Bldg. 9211	2,000
TF-009	No. 2 Diesel	SE of Bldg. 9211	2,000

Source: ITRI, 1987

PRELIMINARY

REFERENCES
APPENDIX F

IT (International Technology Corporation), 1987. "Tank Survey Summary Information, Sandia National Laboratories Albuquerque," Project No. 301112.03, IT Corporation, Albuquerque, New Mexico.

ITRI (Inhalation Toxicology Research Institute), 1987. "Waste Management Site Plan, January 1987," Albuquerque, New Mexico.

PRELIMINARY

APPENDIX G

RADIOLOGICAL CRITERIA

PRELIMINARY

RADIATION DOSE TO THE PUBLIC

Various regulations, such as U.S. Department of Energy (DOE) Orders and U.S. Environmental Protection Agency (EPA) regulations, limit the annual radiation dose to personnel on-site (occupational workers) and to personnel off-site (general public). Because of these regulations, it is necessary for each site to calculate annual doses.

To comply with the differing regulations regarding radiation dose to members of the general public, different methods must be used to determine their dose. There are three general methods of determining the doses, which correspond roughly to the pathways (or exposure mode) of receiving the dose. The dose can be received by:

1) Direct radiation from an on-site facility or radioactive material stored there.

2) Radiation from the airborne effluents (radioactive materials released from the facility) while airborne or on the soil, and dose resulting from uptake through the food chain.

3) Radiation from liquid effluents (radioactive materials released from the facility), including uptake through the food chain, uptake through drinking water, and radiation received from recreational activities.

For most civilian nuclear power plants and for most DOE sites, the predominant radiation dose delivered to the public is through the airborne effluent pathway. The second largest dose is usually delivered through the liquid pathway; direct radiation from on-site facilities is usually minimal. At the Sandia National Laboratories - Albuquerque/Inhalation Toxicology Research Institute (SNLA/ITRI) site, the only significant potential pathway is through airborne emissions of noble gases, tritium, and radioactive particulates. The lack of radioactive liquid effluents from the site and the absence of sources that deliver significant direct radiation preclude the liquid and direct radiation pathways, respectively.

Both SNLA and ITRI obtain airborne samples at the release points or calculate releases to the atmosphere, based on physical parameters of facility operation. Mathematical models are then used to calculate the concentrations and resulting doses at the site boundary and other off-site locations. The following effective dose equivalents were calculated for 1986 using AIRDOS-EPA:

Location	DOE Standard (mrem/yr)	Annual Effective Dose Equivalents From Plant Operations (mrem)	
		SNLA	ITRI
Nearest Member of Public	100	3.1×10^{-4}[a]	5.3×10^{-7}[b]

a from Burnett, 1987
b from McClellan, 1987

PRELIMINARY

REFERENCES FOR APPENDIX G

Burnett, W. D., letter to J. C. Vandermolen, "Annual Radionuclide Air Emission Report - 40 CFR 61.94(C)," SNLA, May 28, 1987.

McClellan, R. O., letter to J. G. Themelis, "Annual Radionuclide Air Emission Report - 40 CFR 61.94(C)," ITRI, May 28, 1987.

PRELIMINARY

APPENDIX H

SUMMARY DESCRIPTION OF DOE-AL WASTE SITES IDENTIFIED AT THE KIRTLAND AIR FORCE BASE ALBUQUERQUE, NEW MEXICO

PRELIMINARY

This appendix presents a tabulation of DOE-AL waste sites identified at the Kirtland Air Force Base (KAFB). The pages which follow present a listing of these waste sites, and in addition, present information on their location, type of wastes handled, release controls employed, and potential impacts to the environment that may result from these sites.

In preparing this appendix, four principal sources of waste site information were synthesized, namely:

- "Installation Restoration Program, Phase I -- Records Search, Hazardous Materials Disposal Sites, Kirtland AFB, New Mexico," prepared by Engineering-Science for U.S. Air Force, AFESC/DEV, Tyndall AFB, Florida, 1981.

- "Comprehensive Environmental Assessment and Response Program, Phase 1: Installation Assessment, Sandia National Laboratories, Albuquerque," issued by U.S. DOE, Albuquerque Operations Office, 1987. This document is referred to as the CEARP.

- "Final RCRA Facility Assessment Report of Solid Waste Management Units at Sandia National Laboratories, Albuquerque, New Mexico," draft report prepared by A. T. Kearney and Harding Lawson Associates for EPA-VI, 1987. This document is referred to in the tabulation as the RFA.

- Survey team observations and notes made during the August 17 - September 4, 1987 site Survey.

The waste site tabulation was printed from a computer data base. In order to compress the lengthy descriptions of each waste site, it was necessary to abbreviate some of the entry headings. Each entry heading is defined below:

- CEARP ID: The unique waste site identification number. Table H-1 is sorted by site use and then location for CERCLA sites. Table H-2 is sorted by ascending CEARP ID number (for CEARP sites) and alphabetically by assigned Survey ID letter designation (for non-CEARP sites). Sites listed in

the RFA Report are assigned an ID number of "0". The final sort under common ID numbers is alphabetically by name when more than one site has the same CEARP ID number. Table H-1 lists only those sites identified as potential CERCLA sites (i.e., inactive waste sites). Table H-2 lists all waste sites, both active and inactive.

- Name: The name assigned to the waste site.
- Building #: The number of the building associated with the waste site.
- Location: This entry provides broad locational information such as Technical Area or relation to a geographic feature.
- Dates: Readily available information was used to define the date when waste site operations started (Datestart) and when they ended (Dateend).
- Action: Proposed action under the CEARP program for future phases of work at the site.
- Waste: The type of waste handled at the site, limited to chemical (chem), radioactive (rad), mixed (radioactive hazardous waste), solid (as defined by RCRA, Subtitle D), and unknown (unk).
- CERCLA/RCRA: Best estimate of regulatory authority likely to control remediation (C = CERCLA) or corrective action (R = RCRA). Table H-1 of this appendix lists all CERCLA sites organized by site use and location. Table H-2 lists all sites (both CERCLA and RCRA) organized by CEARP ID.
- CEARP Finding: The finding presented in Section V of CEARP, either positive, negative, or uncertain for applicability of CERCLA or compliance with other environmental regulations. The action described above is based on the CEARP Finding.

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- Site Use: A designation of D for disposal facility (including uncontrolled, unregulated disposal), T for test facility, and H for hazardous material handling and process areas.

- SI, Septic, Landfill, Surface: These categories describe the type of waste facility located at the site, e.g., a surface impoundment (SI), septic system, landfill, or surface contamination (surface). A true/false (T/F) system is used to associate the facility type with each site.

- Potential Impacts to GW (groundwater), SW (surface water), soil, air, or Subsurf Gas (subsurface gas generation): The potential impacts to these media are ranked low (L), moderate (M), high (H), uncertain (D), or unlikely (U) based on the Survey team's impression of the potential impacts that might result from the waste site under present conditions. These potential impacts were developed based on visual site observations by Survey team members and are subject to change as a result of modeling performed during the prioritization effort or based on the results of Survey-related sampling and analysis.

- RFA No.: The unique identification number assigned by the RFA to solid waste management units.

- Controls: Release controls employed now or when the waste management activities were conducted at the site.

- Comments: Further qualitative description of the waste site.

PRELIMINARY

TABLE H-1

PRELIMINARY

CEARP ID : 66		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name : BOXCAR SITE		MIXED	C	UNCERTAIN	T	F	F	F	T	
Building # : NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)									
Location : 9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN					L	M	M	L	U	H
Dateend : INACTIVE										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POTENTIAL FOR Be, Pb, HE AND dU TO BE DISPERSED ON SURFACE OF THE TEST AREA. FIRING CABLES AND CONCRETE PADS REMAIN.

CEARP ID : 108		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name : FIRING SITE, BUILDING 9940		MIXED	C	UNCERTAIN	T	F	F	F	T	
Building # : 9940	Action : INSTALLATION ASSESS. (SUP. PHASE 1)									
Location : 9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN					L	M	M	M	U	
Dateend : ACTIVE										

Controls : NONE OBSERVED.

Comments : SUSPECT Be AND dU CONTAMINATION ON SURFACE OF TEST AREA. CORIUM THERMITE TEST DEBRIS (dU, Cr, Zn, Ni, Mb) WASHED INTO SOIL. LAST TEST PERFORMED OUTDOORS IN ABOUT 1982.

CEARP ID : 109		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name : FIRING SITE, BUILDING 9956		MIXED	C	POSITIVE	T	F	F	F	T	
Building # : 9956	Action : INSTALLATION ASSESS. (SUP. PHASE 1)									
Location : 9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN					L	L	M	M	U	
Dateend : ACTIVE										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : ABOUT 1967 OR 1968, SOME Be EXPLOSIVELY FIRED IN PITS. NO MONITORING OR CLEANUP. Be AND dU USED IN EXPERIMENTS WHOSE RESIDUES WERE WASHED INTO OUTSIDE SUMP. RESIDUES FROM SUMP PROBABLY PLACED ON DIRT PILES 1/4 MILES UP THE ROAD FROM BLDG. 9956.

CEARP ID : 115		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name : FIRING SITE, BUILDING 9930		CHEM	C	UNCERTAIN	T	F	F	F	T
Building # : 9930	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location : 9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN					L	M	M	M	U	
Dateend : ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : PERFORM ONE-OF-A-KIND TESTS WITH CONVERCIAL HE (C4, ETC.) USING 7 TO 50LB PER TEST. SUSPECT Hg CONTAMINATION ON SURFACE OF T EST AREA.

CEARP ID : D&E		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name : BERYLLIUM TEST PITS		CHEM	C	NA	T	F	F	F	T
Building # : 9920-964	Action : NA								
Location : 9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : EARLY 1960s					L	L	L	L	U	
Dateend : LATE 1970s									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : FIVE TO SIX Be TESTS IN PIT NEAR BLDG. 9920. Be SHOTS NEAR BLDG. 9964.

CEARP ID : 53		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name : BUILDING 9923		RAD	C	NEGATIVE	T	F	F	F	F
Building # : 9923	Action : NONE								
Location : AREA II				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN					U	U	U	U	U	
Dateend : ACTIVE									

Controls : TEST MATERIALS STORED IN BUILDING.

Comments : STORAGE OF RADIOACTIVE MATERIALS (Fe & Al) FROM NEUTRON ACTIVATION EXPERIMENTS AT NTS. SAMPLES EMIT 1-3 mR/hr BETA. NO ENV IRONMENTAL RELEASE EXPECTED.

CEARP ID :	113		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITES, AREA II		CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	922	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA II, EAST SIDE OF AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	L	L	U	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : ONLY VERY SMALL QUANTITIES OF EXPLOSIVES ARE DETONATED. SUSPECT SURFACE CONTAMINATION WITH EXPLOSIVE MATERIALS AND POSSIBLY HEAVY METALS. NOT KNOWN WHAT RESIDUAL MATERIALS LEFT AT SITE.

CEARP ID :	51		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 6924 PAD, TANK & PIT		CHEM	C	UNCERTAIN	T	F	F	T	F
Building # :	6924	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1969					L	L	L	L	U	10 & 11
Dateend :	1971									

Controls : RUNOFF PIT AND CULVERT HAVE ABOVE-GRADE SIDE WALLS TO PREVENT RUNON/RUNOFF. NO OTHER RELEASE CONTROLS WERE OBSERVED DURING SURVEY. UNREGULATED DISPOSAL.

Comments : SOLVENTS CONTAMINATED WITH HE DISCHARGED VIA A DITCH TO A TANK AND IGNITED. UNLINED OVERFLOW PIT CONNECTED TO TANK BY DRAIN PIPE. CEARP SUGGESTS THAT LITLE RESIDUAL CONTAMINATION EXPECTED.

CEARP ID :	107		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE TEST AREA		CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA III, SE CORNER				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : HE TESTS PERFORMED AT SITE. IT IS NOT KNOWN WHAT RESIDUES REMAIN.

CEARP ID :	G	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	DISTURBED AREAS W. AREA III	UNK	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA III, WEST OF AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE OBSERVED.

Comments : FOUR AREAS, USES UNKNOWN.

CEARP ID :	52	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SERF LIQUID WASTE TANKS	RAD	C	UNCERTAIN	T	F	T	F	F
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA V, NEAR BLDG. 6580			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1962				U	U	L	U	U	91,92 & 98
Dateend :	EARLY 1970s, TANKS ARE STILL ACTIVE									

Controls : CONCRETE TANKS, BUT DISCHARGES FROM TANKS IMPACTED THE ENVIRONMENT WHEN SEPTIC SYSTEM FAILED, LIQUID EFFLUENT WAS DISPOSED I N AREA III RADIOACTIVE BURIAL GROUND. PRINCIPALLY COOLING WATER DISCHARGES OF ABOUT 100 GPD STILL PASS THROUGH THESE TANKS.

Comments : LARGE VOLUMES OF SLIGHTLY RADIOACTIVE WATER FROM SERF THAT WAS THEN DISCHARGED TO DRAIN FIELD OR SIs. ABOUT 35 Ci OF CS-137, CO-60 AND OTHER ACTIVATION PRODUCTS DISCHARGED VIA THESE 3 TANKS (CEARP ID: #4 & #5).

CEARP ID :	58	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	COYOTE CANYON BLAST AREA	MIXED	C	POSITIVE	T	F	F	F	T
Building # :	NA Action : CONFIRMATION (PHASE 2)								
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	H	H	L	U	136 - 139
Dateend :	INACTIVE CA. 1960									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : OLD UST, ALSO EXPLOSIVE MATERIAL CONTAMINATION ON TEST AREA SURFACE. THERE IS ALSO A GREAT DEAL OF SHRAPNEL (Pb, Be, AND/OR d U). HILLTOP BLDG. REPORTED TO CONTAIN ASBESTOS WASTE.

CEARP ID :	59		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PENDULUM SITE		UNK	C	NEGATIVE	T	F	F	F	T
Building # :	NA	Action : NONE								
Location :	COYOTE CANYON				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					U	U	U	U	U	
Dateend :	UNKNOWN										

Controls : NONE.

Comments : MICRO-R METER READINGS SHOWED AT POLE SUPPORTS VERY SLIGHTLY ABOVE BACKGROUND (LIKELY CAUSED BY RAD IN CONCRETE). HOWEVER TH ERE IS NO INFORMATION SUGGESTING ANY RELEASE OF MATERIALS FROM SITE. SOME EARLY GUN TESTING PERFORMED IN AREA.

CEARP ID :	60		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUNKER AREA,N.OF PENDULUM SITE		MIXED	C	POSITIVE	T	F	F	T	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	COYOTE CANYON				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	H	H	L	L	124
Dateend :	INACTIVE										

Controls : NONE.

Comments : UP TO 60 pCi/g SOIL CONTAMINATION MAY EXIST IN AREA FROM TESTING AT SITE; HE, dU, Pb, AND Be LIKELY TO BE PRESENT (CEARPID # 10). MIRO-R METER READINGS ABOVE BACKGROUND.

CEARP ID :	62		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GRAYSTONE MANOR SITE		CHEM	C	UNCERTAIN	T	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	COYOTE SPRINGS				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1950s					L	L	H	L	U	
Dateend :	1950s										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DETONATED EXPLOSIVES IN DRY WELLS IN THE VICINITY OF COYOTE SPRINGS. RESIDUAL HE (INCLUDING Ba) MAY REMAIN IN AREA. EXACT L OCATION OF THE SITE IS UNKNOWN.

CEARP ID :	72	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OPERATION BEAVER SITES	SOLID	C	NEGATIVE	T	F	F	F	T
Building # :	NA Action : NONE								
Location :	COYOTE SPRINGS AND CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	DURING VIETNAM WAR				L	L	L	L	U	
Dateend :	DURING VIETNAM WAR									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : EXPLOSIVELY FIRED BARS USED TO CLEAR WOODED AREAS. STUMPS AND FELLED TREES REMAIN ON SIDE OF SITE.

CEARP ID :	63	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BALLOON TEST AREA	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1983				L	L	M	L	U	E
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. RUSTED DRUM, TAIL OF ROCKET MOTOR CASING, EMPTY MOTOR OIL CANS IN & NEAR ARROYO TO WEST AND SOUTH OF SITE. MICROWAVE TRANSMITTER TUBES (RADIOACTIVE) DISCOVERED NE OF SITE DURING SURVEY.

Comments : 1983 TESTING FROM BALLOONS. MOST RECENTLY USED FOR TESTING REMOTE FLYING TV CAMERA. IT IS NOT KNOWN WHAT RESIDUAL CONTAMINATION MAY BE PRESENT FROM EXPERIMENTS.

CEARP ID :	65	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE TEST SITE	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				L	L	L	L	U	119
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. EXCAVATION OF LOW-LEVEL RADIOACTIVE SOIL.

Comments : WIDELY SCATTERED Pb AND dU ANTICIPATED ON TEST AREA SURFACE. DRUMMED RADIOACTIVE SOIL FROM SITE PLACED IN LLW BURIAL GROUND AT AREA III.

CEARP ID :	A	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE NE OF BALLOON TEST AREA	CHEM	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1978				L	L	L	L	U	
Dateend :	CA. 1978									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : 2 CYLINDERS (IONIZING RADIATION, MICROWAVE, BeO LABELS) FOUND NEAR TRENCHES WITH CONSTRUCTION DEBRIS. A MINE SHAFT EXISTS NE ARBY.

CEARP ID :	64	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GUN SITE	CHEM	C	NEGATIVE	T	F	F	F	T
Building # :	NA Action : NONE								
Location :	MADERA CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1960s				L	L	M	L	U	E
Dateend :	LATE 1960s									

Controls : NONE, UNREGULATED DISPOSAL

Comments : NO RADIOACTIVITY SIGNIFICANTLY ABOVE BACKGROUND DETECTED. SOME SHRAPNEL MAY STILL REMAIN IN THE AREA. SHORT-LIVED RADIOACTI VE TRACERS POTENTIALLY USED IN EXPERIMENTS. MOSTLY FIRED CONVENTIONAL PROJECTILES.

CEARP ID :	50	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD CENTRIFUGE SITE/DUMP	CHEM	C	UNCERTAIN	T	F	F	F	F
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	NEAR AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : POSSIBLE RESIDUAL ROCKET PROPELLANT FROM ROCKET-POWERED CENTRIFUGE. WASTE MATERIALS (PAINT CANS, DRUMS, CONCRETE, FIREBRICK, PIPE, WOOD, ETC.) WERE DUMPED OVER THE SIDE OF THE HILL NE OF THIS AREA.

CEARP ID :	67	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FRUSTRATION SITE	CHEM	C	NEGATIVE	T	F	F	F	T
Building # :	NA	Action : NONE							
Location :	OLD AERIAL CABLE AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	L	U	
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEE CEARP ID #28 FOR MINE SHAFT DISCUSSION.

Comments : UNDETONATED EXPLOSIVES AND SHRAPNEL EXIST ON THE SURFACE OF TEST AREA. KAFB PERSONNEL DETERMINED UNECONOMICAL TO REMOVE UNDE TONATED EXPLOSIVES. SITE DISPOSED BY CEARP, SINCE THE SHELLS AND SHRAPNEL ARE CONSIDERED A USAF RESPONSIBILITY.

CEARP ID :	57	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	WORKMAN SITE	MIXED	C	NA	T	F	F	F	T
Building # :	NA	Action : COMPLIANCE AND VERIFICATION (PHASE 5)							
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1940s				L	M	M	L	U	G
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SITE USED IN PROXIMITY FUSE TESTING. OVERPRESSURE BLAST TESTING EQUIPMENT FROM NTS EXPERIMENTS ABANDONED ON SITE. PROXIMITY FUSE DEBRIS CLEANED UP.

CEARP ID :	68	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD BURN SITE	MIXED	C	UNCERTAIN	T	T	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	M	M	L	U	111
Dateend :	LATE 1970s									

Controls : NONE KNOWN.

Comments : OIL WAS BURNED IN 25FT SQ. UNLINED PIT (LATER PLASTIC LINING WAS USED) DURING EXPERIMENTS & DISCHARGED TO TRENCH AND A 30 FT DIA. SI. SOME dU, Pb, AND Th CONTAMINATION OF TEST AREA. RADIOACTIVELY-CONTAMINATED SOIL WAS BURIED IN AREA III RAD B.G.

CEARP ID :	69	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITES (SOUTH KAFB)	CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	INACTIVE									

Controls : NONE, UNCONTROLLED DISPOSAL.

Comments : OLD FIRING CABLES AND SHRAPNEL OBSERVED. IT IS NOT KNOWN WHETHER ANY HAZARDOUS MATERIAL RESIDUES REMAIN.

CEARP ID :	70	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE TEST PIT	CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	D	L	U	127
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DEEP CONCRETE LINED PIT IDENTIFIED ACROSS FROM WATER TOWERS. SIDES OF PIT BLACKENED INDICATING POSSIBLE BURN ACTIVITIES. VER MICULITE SCATTERED ON GROUND AROUND PIT.

CEARP ID :	B	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE SW OF OLD BURN SITE	CHEM	C	NA	T	F	F	F	T
Building # :	NA	Action :	NA						
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED DISPOSAL.

Comments : TWO LARGE METAL PLATFORMS, ONE WITH CONCRETE PLATFORM AND INSULATION PRESENT. POSSIBLE TESTING SITE.

DRAFT FINAL

CEARP ID :	C	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE E. OF U.N.M. SHOCK TUBE	CHEM	C	NA	T	F	F	F	T
Building # :	NA	Action : NA							
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : WIRE & WOOD DEBRIS, MOUND OF SOIL WITH REBAR & CONCRETE PROTRUDING FROM IT, CIRCLE OF CONCRETE BLOCKS AT SITE. MAY BE ASSOCIATED WITH UNM SHOCK TUBE ACTIVITIES.

CEARP ID :	71	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MOONLIGHT SHOT AREA	RAD	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	S. KAFB, NEAR 9925			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	D	L	L	U	F
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : MOCK-UP WEAPONS AND WEAPON COMPONENTS WERE FIRED. RESIDUE INCLUDES DU.

CEARP ID :	61	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SCHOOLHOUSE MESA TEST SITE	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1950s				L	M	H	L	U	
Dateend :	EARLY 1960s									

Controls : NONE.

Comments : HE AND dU WERE DETONATED IN THE AREA. IT IS NOT KNOWN WHAT RESIDUES REMAIN IN THIS AREA.

CEARP ID :	F	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	S.H. MESA/COYOTE S. RD. SITE	CHEM	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : EVIDENCE OF PAST TESTING INCLUDES FIRING CABLES, CONCRETE PAD, CHARRED WOOD, AND RUSTED METAL.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OFFSITE TEST LOCATIONS		C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	SEE APPENDIX L			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				D	D	D	D	D	
Dateend :	NA									

Controls :

Comments : SEE APPENDIX L

CEARP ID :	54	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PICKAX SITE	CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	THUNDER RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1966				L	M	M	L	U	14 & 15
Dateend :	INACTIVE									

Controls : THE PIT IS LINED WITH CONCRETE AND METAL. THE SI IS UNLINED. UNREGULATED DISPOSAL.

Comments : 0.5 - 20 TON EXPLOSIVE TESTS (USING TNT & PRIMACORD) AT THE SITE. ONE UNLINED PIT E. OF BUNKER #1 IS SURROUNDED BY ROPES. P IT HEAVILY VEGETATED. A CONCRETE PAD DRAINS INTO PIT. ANOTHER PIT W. OF BUNKER #1 IS SURROUNDED BY CONCERTINA WIRE.

PRELIMINARY

CEARP ID :	56	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CRATERING SITE, THUNDER RANGE	CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	THUNDER RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1958				L	M	M	L	U	A
Dateend :	1970									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : LARGE (UP TO 15 TONS OF TNT)EXPLOSIONS USED TO PRODUCE CRATERS. VOLUME OF CRATERS DETERMINED BY FILLING THEM WITH POTASSIUM PERMANGANATE SOLUTION. SOME HE RESIDUALS MAY STILL REMAIN IN AREA.

PRELIMINARY

CEARP ID :	27	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ANIMAL CARCASS DISPOSAL PIT	RAD	C	UNCERTAIN	D	F	F	T	F
Building # :	9820	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	9800 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	L	M	L	L	42
Dateend :	EARLY 1960s									

Controls : NONE, DISPOSAL IN UNLINED PIT.

Comments : POTENTIALLY RADIOACTIVE ANIMAL (DONKEY) CARCASSES BURIED AT SITE. NO ELEVATED READING NOTED ON MICRO-R METER.

CEARP ID :	14	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITES	MIXED	C	POSITIVE	D	F	F	T	T
Building # :	9920	Action :	CONFIRMATION (PHASE 2)						
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				L	M	H	L	L	45
Dateend :	LATE 1970s									

Controls : NONE, EXCEPT BURIAL BENEATH SANDY SOIL OF 6000-8000 FLOUR. LIGHT BULBS IN CRATES (CONTAINING HG) BURIED IN 8 FT PIT. CORIUM THERMITE (CONTAINING ZR, FE OXIDES, MB OXIDES, AND 40 KG dU) DEPOSITED IN GRADED AREA TO SOUTH. UNREGULATED DISPOSAL.

Comments : FLUORESCENT LIGHTBULBS FROM TESTS BURIED N. BLDG 9916. NO Hg FOUND BY HP. DEBRIS FROM 2 TESTS WITH CORIUM THERMITE (10 KG E ACH) AND dU REMOVED FROM THE TEST AREA AND COVERED WITH SANDY SOIL. MICRO-R METER SHOWED NEAR BACKGROUND VALUES.

CEARP ID :	103	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SCRAP YARD	MIXED	C	UNCERTAIN	D	F	F	F	T
Building # :	9939	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	H	M	L	L	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED STORAGE/DISPOSAL. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : SCRAP YARD MAY CONTAIN Pb, Be, AND dU.

CEARP ID :	117	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BLDG 9939 TRENCHES	CHEM	C	UNCERTAIN	D	F	F	T	T
Building # :	9939 Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				L	M	M	L	L	93
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL. Na LEFT TO OXIDIZE AND COVERED WITH SANDY SOIL. CONDITION OF UNDERGROUND ACID WASTE TANK UNKNOWN.

Comments : Na (SPRAYED WITH WATER OR LEFT TO OXIDIZE) PLACED IN ONE OR TWO TRENCHES. NOT KNOWN IF REACTIVE Na METAL REMAINS IN TRENCHES . UNDERGROUND STEEL TANK USED FOR WASTE HCL & H2SO4 OBSERVED TO CONTAIN ABOUT 500 GAL LIQUID WASTES. THERMITE ON SURFACE.

CEARP ID :	N	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD PONDS SE CORNER AREA I	UNK	C	NA	D	T	F	F	F
Building # :	NA Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1950				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED								

Controls : UNKNOWN.

Comments : AREA OBSERVED IN AERIAL PHOTOGRAPH. PONDS MAY HAVE BEEN RESPONSIBILITY OF USAF.

CEARP ID :	18	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STORAGE/SALVAGE YARDS	CHEM	C	UNCERTAIN	D	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA I AND AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	H	L	U	54
Dateend :	ACTIVE								

Controls : NONE OBSERVED DURING SURVEY. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : FIVE STORAGE/SALVAGE YARDS TO STORE EXCESS ITEMS. DRUMMED CHEMICAL WASTE MAY EXIST IN STORAGE/SALVAGE YARD. MOSTLY NONRADIO ACTIVE SURPLUS EQUIP. AND NUMEROUS 55-GALLON DRUMS. YARDS NOT BEEN SURVEYED FOR HAZARDOUS MATERIALS.

CEARP ID :	1	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RADIOACTIVE BURIAL SITE	MIXED	C	POSITIVE	D	F	F	T	F
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1949				L	M	H	L	D	32 - 37
Dateend :	2/59								

Controls : 3 UNLINED PITS & 3 UNLINED TRENCHES NOW COVERED WITH 3 FT SOIL AND CONCRETE. DISPOSED MATERIALS NOT CONTAINERIZED.

Comments : NO RECORDS KEPT FOR FIVE YEARS. 11,110 CU FT LL AND HW (MIXED) WASTE PLACED IN BURIAL SITE. PRIMARY RADIONUCLIDES dU, TRITIUM, Ra, Co-60, Cs-137, Ni-63 AND Pu. SOME WASTES MAY HAVE BEEN REMOVED FROM SITE.

CEARP ID :	2	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CLASSIFIED WASTE DISP TRENCHES	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1949				L	M	H	L	D	38 & 39
Dateend :	ACTIVE								

Controls : UNREGULATED DISPOSAL IN UNLINED TRENCHES & PITS OF PRINCIPALLY UNCONTAINERIZED SOLID. CLASSIFIED AND POSSIBLY CHEM & RAD WASTES WITH BACKFILLING AFTER EMPLACEMENT.

Comments : NOW USED FOR DISPOSAL OF NONRADIOACTIVE CLASSIFIED WASTE.

CEARP ID :	3	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CHEMICAL DISPOSAL PIT	CHEM	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	D	H	D	D	40
Dateend :	1959								

Controls : NONE KNOWN, UNREGULATED DISPOSAL.

Comments : REPORTEDLY USED FOR HAZARDOUS CHEMICAL WASTE PRIOR TO 1959. RECORDS NOT MAINTAINED FOR MORE THAN 5 YEARS.

CEARP ID :	114	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE BURN PIT	CHEM	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS (SUP. PHASE 1)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	BOMB ASSEMBLY DAYS				L	L	L	L	D	
Dateend :	BOMB ASSEMBLY DAYS									

Controls : NONE KNOWN, UNREGULATED DISPOSAL BY BURNING OF HE RESIDUES.

Comments : SOME OF THE EXPLOSIVES LIKELY CONTAINED BE WHICH MAY REMAIN IN THE AREA.

CEARP ID :	R	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD DISTURBED SITE, AREA II	UKN	C	NA	D	F	F	F	T
Building # :	NA	Action : NA							
Location :	AREA II, S. OF CENTER ROAD IN E. PORTION			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									

Controls : UNKNOWN.

Comments : DISTURBED AREA IDENTIFIED IN AERIAL PHOTOGRAPH. CUSTODIAN OF SITE UNKNOWN.

CEARP ID :	77	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SURFACE IMPOUNDMENT AREA IV	CHEM	C	NA	D	T	F	F	F
Building # :	NA	Action : REMEDIAL ACTION (PHASE 4)							
Location :	AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				H	L	H	L	U	12
Dateend :	ACTIVE									

Controls : ONE HYPOLON LINED SI. HOWEVER, SIMILAR IMPOUNDMENT FOR FACILITY IS NOT LINED. DURING THE VISIT THERE WAS ABOUT 3 FEET OF FREEBOARD. BOTH SIs RECEIVE WASTEWATER AFTER PROCESSING BY OIL/WATER SEPARATOR. UNREGULATED DISPOSAL.

Comments : ONE SI UNDER REMEDIATION - EXCAVATING SOIL & RELINING. RECEIVES WASTEWATER AFTER RESIN PROCESSING. UNLINED SI USED TO DISPOSE OF WATER WITH HYDRAULIC OIL FROM SUMPS NEAR ACCELERATOR OIL TANKS (OIL SHEEN VISIBLE DURING SURVEY HELICOPTER OVERFLIGHT).

CEARP ID :	4	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD SURFACE IMPOUNDMENTS	RAD	C	POSITIVE	D	T	F	F	F
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	AREA V, OUTSIDE GATE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	6/22/67				M	L	H	U	U	18 & 19
Dateend :	ACTIVE									

Controls : CLAY LINED (BOTTOM) SURFACE IMPOUNDMENTS. REPORTEDLY A TRUCK LOAD OF OIL WAS DUMPED INTO ONE LAGOON IN CA. 1984. SOIL SAMPLING FOUND 40 PPM PCBs. RADIOACTIVITY IN LAGOON AREAS NOW DECAYED TO LOW LOW LEVELS OF LITTLE CONCERN TO HEALTH PHYSICS.

Comments : 2 LINED SIs RECEIVED LARGE QUANTITIES OF WASTEWATER (PRINCIPALLY FROM SERF) CONTAMINATED WITH CS-137, CO-60, AND OTHER ACTIVATION PRODUCTS. 35 CI DISPOSED IN SIs AND DRAIN FIELD (CEARPID #5). MAJOR ACTIVE PERIOD 6/67-7/71. SI-2 RECEIVES 100 GPD.

CEARP ID :	5	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RADIOACTIVE DRAINFIELD	RAD	C	POSITIVE	D	F	T	F	F
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	AREA V, PARKING LOT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1963				M	U	H	D	U	16 & 17
Dateend :	1967									

Controls : ALTHOUGH THE PITS WERE CLAY LINED, THEY DISCHARGED TO SEPTIC DRAIN FIELDS.

Comments : RECEIVED LARGE QUANTITIES OF WASTEWATER (PRINCIPALLY FROM SERF) CONTAMINATED WITH CS-137, CO-60, AND OTHER ACTIVATION PRODUCTS. 35 CI DISPOSED IN DRAIN FIELD AND SIs (CEARPID #4).

CEARP ID :	7	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GAS CYLINDER DISPOSAL PIT	CHEM	C	POSITIVE	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	ARROYO DEL COYOTE (E. OF AREA III)			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				U	D	M	D	D	44
Dateend :	LATE 1970s									

Controls : UNREGULATED DISPOSAL OF GAS CYLINDERS IN PIT NOW COVERED WITH SOIL.

Comments : MID TO LATE 1970's ABOUT 300 GAS CYLINDERS BURIED IN PIT E. OF AREA III. CONTENTS IDENTIFIED AS POISONOUS. EXACT LOCATION OF SITE IS UNKNOWN.

CEARP ID :	16	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OPEN DUMPS	MIXED	C	UNCERTAIN	D	F	F	F	T

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	ARROYO DEL COYOTE E & NE OF AREA III	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	H	H	L	U	21 & 55
Dateend :	1983							

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL PROBABLY IN 100-YEAR FLOOD PLAIN.

Comments : OIL-CONTAMINATED SOIL, SOME DRUMS, AND OTHER SOLID WASTE DISPOSED ATSEVERAL SITES IN ARROYO. SOME CONCRETE POTENTIALLY COAT ED WITH dU FROM FIELD TESTING, HOWEVER MIRO-R METER DID NOT DETECT RADIATION LEVELS ABOVE BACKGROUND.

CEARP ID :	10	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL MOUNDS N. OF PEND. SITE	MIXED	C	POSITIVE	D	F	F	T	T

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	COYOTE CANYON	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	H	H	L	L	60 - 63 & 124
Dateend :	LATE 1970s							

Controls : MOST WASTE LIKELY BURIED IN LOW, SANDY SOIL MOUNDS.

Comments : MOSTLY RAD WASTE WITH POTENTIALLY SOME CHEM WASTE. SCRAP METAL OBSERVED PROTRUDING FROM MOUNDS AND SMALL PIECES OF SHRAPNEL AND HE OBSERVED ON SURFACE. SOME MICRO-R METER READING AT SOIL SURFACE WERE ABOVE BACKGROUND.

CEARP ID :	8	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OPEN DUMP	MIXED	C	POSITIVE	D	F	F	F	T

Building # : NA Action : CONFIRMATION (PHASE 2)

Location :	COYOTE CANYON BLAST AREA	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1940s		L	H	H	L	L	23
Dateend :	1950'S/1960s							

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL IN AN AREA WHERE FLASH FLOODS MAY OCCUR.

Comments : MOST WASTE IS SUBTITLE D SOLID WASTE (WOODEN PALLETS, GLASS JARS, SHRAPNEL, RUSTED DRUMS, TIRES, TIN CANS, FOIL). EXPLOSIVE TESTING ACTIVITIES DISCARDED IN OPEN DUMP. PIECES OF HE SCATTERED AROUND THE DUMP. FIRING CABLES/ELECTRICAL EQUIP. REMAIN.

CEARP ID :	21	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	METAL SCRAP/DRUM	CHEM	C	UNCERTAIN	D	F	F	T	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	COYOTE SPRINGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	D	73
Dateend :	UNKNOWN								

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : EXACT LOCATION UNKNOWN. OLD 55-GALLON DRUM AND SOME PARTIALLY-BURIED PIECES OF METAL NOTED IN PARKING AREA N. OF COYOTE SPRINGS PICNIC AREA AND W. OF KAFB TRAINING AREA. EOD DESTROYED SOME WEAPONS UNITS IN AREA.

CEARP ID :	11	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD/EXPLOSIVE BURIAL MOUNDS	MIXED	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action :	INSTALLATION ASSESS. (PHASE 1)						
Location :	E. OF LOVELACE RD., N. OF TARGET RD.			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1940s				L	L	M	L	D	68 - 70
Dateend :	1950s								

Controls : NONE, EXCEPT WASTE COVERED BY SANDY SOIL.

Comments : NATURE OF WASTE UNKNOWN, EXCEPT MOUNDS ARE FENCED AND MARKED WITH RADIOACTIVE AND EXPLOSIVE WARNING SIGNS. PROBABLY OLD EXPLOSIVE ORDNANCE BURIED. NO SURFICIAL RADIATION LEVELS ABOVE BACKGROUND.

CEARP ID :	102	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD DISPOSAL SITE	RAD	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (PHASE 1)						
Location :	EAST OF AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	D	D	D	
Dateend :	UNKNOWN								

Controls : NONE KNOWN.

Comments : THE AREA THAT WAS RECALLED WAS PROBABLY AN OLD REACTOR TEST SITE ASSOCIATED WITH THE DECOMMISSIONED SANDIA PULSED REACTOR-I.

CEARP ID :	0			Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ITRI INACTIVE SANIT. LAGOON #1			MIXED	C	NA	D	T	F	F	F
Building # :	NA	Action :	NA								
Location :	ITRI					Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1962						H	H	H	L	U	
Dateend :	1970										

Controls : COVERED WITH 1 FT SOIL AND REMOVED FROM SERVICE BECAUSE OF Cs-137 CONTAMINATION TO 150 mCi. LINED SI.

Comments : LAGOON 1 CLOSED BECAUSE OF Cs-137 DISPOSAL. CONDITION OF LINER IS UNKNOWN. POTENTIAL FOR OFFSITE GROUNDWATER CONTAMINATION.

CEARP ID :	T			Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ASH/CINDER PILES, LS-1			SOLID	C	NA	D	F	F	F	T
Building # :	NA	Action :	NA								
Location :	LS-1					Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN						L	L	L	L	U	
Dateend :	UNKNOWN										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : ASH/CINDER PILES (20 FT X 10 FT X30 FT) CONTAINING BURNED METAL PARTS LOCATED NEAR ARROYO NE OF LS-1.

CEARP ID :	12			Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITE/OPEN DUMP			MIXED	C	POSITIVE	D	F	F	T	T
Building # :	NA	Action :	CONFIRMATION (PHASE 2)								
Location :	LURANCE CANYON					Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1950s						L	L	M	L	L	41
Dateend :	ACTIVE										

Controls : NONE OBSERVED DURING VISIT. UNCONTROLLED/UNREGULATED DISPOSAL. PORTION OF OLD DISP. SITE IN ARROYO UNDER PRESENT PARKING AR EA. SITE MAY CONTAIN DEPLETED PIECES OF U, BE, PB, AND/OR HE.

Comments : SUBTITLE D SOLID WASTE WITH SOME CHEM WASTE. SITE MAY CONTAIN PIECES OF dU, Be, Pb, AND/OR HE, AND ABOUT 10 DRUMS OF TCE AND OTHER LIQUIDS ABANDONED IN ARROYO NOTED DURING SURVEY.

CEARP ID :	13	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURN SITE SURFACE IMPOUNDMENTS	CHEM	C	NEGATIVE	D	T	F	F	F
Building # :	NA Action : NONE								
Location :	LURANCE CANYON BURN SITE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				H	L	M	L	U	13
Dateend :	1985									

Controls : NONE, UNLINED SURFACE IMPOUNDMENTS. UNREGULATED DISPOSAL.

Comments : TWO SI, THAT RECEIVED WASTEWATER SLIGHTLY CONTAMINATED WITH JP-4. UNLIKELY THAT EITHER WAS EXTENSIVELY USED. SITE WAS DISMI SSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	15	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	TRASH PITS, S. OF FRUSTR. SITE	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	NEAR OLD AERIAL CABLE AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				D	D	D	D	D	46
Dateend :	INACTIVE									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL IN PITS NOW COVERED WITH SOIL.

Comments : THREE PITS BELIEVED TO BE FILLED WITH TRASH WHOSE NATURE IS UNKNOWN.

CEARP ID :	29	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	KAFB LANDFILLS	SOLID	C	NA	D	F	F	T	F
Building # :	NA Action : KAFB IRP								
Location :	NW KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1943				L	L	H	L	M	
Dateend :	ONE LANDFILL IS ACTIVE									

Controls : NONE, EXCEPT RUNON AT SOME LANDFILLS. PERMITS HELD UNDETERMINED BY SURVEY.

Comments : SUBTITLE D SOLID WASTE, WITH POTENTIAL FOR SOME HAZARDOUS WASTE TO BE DISPOSED IN LANDFILLS BY DOE-AL FACILITIES AT KAFB. LA NDFILLS RECEIVED GENERAL REFUSE FROM SANDIA AND OTHER DOE-AL FACILITIES AT KAFB.

CEARP ID :	19	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SCRAP YARD	MIXED	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	OLD AERIAL CABLE AREA, SW END			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	D	D	U	65
Dateend :	UNKNOWN									

Controls : NONE OBSERVED DURING SURVEY. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : SCRAP YARD LOCATED IN SMALL ARROYO NEAR OLD AERIAL CABLE. DRUMMED WASTE, SNM (BURNED) TRANSPORT CONTAINERS, AND OTHER SOLID WASTE. ALSO A NEARBY FIRING SITE WITH DRUMS, METAL SCRAP, BROKEN BOTTLES.

CEARP ID :	22	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STRG./BURN AREA W OF LAS. HILL	CHEM	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	OLD AERIAL CABLE AREA, W. OF LASER HILL			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	L	106
Dateend :	<11/19/80									

Controls : NONE OBSERVED, UNREGULATED STORAGE/DISPOSAL.

Comments : POTENTIAL FOR IMPROPER DRUM STORAGE. AREA HAS ONE 55-GALLON DRUM, SEVERAL WOODEN PALLETS, AND EVIDENCE OF PAST BURNING.

CEARP ID :	28	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MINE SHAFTS/ADITS	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	REMOTE AREAS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	59
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL SUSPECTED IN AT LEAST SOME SHAFTS/ADITS. UNFENCED OPENINGS POSE A SAFETY HAZARD PER NM MINE SAFETY CODE.

Comments : SUSPECTED DISPOSAL OF CHEM/RAD/MIXED AND SOLID WASTES. SURVEYS AT MINE MOUTHS IN 71 FOUND RADIATION LEVELS ABOVE BACKGROUND, BUT BACKGROUND VALUES FOUND IN 80s. A1 ROCKET MOTORS BURNED NEAR FRUSTRATION SITE. ONE SITE MARKED WITH A RADIATION SIGN.

CEARP ID :	H	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BLACK-LINED PIT	UNK	C	NA	D	F	F	T	T

Building # : NA Action : NA

Location :	S. KAFB, NW OF EXPLOSIVES TEST PIT	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	L	L	L	U	
Dateend :	UNKNOWN							

Controls : NONE, UNREGULATED DISPOSAL.

Comments : 20 FT. X 20 FT. PIT WITH LINER. USE UNKNOWN.

CEARP ID :	I	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SURFACE IMPOUNDMENT, AREA III	UNK	C	NA	D	T	F	F	F

Building # : NA Action : NA

Location :	S.E. PORTION OF AREA III	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	L	L	L	U	
Dateend :	ACTIVE							

Controls : CURRENTLY SURFACE WATER RUNOFF CONTROL POND.

Comments : FIRING SHELLS FOUND AROUND SI.

CEARP ID :	9	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITE/OPEN DUMP	MIXED	C	UNCERTAIN	D	T	F	T	T

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	SCHOOLHOUSE MESA	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s		L	M	M	L	L	43
Dateend :	1960s							

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL. OPEN DUMP CONTAINS OLD METHLYENE CHLORIDE DRUM, 2 ROCKET CASINGS, GAS CYLINDERS, ET C. EXACT LOCATION OF BURIAL SITE AND BURN SITE UNKNOWN.

Comments : SUSPECT DISPOSAL OF CHEMICAL WASTE. BURIAL SITE & OPEN DUMP LOCATED IN ARROYO E. OF SCHOOLHOUSE (SOLID WASTE). URANIUM BURNE D IN AREA. POTENTIAL FOR HAZARDOUS CHEMICALS OR SMALL PIECES OF DEPLETED URANIUM TO REMAIN ON THE SURFACE IN THE SITE AREA.

ARCHIVE

CEARP ID :	20	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	URANIUM BURN SITE AREA	MIXED	C	UNCERTAIN	D	F	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	M	M	L	D	
Dateend :	1960s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL. EOD UNIT REMOVED SOME EXPLOSIVE DEBRIS.

Comments : 20 PIECES OF dU REPORTEDLY BURNED AT DESIGNATED AREA (LOCATION UNKNOWN). SITE CONTAINS SEVERAL SMALL PITS, A WEATHERED CONCR ETE PAD, AND SCATTERED PIECES OF SHRAPNEL, HE, ORDNANCE, AND FIRING CABLES.

CEARP ID :	25	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BURIAL SITE	CHEM	C	UNCERTAIN	D	F	F	T	F	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	SOUTH OF AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				D	D	D	D	D	71
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : OLD BUILDING USED FOR EXPLOSIVE RESEARCH WAS DEMOLISHED AND PLACED IN TRENCH. EXACT LOCATION OF SITE IS UNKNOWN, BUT MAY BE BENEATH A PARKING LOT.

CEARP ID :	17	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SCRAP YARDS/OPEN DUMPS	MIXED	C	POSITIVE	D	F	F	T	T	
Building # :	NA	Action : CONFIRMATION (PHASE 2)								
Location :	THUNDER RANGE (E., S., & W.)			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1950				L	H	H	H	U	74 - 76
Dateend :	AT LEAST ONE SITE IS ACTIVE									

Controls : NONE, UNCONTROLLED/UNREGULATED STORAGE/DISPOSAL ON SURFACE AND IN TWO DISPOSAL PITS (USE OF PITS UNKNOWN).

Comments : FOUR SCRAP YARDS/OPEN DUMPS. ABANDONED(?) FLUORESCENT LIGHTBULBS, 55-GAL DRUMS LABELED CONTAMINATED LIQUID, AND OTHER SOLID WASTE (SUSPECTED Pb,dU & Be) STORED/LANDFILLED. SEVERAL OLD STORAGE TANKS (COVERED WITH ASBESTOS INSULATION) ARE STORED.

CEARP ID :	6	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	GAS CYLINDER DISPOSAL PIT	CHEM	C	POSITIVE	D	F	F	T	F	
Building # :	NA	Action :	INSTALLATION ASSESSMENT (SUP. PHASE 1)							
Location :	THUNDER RANGE, 0.75 mi E OF BLDG 9966			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				U	L	M	D	D	
Dateend :	LATE 1970s									

Controls : UNREGULATED DISPOSAL OF GAS CYLINDERS IN 6-8 FT DEEP PIT.

Comments : IN MID TO LATE 1970's 150-200 GAS (POISONOUS) CYLINDERS BURIED IN 6-8 FT PIT.

CEARP ID :	23	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	DISPOSAL TRENCHES, T. ARROYO	UNK	C	UNCERTAIN	D	F	F	T	F	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	TIJERAS ARROYO, NEAR NATO SITE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1950s				D	D	D	D	D	47 - 49
Dateend :	EARLY 1960s									

Controls : SUSPECT UNREGULATED DISPOSAL WITHOUT RELEASE CONTROLS.

Comments : POTENTIAL FOR SOME RADIOACTIVE WASTE DISPOSAL; LIKELY THAT NO DISPOSAL TOOK PLACE AT THIS SITE (EXACT LOCATION UNKNOWN). NO RADIOACTIVITY LEVELS ABOVE BACKGROUND WERE DETECTED. FOUR 5-GAL PAILS FOUND SE OF ARROYO DURING SURVEY.

CEARP ID :	24	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	LANDFILL/OPEN DUMP, T. ARROYO	CHEM	C	UNCERTAIN	D	F	F	T	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	TIJERAS ARROYO, W. OF BRIDGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	L	
Dateend :	<1970s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : EXACT LOCATION OF SITE IS UNKNOWN. TREE STUMPS, SHRUBS, WOOD SCRAPS, AND GENERAL REFUSE DISPOSED IN AREA WHICH MAY HAVE BEEN WASHED AWAY DURING A 1970s FLOOD.

CEARP ID : 0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name : OFFSITE DISPOSAL SITES		C	NA	D	F	F	T	T	
Building # : NA Action : NA									
Location : VARIOUS; SEE SECTION 4.1			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : NA				D	D	D	D	D	
Dateend : NA									

Controls :

Comments : SEE SECTION 4.1

CEARP ID : 26	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name : BURIAL SITE	CHEM	C	UNCERTAIN	D	F	F	T	F	
Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)									
Location : WESTERN AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart : UNKNOWN				L		M	L	D	
Dateend : UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POSSIBLE DISPOSAL SITE NEAR SW CORNER OF AREA III & BURIAL SITE ON W. SIDE OF LONG TRACK IN AREA III WHICH REPORTEDLY RECEIVED WASTE CHEMICALS. AERIAL PHOTOS SHOW LINEATIONS IN SUSPECTED SITE AREA; CONFIRMED DURING SURVEY HELICOPTER FLYOVER.

PRELIMINARY

CEARP ID :	49	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BUILDING 9820 DRAINS	CHEM	C	UNCERTAIN	H	F	T	F	T	
Building # :	9820	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	9800 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	H	H	U	H	126
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SURROUNDING AREA MAY BE USED FOR FIRING PRACTICE, AS AN EMPTY "SMOKE VIOLET" CASING AND PURPLE P OWDER WERE FOUND ON A HILL NEARBY.

Comments : SOLVENTS (METHANOL, TOLUENE, & ICE) AND OTHER HAZARDOUS SUBSTANCES BELIEVED TO HAVE BEEN DISPOSED IN SEPTIC DRAIN FIELD. OUT FALL TO SMALL ARROYO NOTED DURING SURVEY.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	DRUM STORAGE AREA, B. 9990	CHEM	C	NA	H	F	F	F	T	
Building # :	9990	Action :	NA							
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1980s				L	L	L	L	U	108
Dateend :	INACTIVE									

Controls : UNKNOWN.

Comments : UNIT USED FOR TEMPORARY DRUM STORAGE FOR PERIODS OF LESS THAN 90 DAYS. NOT VISITED BY SURVEY TEAM.

CEARP ID :	38	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BUILDING 9920 OIL SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T	
Building # :	9920	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1959				L	H	H	L	U	U
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OCCASIONAL FUEL OIL OVERFLOW DURING FILLING SINCE 1000-GALLON UNDERGROUND TANK INSTALLED NORTH OF BLDG 9926 IN 1959.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9939 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9939	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE MACHINING. SOME HE CONTAMINANTS MAY HAVE BEEN DISCHARGED IN DRAIN. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CO NCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9960 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9960	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1960					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE (PBX, LX BARITOL, TNT) MACHINING. HE AND WATER WERE DISCHARGED TO EXPLOSIVE SEPTIC SYSTEM. BAG FILTERS OFTEN FAILED. SI TE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9965 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9965	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	L	U	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : HE ASSEMBLY PERFORMED AT SITE. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9967 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9967	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE ASSEMBLY AND PRIMACORD CONSTRUCTION. INSIDE WALLS/FLOORS WASHED DOWN INTO SEPTIC TANK UNTIL CA. 1982. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	112		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9956 SUMP		CHEM	C	UNCERTAIN	H	F	T	F	F
Building # :	9956	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POTENTIAL FOR BLACK POWDER TO HAVE BEEN DISPOSED IN SUMP AND SUBSEQUENT RELEASES TO THE ENVIRONMENT.

CEARP ID :	K		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED DRUMS, BLDG. 9950		CHEM	C	NA	H	F	F	F	T
Building # :	9950	Action : NA								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : FOUR EMPTY DRUMS FOUND WEST OF BLDG. 9950.

CEARP ID :	J	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED DRUMS, BLDG. 9920	CHEM	C	NA	H	F	F	F	T
Building # :	9920	Action : NA							
Location :	9900 AREA, WEST OF BLDG 9920			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO DRUMS DEGREASOL FOUND.

CEARP ID :	30	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PCB SPILL, RECLAMATION YARD	CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : COMPLIANCE AND VERIFICATION (PHASE 5)							
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1986				L	L	M	U	U	
Dateend :	1986									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SPILL CLEANED UP. SANDIA COLLECTED 20 SOIL SAMPLES AND ANALYZED FOR PCB's. NO PCB's DETECTED (1ppm mdl); HOWEVER SOME SAMPLES WERE DARKLY STAINED AND HAD A SOLVENT ODOR.

CEARP ID :	32	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STEAM PLANT OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	605	Action : COMPLIANCE AND VERIFICATION (PHASE 5)							
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1/79				U	U	U	U	U	P
Dateend :	1/79									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : 500 GAL NO. 2 DIESEL OIL SPILLED. OIL AND WASH WATER RETAINED AND RECOVERED. NO RESIDUES SHOULD REMAIN. HOWEVER, EVIDENCE OF SPILLS ARE PRESENT SURROUNDING 55-GAL DRUM OF WASTE PUMP OIL, AND AT TANK FARM REFILLING STATION.

CEARP ID	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
41	CHEM	C	UNCERTAIN	H	F	F	F	T

Name : BUILDING 838 MERCURY SPILL
Building # : 838 Action : INSTALLATION ASSESS. (SUP. PHASE 1)
Location : AREA I
Datestart : 1976
Dateend : 1976

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	U	L	L	U	U	0

Controls : NONE, UNCONTROLLED RELEASE.

Comments : A BATTERY EXPLODED AND RELEASED Hg . CLEAN UP OF Hg SPILL UNCERTAIN, BUT NO SIGNS OF CONTAMINATION WERE OBSERVED DURING THE S URVEY.

CEARP ID	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
104	CHEM	C	NEGATIVE	H	F	F	F	T

Name : PCB SPILL, COMPUTER FACILITY
Building # : COMPUTER Action : NONE
Location : AREA I
Datestart : UNKNOWN
Dateend : UNKNOWN

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	U	U	U	U	U	

Controls : UNCONTROLLED RELEASE.

Comments : SPILL CONFINED TO BUILDING AND CLEANED UP (COMPUTER FACILITY HAS SOME PCB-CONTAINING LINE FILTERS).

CEARP ID	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
U	CHEM	C	NA	H	F	F	F	T

Name : BUILDING 841 OUTFALL
Building # : 841 Action : NA
Location : AREA I
Datestart : UNKNOWN
Dateend : UNKNOWN

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	M	L	U	

Controls : NONE, UNCONTROLLED RELEASE.

Comments : WASTEWATER DISCHARGES TO SOIL AND CONCRETE. BELIEVED TO CONTAIN FERRIC CHLORIDE, METHYLENE CHLORIDE, AND TCE. RELATED TO CEA RPID #46.

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BLUE OIL TANK	CHEM	C	NA	H	F	F	F	T
Building # :	898 Action : NA								
Location :	AREA I, ADJACENT TO BLDG. 898			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	77
Dateend :	RECENTLY INACTIVE									

Controls : 4-INCH CONCRETE BERM WAS PLACED AROUND THE TANK.

Comments : 500 GAL ABOVE-GROUND TANK, USED FOR THE STORAGE OF WASTE OIL. TANK HAD BEEN REMOVED BETWEEN THE RCRA FACILITIES ASSESSMENT SURVEY AND THIS SURVEY. NOT VISITED BY SURVEY TEAM.

CEARP ID :	42	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ACID SPILL, WATER TREAT. FAC.	CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	NA Action : NONE								
Location :	AREA I, NE CORNER OF BLDG. 870			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	JANUARY 9, 1984				U	U	L	U	U	H
Dateend :	JANUARY 9, 1984									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : ABOUT 1000 GAL OF 30% HCL SPILLED. BELIEVED ACID WAS NEUTRALIZED BY SOIL. ALSO SPILL WAS WASHED DOWN INTO STORM DRAINS. THUS, NO ENVIRONMENTAL HAZARDS LIKELY REMAIN.

CEARP ID :	33	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MOTOR POOL OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	NA Action : COMPLIANCE AND VERIFICATION (PHASE 5)								
Location :	AREA I, NEAR BUILDINGS 875 AND 876			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1983				U	U	U	U	U	Q
Dateend :	1983									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OIL SPILL AT MOTOR POOL IN ABOUT 1983. CONTAMINATED SOIL REMOVED AND PLACED IN THE CHEMICAL LANDFILL. A DIESEL SPILL REPORTEDLY OCCURRED DURING TANK OVERFILLING IN 1979.

CEARP ID :	O	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD METAL SCRAP & TRASH YARD	UKN	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA I, SOUTH OF OLD PONDS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOT REDEVELOPED									

Controls : UNKNOWN.

Comments : SITE IDENTIFIED ON AERIAL PHOTOGRAPH. CUSTODIAN UNKNOWN.

CEARP ID :	P	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD STAINED SITE, AREA I	UKN	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA I, SOUTHWESTERN PORTION			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									

Controls : UNKNOWN.

Comments : AREA IDENTIFIED IN AERIAL PHOTOGRAPH. SITE CUSTODIAN UNKNOWN.

CEARP ID :	43	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD STORAGE YARD, AREA II	RAD	C	UNCERTAIN	H	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	57
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING SURVEY. MOST EQUIPMENT PLACED DIRECTLY ON SOIL SURFACE. NO PROVISION FOR RUNOFF COLLECTION.

Comments : SURPLUS RADIOACTIVE CONTAMINATED EQUIPMENT STORED ON FENCED CONCRETE PAD.

PRELIMINARY

CEARP ID :	48	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING DRAINS, AREA II	CHEM	C	UNCERTAIN	H	F	T	F	F
Building # :	904,907	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				M	L	M	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : AREA II UNDER SEPTIC SYSTEM, NOT SANITARY SEWER. SOLVENTS AND OTHER HAZARDOUS SUBSTANCES BELIEVED TO HAVE BEEN DISPOSED IN S EPTIC DRAIN FIELDS FOR AREA II BUILDINGS. HE MAY HAVE BEEN RETAINED IN BURLAP TRAPS IN DRAINS.

CEARP ID :	44	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	DECONTAMINATION SITE, AREA II	RAD	C	UNCERTAIN	H	F	T	F	F
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	AREA II, ACROSS FROM BLDG. 920			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	130
Dateend :	ACTIVE(?)									

Controls : NONE OBSERVED DURING SURVEY, UNLINED SYSTEM.

Comments : INTERVIEWS DURING SURVEY INDICATED FACILITY MAY NEVER HAVE BEEN USED.

CEARP ID :	31	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ELECTRICAL XFORMER OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1973				U	U	U	U	U	
Dateend :	1973									

Controls : NONE, UNCONTROLLED RELEASE MAY HAVE OCCURRED.

Comments : IN 1973 A TRANSFORMER BLEW UP AND A CLEANUP WAS MADE. IT WAS REPORTED THAT NO OIL WAS SPILLED.

CEARP ID :	34		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CENTRIFUGE OIL SPILL		CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : COMPLIANCE AND VERIFICATION (PHASE 5)								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	H	U	U	R
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASES/DISPOSAL. SPILLS ALSO NOTED AT UST REFILLING STATION NEAR BLDG 6525 AND OUTFALL FROM UNDERGROUND PIPE LEADING FROM BLDG 6527.

Comments : AFTER INTERIOR SPILLS, MOLYBDENUM-BASED OIL PUMPED FROM BUILDING TO GROUND AND THEN PLACED IN DRUMS. OCCASIONAL SPILLS CLEANED USING ABSORBING CLAY. CLAY PLACED IN LOW SPOTS OR HAULED AWAY TO LANDFILL OR TO ARROYO DEL COYOTE.

CEARP ID :	35		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	VIBRATION OIL SPILL		CHEM	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	H	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED RELEASES.

Comments : SEVERAL SPILLS & DUMPING OF OIL (PROBABLY DIALEX) ALONG EASTERN FENCE. CONTAMINATED MATERIAL FROM SOME SPILLS MOVED FROM PAVEMENT TO NEIGHBORING SURFACE OF UNPAVED AREAS. REPORTED THAT UNTIL 3 YEARS AGOA PUMP LEAKED OUTSIDE OF BLDG 6560

CEARP ID :	105		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MERCURY INVENTORY LOSS		CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	6536	Action : NONE								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1972					U	U	U	U	U	
Dateend :	<1972									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SUSPECTED LOSS OF 11 TO 13 LBS OF Hg INSIDE BLDG., BUT HP COULD NOT DETECT ANY Hg IN THE ENVIRONMENT.

CEARP ID :	Q	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD IGLOOS IN AREA III	UNK	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1962				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED.									

Controls : UNKNOWN.

Comments : SITE IDENTIFIED IN AERIAL PHOTOGRAPHS. CUSTODIAN OF SITE UNKNOWN.

CEARP ID :	37	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PROTO OIL SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESSMENT (SUP. PHASE I)								
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	H	L	U	T
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASES.

Comments : TWO 100 GAL SPILLS FROM ABOVE GROUND TANK OCCURRED. EFFECTS OF SPILL STILL VISIBLE. OTHER FILL STATION SPILLS NOTED. DRY W ELLS LOCATED AT TANK FARM COULD BE INSPECTED FOR OIL CONTAMINATION. LEAKING DRUMS OF FREON TF SOLVENT PRESENT IN SITE AREA.

CEARP ID :	36	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	HERMES OIL SPILL	CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	NA Action : NONE								
Location :	AREA V, EAST SIDE OF BLDG. 6596			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	2/85				L	M	H	L	U	S
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SPILLED ABOUT 1500 GAL MINERAL OIL. SOIL PLACED OVER SPILL, BUT OIL STAINING ON PAVED AREA STILL VISIBLE. OTHER SPILLS AT S ITE FILL STATIONS OBSERVED DURING THE SURVEY.

CEARP ID :	H		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDON.DRUMS NEAR GOLF COURSE		CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : NA								
Location :	ARROYO DEL COYOTE, SOUTH				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : MORE THAN 75 DRUMS FOUND. THESE DRUMS COULD BELONG TO KAFB.

CEARP ID :	S		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED GAS CYLINDERS, LS-1		UNK	C	NA	H	F	F	F	T
Building # :	NA	Action : NA								
Location :	LS-1				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1940					L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : FOUR 1940 US ARMY GAS CYLINDERS NEAR LAKE CHRISTIAN.

CEARP ID :	V		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ARCH-TYPE AIRCRAFT SHELTER		CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : NA								
Location :	MADERA CANYON				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	M	L	L	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : BELIEVED TO BE A USAF SITE. DRUMS OF OIL AND SPILLS FOUND. ARROYO CONTAINED DEBRIS AND FIRING CABLES.

PRELIMINARY

CEARP ID :	40	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	6000 IGLOO AREA OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	6020	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	NW KAFB, 6000 IGLOO AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1984				L	L	L	U	U	W
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : 15 GAL OF NO. 2 DIESEL OIL SPILLED DURING FILLING IS NOW CLEANED UP. SIMILAR FUTURE SPILLS LIKELY.

CEARP ID :	45	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LIQ. DISCHARGES,OUTSD AREA IV	UNK	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	OUTSIDE AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED RELEASES.

Comments : SUSPECT TRUCK(S) MAY HAVE REGULARLY DISCHARGED LIQUID WASTES INTO TIJERAS ARROYO.

CEARP ID :	39	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SOLAR FACILITY OIL SPILL	CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	NA	Action :	NONE						
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1980				U	U	U	U	U	V
Dateend :	1980									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OIL (THERMINOL) SPILL AND FIRE AREA CONFINED TO 30 FT DIAMETER. HAVE ALSO SPILLED GLYCOL AND DIESEL DURING REFILLING. NO ENVIRONMENTAL HAZARDS SHOULD REMAIN. ABOUT 10 DRUMS OF HEAT TRANSFER FLUID STORED IN SCRAP YARD AT SITE.

CEARP ID :	L	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED DRUMS, N. TARGET RD.	CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : NA							
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO DRUMS FOUND. CONTENTS UNKNOWN.

CEARP ID :	47	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OUTFALL FROM BUNKER	UNK	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	S. KAFB, ACROSS FROM USGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				M	L	L	D	U	133 - 134
Dateend :	1970s									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO BUNKERS, ONE OF WHICH HAS AN OUTFALL LINE THAT DISCHARGES TO NEARBY ARROYO.

CEARP ID :	46	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD ACID WASTE LINE OUTFALL	CHEM	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	TIJERAS ARROYO			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				M	H	H	L	U	112
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. CURRENT DISCHARGE IS TO GROUND BEHIND BLDG 841, THEN RUNOFF TO SEWER.

Comments : 200 GPD CHROMIC ACID AND FERRIC CHLORIDE DISCHARGED WITH LARGE VOLUME OF OTHER WASTEWATER TO TIJERAS ARROYO. ANALYSIS OF SOIL SAMPLE FROM OUTFALL AREA SHOWED HIGH LEVELS OF FERRIC CHLORIDE BUT NO CHROMATES. WASTE LINE NOW ABANDONED IN PLACE.

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	NONCEARP SPILL AREAS		C	NA	H	F	F	F	T	
Building # :	NA	Action : NA								
Location :	VARIOUS, SEE TABLE 4-20 IN TEXT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				D	D	D	D	D	
Dateend :	NA									

Controls :

Comments : SEE TABLE 4-20 IN TEXT.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	INACTIVE USTS		C	NA	H	F	F	F	F	
Building # :	NA	Action : NA								
Location :	VARIOUS, SEE TABLE 4-21 IN TEXT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				D	D	D	D	D	
Dateend :	NA									

Controls :

Comments : SEE TABLE 4-21 IN TEXT.

PRELIMINARY

TABLE H-2

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BLUE OIL TANK	CHEM	C	NA	H	F	F	F	T	
Building # :	898 Action : NA									
Location :	AREA I, ADJACENT TO BLDG. 898			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	77
Dateend :	RECENTLY INACTIVE									

Controls : 4-INCH CONCRETE BERM WAS PLACED AROUND THE TANK.

Comments : 500 GAL ABOVE-GROUND TANK, USED FOR THE STORAGE OF WASTE OIL. TANK HAD BEEN REMOVED BETWEEN THE RCRA FACILITIES ASSESSMENT S URVEY AND THIS SURVEY. NOT VISITED BY SURVEY TEAM.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	COYOTE SPRINGS PICNIC AREA	CHEM	R	NA	H	F	F	F	T	
Building # :	NA Action : NA									
Location :	COYOTE CANYON, AT COYOTE SPRINGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				L	L	L	U	U	
Dateend :	ACTIVE									

Controls : UNCONTROLLED STORAGE OF MEK AND PAINT.

Comments : SEVERAL CANS OF PAINT AND A 5GAL. CAN OF MEK DISCOVERED STORED (ABANDONED?) UNDER TRAILER IN AREA OF COYOTE SPRINGS PICNIC AR EA. RED STAINS NOTED ON WALL NEARBY. PARTS OF 1-2 RUSTED DRUMS LAYING ADJACENT TO THE TREELINE APPROX 50FT NW OF AREA 3.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	CTA SEPTIC DRAIN SYSTEM, LFR	CHEM	R	NA	H	F	T	F	F	
Building # :	NA Action : NA									
Location :	COYOTE CANYON, LIVE FIRE RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	U	H	U	M	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SEPTIC-DRAIN FIELD SYSTEM

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	CTA TRAINING CAMPUS, M.B.	CHEM	R	NA	H	F	T	F	F	
Building # :	NA	Action : NA								
Location :	MANZANO BASE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	U	H	U	M	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL

Comments : SEPTIC TANK-DRAIN FIELD SYSTEM

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	DRUM STORAGE AREA, B. 9990	CHEM	C	NA	H	F	F	F	T	
Building # :	9990	Action : NA								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1980s				L	L	L	L	U	108
Dateend :	INACTIVE									

Controls : UNKNOWN.

Comments : UNIT USED FOR TEMPORARY DRUM STORAGE FOR PERIODS OF LESS THAN 90 DAYS. NOT VISITED BY SURVEY TEAM.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	EMERGENCY HOSPITAL TANKS,B.831	RAD	R	NA	H	F	F	F	F	
Building # :	831	Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1967				D	D	D	D	D	88 - 90
Dateend :	UNKNOWN									

Controls : UNKNOWN

Comments : UNDERGROUND TANKS ADJACENT TO BLDG. 831 DESIGNED TO CONTAIN WASH WATER GENERATED DURING CLEANING OF HOSPITAL PERSONNEL CONTAMINATED WITH RADIOACTIVE MATERIALS. TANKS MAY NEVER HAVE BEEN USED.

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EMERGENCY SPILL CONTAIN UST	UKN	R	NA	H	F	F	F	F
Building # :	970a Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	94
Dateend :	UNKNOWN								

Controls : UNKNOWN

Comments : 500 GAL UNDERGROUND FIBERGLASS REINFORCED PLASTIC TANK DESIGNED FOR USE IN EMERGENCY SPILL CONTROL. THE TANK HAS NEVER BEEN U SED.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	HAMMERMILL PULVERIZER	SOLID	R	NA	D	F	F	F	F
Building # :	NA Action : NA								
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	104
Dateend :	ACTIVE								

Controls : RELEASES ARE REGULATED BY AN AIR QUALITY PERMIT ISSUED BY THE CITY OF ALBUQUERQUE.

Comments : PULVERIZES NON-HAZARDOUS LIGHTWEIGHT CLASSIFIED DOCUMENTS AND FILM.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	HW CONTAINER STORAGE AREA	CHEM	R	NA	H	F	F	F	T
Building # :	895 Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	105
Dateend :	ACTIVE								

Controls : EPOXY-COATED CEMENT FLOOR WITH 4-FT. WALLS SEPARATING EACH BAY AREA AND 6-INCH BERMS FOR SPILL CONTAINMENT. RUNON DIVERTED B Y BERMS SURROUNDING THE BUILDING.

Comments : CONCRETE BLOCK STRUCTURE USED TO CONTAINERIZE AND SOLIDIFY WASTES WITH VERMICULITE. WASTES STORED LESS THAN 90 DAYS.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	INACTIVE USTS		C	NA	H	F	F	F	F
Building # :	NA	Action : NA							
Location :	VARIOUS, SEE TABLE 4-21 IN TEXT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				D	D	D	D	D	
Dateend :	NA									

Controls :

Comments : SEE TABLE 4-21 IN TEXT.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	INCINERATOR	SOLID	R	NA	D	F	F	F	F
Building # :	NA Action : NA								
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	L	L	U	103
Dateend :	ACTIVE									

Controls : RELEASES REGULATED BY AIR QUALITY PERMIT ISSUED BY BERNALILLO COUNTY AIR QUALITY BOARD.

Comments : INCINERATES ABOUT 2000 POUNDS OF CLASSIFIED DOCUMENTS PER WEEK.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ITRI "HOT PONDS"	MIXED	R	NA	B	T	F	F	F
Building # :	NA Action : NA								
Location :	ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1966				H	H	H	L	U	
Dateend :	1986 (CURRENTLY ADDING WATER FOR DUST CONTROL)									

Controls : LINED SIs, BUT LINERS IN POOR CONDITION. CONDITION OF CONCRETE PAD UNDER THE LINERS IS UNKNOWN. UNREGULATED DISPOSAL. WATE
R ADDED TO CONTROL FUGITIVE EMISSIONS.

Comments : SIs RECEIVED INTERMEDIATE LEVEL WASTES. SUSPECT THAT THEY MAY HAVE ALSO RECEIVED HAZARDOUS WASTES.

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ITRI INACTIVE SANIT. LAGOON #1	MIXED	C	NA	D	T	F	F	F
Building # :	NA Action : NA								
Location :	ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1962				H	H	H	L	U	
Dateend :	1970									

Controls : COVERED WITH 1 FT SOIL AND REMOVED FROM SERVICE BECAUSE OF Cs-137 CONTAMINATION TO 150 mCi. LINED SI.

Comments : LAGOON 1 CLOSED BECAUSE OF Cs-137 DISPOSAL. CONDITION OF LINER IS UNKNOWN. POTENTIAL FOR OFFSITE GROUNDWATER CONTAMINATION.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ITRI SANITARY LAGOONS #2-#6	MIXED	R	NA	D	T	F	F	F
Building # :	NA Action : NA								
Location :	ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1962				H	H	H	L	U	
Dateend :	ACTIVE									

Controls : LINED SI (#2 &3, COMPACTED EARTH FOR #4-#6) UNREGULATED DISPOSAL. EM-31 SURVEY SUGGESTS THAT SYSTEM MAY BE LEAKING.

Comments : LAGOON 1 CLOSED BECAUSE OF Cs-137 DISPOSAL. CONDITION OF LINERS IS UNKNOWN, THAT FOR LAGOON 6 MAY BE PERTURBED BY VEGETATION GROWING IN LAGOON.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LAKE CHRISTIAN, LS-1	CHEM	R	NA	T	T	F	F	F
Building # :	NA Action : NA								
Location :	LOVELACE ROAD, 1 mi. N. OF ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				H	H	M	L	L	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : EXPLOSIVES TESTING PERFORMED IN SI WITH LINING. CONDITION OF LINING IS UNKNOWN, BUT LEAKING MAY OCCUR (INDUCED BY EXPLOSIVE TESTING AND AGE OF LINER). NITRATES AND EXPLOSIVE RESIDUALS MAY EXIST IN SI. FISH POPULATE THE SI.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LLRW TRANSPORT DRUMS	RAD	R	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	119
Dateend :	ACTIVE								

Controls : NONE.

Comments : RADIOACTIVE-CONTAMINATED SOIL EXCAVATED AFTER EXPERIMENTS AND PLACEDIN DRUMS AND THEN TRANSFERRED TO THE LL RAD BURIAL GROU ND IN AREA III ABOUT TWICE A YEAR.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LURANCE CANYON SALVAGE YARD	SOLID	R	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1975				L	L	L	L	U	58
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED STORAGE.

Comments : SCRAP METAL, OLD EQUIPMENT, EMPTY DRUMS AND TANKS USED IN EXPERIMENTS CONTAINED IN A 3-5 ACRE AREA. THE STORAGE OF LIQUIDS W AS NOT NOTED.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	NONCEARP SPILL AREAS		C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	VARIOUS, SEE TABLE 4-20 IN TEXT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				D	D	D	D	D	
Dateend :	NA								

Controls :

Comments : SEE TABLE 4-20 IN TEXT.

CEARP ID : 0
Name : OFFSITE DISPOSAL SITES
Building # : NA Action : NA
Location : VARIOUS; SEE SECTION 4.1
Datestart : NA
Dateend : NA

Controls :

Comments : SEE SECTION 4.1

Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
	C	NA	D	F	F	T	T

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	D	D	D	D	D	

CEARP ID : 0
Name : OFFSITE TEST LOCATIONS
Building # : NA Action : NA
Location : SEE APPENDIX L
Datestart : NA
Dateend : NA

Controls :

Comments : SEE APPENDIX L

Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
	C	NA	T	F	F	F	T

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	D	D	D	D	D	

CEARP ID : 0
Name : POTW SEPTIC TANKS/PIPING
Building # : NA Action : NA
Location : AREA I & AREA IV
Datestart : UNKNOWN
Dateend : ACTIVE

Controls : UNKNOWN, UNDERGROUND TANKS AND PIPING.

Comments : AREA I & IV SEPTIC TANKS CONNECTED TO POTW VIA UNDERGROUND PIPES. SYSTEM RECEIVES BOTH INDUSTRIAL AND SANITARY WASTES. CONDITION OF TANKS AND PIPING UNKNOWN.

Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
CHEM	R	NA	H	F	T	F	F

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	D	L	H	80

PRELIMINARY

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RINSEWATER UST, BLDG. 867	UNK	R	NA	H	F	F	F	F
Building # :	867 Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				U	U	U	U	U	98
Dateend :	TANK NEVER USED								

Controls : UNKNOWN.

Comments : 4000 GAL UNDERGROUND TANK LOCATED NEAR BLDG 867 DESIGN FOR TEMPORARY STORAGE OF ACIDIC AND CAUSTIC RINSE WATER. TANK CONSTRUCTED OF FIBERGLASS-REINFORCED PLASTIC. SNLA STAFF ANTICIPATE TANK WILL BE USED IN 1987.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SANITARY LAGOONS, KAFB	CHEM	R	NA	D	T	F	F	F
Building # :	NA Action : NA								
Location :	PENNSYLVANIA AVE., 0.2 mi. N. TRESTLE F.			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				M	H	M	L	L	
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL OF INDUSTRIAL AND SANITARY WASTES.

Comments : SNLA DISCHARGES TO THESE 2 KAFB SANITARY LAGOONS AND IS SUSPECTED OF DISCHARGING RECENTLY DISCOVERED CHEMICALS (ACETONE, TRICHLOROETHANE, & METHYLENE CHLORIDE). THE 14 ACRE SYSTEM OF 2 LAGOONS HAS CONCRETE LINED SIDES AND CLAY BOTTOM WITH 5ft. HEAD.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SEPTIC-DRAIN SYSTEM, LS-1	CHEM	R	NA	H	F	T	F	F
Building # :	NA Action : NA								
Location :	LOVELACE ROAD, 1 mi N. OF ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				M	U	H	U	M	
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SEPTIC-DRAIN FIELD SYSTEM.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SHEEP BURIAL TRENCHES, LS-1	SOLID	R	NA	H	F	F	T	F	
Building # :	NA Action : NA									
Location :	LOVELACE ROAD, 1 mi. N. OF ITRI			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				L	M	M	H	L	
Dateend :	ACTIVE									

Controls : TRENCHES PERIODICALLY COVERED. UNREGULATED DISPOSAL.

Comments : STRONG ODORS OF DECAYING FLESH FROM ACTIVE TRENCH, WITH EVIDENCE OF SCAVENGER ACTIVITY, BECAUSE THE TRENCH WAS NOT COVERED AD EQUATELY. SOIL MOUNDED OVER OLD TRENCHES.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SPILL CONTAINMENT TANK,B. 6597	CHEM	R	NA	H	F	F	F	F	
Building # :	6597 Action : NA									
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	D	U	D	99
Dateend :	ACTIVE									

Controls : UNKNOWN

Comments : 17,000 GAL CAPACITY STEEL ABOVE GROUND SPILL COANTAINMENT TANK.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SPILL CONTAINMENT UST, B. 844	UNK	R	NA	H	F	F	F	F	
Building # :	844 Action : NA									
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	95
Dateend :	UNKNOWN									

Controls : UNKNOWN

Comments : A 150 GAL TANK DESIGNED FOR COLLECTION AND STORAGE OF WASTE OIL UNTIL IT CAN BE RECYCLED. THERE IS NO LONGER ANY ACCESS TO THE TANK AND IT IS DOUBTED IF THE TANK WAS EVER USED.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SUMP AND OIL/WATER SKIMMER, IV	CHEM	R	NA	H	F	F	F	F
Building # :	NA Action : NA								
Location :	AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	D	D	H	U	81 & 82
Dateend :	ACTIVE									

Controls : SECONDARY CONCRETE CONTAINMENT SYSTEM FOR SKIMMER. LEAKS AT SKIMMERROUTED TO CONCRETE SUMP. RELEASE CONTROLS FOR SUMP ARE U NKNOWN.

Comments : ALL ABOVE-GROUND PRODUCT OIL STORAGE TANKS IN AREA IV DESIGNED TO DISCHARGE TO CONCRETE SUMP (150x20x10ft). WASTE OIL THEM P UMPED TO OIL/WATER SKIMMER. SKIMMED OIL IS DISPOSED IN UNDERGROUND WASTE OIL TANK (RFA No. 83)

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SURFACE WATER COLLECTION POND	CHEM	R	NA	D	T	F	F	F
Building # :	NA Action : NA								
Location :	AREA III, NEAR CHEMICAL LANDFILL			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1982				L	L	M	U	U	9
Dateend :	ACTIVE									

Controls : POND DESIGNED TO COLLECT CONTAMINATED RUNOFF. UNREGULATED DISPOSAL.

Comments : 10 X 450 ft COLLECTION POND FOR RUNOFF FROM CHEMICAL LANDFILL. POND UNLIKELY TO HAVE RECEIVED CONTAMINATED WATER.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	TRANSPORTATION & SAFEGUARDS DV	CHEM	R	NA	H	F	T	F	F
Building # :	NA Action : NA								
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	NA				H	U	H	U	M	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SEPTIC-DRAIN FIELD SYSTEM

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	UNDERGROUND SPENT ACID TANK	CHEM	R	NA	H	F	F	F	F	
Building # :	9939 Action : NA									
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				L	L	D	L	L	93
Dateend :	ACTIVE									

Controls : UNKNOWN, HOWEVER THE TANK HAS AN OUTER ASPHALTIC COATING.

Comments : 7000 GAL WASTE ACID TANK CONTAINING ABOUT 500 GAL OF FLUIDS. SEE CEARP ID #117.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	UNDERGROUND WASTE OIL TANK, IV	CHEM	R	NA	H	F	F	F	F	
Building # :	NA Action : NA									
Location :	AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1970s				L	L	D	L	L	83
Dateend :	ACTIVE									

Controls : UNKNOWN, UNDERGROUND STORAGE TANK.

Comments : 2000 GAL. UNDERGROUND STORAGE TANKS USED TO STORE WASTE OIL DISCHARGED FROM THE OIL/WATER SKIMMER.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	UNDERGROUND WASTEWATER TANKS	RAD	R	NA	H	F	F	F	F	
Building # :	6580 Action : NA									
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				D	L	D	L	L	91 & 92
Dateend :	ACTIVE									

Controls : UNKNOWN.

Comments : TWO UNDERGROUND HOLDING TANKS ADJACENT TO BUILDING 6580 CONTAIN WASTEWATER FROM THE HOT CELL LABORATORY AND OTHER DRAINS. DI SCHARGES FROM TANKS TO "LAKE 2" (SEE CEARP ID #4).

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	UST (REMOVED) AT BLDG. 6712	UNK	R	NA	H	F	F	F	F	
Building # :	6712 Action : NA									
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID-1960s				U	U	U	U	U	97
Dateend :	TANK REMOVED									
Controls :	UNKNOWN									
Comments :	TANK NOW REMOVED. TANK PROBABLY USED FOR STORAGE OF WASTE FUEL OIL.									

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	WASTE CUTTING OIL TANK	CHEM	R	NA	H	F	F	F	F	
Building # :	840 Action : NA									
Location :	AREA I, SOUTH OF BLDG. 840			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1950				L	L	M	L	L	78
Dateend :	ACTIVE									
Controls :	OLD UNDERGROUND STORGE TANK WITH POTENTIAL FOR LEAKS.									
Comments :	500 GAL STEEL UNDERGROUND WASTE OIL STORAGE TANK.									

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	WASTE HYDRAULIC FLUID DRUM	CHEM	R	NA	H	F	F	F	T	
Building # :	851 Action : NA									
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	120
Dateend :	ACTIVE									
Controls :	NONE.									
Comments :	55-GAL DRUM LOCATED ON A WOODEN PALLET USED TO STORE WASTE HYDRAULIC FLUID PRIOR TO DISPOSAL BY SNLA STAFF.									

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	WASTE MOTOR OIL TANK,BLDG 6587	CHEM	R	NA	H	F	F	F	F	
Building # :	6587 Action : NA									
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID-1960s				L	L	D	L	L	86
Dateend :	ACTIVE									

Controls : UNDERGROUND STORAGE TANK WITH NO INTERNAL OR EXTERNAL PROTECTION KNOWN TO EXIST.

Comments : 1000 GAL STORAGE TANKS FOR WASTE OIL.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	WASTE MOTOR OIL TANK,BLDG. 876	CHEM	R	NA	H	F	F	F	F	
Building # :	876 Action : NA									
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1950s				L	L	D	L	L	87
Dateend :	ACTIVE									

Controls : UNKNOWN

Comments : TANK USED FOR STORAGE OF WASTE OIL UNTIL IT CAN BE RECYCLED BY A CONTRACTOR.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	WASTE OIL DRUM STORAGE AREA	CHEM	R	NA	H	F	F	F	T	
Building # :	840 Action : NA									
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	117
Dateend :	ACTIVE									

Controls : NONE.

Comments : TEMPORARY WASTE OIL STORAGE AREA ADJACENT TO BLDG. 840. MOST OF THE DRUM APPEARED IN GOOD CONDITION DURING RCRA FACILITY ASSESSMENT VISIT.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	WASTE OIL TANK, BLDG. 865	CHEM	R	NA	H	F	F	F	F
Building # :	865 Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1965s				L	L	L	U	U	100
Dateend :	ACTIVE								

Controls : NO SECONDARY CONTAINMENT, BUT AREA AROUND TANK LOOKED LIKE NO ENVIRONMENTAL RELEASES HAD OCCURRED.

Comments : 22 YEAR OLD 200 GAL ABOVE GROUND TANK USED TO MANAGE WASTE OIL.

CEARP ID :	0	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	WASTE SOLVENT DRUM, B. 6587	CHEM	R	NA	H	F	F	F	T
Building # :	6587 Action : NA								
Location :	AREA V			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	118
Dateend :	ACTIVE								

Controls : NONE, EXCEPT ASPHALT PARKING LOT.

Comments : 55-GAL DRUM USED TO COLLECT DIRTY MINERAL SPIRITS AND LACQUER THINNER PRIOR TO PICKUP.

CEARP ID :	1	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RADIOACTIVE BURIAL SITE	MIXED	C	POSITIVE	D	F	F	T	F
Building # :	NA Action : CONFIRMATION (PHASE 2)								
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1949				L	M	H	L	D	32 - 37
Dateend :	2/59								

Controls : 3 UNLINED PITS & 3 UNLINED TRENCHES NOW COVERED WITH 3 FT SOIL AND CONCRETE. DISPOSED MATERIALS NOT CONTAINERIZED.

Comments : NO RECORDS KEPT FOR FIVE YEARS. 11,110 CU FT LL AND HW (MIXED) WASTE PLACED IN BURIAL SITE. PRIMARY RADIONUCLIDES dU, TRITIUM, Ra, Co-60, Cs-137, Ni-63 AND Pu. SOME WASTES MAY HAVE BEEN REMOVED FROM SITE.

CEARP ID :	2	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CLASSIFIED WASTE DISP TRENCHES	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1949				L	M	M	L	D	38 & 39
Dateend :	ACTIVE									

Controls : UNREGULATED DISPOSAL IN UNLINED TRENCHES & PITS OF PRINCIPALLY UNCONTAINERIZED SOLID, CLASSIFIED AND POSSIBLY CHEM & RAD WASTES WITH BACKFILLING AFTER EMPLACEMENT.

Comments : NOW USED FOR DISPOSAL OF NONRADIOACTIVE CLASSIFIED WASTE.

CEARP ID :	3	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CHEMICAL DISPOSAL PIT	CHEM	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	D	M	D	D	40
Dateend :	1959									

Controls : NONE KNOWN, UNREGULATED DISPOSAL.

Comments : REPORTEDLY USED FOR HAZARDOUS CHEMICAL WASTE PRIOR TO 1959. RECORDS NOT MAINTAINED FOR MORE THAN 5 YEARS.

CEARP ID :	4	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD SURFACE IMPOUNDMENTS	RAD	C	POSITIVE	D	T	F	F	F
Building # :	NA	Action :	CONFIRMATION (PHASE 2)						
Location :	AREA V, OUTSIDE GATE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	6/22/67				M	L	M	U	U	18 & 19
Dateend :	ACTIVE									

Controls : CLAY LINED (BOTTOM) SURFACE IMPOUNDMENTS. REPORTEDLY A TRUCK LOAD OF OIL WAS DUMPED INTO ONE LAGOON IN CA. 1984. SOIL SAMPLING FOUND 40 PPM PCBs. RADIOACTIVITY IN LAGOON AREAS NOW DECAYED TO LOW LOW LEVELS OF LITTLE CONCERN TO HEALTH PHYSICS.

Comments : 2 LINED SIs RECEIVED LARGE QUANTITIES OF WASTEWATER (PRINCIPALLY FROM SERF) CONTAMINATED WITH CS-137, CO-60, AND OTHER ACTIVATION PRODUCTS. 35 CI DISPOSED IN SIs AND DRAIN FIELD (CEARPID #5). MAJOR ACTIVE PERIOD 6/67-7/71. SI-2 RECEIVES 100 GPD.

CEARP ID :	5	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RADIOACTIVE DRAINFIELD	RAD	C	POSITIVE	D	F	T	F	F
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	AREA V, PARKING LOT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1965				M	U	H	D	U	16 & 17
Dateend :	1967									

Controls : ALTHOUGH THE PITS WERE CLAY LINED, THEY DISCHARGED TO SEPTIC DRAIN FIELDS.

Comments : RECEIVED LARGE QUANTITIES OF WASTEWATER (PRINCIPALLY FROM SERF) CONTAMINATED WITH CS-137, CO-60, AND OTHER ACTIVATION PRODUCTS. 35 CI DISPOSED IN DRAIN FIELD AND SIs (CEARPID #4).

CEARP ID :	6	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GAS CYLINDER DISPOSAL PIT	CHEM	C	POSITIVE	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESSMENT (SUP. PHASE I)							
Location :	THUNDER RANGE; 0.75 mi S OF BLDG 9966			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				U	L	M	D	D	
Dateend :	LATE 1970s									

Controls : UNREGULATED DISPOSAL OF GAS CYLINDERS IN 6-8 FT DEEP PIT.

Comments : IN MID TO LATE 1970's 150-200 GAS (POISONOUS) CYLINDERS BURIED IN 6-8 FT PIT.

CEARP ID :	7	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GAS CYLINDER DISPOSAL PIT	CHEM	C	POSITIVE	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	ARROYO DEL COYOTE (E. OF AREA III)			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				U	D	M	D	D	44
Dateend :	LATE 1970s									

Controls : UNREGULATED DISPOSAL OF GAS CYLINDERS IN PIT NOW COVERED WITH SOIL.

Comments : MID TO LATE 1970's ABOUT 300 GAS CYLINDERS BURIED IN PIT E. OF AREA III. CONTENTS IDENTIFIED AS POISONOUS. EXACT LOCATION OF SITE IS UNKNOWN.

CEARP ID :	8	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	OPEN DUMP	MIXED	C	POSITIVE	D	F	F	F	T	
Building # :	NA	Action : CONFIRMATION (PHASE 2)								
Location :	COYOTE CANYON BLAST AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1940s				L	H	H	L	L	23
Dateend :	1950'S/1960s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL IN AN AREA WHERE FLASH FLOODS MAY OCCUR.

Comments : MOST WASTE IS SUBTITLE D SOLID WASTE (WOODEN PALLETS, GLASS JARS, SHRAPNEL, RUSTED DRUMS, TIRES, TIN CANS, FOIL). EXPLOSIVE TESTING ACTIVITIES DISCARDED IN OPEN DUMP. PIECES OF HE SCATTERED AROUND THE DUMP. FIRING CABLES/ELECTRICAL EQUIP. REMAIN.

CEARP ID :	9	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BURIAL SITE/OPEN DUMP	MIXED	C	UNCERTAIN	D	F	F	T	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE I)								
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	H	H	L	L	43
Dateend :	1960s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL. OPEN DUMP CONTAINS OLD METHLYENE CHLORIDE DRUM, 2 ROCKET CASINGS, GAS CYLINDERS, ET C. EXACT LOCATION OF BURIAL SITE AND BURN SITE UNKNOWN.

Comments : SUSPECT DISPOSAL OF CHEMICAL WASTE. BURIAL SITE & OPEN DUMP LOCATED IN ARROYO E. OF SCHOOLHOUSE (SOLID WASTE). URANIUM BURNE D IN AREA. POTENTIAL FOR HAZARDOUS CHEMICALS OR SMALL PIECES OF DEPLETED URANIUM TO REMAIN ON THE SURFACE IN THE SITE AREA.

CEARP ID :	10	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BURIAL MOUNDS N. OF PEND. SITE	MIXED	C	POSITIVE	D	F	F	T	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	H	H	L	L	60 - 63 & 124
Dateend :	LATE 1970s									

Controls : MOST WASTE LIKELY BURIED IN LOW, SANDY SOIL MOUNDS.

Comments : MOSTLY RAD WASTE WITH POTENTIALLY SOME CHEM WASTE. SCRAP METAL OBSERVED PROTRUDING FROM MOUNDS AND SMALL PIECES OF SHRAPNEL AND HE OBSERVED ON SURFACE. SOME MICRO-R METER READING AT SOIL SURFACE WERE ABOVE BACKGROUND.

CEARP ID :	11	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RAD/EXPLOSIVE BURIAL MOUNDS	MIXED	C	UNCERTAIN	D	F	F	T	F
Building # :	NA Action : INSTALLATION ASSESS. (PHASE 1)								
Location :	E. OF LOVELACE RD., N. OF TARGET RD.			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1940s				L	L	M	L	D	68 - 70
Dateend :	1950s									

Controls : NONE, EXCEPT WASTE COVERED BY SANDY SOIL.

Comments : NATURE OF WASTE UNKNOWN, EXCEPT MOUNDS ARE FENCED AND MARKED WITH RADIOACTIVE AND EXPLOSIVE WARNING SIGNS. PROBABLY OLD EXPLOSIVE ORDNANCE BURIED. NO SURFICIAL RADIATION LEVELS ABOVE BACKGROUND.

CEARP ID :	12	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITE/OPEN DUMP	MIXED	C	POSITIVE	D	F	F	T	T
Building # :	NA Action : CONFIRMATION (PHASE 2)								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1950s				L	L	M	L	L	41
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING VISIT. UNCONTROLLED/UNREGULATED DISPOSAL. PORTION OF OLD DISP. SITE IN ARROYO UNDER PRESENT PARKING AREA. SITE MAY CONTAIN DEPLETED PIECES OF U, BE, PB, AND/OR HE.

Comments : SUBTITLE D SOLID WASTE WITH SOME CHEM WASTE. SITE MAY CONTAIN PIECES OF DU, Be, Pb, AND/OR HE, AND ABOUT 10 DRUMS OF TCE AND OTHER LIQUIDS ABANDONED IN ARROYO NOTED DURING SURVEY.

CEARP ID :	13	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURN SITE SURFACE IMPOUNDMENTS	CHEM	C	NEGATIVE	D	T	F	F	F
Building # :	NA Action : NONE								
Location :	LURANCE CANYON BURN SITE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				H	L	M	L	U	13
Dateend :	1985									

Controls : NONE, UNLINED SURFACE IMPOUNDMENTS. UNREGULATED DISPOSAL.

Comments : TWO SI, THAT RECEIVED WASTEWATER SLIGHTLY CONTAMINATED WITH JP-4. UNLIKELY THAT EITHER WAS EXTENSIVELY USED. SITE WAS DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	14	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITES	MIXED	C	POSITIVE	D	F	F	T	T
Building # :	9920	Action : CONFIRMATION (PHASE 2)							
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				L	M	H	L	L	45
Dateend :	LATE 1970s									

Controls : NONE, EXCEPT BURIAL BENEATH SANDY SOIL OF 6000-8000 FLOUR. LIGHT BULBS IN CRATES (CONTAINING HG) BURIED IN 8 FT PIT. CORIUM THERMITE (CONTAINING ZR, FE OXIDES, NB OXIDES, AND 40 KG dU) DEPOSITED IN GRADED AREA TO SOUTH. UNREGULATED DISPOSAL.

Comments : FLUORESCENT LIGHTBULBS FROM TESTS BURIED N. BLDG 9916. NO Hg FOUND BY HP. DEBRIS FROM 2 TESTS WITH CORIUM THERMITE (10 KG E ACH) AND dU REMOVED FROM THE TEST AREA AND COVERED WITH SANDY SOIL. MICRO-R METER SHOWED NEAR BACKGROUND VALUES.

CEARP ID :	15	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	TRASH PITS, S. OF FRUSTR. SITE	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	NEAR OLD AERIAL CABLE AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				D	D	D	D	D	46
Dateend :	INACTIVE									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL IN PITS NOW COVERED WITH SOIL.

Comments : THREE PITS BELIEVED TO BE FILLED WITH TRASH WHOSE NATURE IS UNKNOWN.

CEARP ID :	16	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OPEN DUMPS	MIXED	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	ARROYO DEL COYOTE E & NE OF AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	H	H	L	U	21 & 55
Dateend :	1983									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL PROBABLY IN 100-YEAR FLOOD PLAIN.

Comments : OIL-CONTAMINATED SOIL, SOME DRUMS, AND OTHER SOLID WASTE DISPOSED ATSEVERAL SITES IN ARROYO. SOME CONCRETE POTENTIALLY COAT ED WITH dU FROM FIELD TESTING; HOWEVER MIRO-R METER DID NOT DETECT RADIATION LEVELS ABOVE BACKGROUND.

CEARP ID :	17	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SCRAP YARDS/OPEN DUMPS	MIXED	C	POSITIVE	D	F	F	T	T
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	THUNDER RANGE (E., S., & W.)			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1950				L	H	H	H	U	74 - 76
Dateend :	AT LEAST ONE SITE IS ACTIVE									

Controls : NONE. UNCONTROLLED/UNREGULATED STORAGE/DISPOSAL ON SURFACE AND IN TWO DISPOSAL PITS (USE OF PITS UNKNOWN).

Comments : FOUR SCRAP YARDS/OPEN DUMPS. ABANDONED(?) FLUORESCENT LIGHTBULBS, 55-GAL DRUMS LABELED CONTAMINATED LIQUID, AND OTHER SOLID WASTE (SUSPECTED Pb,dU & Be) STORED/LANDFILLED. SEVERAL OLD STORAGE TANKS (COVERED WITH ASBESTOS INSULATION) ARE STORED.

CEARP ID :	18	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STORAGE/SALVAGE YARDS	CHEM	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA I AND AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	U	54
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING SURVEY. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : FIVE STORAGE/SALVAGE YARDS TO STORE EXCESS ITEMS. DRUMMED CHEMICAL WASTE MAY EXIST IN STORAGE/SALVAGE YARD. MOSTLY NONRADIO ACTIVE SURPLUS EQUIP. AND NUMEROUS 55-GALLON DRUMS. YARDS NOT BEEN SURVEYED FOR HAZARDOUS MATERIALS.

CEARP ID :	19	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SCRAP YARD	MIXED	C	UNCERTAIN	D	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	OLD AERIAL CABLE AREA, NW END			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	D	D	U	65
Dateend :	UNKNOWN									

Controls : NONE OBSERVED DURING SURVEY. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : SCRAP YARD LOCATED IN SMALL ARROYO NEAR OLD AERIAL CABLE. DRUMMED WASTE, SNM (BURNED) TRANSPORT CONTAINERS, AND OTHER SOLID WASTE. ALSO A NEARBY FIRING SITE WITH DRUMS, METAL SCRAP, BROKEN BOTTLES.

CEARP ID :	20	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	URANIUM BURN SITE AREA	MIXED	C	UNCERTAIN	D	F	F	F	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	M	M	L	D	
Dateend :	1960s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL. EOD UNIT REMOVED SOME EXPLOSIVE DEBRIS.

Comments : 20 PIECES OF dU REPORTEDLY BURNED AT DESIGNATED AREA (LOCATION UNKNOWN). SITE CONTAINS SEVERAL SMALL PITS, A WEATHERED CONCR ETE PAD, AND SCATTERED PIECES OF SHRAPNEL, HE, ORDNANCE, AND FIRING CABLES.

CEARP ID :	21	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	METAL SCRAP/DRUM	CHEM	C	UNCERTAIN	D	F	F	T	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	COYOTE SPRINGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	D	73
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : EXACT LOCATION UNKNOWN. OLD 55-GALLON DRUM AND SOME PARTIALLY-BURIED PIECES OF METAL NOTED IN PARKING AREA N. OF COYOTE SPRI NGS PICNIC AREA AND W. OF KAFB TRAINING AREA. EOD DESTROYED SOME WEAPONS UNITS IN AREA.

CEARP ID :	22	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	STRG./BURN AREA W OF LAS. HILL	CHEM	C	UNCERTAIN	D	F	F	F	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	OLD AERIAL CABLE AREA, W. OF LASER HILL			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	L	106
Dateend :	<11/19/80									

Controls : NONE OBSERVED, UNREGULATED STORAGE/DISPOSAL.

Comments : POTENTIAL FOR IMPROPER DRUM STORAGE. AREA HAS ONE 55-GALLON DRUM, SEVERAL WOODEN PALLETS, AND EVIDENCE OF PAST BURNING.

CEARP ID :	23	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	DISPOSAL TRENCHES, T. ARROYO	UNK	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	TIJERAS ARROYO, NEAR HATO SITE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1950s				D	D	D	D	D	47 - 49
Dateend :	EARLY 1960s									

Controls : SUSPECT UNREGULATED DISPOSAL WITHOUT RELEASE CONTROLS.

Comments : POTENTIAL FOR SOME RADIOACTIVE WASTE DISPOSAL; LIKELY THAT NO DISPOSAL TOOK PLACE AT THIS SITE (EXACT LOCATION UNKNOWN). NO RADIOACTIVITY LEVELS ABOVE BACKGROUND WERE DETECTED. FOUR 5-GAL PAILS FOUND SE OF ARROYO DURING SURVEY.

CEARP ID :	24	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LANDFILL/OPEN DUMP, T. ARROYO	CHEM	C	UNCERTAIN	D	F	F	T	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	TIJERAS ARROYO, W. OF BRIDGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	L	
Dateend :	<1970s									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : EXACT LOCATION OF SITE IS UNKNOWN. TREE STUMPS, SHRUBS, WOOD SCRAPS, AND GENERAL REFUSE DISPOSED IN AREA WHICH MAY HAVE BEEN WASHED AWAY DURING A 1970s FLOOD.

CEARP ID :	25	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITE	CHEM	C	UNCERTAIN	D	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	SOUTH OF AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				D	D	D	D	D	71
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : OLD BUILDING USED FOR EXPLOSIVE RESEARCH WAS DEMOLISHED AND PLACED IN TRENCH. EXACT LOCATION OF SITE IS UNKNOWN, BUT MAY BE BENEATH A PARKING LOT.

CEARP ID :	26	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURIAL SITE	CHEM	C	UNCERTAIN	D	F	F	T	F

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location : WESTERN AREA III

Datestart : UNKNOWN

Dateend : UNKNOWN

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	M	L	D	

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POSSIBLE DISPOSAL SITE NEAR SW CORNER OF AREA III & BURIAL SITE ON W. SIDE OF LONG TRACK IN AREA III WHICH REPORTEDLY RECEIVE D WASTE CHEMICALS. AERIAL PHOTOS SHOW LINEATIONS IN SUSPECTED SITE AREA; CONFIRMED DURING SURVEY HELICOPTER FLYOVER.

CEARP ID :	27	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ANIMAL CARCASS DISPOSAL PIT	RAD	C	UNCERTAIN	D	F	F	T	F

Building # : 9820 Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location : 9800 AREA

Datestart : 1950s

Dateend : EARLY 1960s

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	M	L	L	42

Controls : NONE, DISPOSAL IN UNLINED PIT.

Comments : POTENTIALLY RADIOACTIVE ANIMAL (DONKEY) CARCASSES BURIED AT SITE. NO ELEVATED READING NOTED ON MICRO-R METER.

CEARP ID :	28	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MINE SHAFTS/ADITS	UNK	C	UNCERTAIN	D	F	F	T	F

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location : REMOTE AREAS

Datestart : UNKNOWN

Dateend : UNKNOWN

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	L	L	U	59

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL SUSPECTED IN AT LEAST SOME SHAFTS/ADITS. UNFENCED OPENINGS POSE A SAFETY HAZARD PER NM MINE SAFETY CODE.

Comments : SUSPECTED DISPOSAL OF CHEM/RAD/MIXED AND SOLID WASTES. SURVEYS AT MINE MOUTHS IN 71 FOUND RADIATION LEVELS ABOVE BACKGROUND, BUT BACKGROUND VALUES FOUND IN 80s. A1 ROCKET MOTORS BURNED NEAR FRUSTRATION SITE. ONE SITE MARKED WITH A RADIATION SIGN.

CEARP ID :	29	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface .
Name :	KAFB LANDFILLS	SOLID	C	NA	D	F	F	T	F

Building # : NA Action : KAFB IRP

Location : MW KAFB

Datestart : 1943

Dateend : ONE LANDFILL IS ACTIVE

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	H	L	M	

Controls : NONE, EXCEPT RUNON AT SOME LANDFILLS. PERMITS HELD UNDETERMINED BY SURVEY.

Comments : SUBTITLE D SOLID WASTE, WITH POTENTIAL FOR SOME HAZARDOUS WASTE TO BE DISPOSED IN LANDFILLS BY DOE-AL FACILITIES AT KAFB. LA NDFILLS RECEIVED GENERAL REFUSE FROM SANDIA AND OTHER DOE-AL FACILITIES AT KAFB.

CEARP ID :	30	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PCB SPILL, RECLAMATION YARD	CHEM	C	NA	H	F	F	F	T

Building # : NA Action : COMPLIANCE AND VERIFICATION (PHASE 5)

Location : AREA I

Datestart : 1986

Dateend : 1986

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	L	L	M	U	U	

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SPILL CLEANED UP. SANDIA COLLECTED 20 SOIL SAMPLES AND ANALYZED FOR PCB's. NO PCB's DETECTED (1ppm mdl); HOWEVER SOME SAMPL ES WERE DARKLY STAINED AND HAD A SOLVENT ODOR.

CEARP ID :	31	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ELECTRICAL XFORMER OIL SPILL	CHEM	C	NA	H	F	F	F	T

Building # : NA Action : COMPLIANCE AND VERIFICATION (PHASE 5)

Location : AREA III

Datestart : 1973

Dateend : 1973

Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
	U	U	U	U	U	

Controls : NONE, UNCONTROLLED RELEASE MAY HAVE OCCURRED.

Comments : IN 1973 A TRANSFORMER BLEW UP AND A CLEANUP WAS MADE. IT WAS REPORTED THAT NO OIL WAS SPILLED.

CEARP ID :	32	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STEAM PLANT OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	605	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1/79				U	U	U	U	U	P
Dateend :	1/79									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : 500 GAL NO. 2 DIESEL OIL SPILLED. OIL AND WASH WATER RETAINED AND RECOVERED. NO RESIDUES SHOULD REMAIN. HOWEVER, EVIDENCE OF SPILLS ARE PRESENT SURROUNDING 55-GAL DRUM OF WASTE PUMP OIL, AND AT TANK FARM REFILLING STATION.

CEARP ID :	33	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MOTOR POOL OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	AREA I, NEAR BUILDINGS 875 AND 876			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1983				U	U	U	U	U	Q
Dateend :	1983									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OIL SPILL AT MOTOR POOL IN ABOUT 1983. CONTAMINATED SOIL REMOVED AND PLACED IN THE CHEMICAL LANDFILL. A DIESEL SPILL REPORTEDLY OCCURRED DURING TANK OVERFILLING IN 1979.

CEARP ID :	34	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CENTRIFUGE OIL SPILL	CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	H	U	U	R
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASES/DISPOSAL. SPILLS ALSO NOTED AT UST REFILLING STATION NEAR BLDG 6525 AND OUTFALL FROM UNDERGROUND PIPE LEADING FROM BLDG 6527.

Comments : AFTER INTERIOR SPILLS, MOLYBDENUM-BASED OIL PUMPED FROM BUILDING TO GROUND AND THEN PLACED IN DRUMS. OCCASIONAL SPILLS CLEANED USING ABSORBING CLAY. CLAY PLACED IN LOW SPOTS OR HAULED AWAY TO LANDFILL OR TO ARROYO DEL COYOTE.

CEARP ID :	35	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	VIBRATION OIL SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T

Building # : NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	AREA III	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	M	H	L	U	
Dateend :	UNKNOWN							

Controls : NONE, UNCONTROLLED RELEASES.

Comments : SEVERAL SPILLS & DUMPING OF OIL (PROBABLY DIALEX) ALONG EASTERN FENCE. CONTAMINATED MATERIAL FROM SOME SPILLS MOVED FROM PAV EMENT TO NEIGHBORING SURFACE OF UNPAVED AREAS. REPORTED THAT UNTIL 3 YEARS AGOA PUMP LEAKED OUTSIDE OF BLDG 6560

CEARP ID :	36	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	HERMES OIL SPILL	CHEM	C	NEGATIVE	H	F	F	F	T

Building # : NA Action : NONE

Location :	AREA V, EAST SIDE OF BLDG. 6596	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	2/85		L	M	H	L	U	S
Dateend :	ACTIVE							

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SPILLED ABOUT 1500 GAL MINERAL OIL. SOIL PLACED OVER SPILL, BUT OIL STAINING ON PAVED AREA STILL VISIBLE. OTHER SPILLS AT S ITE FILL STATIONS OBSERVED DURING THE SURVEY.

CEARP ID :	37	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PROTO OIL SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T

Building # : NA Action : INSTALLATION ASSESSMENT (SUP. PHASE 1)

Location :	AREA V	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	M	H	L	U	T
Dateend :	ACTIVE							

Controls : NONE, UNCONTROLLED RELEASES.

Comments : TWO 100 GAL SPILLS FROM ABOVE GROUND TANK OCCURRED. EFFECTS OF SPILL STILL VISIBLE. OTHER FILL STATION SPILLS NOTED. DRY W ELLS LOCATED AT TANK FARM COULD BE INSPECTED FOR OIL CONTAMINATION. LEAKING DRUMS OF FREON TF SOLVENT PRESENT IN SITE AREA.

CEARP ID :	38	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BUILDING 9920 OIL SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T	
Building # :	9920	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1959				L	M	H	L	U	U
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OCCASIONAL FUEL OIL OVERFLOW DURING FILLING SINCE 1000-GALLON UNDERGROUND TANK INSTALLED NORTH OF BLDG 9926 IN 1959.

CEARP ID :	39	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SOLAR FACILITY OIL SPILL	CHEM	C	NEGATIVE	H	F	F	F	T	
Building # :	NA	Action : NONE								
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1980				U	U	U	U	U	V
Dateend :	1980									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : OIL (THERMINOL) SPILL AND FIRE AREA CONFINED TO 30 FT DIAMETER. HAVE ALSO SPILLED GLYCOL AND DIESEL DURING REFILLING. NO ENVIRONMENTAL HAZARDS SHOULD REMAIN. ABOUT 10 DRUMS OF HEAT TRANSFER FLUID STORED IN SCRAP YARD AT SITE.

CEARP ID :	40	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	6000 IGLOO AREA OIL SPILL	CHEM	C	NA	H	F	F	F	T	
Building # :	6020	Action : COMPLIANCE AND VERIFICATION (PHASE 5)								
Location :	NW KAFB, 6000 IGLOO AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1984				L	L	L	U	U	V
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : 15 GAL OF NO. 2 DIESEL OIL SPILLED DURING FILLING IS NOW CLEANED UP. SIMILAR FUTURE SPILLS LIKELY.

CEARP ID :	41	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BUILDING 838 MERCURY SPILL	CHEM	C	UNCERTAIN	H	F	F	F	T	
Building # :	838	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1976				U	L	L	U	U	0
Dateend :	1976									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : A BATTERY EXPLODED AND RELEASED Hg. CLEAN-UP OF Hg SPILL UNCERTAIN, BUT NO SIGNS OF CONTAMINATION WERE OBSERVED DURING THE S URVEY.

CEARP ID :	42	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	ACID SPILL, WATER TREAT. FAC.	CHEM	C	NEGATIVE	H	F	F	F	T	
Building # :	NA	Action :	NONE							
Location :	AREA I, NE CORNER OF BLDG. 870			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	JANUARY 9, 1984				U	U	L	U	U	M
Dateend :	JANUARY 9, 1984									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : ABOUT 1000 GAL OF 30% HCL SPILLED. BELIEVED ACID WAS NEUTRALIZED BY SOIL. ALSO SPILL WAS WASHED DOWN INTO STORM DRAINS. THU S, NO ENVIRONMENTAL HAZARDS LIKELY REMAIN.

CEARP ID :	43	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	RAD STORAGE YARD, AREA II	RAD	C	UNCERTAIN	H	F	F	F	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	57
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING SURVEY. MOST EQUIPMENT PLACED DIRECTLY ON SOIL SURFACE. NO PROVISION FOR RUNOFF COLLECTION.

Comments : SURPLUS RADIOACTIVE CONTAMINATED EQUIPMENT STORED ON FENCED CONCRETE PAD.

CEARP ID :	44	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	DECONTAMINATION SITE, AREA II	RAD	C	UNCERTAIN	H	F	T	F	F
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	AREA II, ACROSS FROM BLDG. 920			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	130
Dateend :	ACTIVE(?)									

Controls : NONE OBSERVED DURING SURVEY. UNLINED SYSTEM.

Comments : INTERVIEWS DURING SURVEY INDICATED FACILITY MAY NEVER HAVE BEEN USED.

CEARP ID :	45	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LIQ. DISCHARGES,OUTSD AREA IV	UNK	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	OUTSIDE AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED RELEASES.

Comments : SUSPECT TRUCK(S) MAY HAVE REGULARLY DISCHARGED LIQUID WASTES INTO TIJERAS ARROYO.

CEARP ID :	46	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD ACID WASTE LINE OUTFALL	CHEM	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	TIJERAS ARROYO			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				M	H	H	L	U	112
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. CURRENT DISCHARGE IS TO GROUND BEHIND BLDG 841, THEN RUNOFF TO SEWER.

Comments : 200 GPD CHROMIC ACID AND FERRIC CHLORIDE DISCHARGED WITH LARGE VOLUME OF OTHER WASTEWATER TO TIJERAS ARROYO. ANALYSIS OF SOI
L SAMPLE FROM OUTFALL AREA SHOWED HIGH LEVELS OF FERRIC CHLORIDE BUT NO CHROMATES. WASTE LINE NOW ABANDONED IN PLACE.

CEARP ID :	47	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OUTFALL FROM BUNKER.	UNK	C	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	S. KAFB, ACROSS FROM USGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				M	L	L	D	U	133 - 134
Dateend :	1970s									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO BUNKERS, ONE OF WHICH HAS AN OUTFALL LINE THAT DISCHARGES TO NEARBY ARROYO.

CEARP ID :	48	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING DRAINS, AREA II	CHEM	C	UNCERTAIN	H	F	T	F	F
Building # :	904,907	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				M	L	M	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : AREA II UNDER SEPTIC SYSTEM, NOT SANITARY SEWER. SOLVENTS AND OTHER HAZARDOUS SUBSTANCES BELIEVED TO HAVE BEEN DISPOSED IN S EPTIC DRAIN FIELDS FOR AREA II BUILDINGS. HE MAY HAVE BEEN RETAINED IN BURLAP TRAPS IN DRAINS.

CEARP ID :	49	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9820 DRAINS	CHEM	C	UNCERTAIN	H	F	T	F	T
Building # :	9820	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	9800 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	H	M	U	M	126
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SURROUNDING AREA MAY BE USED FOR FIRING PRACTICE, AS AN EMPTY "SMOKE VIOLET" CASING AND PURPLE P OWDER WERE FOUND ON A HILL NEARBY.

Comments : SOLVENTS (METHANOL, TOLUENE, & TCE) AND OTHER HAZARDOUS SUBSTANCES BELIEVED TO HAVE BEEN DISPOSED IN SEPTIC DRAIN FIELD. OUT FALL TO SMALL ARROYO NOTED DURING SURVEY.

CEARP ID :	50	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD CENTRIFUGE SITE/DUMP	CHEM	C	UNCERTAIN	T	F	F	F	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	NEAR AREA II			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : POSSIBLE RESIDUAL ROCKET PROPELLANT FROM ROCKET-POWERED CENTRIFUGE. WASTE MATERIALS (PAINT CANS, DURMS, CONCRETE, FIREBRICK, PIPE, WOOD, ETC.) WERE DUMPED OVER THE SIDE OF THE HILL NE OF THIS AREA.

CEARP ID :	51	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 6924 PAD, TANK & PIT	CHEM	C	UNCERTAIN	T	F	F	T	F
Building # :	6924	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1969				L	L	L	L	U	10 & 11
Dateend :	1971									

Controls : RUNOFF PIT AND CULVERT HAVE ABOVE-GRADE SIDE WALLS TO PREVENT RUNON/RUNOFF. NO OTHER RELEASE CONTROLS WERE OBSERVED DURING SURVEY. UNREGULATED DISPOSAL.

Comments : SOLVENTS CONTAMINATED WITH HE DISCHARGED VIA A DITCH TO A TANK AND IGNITED. UNLINED OVERFLOW PIT CONNECTED TO TANK BY DRAIN PIPE. CEARP SUGGESTS THAT LITLE RESIDUAL CONTAMINATION EXPECTED.

CEARP ID :	52	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SERF LIQUID WASTE TANKS	RAD	C	UNCERTAIN	T	F	T	F	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA V, NEAR BLDG. 6580			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1962				U	U	L	U	U	91,92 & 98
Dateend :	EARLY 1970s, TANKS ARE STILL ACTIVE									

Controls : CONCRETE TANKS, BUT DISCHARGES FROM TANKS IMPACTED THE ENVIRONMENT. WHEN SEPTIC SYSTEM FAILED, LIQUID EFFLUENT WAS DISPOSED IN AREA III RADIOACTIVE BURIAL GROUND. PRINCIPALLY COOLING WATER DISCHARGES OF ABOUT 100 GPD STILL PASS THROUGH THESE TANKS.

Comments : LARGE VOLUMES OF SLIGHTLY RADIOACTIVE WATER FROM SERF THAT WAS THEN DISCHARGED TO DRAIN FIELD OR SIs. ABOUT 35 Ci OF CS-137, CO-60 AND OTHER ACTIVATION PRODUCTS DISCHARGED VIA THESE 3 TANKS (CEARPIDs #4 & #5).

CEARP ID :	53		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9923		RAD	C	NEGATIVE	T	F	F	F	F
Building # :	9923	Action : NONE								
Location :	AREA II				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					U	U	U	U	U	
Dateend :	ACTIVE										

Controls : TEST MATERIALS STORED IN BUILDING.

Comments : STORAGE OF RADIOACTIVE MATERIALS (Fe & Al) FROM NEUTRON ACTIVATION EXPERIMENTS AT NTS. SAMPLES EMIT 1-3 mR/hr BETA. NO ENV IRONMENTAL RELEASE EXPECTED.

CEARP ID :	54		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PICKAX SITE		CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	THUNDER RANGE				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1966					L	M	M	L	U	14 & 15
Dateend :	INACTIVE										

Controls : THE PIT IS LINED WITH CONCRETE AND METAL. THE SI IS UNLINED. UNREGULATED DISPOSAL.

Comments : 0.5 - 20 TON EXPLOSIVE TESTS (USING TNT & PRIMACORD) AT THE SITE. ONE UNLINED PIT E. OF BUNKER #1 IS SURROUNDED BY ROPES. P IT HEAVILY VEGETATED. A CONCRETE PAD DRAINS INTO PIT. ANOTHER PIT W. OF BUNKER #1 IS SURROUNDED BY CONCERTINA WIRE.

CEARP ID :	55		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RED TOWERS SITE, THUNDER RANGE		CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	THUNDER RANGE				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1981					L	M	M	L	U	
Dateend :	ACTIVE										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : THE AREA MAY BE CONTAMINATED WITH dU, Pb, AND Be FROM EXPLOSIVE CHARGES OF 50 TO 200 LBS.

CEARP ID :	56	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CRATERING SITE, THUNDER RANGE	CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	THUNDER RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1958				L	H	M	L	U	A
Dateend :	1970									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : LARGE (UP TO 15 TONS OF TNT)EXPLOSIONS USED TO PRODUCE CRATERS. VOLUME OF CRATERS DETERMINED BY FILLING THEM WITH POTASSIUM PERMANGANATE SOLUTION. SOME HE RESIDUALS MAY STILL REMAIN IN AREA.

CEARP ID :	57	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	WORKMAN SITE	MIXED	C	NA	T	F	F	F	T
Building # :	NA	Action :	COMPLIANCE AND VERIFICATION (PHASE 5)						
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1940s				L	H	M	L	U	G
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SITE USED IN PROXIMITY FUSE TESTING. OVERPRESSURE BLAST TESTING EQUIPMENT FROM NTS EXPERIMENTS ABANDONED ON SITE. PROXIMITY FUSE DEBRIS CLEANED UP.

CEARP ID :	58	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	COYOTE CANYON BLAST AREA	MIXED	C	POSITIVE	T	F	F	F	T
Building # :	NA	Action :	CONFIRMATION (PHASE 2)						
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1950s				L	H	H	L	U	136 - 139
Dateend :	INACTIVE CA. 1960									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : OLD UST, ALSO EXPLOSIVE MATERIAL CONTAMINATION ON TEST AREA SURFACE. THERE IS ALSO A GREAT DEAL OF SHRAPNEL (Pb, Be, AND/OR d U). HILLTOP BLDG. REPORTED TO CONTAIN ASBESTOS WASTE.

CEARP ID :	59	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	PENDULUM SITE	UNK	C	NEGATIVE	T	F	F	F	T	
Building # :	NA	Action : NONE								
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	UNKNOWN									

Controls : NONE.

Comments : MICRO-R METER READINGS SHOWED AT POLE SUPPORTS VERY SLIGHTLY ABOVE BACKGROUND (LIKELY CAUSED BY RAD IN CONCRETE). HOWEVER TH ERE IS NO INFORMATION SUGGESTING ANY RELEASE OF MATERIALS FROM SITE. SOME EARLY GUN TESTING PERFORMED IN AREA.

CEARP ID :	60	Waste	CERCLA/RCRA	CEARP Finding	S	Use	SI	Septic	Landfill	Surface
Name :	BUNKER AREA,N.OF PENDULUM SITE	MIXED	C	POSITIVE			F	F	T	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	H	H	L	L	124
Dateend :	INACTIVE									

Controls : NONE.

Comments : UP TO 60 pCi/g SOIL CONTAMINATION MAY EXIST IN AREA FROM TESTING AT SITE. HE, dU, Pb, AND Be LIKELY TO BE PRESENT (CEARPID # 10). MIRO-R METER READINGS ABOVE BACKGROUND.

CEARP ID :	61	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SCHOOLHOUSE MESA TEST SITE	MIXED	C	UNCERTAIN	T	F	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1950s				L	H	M	L	U	
Dateend :	EARLY 1960s									

Controls : NONE.

Comments : HE AND dU WERE DETONATED IN THE AREA. IT IS NOT KNOWN WHAT RESIDUES REMAIN IN THIS AREA.

CEARP ID :	62	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GRAYSTONE MANOR SITE	CHEM	C	UNCERTAIN	T	F	F	T	F
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	COYOTE SPRINGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1950s				L	L	H	L	U	
Dateend :	1950s									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DETONATED EXPLOSIVES IN DRY WELLS IN THE VICINITY OF COYOTE SPRINGS. RESIDUAL HE (INCLUDING Ba) MAY REMAIN IN AREA. EXACT L OCATION OF THE SITE IS UNKNOWN.

CEARP ID :	63	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BALLOON TEST AREA	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1983				L	L	M	L	U	E
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. RUSTED DRUM, TAIL OF ROCKET MOTOR CASING, EMPTY MOTOR OIL CANS IN & NEAR ARROYO TO WEST AND SOUT H OF SITE. MICROWAVE TRANSMITTER TUBES (RADIOACTIVE) DISCOVERED NE OF SITE DURING SURVEY.

Comments : 1983 TESTING FROM BALLOONS. MOST RECENTLY USED FOR TESTING REMOTE FLYING TV CAMERA. IT IS NOT KNOWN WHAT RESIDUAL CONTAMINA TION MAY BE PRESENT FROM EXPERIMENTS.

CEARP ID :	64	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GUN SITE	CHEM	C	NEGATIVE	T	F	F	F	T
Building # :	NA	Action : NONE							
Location :	MADERA CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	LATE 1960s				L	L	M	L	U	E
Dateend :	LATE 1960s									

Controls : NONE, UNREGULATED DISPOSAL

Comments : NO RADIOACTIVITY SIGNIFICANTLY ABOVE BACKGROUND DETECTED. SOME SHRAPNEL MAY STILL REMAIN IN THE AREA. SHORT-LIVED RADIOACTI VE TRACERS POTENTIALLY USED IN EXPERIMENTS. MOSTLY FIRED CONVENTIONAL PROJECTILES.

CEARP ID :	65	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE TEST SITE	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				L	L	L	L	U	119
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL. EXCAVATION OF LOW-LEVEL RADIOACTIVE SOIL.

Comments : WIDELY SCATTERED Pb AND dU ANTICIPATED ON TEST AREA SURFACE. DRUMMED RADIOACTIVE SOIL FROM SITE PLACED IN LLW BURIAL GROUND AT AREA III.

CEARP ID :	66	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BOXCAR SITE	MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	L	U	H
Dateend :	INACTIVE								

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POTENTIAL FOR Be, Pb, HE AND dU TO BE DISBURSED ON SURFACE OF THE TEST AREA. FIRING CABLES AND CONCRETE PADS REMAIN.

CEARP ID :	67	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FRUSTRATION SITE	CHEM	C	NEGATIVE	T	F	F	F	T
Building # :	NA	Action : NONE							
Location :	OLD AERIAL CABLE AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	H	L	U	
Dateend :	INACTIVE								

Controls : NONE, UNREGULATED DISPOSAL. SEE CEARP ID #28 FOR MINE SHAFT DISCUSSION.

Comments : UNDETONATED EXPLOSIVES AND SHRAPNEL EXIST ON THE SURFACE OF TEST AREA. KAFB PERSONNEL DETERMINED UNECONOMICAL TO REMOVE UNDE TONATED EXPLOSIVES. SITE DISMISSED BY CEARP, SINCE THE SHELLS AND SHRAPNEL ARE CONSIDERED A USAF RESPONSIBILITY.

CEARP ID :	68	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	OLD BURN SITE	MIXED	C	UNCERTAIN	T	T	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	M	M	L	U	111
Dateend :	LATE 1970s									

Controls : NONE KNOWN.

Comments : OIL WAS BURNED IN 25FT SQ. UNLINED PIT (LATER PLASTIC LINING WAS USED) DURING EXPERIMENTS & DISCHARGED TO TRENCH AND A 30 FT DIA. SI. SOME dU, Pb, AND Th CONTAMINATION OF TEST AREA. RADIOACTIVELY-CONTAMINATED SOIL WAS BURIED IN AREA III RAD B.G.

CEARP ID :	69	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	FIRING SITES (SOUTH KAFB)	CHEM	C	UNCERTAIN	T	F	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	INACTIVE									

Controls : NONE, UNCONTROLLED DISPOSAL.

Comments : OLD FIRING CABLES AND SHRAPNEL OBSERVED. IT IS NOT KNOWN WHETHER ANY HAZARDOUS MATERIAL RESIDUES REMAIN.

CEARP ID :	70	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	EXPLOSIVE TEST PIT	CHEM	C	UNCERTAIN	T	F	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	S. KAFB			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	D	L	U	127
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DEEP CONCRETE LINED PIT IDENTIFIED ACROSS FROM WATER TOWERS. SIDES OF PIT DARKENED INDICATING POSSIBLE BURN ACTIVITIES. VER MICULITE SCATTERED ON GROUND AROUND PIT.

CEARP ID :	71	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	MOONLIGHT SHOT AREA	RAD	C	UNCERTAIN	T	F	F	F	T	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	S. KAFB, NEAR 0025			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	D	L	L	U	F
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : MOCK-UP WEAPONS AND WEAPON COMPONENTS WERE FIRED. RESIDUE INCLUDES dU.

CEARP ID :	72	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	OPERATION BEAVER SITES	SOLID	C	NEGATIVE	T	F	F	F	T	
Building # :	NA Action : NONE									
Location :	COYOTE SPRINGS AND CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	DURING VIETNAM WAR				L	L	L	L	U	
Dateend :	DURING VIETNAM WAR									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : EXPLOSIVELY FIRED BARS USED TO CLEAR WOODED AREAS. STUMPS AND FELLED TREES REMAIN ON SIDE OF SITE.

CEARP ID :	73	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	HW REPACKAGE/STORAGE, CHEM LF.	CHEM	R	POSITIVE	H	F	F	F	T	
Building # :	NA Action : RCRA INTERIM STATUS (SANDIA)									
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	D	101, 107, & 110
Dateend :	ACTIVE									

Controls : NO CONTROLS FOR SPILLS.

Comments : SOME HW SPILLS ON CHEMICAL LANDFILL DURING REPACKAGING AND STORAGE. SOME STORED DRUMS SHOW SIGNS OF PRESSURE. CLOSURE AND POST-CLOSURE PLANS/PERMIT APPLICATION SUBMITTED (SEE CEARPID #74).

CEARP ID :	74	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CHEMICAL LANDFILL/SI	CHEM	R	POSITIVE	D	F	F	T	F
Building # :	NA	Action : RCRA INTERIM STATUS/CLOSURE (SANDIA)							
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1962				M	M	H	M	M	1 - 8 & 20
Dateend :	1/26/83 EXCEPT PIT 4									

Controls : RUNON CONTROLLED. CLOSURE NOT YET BEING EFFECTED. LANDFILL PITS AND TRENCHES ARE UNLINED. ONE CHROMIC ACID PIT IS LINED WITH 10" OF BENTONITE CLAY AND TWO HYPALON LINERS.

Comments : SUBSIDANCE AND EMERGENCE OF DRUMS OCCURING IN SOME TRENCH AREAS. REPORTEDLY, FOAM SQUEEZES TO THE SURFACE FROM PAST DISPOSAL TRENCHES. A Cr FRONT OBSERVED AT A DEPTH OF 76' IN VADOSE ZONE. WASTES DUMPED INCL LIQS.

CEARP ID :	75	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	THERMAL TREATMENT FACILITY	CHEM	R	POSITIVE	T	F	F	F	T
Building # :	NA	Action : RCRA INTERIM STATUS.							
Location :	AREA III, NEAR 6715			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	M	U	102
Dateend :	ACTIVE									

Controls : NONE.

Comments : THEMRAL DESTRUCTION OF HIGH LIGHT AND SL SENSITIVE EXPLOSIVES.

CEARP ID :	76	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	RADIOACTIVE BURIAL SITE	MIXED	R	POSITIVE	D	F	F	T	T
Building # :	NA	Action : CONFIRMATION (PHASE 2)							
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	3/1959				M	H	H	L	L	24 - 28
Dateend :	ACTIVE									

Controls : RUNON REACHES ACTIVE AND INACTIVE TRENCHES. UNREGULATED DISPOSAL. LIQUID Cs AND Co SOLIDIFIED IN CONCRETE PRIOR TO DISPOSAL. FULL PITS COVERED WITH SOIL. PITS NOT LINED.

Comments : MIXED WASTED DISPOSAL CONFIRMED DURING SURVEY. Co AND Cs FROM SMALL SEALED SOURCES PLACED IN CONCRETE PRIOR TO DISPOSAL. RA D. CONTAM. WASTEWATER DISCHARGED DURING 1 MONTH IN 1967. URANIUM FIRE IN 1974.

CEARP ID :	77	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SURFACE IMPOUNDMENT AREA IV	CHEM	C	NA	D	T	F	F	F	
Building # :	NA	Action : REMEDIAL ACTION (PHASE 4)								
Location :	AREA IV			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				H	L	H	L	U	12
Dateend :	ACTIVE									

Controls : ONE HYPOLON LINED SI. HOWEVER, SIMILAR IMPOUNDMENT FOR FACILITY IS NOT LINED. DURING THE VISIT THERE WAS ABOUT 3 FEET OF FRE EBOARD. BOTH SIs RECEIVE WASTEWATER AFTER PROCESSING BY OIL/WATER SEPARATOR. UNREGULATED DISPOSAL.

Comments : ONE SI UNDER REMEDIATION - EXCAVATING SOIL & RELINING. RECEIVES WASTEWATER AFTER RESIN PROCESSING. UNLINED SI USED TO DISPO SE OF WATER WITH HYDRAULIC OIL FROM SUMPS NEAR ACCELERATOR OIL TANKS (OIL SHEEN VISIBLE DURING SURVEY HELICOPTER OVERFLIGHT).

CEARP ID :	78	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	GAS CYLINDER DISPOSAL PIT	CHEM	R	UNCERTAIN	D	F	F	T	F	
Building # :	NA	Action : CONFIRMATION (PHASE 2)								
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1962				L	M	H	L	L	31
Dateend :	11/1985									

Controls : NONE OBSERVED DURING SURVEY. UNLINED PIT. UNREGULATED DISPOSAL.

Comments : LARGE PIT 50x80 FT. EAST OF LANDFILL OCCASIONALLY USED TO DISPOSE OLD GAS CYLINDERS. PIT ALSO USED IN PAST FOR TREATMENT AND DISPOSAL OF LiHYDRIDE AND OTHER REACTIVE WASTES. CYLINDERS WERE REPORTEDLY REMOVED IN THE LATE 1970s.

CEARP ID :	79	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	GAS CYLINDER DISPOSAL	CHEM	R	UNCERTAIN	D	F	F	T	F	
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	THUNDER RANGE, NEAR BLDG. 9964			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	MID 1970s				L	L	L	L	U	72
Dateend :	LATE 1970s									

Controls : NONE, UNREGULATED DISPOSAL IN AN UNLINED PIT.

Comments : EMPTY CYLINDERS WHICH CONTAINED HAZARDOUS GAS ARE DISCARDED AT THE SITE. CYLINDERS REPORTEDLY REMOVED IN LATE 1970s.

CEARP ID :	80	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	KAFB CURRENT LANDFILL #6	CHEM	R	NA	D	F	F	T	F	
Building # :	NA	Action : KAFB IRP								
Location :	SE OF AREA I, ON TIJERAS ARROYO			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	H	M	H	
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : SOME HS FROM DOE-AL FACILITIES AT KAFB MAY HAVE BEEN DISPOSED IN THIS SUBTITLE D SOLID WASTE LADFILL. SOME PCB-CONTAINING CA PACITORS DUMPED IN LANDFILL IN 1983. CAPACITORS & CONTAMINATED SOIL REMOVED. FINDING FOR RCRA MAY NOT BE APPROPRIATE.

CEARP ID :	81	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	BURIAL/DUMP,NEW AERIAL TEST A.	CHEM	R	POSITIVE	T	F	F	T	T	
Building # :	NA	Action : CONFIRMATION (PHASE 2)								
Location :	SOL SE METE CHYN, NEW ARL CABLE TST AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1970s				L	M	H	L	L	22, 50, & 51
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING VISIT. UNCONTROLLED/UNREGULATED DISPOSAL.

Comments : DEBRIS FROM EXPERIMENTS, EXPLOSIVES AND ROCKET PROPELLENT DISPOSED AT TEST SITE. AREA MAY BE CONTAMINATED WITH Pb, Be, AND d U. SOME MATERIALS REMOVED FROM AREA ADJACENT TO SLED TRACK.

CEARP ID :	82	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	OLD CABLE AREA/YARD DUMP	MIXED	R	POSITIVE	T	F	F	T	T	
Building # :	NA	Action : CONFIRMATION (PHASE 2)								
Location :	OLD AERIAL CABLE TEST, SE OF AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	PRE-VIETNAM WAR				L	M	H	L	L	66 & 67
Dateend :	ACTIVE									

Controls : NONE, UNCONTROLLED/UNREGULATED DISPOSAL. TESTS WITH BURNING U ALSO PERFORMED. SCRAP METAL WAS REMOVED FROM ARROYO.

Comments : SIMULATED Pu AEROSOL DISPERSION TESTS CONDUCTED AT SITE USING dU. DEBRIS FROM EXPLOSIVE TESTING DISPOSED IN ARROYO AND LIKEL Y DISPOSED ON SURFACE OF THE TEST AREA. AREA MAY BE CONTAM. WITH Pb, Be, dU, HE(INCL. Ba), AND ROCKET PROPELLANT.

CEARP ID :	83	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SLED TRACKS, AREA III	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	M	U	I
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : IMPACT AND ACCELERATION TESTING OF 2 SLED TRACKS. SITE AREA CONTAINS SHRAPNEL AND CHEMICALS (Pb, Be, dU PROPELLANT) FROM EXP LOSIVE TESTING MAY HAVE BEEN DISPOSED ON THE SURFACE OF THE TEST AREA.

CEARP ID :	84	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	GUN FACILITIES, AREA III	CHEM	R	NEGATIVE	T	F	F	F	T
Building # :	NA Action : NONE								
Location :	AREA III, NEAR BLDG 6918			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE. UNREGULATED DISPOSAL MAY HAVE OCCURRED.

Comments : 75-MM GASES USED TO SHOOT VARIOUS PROJECTILES TO SOUTHERN AREA III. NO TOXIC MATERIALS EXPECTED TO OCCUR AT THIS SITE EVEN T HOUGH SHRAPNEL MAY BE FOUND IN THE AREA.

CEARP ID :	85	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9920	CHEM	R	POSITIVE	T	F	F	F	T
Building # :	9920 Action : CONFIRMATION (PHASE 2)								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1960				L	H	H	L	U	125
Dateend :	INACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SUSPECT DISPOSAL OF SMALL QUANTITIES OF SOLVENTS ON GROUND SURFACE. Be FRAGMENTS CONTAINED IN TEST HOLES COVERED WITH CONCRE TE. THESE AREAS COULD NOT BE LOCATED.

CEARP ID :	86	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9927	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1960s				L	M	M	M	U	C
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL.

Comments : SOME TESTS WITH LEAD CONTAINERS FILLED WITH HE. DEBRIS INCLUDES Pb, Ba, Be, AND dU, MAY EXIST ON THE SURFACE OF THE TEST ARE A. LARGE PIECES OF SHRAPNEL PICKED UP AFTER A TEST, BUT FINELY DIVIDED MATERIAL LEFT SCATTERED IN THE AREA.

CEARP ID :	87	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9990	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	9990	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1980s				L	M	M	M	U	108, D
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DEBRIS FROM FIRING TESTS, INCLUDING Pb, Ba, Be, AND dU, MAY EXIST ON THE SURFACE OF THE TEST AREA. DRUM STORAGE ESTABLISHED ADJACENT TO BLDG. IN EARLY 1980s FOR NITROMETHANE.

CEARP ID :	88	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, GUARD TOWERS	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	COYOTE SPRINGS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	M	U	J
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DEBRIS FROM FIRING TESTS, INCLUDING Pb, Ba, Be, AND dU, MAY EXIST ON THE SURFACE OF THE TEST AREA. FINELY DIVIDED MATERIAL AFTER A TEST MAY BE LEFT IN THE AREA.

CEARP ID :	89	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SHOCK TUBE SITE, THUNDER RANGE	MIXED	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	THUNDER RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	M	M	M	U	56
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : THE AREA SURROUNDING THE SHOCK TUBES MAY BE CONTAMINATED WITH HE (INCLUDING Ba), Pb, Be, OR dU. IN ADDITION, FINELY DIVIDED MATERIAL MAY BE LEFT SCATTERED IN THE SOIL.

CEARP ID :	90	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BERYLLIUM FIRING SITE, T.R.	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)						
Location :	THUNDER RANGE, NEAR BLDG. 9964			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				L	L	L	L	U	8
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : DEBRIS FROM FIRING SMALL EXPLOSIVE CHARGES, INCLUDING Be, MAY EXIST ON THE SURFACE OF THE TEST AREA. LARGE PIECES OF Be CAUG HT IN CATCHER BOXES.

CEARP ID :	91	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LEAD FIRING RANGE, THUNDER R.	CHEM	R	POSITIVE	T	F	F	F	T
Building # :	NA	Action :	CONFIRMATION (PHASE 2)						
Location :	THUNDER RANGE			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	H	H	H	U	132
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. UNDERGROUND SHOTS IN UNLINED TRENCHES.

Comments : DEBRIS FROM FIRING TESTS, INCLUDING UP TO 4000 LB OF Pb AS WELL AS Ba MAY EXIST ON THE SURFACE OF THE TEST AREA. FINELY DIVI DED MATERIAL MAY BE SCATTERED IN THE AREA.

CEARP ID :	92	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PRESSURE VESSEL TEST SITE,C.C.	CHEM	R	NEGATIVE	T	F	F	F	T
Building # :	NA	Action : NONE							
Location :	COYOTE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	ACTIVE									
Controls :	NA									
Comments :	NITROGEN GAS USED TO PRESSURIZE SCALE MODELS OF REACTOR PRESSURE VESSELS. NO HAZARDOUS MATERIALS USED IN THE EXPERIMENTS DON E ON THE SITE.									

CEARP ID :	93	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ROCKET LAUNCH PADS, MADERA C.	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	MADERA CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				L	L	L	L	L	E
Dateend :	INACTIVE									
Controls :	NONE, UNREGULATED DISPOSAL.									
Comments :	RESIDUAL ROCKET PROPELLANT AND LINER MATERIAL FROM ROCKET PATTERN TEST FIRINGS MAY EXIST ON THE SURFACE OF THE TEST AREA.									

CEARP ID :	94	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BURN SITE, COYOTE CANYON	CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1970s				L	M	M	M	U	
Dateend :	ACTIVE									
Controls :	NONE, UNREGULATED DISPOSAL.									
Comments :	JP-4, PROPELLANTS, AND NITROMETHANE FUELS BURNED ON SITE. METALLIC PARTICULATES RELEASED TO THE ENVIRONMENT (SEE CEARPID #13).									

PRELIMINARY

CEARP ID :	95		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	LIVE FIRE RANGE, CTA		CHEM	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	COYOTE CANYON				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					M	L	H	L	U	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : LEAD BULLETS AND RELATED DEBRIS ARE KNOWN TO EXIST ON THE FIRING RANGE.

CEARP ID :	96		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STORM DRAIN SYSTEM		CHEM	R	UNCERTAIN	H	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA I				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	PRE-1970					L	H	H	L	L	113
Dateend :	ACTIVE									

Controls : NONE OBSERVED DURING SURVEY. 3 MAJOR RELEASES KNOWN.

Comments : THE DRAIN SYSTEM MAY HAVE DISCHRGD HAZ SUBSTANCES TO TIJERAS ARROYO FOR SPILLS AND FIRES. THESE INCLUDE 1000 GALS OF HCl, 2 00 GALS OF 20% NaOH, Cr, NO. 2 DIESEL, AND 50-100 GALS OF CHROMOSULFURIC ACID. ONCE H2O FOUND RED & SEDIMENT CONTAM WITH OIL

CEARP ID :	97		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	STILL PHOTO LAB, BLDG. 863		CHEM	R	UNCERTAIN	H	F	F	F	F
Building # :	802	Action : RCRA EVALUATION (SANDIA)								
Location :	AREA I				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					U	U	U	U	U	
Dateend :	ACTIVE									

Controls : A SILVER RECOVERY UNIT INSTALLED.

Comments : WASTE DISCHARGED TO SEWER FOLLOWING SILVER RECOVERY UNIT MAY CONSTITUTE RELEASE/DISPOSAL OF HAZARDOUS WASTES.

CEARP ID :	98	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MOTION PICTURE LAB. BLDG. 863	CHEM	R	UNCERTAIN	H	F	F	F	F
Building # :	863	Action : RCRA EVALUATION (SANDIA)							
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas
Datestart :	UNKNOWN				U	U	U	U	U
Dateend :	ACTIVE								

Controls : A SILVER RECOVERY UNIT INSTALLED.

Comments : WASTE DISCHARGED INTO AN OLD ACID WASTE LINE FOLLOWING SILVER RECOVERY UNIT MAY CONSTITUTE RELEASE/DISCHARGE OF HAZARDOUS WAS TES.

CEARP ID :	99	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	CATCH BOXES	CHEM	R	UNCERTAIN	H	F	T	F	F
Building # :	840, 841	Action : RCRA EVALUATION (SANDIA)							
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas
Datestart :	UNKNOWN				U	U	U	U	U
Dateend :	ACTIVE								

Controls : ONLY CATCH BOXES.

Comments : CATCH BOXES RETAIN TOXIC AND/OR EXPLOSIVE MATERIALS DISCHARGED INTO THE SANITARY WASTE SYSTEM. THESE CATCH BOXES ARE PERIODI CALLY CLEANED AND THE WASTE SHIPPED OFFSITE.

CEARP ID :	100	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	HE SUMP/DRAIN, BLDG. 6620	CHEM	R	UNCERTAIN	H	F	T	F	F
Building # :	6620	Action : INSTALLATION ASSESS. (SUP. PHASE 1)							
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas
Datestart :	UNKNOWN				L	U	H	U	H
Dateend :	ACTIVE								

Controls : ONLY CATCH BOX. SEPTIC SYSTEM DISCHARGES TO LEACH FIELDS.

Comments : SUSPECT DISPOSAL OF HIGH EXPLOSIVE RESIDUES AND SOLVENTS TO DRAIN SYSTEM.

CEARP ID :	101		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	CONTAMINATED DRAIN, BLDG. 9920		CHEM	R	UNCERTAIN	H	F	T	F	F	
Building # :	9920	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE										

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : SUSPECT THE DISHARGE OF SOLVENTS VIA THE 2 BUILDING SEPTIC DRAIN SYSTEM.

CEARP ID :	102		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	RAD DISPOSAL SITE		RAD	C	UNCERTAIN	D	F	F	F	T	
Building # :	NA	Action :	INSTALLATION ASSESS. (PHASE 1)								
Location :	EAST OF AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	D	D	D	
Dateend :	UNKNOWN										

Controls : NONE KNOWN.

Comments : THE AREA THAT WAS RECALLED WAS PROBABLY AN OLD REACTOR TEST SITE ASSOCIATED WITH THE DECOMMISSIONED SANDIA PULSED REACTOR-I.

CEARP ID :	103		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface	
Name :	SCRAP YARD		MIXED	C	UNCERTAIN	D	F	F	F	T	
Building # :	9939	Action :	INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	H	M	L	L	
Dateend :	ACTIVE										

Controls : NONE, UNREGULATED STORAGE/DISPOSAL. MATERIALS MAY BE ABANDONED IN PLACE.

Comments : SCRAP YARD MAY CONTAIN Pb, Be, AND dU.

CEARP ID :	104		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	PCB SPILL, COMPUTER FACILITY		CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	COMPUTER	Action : NONE								
Location :	AREA I				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					U	U	U	U	U	
Dateend :	UNKNOWN										

Controls : UNCONTROLLED RELEASE.

Comments : SPILL CONFINED TO BUILDING AND CLEANED UP (COMPUTER FACILITY HAS SOME PCB-CONTAINING LINE FILTERS).

CEARP ID :	105		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	MERCURY INVENTORY LOSS		CHEM	C	NEGATIVE	H	F	F	F	T
Building # :	6536	Action : NONE								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	<1972					U	U	U	U	U	
Dateend :	<1972										

Controls : NONE, UNCONTROLLED RELEASE.

Comments : SUSPECTED LOSS OF 11 TO 13 LBS OF Hg INSIDE BLDG., BUT HP COULD NOT DETECT ANY Hg IN THE ENVIRONMENT.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9939 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9939	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE										

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE MACHINING. SOME HE CONTAMINANTS MAY HAVE BEEN DISCHARGED IN DRAIN. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CO NCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9960 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9960	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1960					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE (PBX, LX BARITOL, TNT) MACHINING. HE AND WATER WERE DISCHARGED TO EXPLOSIVE SEPTIC SYSTEM. BAG FILTERS OFTEN FAILED. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9965 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9965	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	L	U	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : HE ASSEMBLY PERFORMED AT SITE. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	106		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9967 DRAIN		CHEM	C	NEGATIVE	H	F	T	F	F
Building # :	9967	Action : NONE								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : HE ASSEMBLY AND PRIMACORD CONSTRUCTION. INSIDE WALLS/FLOORS WASHED DOWN INTO SEPTIC TANK UNTIL CA. 1982. SITE DISMISSED BY CEARP, BUT IS A POTENTIAL AREA OF CONCERN FOR SURVEY ACTIVITIES.

CEARP ID :	107		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE TEST AREA		CHEM	C	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	AREA III, SE CORNER				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : HE TESTS PERFORMED AT SITE. IT IS NOT KNOWN WHAT RESIDUES REMAIN.

CEARP ID :	108		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9940		MIXED	C	UNCERTAIN	T	F	F	F	T
Building # :	9940	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	M	M	M	U	
Dateend :	ACTIVE									

Controls : NONE OBSERVED.

Comments : SUSPECT Be AND dU CONTAMINATION ON SURFACE OF TEST AREA. CORIUM-THERMITE TEST DEBRIS (dU, Cr, Zn, Ni, Mb) WASHED INTO SOIL. LAST TEST PERFORMED OUTDOORS IN ABOUT 1982.

CEARP ID :	109		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9956		MIXED	C	POSITIVE	T	F	F	F	T
Building # :	9956	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	M	M	U	
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : ABOUT 1967 OR 1968, SOME Be EXPLOSIVELY FIRED IN PITS. NO MONITORING OR CLEANUP. Be AND dU USED IN EXPERIMENTS WHOSE RESIDUES WERE WASHED INTO OUTSIDE SUMP. RESIDUES FROM SUMP PROBABLY PLACED ON DIRT PILES 1/4 MILES UP THE ROAD FROM BLDG. 9956.

CEARP ID :	110		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	THUNDER RANGE		MIXED	R	UNCERTAIN	T	F	F	F	T
Building # :	NA	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	THUNDER RANGE				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1979					L	H	M	L	U	
Dateend :	1981									

Controls : NONE, UNREGULATED DISPOSAL. ABOUT 20 YEARS AGO SCATTERED SHELLS PICKED UP BY MILITARY; ABOUT 10 YEARS AGO SNLA CLEANED UP AR EA.

Comments : UP TO 2000 FLUORESCENT LIGHT BULBS USED IN TESTS AND UP TO 2000 IN THE SCRAP YARD EAST OF BLDG. 9967. EXPLOSIVE TEST WITH 5k g BLOCKS OF Pb AND 5g dU. THUNDERWELLS IN AREA USED FOR LEAD EXPLOSIVE SHOTS IN 1963-64.

CEARP ID :	111		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SUMP/DRAINS, BUILDING 6715		CHEM	R	POSITIVE	H	F	T	F	F
Building # :	6715	Action : RCRA EVALUATION (SANDIA)								
Location :	AREA III				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : SUSPECT THE DISCHARGE OF SOLVENTS VIA THE BUILDING SEPTIC DRAIN SYSTEM. TREATED ACIDIC WASTE STREAMS CONTAINING Ag AND HE RE LEASED TO DRAINFIELD.

CEARP ID :	112		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 9956 SUMP		CHEM	C	UNCERTAIN	M	F	T	F	F
Building # :	9956	Action : INSTALLATION ASSESS. (SUP. PHASE 1)								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	U	H	U	M	79
Dateend :	ACTIVE									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : POTENTIAL FOR BLACK POWDER TO HAVE BEEN DISPOSED IN SUMP AND SUBSEQUENT RELEASES TO THE ENVIRONMENT.

CEARP ID :	113	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITES, AREA II	CHEM	C	UNCERTAIN	T	F	F	F	T

Building # : 922 Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	AREA II, EAST SIDE OF AREA	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	M	L	L	U	
Dateend :	ACTIVE							

Controls : NONE, UNREGULATED DISPOSAL.

Comments : ONLY VERY SMALL QUANTITIES OF EXPLOSIVES ARE DETONATED. SUSPECT SURFACE CONTAMINATION WITH EXPLOSIVE MATERIALS AND POSSIBLY HEAVY METALS. NOT KNOWN WHAT RESIDUAL MATERIALS LEFT AT SITE.

CEARP ID :	114	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	EXPLOSIVE BURN PIT	CHEM	C	UNCERTAIN	D	F	F	F	T

Building # : NA Action : INSTALLATION ASSESS (SUP. PHASE 1)

Location :	AREA II	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	BOMB ASSEMBLY DAYS		L	L	L	L	D	
Dateend :	BOMB ASSEMBLY DAYS							

Controls : NONE KNOWN, UNREGULATED DISPOSAL BY BURNING OF HE RESIDUES.

Comments : SOME OF THE EXPLOSIVES LIKELY CONTAINED BA WHICH MAY REMAIN IN THE AREA.

CEARP ID :	115	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	FIRING SITE, BUILDING 9930	CHEM	C	UNCERTAIN	T	F	F	F	T

Building # : 9930 Action : INSTALLATION ASSESS. (SUP. PHASE 1)

Location :	9900 AREA	Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN		L	M	M	M	U	
Dateend :	ACTIVE							

Controls : NONE, UNREGULATED DISPOSAL.

Comments : PERFORM ONE-OF-A-KIND TESTS WITH COMMERCIAL HE (C4, ETC.) USING 7 TO 50LB PER TEST. SUSPECT Hg CONTAMINATION ON SURFACE OF T EST AREA.

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CEARP ID :	116	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SEPTIC TANK/DRAIN, BLDG. 9990	CHEM	R	POSITIVE	H	F	T	F	F
Building # :	9990 Action : RCRA EVALUATION (SANDIA)								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				H	U	H	U	M	79
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL. SEPTIC TANK CONTENTS DISCHARGED TO LEACH FIELDS.

Comments : DISCHARGE OF SPENT CHEMICALS (SOLVENTS AND Ag) VIA THE BUILDING SEPTIC DRAIN SYSTEM. EXPLOSIVE TESTS FORMERLY PERFORMED AT SITE.

CEARP ID :	117	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BLDG 9939 TRENCHES	CHEM	C	UNCERTAIN	D	F	F	T	T
Building # :	9939 Action : INSTALLATION ASSESS. (SUP. PHASE I)								
Location :	9900 AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1960s				L	M	M	L	L	93
Dateend :	ACTIVE								

Controls : NONE, UNREGULATED DISPOSAL. Na LEFT TO OXIDIZE AND COVERED WITH SANDY SOIL. CONDITION OF UNDERGROUND ACID WASTE TANK UNKNOWN.

Comments : Na (SPRAYED WITH WATER OR LEFT TO OXIDIZE) PLACED IN ONE OR TWO TRENCHES. NOT KNOWN IF REACTIVE Na METAL REMAINS IN TRENCHES. UNDERGROUND STEEL TANK USED FOR WASTE HCL & H2SO4 OBSERVED TO CONTAIN ABOUT 500 GAL LIQUID WASTES. THERMITE ON SURFACE.

CEARP ID :	A	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE NE OF BALLOON TEST AREA	CHEM	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	LURANCE CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1978				L	L	L	L	U	
Dateend :	CA. 1978									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : 2 CYLINDERS (IONIZING RADIATION, MICROWAVE, BeO LABELS) FOUND NEAR TRENCHES WITH CONSTRUCTION DEBRIS. A MINE SHAFT EXISTS NEARBY.

CEARP ID :	B		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE SW OF OLD BURN SITE		CHEM	C	NA	T	F	F	F	T
Building # :	NA	Action : NA								
Location :	S. KAFB				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN										

Controls : NONE, UNCONTROLLED DISPOSAL.

Comments : TWO LARGE METAL PLATFORMS, ONE WITH CONCRETE PLATFORM AND INSULATION PRESENT. POSSIBLE TESTING SITE.

CEARP ID :	C		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	SITE E. OF U.N.M. SHOCK TUBE		CHEM	C	NA	T	F	F	F	T
Building # :	NA	Action : NA								
Location :	S. KAFB				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : WIRE & WOOD DEBRIS, MOUND OF SOIL WITH REBAR & CONCRETE PROTRUDING FROM IT. CIRCLE OF CONCRETE BLOCKS AT SITE. MAY BE ASSOC IATED WITH UNM SHOCK TUBE ACTIVITIES.

CEARP ID :	D&E		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BERYLLIUM TEST PITS		CHEM	C	NA	T	F	F	F	T
Building # :	9920-964	Action : NA								
Location :	9900 AREA				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	EARLY 1960s					L	L	L	L	U	
Dateend :	LATE 1970s										

Controls : NONE, UNREGULATED DISPOSAL.

Comments : FIVE TO SIX Be TESTS IN PIT NEAR BLDG. 9920. Be SHOTS NEAR BLDG. 9964.

CEARP ID :	F	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	S.H. MESA/COYOTE S. RD. SITE	CHEM	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	SCHOOLHOUSE MESA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : EVIDENCE OF PAST TESTING INCLUDES FIRING CABLES, CONCRETE PAD, CHARRED WOOD, AND RUSTED METAL.

CEARP ID :	G	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	DISTURBED AREAS W. AREA III	UNK	C	NA	T	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA III, WEST OF AREA			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE OBSERVED.

Comments : FOUR AREAS, USES UNKNOWN.

CEARP ID :	H	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BLACK-LINED PIT	UNK	C	NA	D	F	F	T	T
Building # :	NA Action : NA								
Location :	S. KAFB, NW OF EXPLOSIVES TEST PIT			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : 20 FT. X 20 FT. PIT WITH LINER. USE UNKNOWN.

PRELIMINARY

CEARP ID	Name	Building #	Action	Location	Datestart	Dateend	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
I	SURFACE IMPOUNDMENT, AREA III	NA	NA	S.E. PORTION OF AREA III	UNKNOWN	ACTIVE	UNK	C	NA	D	T	F	F	F

Potential Impacts :

GW	SW	Soil	Air	Subsurf.Gas	RFA No.
L	L	L	L	U	

Controls : CURRENTLY SURFACE WATER RUNOFF CONTROL POND.

Comments : FIRING SHELLS FOUND AROUND SI.

CEARP ID	Name	Building #	Action	Location	Datestart	Dateend	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
J	ABANDONED DRUMS, BLDG. 9920	9920	NA	9900 AREA, WEST OF BLDG 9920	UNKNOWN	UNKNOWN	CHEM	C	NA	H	F	F	F	T

Potential Impacts :

GW	SW	Soil	Air	Subsurf.Gas	RFA No.
L	L	L	L	U	

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO DRUMS DEGREASOL FOUND.

CEARP ID	Name	Building #	Action	Location	Datestart	Dateend	Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
K	ABANDONED DRUMS, BLDG. 9950	9950	NA	9900 AREA	UNKNOWN	UNKNOWN	CHEM	C	NA	H	F	F	F	T

Potential Impacts :

GW	SW	Soil	Air	Subsurf.Gas	RFA No.
L	L	L	L	U	

Controls : NONE, UNREGULATED DISPOSAL.

Comments : FOUR EMPTY DRUMS FOUND WEST OF BLDG. 9950.

PRELIMINARY

CEARP ID :	L		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED DRUMS, N. TARGET RD.		CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : NA								
Location :	S. KAFB				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : TWO DRUMS FOUND. CONTENTS UNKNOWN.

CEARP ID :	M		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDON.DRUMS NEAR GOLF COURSE		CHEM	C	NA	H	F	F	F	T
Building # :	NA	Action : NA								
Location :	ARROYO DEL COYOTE, SOUTH				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN					L	L	L	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : MORE THAN 75 DRUMS FOUND. THESE DRUMS COULD BELONG TO KAFB.

CEARP ID :	N		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD PONDS SE CORNER AREA I		UNK	C	NA	D	T	F	F	F
Building # :	NA	Action : NA								
Location :	AREA I				Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1950					U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									

Controls : UNKNOWN.

Comments : AREA OBSERVED IN AERIAL PHOTOGRAPH. PONDS MAY HAVE BEEN RESPONSIBILITY OF USAF.

PRELIMINARY

CEARP ID : O		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD METAL SCRAP & TRASH YARD	UKN	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA I, SOUTH OF OLD PONDS			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOT REDEVELOPED									

Controls : UNKNOWN.

Comments : SITE IDENTIFIED ON AERIAL PHOTOGRAPH. CUSTODIAN UNKNOWN.

CEARP ID : P		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD STAINED SITE, AREA I	UKN	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA I, SOUTHWESTERN PORTION			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									

Controls : UNKNOWN.

Comments : AREA IDENTIFIED IN AERIAL PHOTOGRAPH. SITE CUSTODIAN UNKNOWN.

CEARP ID : Q		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD IGLOOS IN AREA III	UNK	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA III			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	CA. 1962				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									

Controls : UNKNOWN.

Comments : SITE IDENTIFIED IN AERIAL PHOTOGRAPHS. CUSTODIAN OF SITE UNKNOWN.

CEARP ID : R		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	OLD DISTURBED SITE, AREA II	UKN	C	NA	D	F	F	F	T
Building # :	NA Action : NA								
Location :	AREA II, S. OF CENTER ROAD IN E. PORTION			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				U	U	U	U	U	
Dateend :	INACTIVE, SITE NOW REDEVELOPED									
Controls :	UNKNOWN.									
Comments :	DISTURBED AREA IDENTIFIED IN AERIAL PHOTOGRAPH. CUSTODIAN OF SITE UNKNOWN.									

CEARP ID : S		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ABANDONED GAS CYLINDERS, LS-1	UNK	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	LS-1			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	1940				L	L	L	L	U	
Dateend :	UNKNOWN									
Controls :	NONE, UNCONTROLLED/UNREGULATED DISPOSAL.									
Comments :	FOUR 1940 US ARMY GAS CYLINDERS NEAR LAKE CHRISTIAN.									

CEARP ID : T		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ASH/CINDER PILES, LS-1	SOLID	C	NA	D	F	F	F	T
Building # :	NA Action : NA								
Location :	LS-1			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	L	L	U	
Dateend :	UNKNOWN									
Controls :	NONE, UNREGULATED DISPOSAL.									
Comments :	ASH/CINDER PILES (20 FT X 10 FT X30 FT) CONTAINING BURNED METAL PARTS LOCATED NEAR ARROYO NE OF LS-1.									

CEARP ID : U		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	BUILDING 841 OUTFALL	CHEM	C	NA	H	F	F	F	T
Building # :	841 Action : NA								
Location :	AREA I			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	U	
Dateend :	UNKNOWN									

Controls : NONE, UNCONTROLLED RELEASE.

Comments : WASTEWATER DISCHARGES TO SOIL AND CONCRETE. BELIEVED TO CONTAIN FERRIC CHLORIDE, METHYLENE CHLORIDE, AND TCE. RELATED TO CEA RPID #46.

CEARP ID : V		Waste	CERCLA/RCRA	CEARP Finding	Site Use	SI	Septic	Landfill	Surface
Name :	ARCH-TYPE AIRCRAFT SHELTER	CHEM	C	NA	H	F	F	F	T
Building # :	NA Action : NA								
Location :	MADERA CANYON			Potential Impacts :	GW	SW	Soil	Air	Subsurf.Gas	RFA No.
Datestart :	UNKNOWN				L	L	M	L	L	
Dateend :	UNKNOWN									

Controls : NONE, UNREGULATED DISPOSAL.

Comments : BELIEVED TO BE A USAF SITE. DRUMS OF OIL AND SPILLS FOUND. ARROYO CONTAINED DEBRIS AND FIRING CABLES.

PRELIMINARY

APPENDIX I

MAJOR SANDIA-ALBUQUERQUE BUILDINGS

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST

Technical Area I	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	605	Steam Plant	
	803	Ion Implantation Physics Laboratory	
	805	Misc. Light Chemistry/Physics Laboratories	
	806	Misc. Light Chemistry/Physics Laboratories	Metal Organic Chemical Vapor Deposition Laboratory (MOCVD)
	807	Misc. Light Chemistry/Physics Laboratories	
	808	Shock Wave/Explosives Facility	Air Gun Facility Fabrication of Encapsulated Targets for Bldg. 9920 Explosive Tests
	809	Weapons Development Laboratory Machine Shop	
	818	Source Range Facility	
	819	Nuclear Material Warehouse	
	820	Safeguards Shop	
	821	Nuclear Safeguards Security Laboratory	
	823	System Research and Development	
	834	Plastics Shop Physical Electronics Shop	
	835	Weapons System Laboratory	
	836	Weapons System Engineering	

ARCHIVE COPY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	840	Development Shops	Ceramics Shop Machine Shops Heat Treatment Facility
	841	Development Shops	Plating Shop Printed Circuits Laboratory Foundry Coatings Laboratory
	845	Investment Casting	
	847	Advanced Weapons Development	
	853	Highbay Shop Photovoltaic Facility	
	860	Environmental Testing Laboratory	
	862	Emergency Power Diesel Generators	
	863	Motion Picture and Film Development	
	864	Glass Development Laboratory	
	865	Aerothermodynamics Laboratory	
	866	Box and Cabinet Shop	
	867	Nuclear Material Transport and Storage	
	868	Systems Laboratory	
	869	Environmental Health Laboratory Toxic Metals Machine Shop	
	[870]	[Bendix Albuquerque Operations]	[Microelectronics Fabrication]

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	871	Electromagnetic Environmental Simulation Facility	
	872	Radio Frequency Facility	
	873	Vehicle dispatch - motor pool	
	874	Computer Building - motor pool	
	875	Shops and Office - motor pool	
	876	Shop - motor pool	
	877	Filter Cleaning/Sandblasting	
	878	Hazardous Materials Storage	
	879	Hazardous Materials Storage	
	881	Component Laboratory	
	882	Component Laboratory	
	884	Ion Physics Laboratory	
	887	Plant Engineering	Paint Shop Carpentry Shop
	891	Tritium Laboratories	
	893	Laser Physics Laboratory MOCVD Facility	
	894	Battery Development Laboratory	
	895	Chemical and Flammable Material Storage	

Unlimited Release

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area II	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	904	Smoke Machine Test Facility	
	907	Detonator Laboratory	
	913	Vapor Deposition Laboratory	
	913A	Pressure Laboratory	
	915	Explosives Development Facility	
	917	Explosives Assembly Facility	
	919	Lithium Battery Destructive Testing	
	922	Air Gun/Laser Facility	
	935	Neutron Generator Test Facility	
	940	Explosives Aging Laboratory	

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area III	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	6501	Nonhazardous Assembly	
	6502	Storage and Assembly Building	
	6505	Drop Test Support Building	(Former Sodium Facility)
	6505A	Thermal Evaluation Facility	
	6520	Hydraulic Centrifuge Facility	
	6526	25-Foot Centrifuge Facility	
	6530	Radiant Heat Facility	
	6536	Re-Entry Simulation Test Facility	
	6540	Photometrics Building	
	6542	Photometrics Building	
	6550	1,800-Foot Test Track	
	6560	Vibration Test Facility	
	6570	Dynamic Shock Test Facility	18-Inch Actuator
	6583	Classified Waste Incinerator	
	6587	Area III Shop and Maintenance	
	6610	Complex Wave Test Facility	
	6620	High Explosives Assembly	

ARCHIVE

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	6630	Climatic Test Facility Melting and Solidification Laboratory	
	6635	Radiographic Facility	(Nondestructive Testing)
	6640	Microwave Test Facility	
	6650	Vibration Control Facility	
	6710	Air Gun Test Facility	Inactive
	6715	Light-Initiated Explosives	
	6720	Explosive Loading Facility Mechanical Maintenance	Inactive
	6725	Dry Sewage Sludge Irradiator	Inactive
	6730	Structural Mechanics Laboratory	Inactive
	6740	10,000-Foot Test Track	
	6750	Air Gun Test Facility	Inactive
	6753	Gun Charge Assembly Facility	Inactive
	6911	Reactor Safety Facility	Inactive
	6922	Thermite Pressure Test Laboratory	
	6922	Molten Core Laboratory	(Former Enhanced Oil Recovery Program)
	6924	Hydrazine Facility	Inactive

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area IV	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	961	Reactor Support Facility - Shop/Lab	
	961-A	Reactor Support Facility - Pump House	
	980	Particle Beam Fusion Facility Office	
	981	Particle Beam Fusion Facility Lab	
	981-A	Fluid Cooler and Storage Building	
	981-I	Air Support Structure - South of 981	
	983	Particle Beam Fusion - Lab Bldg. (Partial)	
	986	Component Development Lab	
	T Bldg.	Transportable Buildings	

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area V	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	6500	Gate House Security Operations Bldg	
	6578	Communication and Defense Center	
	6580	Reactor Facility	
	6581	Febetron Building	
	6582	Emergency Evacuation Center	
	6585	Water Well Pump Station	
	6586	Maintenance Bldg. - Water Treatment	
	6588	Gamma Irradiation Facility	
	6590	Pulsed Reactor Facility	
	6590-A	UPS - Generator/General Lab	
	6591	Reactor Control & Radiation Simul. Facility	
	6592	Pulsed Reactor Lab Building	
	6593	Pulsed Reactor Equipment Building	
	6593-A	Storage Building - Pulsed Reactor Facility	
	6593-B	Storage Building - Pulsed Reactor Facility	
	6593-C	Storage Building - Pulsed Reactor Facility	

LIBRARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

Technical Area V	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	6594	Low-Level Counting Lab	
	6595	Irradiated Material Storage	
	6596	Flash X-ray Facility	
	6597	Radiation Simulation Development Facility	

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

CTF*/Remote Areas	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	9830	Burn Site	LAARC Enclosed Burn Facility Corrugated Chimney Burn Facility "Tenth Scale Enclosed Burn Facility" "Swimming Pool" Open Burn Facility Bunker 9830 - PVC Burn Test Facility
	9820	Laser Facility	
	9832	ocket Motor Storage	(Cable Facility Support)
	9849	Repeater Tower	
	9927	Exposives Firing Site	Deactivated
	9930	Explosive Test Facility	Detonator Testing, Davis Gun
	9938	High Pressure Test Facility	
	9939	Large Melt Facility	Sodium/Concrete Induction Tests
	9940	Steam Explosion Test Facility	
	9950	Hypervelocity Gunsite Complex	
	9956	Hypervelocity Gunsite Complex	
	9957	Hypervelocity Gunsite Complex	
	9960	Explosives Machining	
	9961	Explosives Assembly	

* Coyote Test Field

PRELIMINARY

MAJOR SANDIA-ALBUQUERQUE BUILDINGS LIST (Continued)

CTF*/Remote Areas	Building Number	Name of Facility/Description	Comments on Use/Historical Operations
	9964	Explosive Assembly and Firing	Deactivated (Former Penetrator Test, Steel Flyer Plate Test and "Gun Type" Weapons Test Area)
	9967	Explosive Assembly and Firing	Deactivated (Former Penetrator Test, Steel Flyer Plate Test and "Gun Type" Weapons Test Area)
	9965	Shock Tube Control Building	
	9966	Flyer Plate Test Area	
	9920	Explosive Test Facility Complex	Shock Wave Tests, "Air Building Dispersion Tests," Fuel/Air Mixture Detonation
	9926	Explosive Test Facility Complex	Shock Wave Tests, "Air Building Dispersion Tests," Fuel/Air Mixture Detonation
	9990	Electro Explosive Facility	Large Capacitor Switch Testing

*Coyote Test Field

PRELIMINARY

APPENDIX J

SNLA TECHNICAL AREAS I AND II

LABORATORIES AND DEVELOPMENT SHOPS

PRELIMINARY

Technical Area I Laboratories - Buildings 805, 806, 807, 808, 892

Technical Area I has numerous light Research and Development Laboratories located in Buildings 805-808, Building 892, and other buildings. These laboratories are for the most part typical chemistry/physics laboratories that conduct experiments related to such fields as metallurgy, organic chemistry, polymer chemistry, semiconductor materials, etc. In some areas of these buildings, laboratories are interdispersed with offices. The laboratories are ventilated by a combination of general building ventilation, laboratory hood exhausts, and individual machine exhausts (e.g., laboratory furnaces). Each building has a number of roof vents/fans that exhaust various areas of the buildings.

According to the purchasing inventory provided by SNLA, the laboratories use small quantities of an extremely wide variety of organic and inorganic chemical compounds. These compounds include organic solvents and reagents, organic and mineral acids, and metal compounds. These compounds are disposed of primarily as liquid discharges and hazardous wastes. It is expected that small amounts of some compounds, particularly volatile organic compounds (VOCs) and acids, will be evaporated into the laboratory ventilation systems.

Metal Organic Chemical Vapor Deposition Laboratories - Buildings 806 and 893

The Metal Organic Chemical Vapor Deposition (MOCVD) Laboratories, located in Buildings 806 and 893, conduct experiments in growing semiconductor from metal hydrides and organometallic materials. Metal and organometallic materials are deposited on commercially procured gallium arsenide and other substrates. The vapor deposition process is located in two ventilated hoods in the Building 806 Laboratory and two ventilated hoods in the Building 893 Laboratory. Various toxic and corrosive gases including arsine, phosphine, silane, hydrogen selenide, and hydrogen chloride are used in the metal deposition studies, as well as gram quantities of pyrophoric organometallic (heavy metal) compounds. The reactor hoods, both of which are isolated from the general building exhausts, are vented separately from the room ventilation system. The reactors exhaust through a coarse filter, an activated charcoal filter, and an afterburner, which absorb and

oxidize arsenic and other metal compounds. The charcoal filters are replaced approximately once a year.

Building 893 Laboratory

The MOCVD Laboratories are extensively monitored for arsine and other toxic gas levels, using emission spectroscopy monitors, which alarm at 50 ppb, the Threshold Limit Value (TLV) for arsine. The Building 806 Laboratory is monitored at 16 locations, including the gas cylinder storage, reactor hoods, and laboratory stack. The hood fans and room ventilation system are also alarmed. The laboratory is maintained at negative pressure, and is ventilated 24 hours per day. A loss of ventilation in the laboratory or toxic gas levels above the TLV of 50 ppb require cessation of laboratory operations. A second-level alarm indicates toxic gas concentrations at acute hazard levels, and requires immediate building evacuation. (Building 806 is a mixed-use laboratory/office building. The MOCVD Laboratory was scheduled to be moved into Building 893 in late 1987.) The Building 893 Laboratory is similarly monitored and alarmed.

MOCVD reactors and equipment are etched with cold hydrochloric and nitric acids in acid hoods in both laboratories. Minimal evaporation occurs in these hoods. Acid solutions may contain arsenic, and are collected and disposed of as hazardous waste. A separate laboratory in Building 806 grows gallium arsenide substrates from the base metals at liquid nitrogen temperatures. Air emissions of arsenic from this laboratory are minimal.

Plastics Shop - Building 834

The Plastics Shop is located in the western half of Building 834. Parts are fabricated from various types of plastics and foams in the shop and parts are encapsulated using various epoxy resins. Materials used include epichlorohydrin-based resins including EPON 828, polyurethane, and diisocyanate foams such as conathane, adhesives, and resin hardeners containing methylene dianiline and diethanolamine.

Resin mixtures consist of a one- or two-part resin, a curing agent, and in some cases a solid filler material. Aluminum oxide (Alox) or glass microbaloons (GMB) are filler materials used with phenolic epichlorohydrin-based resins such as EPON 828. The

Alox is dried in an oven before use. The solid material is mixed with the resin in a hood and dispensed, usually under vacuum, with a curing agent into a mold. The resin-filled molds are cured for several hours in ventilated ovens. The molds are removed from the oven and cooled on a downdraft bench before the part is removed from the mold. The bench is also used to cure foam parts. Small quantities of toluene are used in a hood located in the adhesives room to release parts from the molds. Some formulation of cyclohexane-based adhesives is done in this hood.

Resin dispensing and oven-curing take place in a clean room located in Building 834. A vacuum system is used to draw vacuum on resin storage boxes and dispensing units. The curing ovens exhaust to the building roof. Resin materials are also cured using pressure or ultraviolet light in machines located in the plastics room. Waste resin materials are solidified before disposal.

Plastic parts are fabricated using a vacuum-forming machine located in the plastics room. The forming process generates some fumes, which are exhausted through a hood. Other machines form fiberglass parts by heating fiberglass chips, which causes the material to flow into a mold. The machines have hoods to exhaust heat and fumes from the area.

Various types of solvents are used in the Plastics Shop. Epoxy is dissolved in an acetone bath located in a room exhausted through a water wall. This room is also used for sanding of plastic parts, etching of Teflon, and dissolving of plastics and silicones with solvents. These are job-specific activities and are not routinely done. The water wall is used to control emissions of solvents and strippers from the room. The water is recirculated through a 1,000-gallon sump, and the water is changed approximately once a month. In the plastics room, 1,1,1-trichloroethane is used in a refrigerated vapor degreaser. Approximate solvent consumption in the Plastics Shop is 300 gallons per month of toluene/acetone and 5 gallons per month of 1,1,1-trichloroethane. Small amounts of methylene chloride are used. The major part of these solvents is disposed of with the hazardous wastes from the facility. A smaller quantity is disposed of with the sump water from the water wall or evaporates through the hoods.

Many of the resin bases and curing agents used in Plastics Shop operations contain toxic substances including epichlorohydrin, TDI, MDA, urethanes, and various

amines. The resin bases and curing agents are primarily incorporated into the products being encapsulated. However, as they are handled under vacuum and cured in ventilated ovens, some potential exists for volatilization of the resin bases and curing agents and/or generation of decomposition products containing cyanides, urethanes, or amines.

SNLA has not conducted any monitoring or characterization of the oven or vacuum exhausts. Based on the amount of resin and foam compounds used, emissions are expected to be small.

Large and Small Scale and Carbon/Graphite Machine Shops - Building 840 and Building 809

A large-scale machine shop located in Building 840 and small-scale shop located in Building 809 machine parts for development studies conducted through SNLA. Metals machined in the small-scale shop include steels/aluminum, copper, and various plastics, including nylon and Teflon. The machines use cutting oils of various types to cool the machined parts and do not have local ventilation. Dusts generated by machining are generally nuisance-type dusts; aluminum and plastic materials can generate fine dusts.

Potentially toxic materials are not machined in the large- or small-scale shops; machining of these types of materials is confined to the carbon/graphite machine shop, located in two rooms adjacent to the large-scale machine shop. Materials that may be machined in this area include graphite and various composite materials, and are listed in Table J-1. Individual machine tools in this area are exhausted by flexible hoses, which exhaust through a fan to a bag filter located outside Building 840. The filter bags are replaced every 3 months by an off-site contractor. The collected dust empties into hoppers that are periodically emptied. The efficiency of the bag filter has not been measured; bag filters are generally on the order of 99 percent efficient in collecting fine dust. Dust emissions from the machining operations are therefore expected to be small.

TABLE J-1

MATERIALS MACHINED IN BUILDING 840 GRAPHITE MACHINE SHOP

MATERIALS

METALS	NON-METALS
Aluminum	Quartz
Low-Carbon Steel	Glass Ceramics
Stainless Steel	Ceramic
Tool Steel	Foam
Tantalum	Rubber
Titanium	Phenolic
Tungsten	Silica Phenolic
Molybdenum	Carbon Phenolic
Carbide	Graphite
Boron Carbide	Lava
Aluminum Boron	Coal
Boron Nitride	Oil Shale
	Marble, Granite
	Limestone
	Salt
	Concrete
	Magnesium Oxide
	Zirconium Oxide
	Nylon, Nylatron
	Lucite, Lexan
	Polycarbonate
	Polypropylene
	Kevlar

PRELIMINARY

Heat Treatment Facility - Building 840

Metal parts are heat-treated in this facility. The facility includes box furnaces, fluidized beds, and hot salt baths. Three salt baths, one containing sodium and potassium nitrate, one containing sodium and barium chloride, and one containing sodium cyanide, are used to treat steel. The sodium and potassium nitrate bath is a low-temperature bath maintained between 250 and 1000°F. The two other baths are high-temperature baths, maintained at about 1600°F. The low-temperature bath contains 500 pounds of salt; the high-temperature baths each contain 300 pounds of salt. The baths are electrically heated, and require about 3 hours to achieve temperature from the solid state. The salt baths and inconel crucibles which contain them are replaced twice each year.

Each salt bath is equipped with slot vents above the bath cover, which exhaust heat and fumes generated when the baths are uncovered. All three baths exhaust through a fan to a stack outside Building 840. No emission controls are applied to the exhaust. The vapor pressures of the salts used are very low at the temperatures of the baths, and vaporization of the salts into the exhaust is minimal.

Metal parts are also treated in three fluidized beds, in which aluminum oxide is fluidized with nitrogen gas. Some particulate emissions result from these units when they are used; however, the aluminum oxide is fairly coarse, and collects around the machine and is for the most part not entrained in the room ventilation system. The heat treatment facility also contains oil, saltwater, and freshwater quench baths. The oil bath is about 500 gallons. All three baths are ventilated by a single large canopy hood, which exhausts heat and oil fumes to a roof vent.

Several argon atmosphere and air-recirculated electric furnaces are used to heat-treat metal parts. These furnaces do not have separate ventilation systems. A large vacuum furnace is used to treat steels, and exhausts through a cryogenic helium vacuum pump. A rail-car sized gas-fired furnace with a water quench tank is occasionally used to treat large steel parts.

Ceramics Laboratory - Building 840

The Ceramics Laboratory prepares and machines various types of ceramic materials for development purposes. Materials used include lead oxide (PbO), titanium dioxide (TiO_2), zirconium oxide (ZrO), alumina (Al_2O_3) and silicon/germanium (Si/Ge). The Ceramics Laboratory was formerly used for the preparation and machining of lead zircon titanate (PZT) and lead zircon lanthanum titanate (PZLT) electro-optic materials. PZT/PZLT processing equipment is now maintained for development purposes, and on the order of 5 pounds of PZT/PZLT are processed annually. Small quantities of materials containing depleted uranium have occasionally been machined in this facility in the past. Depleted uranium has not been handled in the Ceramics Laboratory in approximately 5 years.

PZT and PZLT materials are prepared from metal oxides. Small-batch mixing/grinding is done in a hood that exhausts to an electrostatic precipitator (ESP). Large-batch equipment, including a calciner, extruder, grinder, furnace, and drying ovens, also exhaust to the ESP. Other machines have flexible hose-type local ventilation and other hoods also exhaust to the ESP. Electrostatic precipitators are generally highly efficient in collecting particulate from mixing/grinding-type operations.

PZT, PZLT, and other ceramic materials are machined in the ceramics machine room. The machine tools do not have local ventilation; freshwater is used to wet machined parts, which minimizes dust generation. Ceramic materials are also pressed in several vacuum and atmospheric presses to increase the density of the materials by applying high pressure/temperature. Vacuum is drawn by rotating vacuum-oil pumps. The oil is not expected to become contaminated with ceramic materials, as the ceramic is kept under high pressure when in the press. Various types of solvents, including alcohols, acetone, Freon TF, methylene chloride, and trichloroethylene are used in small quantities to dissolve waxes, clean machine tools, etc.

Coatings Laboratory - Building 841

The Coatings Laboratory uses various types of solvent-based and water-based paints, silicone compounds, etc., to coat a variety of materials, including metals and plastics. Materials are prepared for painting by vapor blasting, acid/caustic etching,

and/or solvent cleaning. A series of 440-gallon tanks containing cold caustic (NaOH) solution, cold 50 percent nitric acid, and hot water are used to etch aluminum parts prior to coating. The tanks are ventilated by slot vents and a central fan that exhausts to the roof. The acid and caustic baths normally do not have to be changed; makeup water is periodically added to account for evaporation. A small tank of cold Alodyne, a trade-name chromic acid solution, is also used to prepare aluminum. A small cold tank (about 1 foot by 2 feet in area) of methylene chloride is used to strip polyurethane coatings from parts. This unit has an exhaust separate from the acid tanks and is constantly ventilated. A dry vapor blaster is also used for aluminum cleaning and preparation of plastic materials. This unit uses glass beads, which are collected by a filter and disposed of after one use.

Parts are coated either manually in the Coatings Laboratory or in a large walk-in paint spray room. The room is equipped with internal fiberglass filters and a roof fan. As coating droplets are collected on the filters, the pressure drop across the filter increases. A pressure drop sensor visually alarms when pressure drop becomes too high, indicating that the filters require changing. Filters are changed by the maintenance department.

Parts are allowed to air-dry, or are dried in a walk-in electric oven. This oven is also equipped with internal filters and a separate exhaust system. The oven filters and ventilation system do not have an alarmed pressure drop sensor as does the paint spray room, as substantially less coating material is collected on the oven filters.

Organic solvents are the major pollutants emitted from the Coatings Laboratory. Solvents used in the Coatings Laboratory, in addition to those in the solvent-based coatings, include xylene, methyl ethyl ketone, toluene, and similar solvents. The facility is moving toward water-based, rather than solvent-based, coatings, according to the operator. At the time of the Survey, many types of solvent-based coatings were in use.

Foundry - Building 841

The foundry, located in Building 841, fabricates molded parts from metals, primarily aluminum, brass, and lead. Metal ingots are placed in crucibles and then melted in one of three gas-fired furnaces. The molten metal is poured into sand molds and

cooled overnight. Molds are fabricated from either Beroid (red oil) sand or airset sand. After the metal solidifies, the mold is broken to release the metal part. Castings are cleaned in one of two dry sandblast units, both of which are manually operated and use garnet sand. Investment casting molds are occasionally used in the foundry. These are baked in a 500°F oven to remove residual wax from the molds before pouring the metal.

The principal metal cast in the foundry is aluminum. Several hundred thousand pounds of aluminum, approximately 20,000 pounds/year of lead, and 1,000/pounds/year of brass are cast. Approximately 300 pounds (10 ingots) of aluminum are charged to the furnace for each batch melt. The heat and fumes from the furnaces exhaust through a single stack and fan, with an exhaust rate of approximately 15,000 ft^3/minute. The foundry room is ventilated by roof fans. No controls are applied for metal fume emissions from the furnaces. Chlorine gas is used to degas hydrogen gas from the aluminum melt, to control the quality of the aluminum castings. Approximate chlorine consumption is 1,500 pounds annually. No emission controls are applied to the furnace exhaust for control of chlorine emissions. The chlorine storage and distribution system is scheduled to be refurbished in late 1987. Chlorine detectors, set to audible alarm at 10 ppm, are used to monitor the chlorine concentration in storage shed and foundry room air.

Sand molds are fabricated from two types of foundry sand. Beroid sand, also referred to as red oil sand, is a barium-containing sand. This sand is mixed with silica and 40-weight oil in an enclosed mixer equipped with a cartridge-type filter. The cartridge is changed every 3 months by an off-site contractor. The mixed sand is fabricated into molds and generally left to set overnight in the foundry room before use. Airset sand is mixed with a two-part resin compound in a ratio greater than 99 parts sand to 1 part setting compound. Approximately one 55-gallon drum of resin is used every 3 months. The sand and resin are mixed in an automatic mixing machine referred to as a Mueller machine. The mixed sand is dispensed from the machine as needed and the mold is fabricated and allowed to set. The setting resin compound is a toxic compound containing isocyanates, and operators wear breathing apparatus and gloves when using the machine. The Mueller machine does not have a dedicated ventilation system and depends on the general room ventilation system to exhaust any resin compounds that may be generated.

Molten metal (aluminum, lead, or brass) is poured into the sand molds in the foundry room. Some smoke is generated from the molds during pouring. Local ventilation is not applied; however, the general room ventilation rate is high and any fumes generated are exhausted by the roof fans. The sand molds are broken after the metal solidifies and cools. The Beroid sand is reused, and is replaced about once a year. The airset sand cannot be reused and is disposed of.

The cast metal parts are cleaned in one of two dry sandblasters. Both are manually operated and use 60-mesh garnet sand. Lead particulate may be incorporated into the sand when lead castings are cleaned. Dust emissions from the smaller sandblaster are controlled by a bag filter. The bags are manually cleaned twice a month by a manual shaker system. The collected fines are manually removed and disposed of. Filter bags are replaced as required by the maintenance group. The larger sandblaster is an approximately 10-foot x 40-foot walk-in unit. The operator works inside the sandblast room wearing protective clothing. Dust emissions from the large unit are controlled by a bag filter located outside Building 841. The bags are cleaned by an automatic shaker system, and the collected fines are automatically emptied into 55-gallon drums, which are changed every 2 months. A new exhaust fan was installed on this unit at the beginning of 1987, after abrasion from the sand wore out the existing fan. The filter bags were also replaced at that time.

Investment Casting - Building 845

Molds for use in metal casting in the foundry (Building 841) and melting/solidification laboratory (Building 6630) are made in this facility by investment casting, a lost-wax-type process. Wax molds are fabricated in the shape of the desired metal part. The wax molds are cleaned using cold Freon TF, which is contained in 30-gallon covered drums. The cleaned molds are dipped into a zirconium oxide (ZrO) or fused silica slurry in a slurry mixer. A small quantity of colloidal silica/caustic is added as a binder. The coated molds are sprinkled with 70-mesh alumina sand in one of three hooded tumblers, which exhaust to a single fan and roof vent. Relatively coarse sand is used, and no particulate emission controls are applied to the tumbler exhaust. After several alternating coats of slurry and sand are applied, the thickness of the mold becomes sufficient such that it can be dried. After the mold is dried, the wax center of the mold is melted in a steam

autoclave. Some of the wax vaporizes into the steam exhaust, and the remaining wax is poured out of the mold as a liquid. The wax vapors in the steam line are solidified in a water-cooled condenser. Small quantities of residual wax remain in the molds after they are processed in the autoclave. This wax is burned off in a large enclosed furnace. The furnace operates on a 4-hour cycle at 1200°F to 1400°F. The furnace is not continuously exhausted. Any fumes resulting from the burned wax are exhausted when the furnace door is opened by a roof fan located above the furnace.

Glass Shop - Building 864

The Glass Shop, located in Building 864, fabricates glass, glass/metal and glass/ceramic parts in support of weapons and explosives development and other operations at SNLA. More than 100 different raw materials are used, mostly such compounds as aluminum oxide, various borates and phosphates, silicates, potassium nitrates, etc. The raw materials are charged to one of two calcining furnaces to remove water. Approximately 1 to 2 pounds of raw materials are mixed in a downdraft-type hood, and then are charged to one of the eight electric melting furnaces, which are hooded and vented to the building roof. The number of glass melts per year is about 500. Small amounts of particulates may be exhausted from the furnaces. The glass is then molded and charged to annealing furnaces. These do not have exhaust systems. One annealing furnace is occasionally used with lavendar oil, a hydrocarbon mixture which has a strong odor when burned. This furnace is ventilated.

Glass parts may be blown or shaped on lathes, which burn small amounts of hydrogen or natural gas to heat the glass. Heat and combustion products are exhausted through hoods. Glass parts may also be etched in a hydrogen fluoride (HF) solution. The HF tank is completely enclosed and hooded, and small amounts of HF fumes may be exhausted during use. A hooded area in the acid room is also used for etching glass with HF. This room also contains a water-cooled vapor degreaser, which uses 1,1,1-trichloroethane to clean glass parts. Glass/metal parts are cleaned and etched with cold 1,1,1-trichloroethane, acetone, dilute potassium dichromate, HCl, HF, and other solvents and acids in downdraft-type hoods located in a separate room, which also contains an ultrasonic refrigerated vapor degreaser. This degreaser uses 1,1,1-trichloroethane, and at the time of the Survey was not

hooded. A ventilation system was scheduled to be installed. Sealing of glass/metal parts is done in various hydrogen-fired furnaces. The combustion products (amounts of nitric oxides) and heat from the furnaces are exhausted to the atmosphere.

Battery Development - Building 894

The Battery Development Laboratory, located in Building 894, conducts development studies of various types of thermal and ambient temperature batteries. Development activities include fabrication of batteries and battery materials, and destructive and nondestructive testing of batteries. Batteries and battery materials are also purchased from commercial suppliers.

Lithium/sulfur dioxide and lithium/thionyl chloride batteries are assembled in glove boxes or fume hoods in the Primary Battery Development Laboratory. The thionyl chloride/sulfur dioxide functions as the electrolyte and cathode in the battery. Vanadium pentoxide (V_2O_5) is also used as a cathode material. This material is handled in a separate hood. Vanadium pentoxide has not been detected in personnel or laboratory sampling for Industrial Hygiene purposes, and, according to the laboratory operator, the particle size of the powder used is too large for particles to easily become airborne. Some work with carbon/zinc, silver/zinc, and mercury batteries is also performed in this laboratory. Battery sizes range from standard AA-size cells to standard D-size cells. Each battery contains on the order of 50 grams of anode/cathode material.

Lithium/thionyl chloride batteries are subjected to destructive and nondestructive tests including charge testing, shock testing, and electrolyte aging. Failure of a tested battery can release small amounts of thionyl chloride gas into the laboratory. Portable gas monitors are used in the laboratory to monitor destructive testing, so that any release of thionyl chloride, which forms a corrosive mixture of sulfuric and hydrochloric acids on contact with air, can be detected. The minimum detection limit is 2 ppm, and the portable gas monitor alarms at 5 ppm, the TLV for the substance.

Nickel/cadmium aqueous batteries, nickel/hydrogen batteries, and bromine complex liquid batteries are tested in the Secondary Battery Development

Laboratory. Charging studies of aqueous nickel batteries can generate explosive hydrogen mixtures, and these studies are therefore conducted under a hood. The bromine complex battery is a liquid bromine flow system, and about 2 liters of liquid bromine is contained in a glass/Teflon flow system in a hood. The potential for atmospheric release of bromine from this system is low.

A thionyl chloride distillation unit was scheduled to be constructed in this area in late 1987 to support the lithium/thionyl chloride battery assembly effort. The system will consist of a 5-foot vacuum distillation column, vacuum system, and fume hood ventilation system. The column will be automated, and will prepare battery-grade thionyl chloride on a batch basis, each batch being several liters. Small quantities of thionyl chloride are expected to be emitted through the vacuum system exhaust. A laboratory-scale thionyl chloride vacuum distillation unit is located in a fume hood in a separate laboratory in Building 894.

A second bromine flow battery is located in a hood in the secondary laboratory devoted to secondary battery development. Sodium/sulfur and nickel/hydrogen batteries are also tested in temperature chambers in this laboratory. Standard C-cell size and 1-1/2-foot-cylinder-size batteries are tested under canopy hoods to protect against explosion hazard. Reactive metals, such as lithium and sodium, are handled in several glove box areas where batteries are assembled and disassembled in inert-atmosphere glove boxes. A dry room for assembly of lithium batteries was scheduled for construction at the time of the Survey. Lithium/thionyl chloride batteries are assembled in the lithium battery development laboratory. Carbon/Teflon cathode material is rolled with lithium metal anode material in a dry room, and the batteries are gravity-filled with thionyl chloride in inert-atmosphere hoods. Small quantities of thionyl chloride are released from the hoods during filling operations.

Thermal batteries are fabricated in the thermal battery dry room using a lithium/silicon (Li/Si) alloy, iron disulfide (FeS_2), magnesium oxide, potassium perchlorate, and other powder materials. The reactivity of the Li/Si alloy is such that it must be stored and handled in a low-humidity environment. Both the lithium battery and thermal battery dry rooms are supplied with dry air (3 percent humidity) from a dehumidifier system outside the building.

Thermal battery manufacturing involves powder processing; pelletizing the powders into heat pellets, as well as anode, cathode, and separator pellets; and hand-assembling the pellets into batteries. Iron disulfide, Li/Si, and/or other powders are ground, sieved, and mixed in powder processing air curtain hoods or under vacuum. The air from these hoods is not exhausted; it is recirculated into the hoods through filters. The powder materials are formed into pellets in small batches in pellet presses. Electric ovens are used to dry and process electrolyte materials, and have vents above the doors to exhaust heat from the room. The pelleted materials are hand-assembled into batteries and wired at work benches in a separate room.

Each battery contains on the order of 30 to 60 grams of Li/Si electrolyte heat powder, and iron disulfide material. The low process throughput and the limited ventilation requirements of the dry rooms minimize the potential for particulate emissions from the rooms. Post-mortem disassembly of tested batteries, performed in the thermal battery dry room, can release small quantities of hydrogen sulfide. Three furnaces for curing epoxy resin material used to encapsulate thermal battery parts are located in a separate dry room along with a small vapor degreaser which uses trichloroethylene to clean parts. The furnaces are located in a hood, and may emit small quantities of resin degradation products. The solvent emissions from the degreaser are expected to be small, based on its small size.

Smoke Machine Test Facility - Building 904

Military-type smoke generators are cleaned with acetone and alcohol and are prepared for testing at this facility. The machines contain titanium tetrachloride and ammonium hydroxide, which are irritant substances. The two substances are mixed to form smoke. The actual tests are conducted at a remote facility, and have not been performed recently. The tests disperse titanium oxide, some HCl, and ammonia compounds into the environment. Titanium oxide has no demonstrated toxic effects and is considered a nuisance dust. The amount of HCl and ammonia compounds released by these tests is small.

Detonator Laboratory - Building 907

Testing is performed in this facility to determine the characteristics of explosives, explosive actuators, and detonators. Explosives and explosive devices may be exposed to lasers or X-rays during tests, and electronic test equipment is used to monitor test conditions. The actuators and detonators, which generally contain on the order of several grams of explosives, are exploded in several explosive test chambers or "Boom Boxes" located inside and outside the building.

One chamber located in the building is a 2-foot cube, which is enclosed and vented to the roof through an exhaust fan. This chamber is used to test detonators or actuators containing up to about 1 gram of material. There are also several other chambers in which small-scale explosive tests and environmental testing of explosive devices are done. These chambers are completely enclosed and are not vented to the atmosphere.

The outdoor explosive test chambers are designed to handle larger scale explosive tests than the indoor chambers. The detonator table and catcher box are fabricated of steel plate. Each chamber is approximately a 6-foot cube, and up to 1 pound of explosive can be tested. PETN and HXN are the main types of explosives tested (chemical characteristics of explosives are discussed in Appendix K). The catcher box is used for tests involving more than 20 grams of explosive, to collect shrapnel that would otherwise be dispersed over a wide area. Debris is cleaned up by the facility operators. The Industrial Hygiene group has conducted tests of the air in the chamber after explosive tests, and has directed the operators to wait about 5 minutes before entering the test area, so that the fumes (primarily nitrogen oxides and ammonia) from the test may dissipate. Explosive tests are performed approximately once or twice a week in the outdoor chambers. Tests involving more than 1/2 pound of explosive may be performed twice a year. The emissions from these tests are small, as the total amount of explosive tested is small, and the major portion of the debris from larger scale tests is contained in the catcher box.

Explosive Burn Test and Explosive Test Facility - Building 915

Tests of explosives are conducted in environmental test chambers ("cook-off units") inside and outside Building 915. Tests involving up to 1/4 pound of explosive can be

conducted in Building 915. The explosive materials are exposed to steadily increasing temperatures in electrically heated chambers until ignition. These tests are generally conducted using about 3 grams of explosives. The indoor test furnaces are vented to the atmosphere after an ignition test before being opened and cleaned of debris. The outdoor chamber (approximately a 1-foot-diameter cylinder) is fully enclosed and not vented before being opened. Also located outside Building 915 is an explosive test cabinet that can test up to 4 grams of explosive. A fully enclosed explosive test chamber is scheduled to be constructed outside the building. This will be used to conduct larger scale explosive tests.

Explosive devices are assembled using small amounts of acetone, alcohol, and adhesives and epoxies in ventilated hoods. The explosive storage and weighing areas and epoxy curing oven are not ventilated.

Explosives Aging Laboratory - Building 940

This facility is used to conduct accelerated aging tests on explosives. No explosive firing is done in Building 940. Four environmental test chambers are used to subject material to controlled and cycling temperature and humidity conditions. These chambers are vented to the roof, and each test bay can contain no more than 1 pound of explosive. The chambers are friction air-type furnaces, which do not have heating elements. Air is heated by being forced through a small orifice into the chamber. The materials generally do not ignite during the tests. Explosives tested include PETN and other organic nitrates, as well as some boron- and chromate-containing compounds.

PRELIMINARY

APPENDIX K

EXPLOSIVES USED AT SNLA

PRELIMINARY

Sandia National Laboratories-Albuquerque (SNLA) conducts laboratory and field tests of explosives and explosive-containing components. Devices tested range from detonators to weapons components. Explosives are detonated to conduct projectile studies (e.g., penetration tests and flyer plate tests) and to study the characteristics of explosive detonation in real time. Weapons components containing explosives are subjected to fire during burn tests. Large-scale tests involving on the order of 1,000 pounds of explosive were historically conducted to study the characteristics of large detonations and to subject components to mechanical shock. Current field explosive tests conducted at SNLA can involve on the order of 100 pounds of explosive.

Explosives typically used at SNLA are listed in Table K-1. These, for the most part, are standard military explosives. As shown in the table, the explosives are mostly organonitrate and nitrogen/carbon compounds, composed of carbon, hydrogen, nitrogen, and oxygen. Some types of explosives, notably PBX explosives, contain small amounts of plastic binders, some of which are halogenated compounds. Some explosives contain metal compounds. Baratol is a mixture of barium nitrate and TNT. Thermite and HBX both contain aluminum metal. With the exception of explosives containing metal compounds, the by-products of explosive detonation are generally low-molecular-weight gaseous and solid organic and organonitrate compounds, ammonia, nitrogen oxides, and carbon monoxide. Secondary explosives (e.g., black powder) detonated in an oxygen-poor environment (such as in the hypervelocity gun facility) can generate explosive mixtures containing hydrogen and methane. The amount of gases generated, by weight, is roughly equivalent to the amount of explosive detonated.

The SNLA Industrial Hygiene Division has sampled ambient air after field explosive detonations, and has, for the purposes of limiting worker exposure, written procedures allowing entry into explosive detonation zones only after sufficient time for dissipation of the by-product gases has elapsed. Gases generally dissipate rapidly both due to wind and through the force of the explosion. As the amount of gases generated is small, ambient concentrations remote from the test area are expected to be small.

TABLE K-1

EXPLOSIVES USED AT SNLA

Name	Chemical Formula	Elemental Composition
PETN	2,2-Bis [(Nitrooxy) Methyl]-1,3 - Propanediol, Dinitrate	$C_5H_8N_4O_{12}$
HMX	Octahydro - 1,3,5,7 Tetranitro-1,3,5,7-Tetrazocine	$C_4H_8N_8O_8$
NQ NC	Nitroguanidine Nitrocellulose	$CH_4N_4O_2$ $C_6H_7N_3O_{11}$
RDX	Hexahydro - 1,3,5 - Trinitro - 1,3,5 - Triazine	$C_3H_6N_6O_6$
TATB	2,4,6 - Trinitro - 1,3,5 - Benzene-triamine	$C_6H_6N_6O_6$
TNT	2-Methyl - 1,3,5 - Trinitro - Benzene	$C_7H_5N_3O_6$
BARATOL	24% TNT 76% Barium Nitrate	$(Ba(NO_3)_2)$
HBX-1	38% TNT 40% RDX 17% Aluminum	
HBX-3	29% TNT 31% RDX 35% Aluminum	
PENTOLITE	50% TNT 50% PETN	
PBX	Various	
Black Powder	Nitrocellulose Nitrostyphenate	
COMP C-4	91% RDX 5.3% DI (2-Ethylhexyl) Sebacate 2.1% Polyisobutylene 1.6% Motor Oil	$C_{1.82}H_{3.54}N_{2.46}O_{2.51}$ (Approximate)

Source: Dobratz and Crawford, 1985

Depending on the test conditions, a significant amount of explosive material may remain undetonated after an explosive test. Large fragments are generally collected and disposed of by Explosive Ordnance Division (EOD) personnel. More finely divided explosive may be destroyed in place, or if widely dispersed, left in place. Explosives containing metals will generate and disperse finely divided metal oxides when detonated.

Explosive materials vary widely in toxicity, according to the LLL explosives handbook (Dobratz and Crawford, 1985). PETN, nitroguanidine, and Baratol are relatively highly toxic, while RDX, TATB, nitrocellulose, and HMX are not highly toxic. TNT and C-4 are both moderately toxic, C-4 because of its additives, as its major component (RDX) is of low toxicity. Barium oxide, a detonation product of Baratol, is also toxic. SNLA may replace this explosive with nitroguanidine to reduce the potential for worker exposure.

Explosive compounds can be absorbed through the skin, as well as being inhaled or ingested. Explosive compounds and by-products in the environment are expected to be widely dispersed from field tests, minimizing the potential toxic effects of these substances.

PRELIMINARY

APPENDIX K REFERENCES

Dobratz and Crawford, 1985. Lawrence Livermore National Laboratory: Explosive Handbook.

PRELIMINARY

APPENDIX L

SNLA OFF-SITE TESTING LOCATIONS

PRELIMINARY

APPENDIX L

SNLA OFF-SITE TESTING LOCATIONS

Location	Date
Alamogordo, New Mexico	
Trinity Test	1945
Las Lunas Range, New Mexico	1945
Las Cruces, New Mexico (near Carlsbad)	
"Gnome"	12/10/61
Los Alamos National Laboratory, New Mexico	NA
Manzano Base, New Mexico	NA
Edgewood, New Mexico	NA
White Sands Missile Base, New Mexico	NA
Holloman Air Force Base, New Mexico	NA
Bikini Atoll-Pacific Proving Grounds, South Pacific	
Crossroads	6/30/46 - 7/24/46
Operation Castle	2/28/54 - 5/13/54
Operation Redwing	5/4/56 - 7/21/56
Operation Wigwam	5/14/55
Cook Island, South Pacific	NA
Eniwetok Atoll, South Pacific	
Sandstone	4/14/48 - 5/14/48
Operation Greenhouse	1951
Operation Ivy	10/31/52 - 11/15/52
Operation Castle	2/28/54 - 5/13/54
Operation Redwing	5/4/56 - 7/21/56
Johnson Is., Eniwetok Atoll, South Pacific	
Operation Hardtack I	4/28/58 - 8/18/58
Operation Storax	7/6/62 - 6/25/63

APPENDIX L

SNLA OFF-SITE TESTING LOCATIONS (Continued)

Location	Date
Christmas Island Area, South Pacific	
Operation Dominic II	7/62
Bombing Range	
Project 57	4/24/57
South Atlantic	
Operation Argus	8/27/58 - 9/6/58
Tonopah Test Range, Nevada	1961
Nevada Test Site/Nevada Proving Grounds, Nevada	
Operation Ranger	1/27/51 - 2/6/51
Operation Buster	4/7/51 - 5/24/51
	10/22/51 - 11/5/51
Operation Jangle	11/19/51 - 11/29/51
Operation Upshot - Knothole	3/17/53 - 6/4/53
Operation Teapot	2/18/55 - 5/15/55
Project 56	11/1/55-11/18/56
Operation Plumbbob	5/28/57-10/7/57
Project 58	12/6/57-12/9/57
Operation Plumbbob	2/22/58
Operation Argus	9/12/58 - 10/30/58
Operation Hardtack II	9/12/58 - 10/30/58
Operation Nougat (Part of Plowshare)	9/15/61 - 4/21/62

APPENDIX L

SNLA OFF-SITE TESTING LOCATIONS (Continued)

Location	Date
Operation Dominic I (?)	4/25/62 - 6/30/62
Operation Dominic II	7/62
Operation Storax	7/6/62 - 6/25/63
Operation Niblick	8/13/63 - 6/30/64
Operation Whetstone	7/16/64 - 6/17/65
Operation Flintlock	7/23/65 - 6/30/66
Operation Latchkey	7/28/66 - 6/29/67
Operation Crosstie	7/26/67 - 6/28/68
Operation Bowline	7/30/68 - 6/12/69
Operation Mandrell (?)	7/69 - 6/70
Operation Emory	10/14/70 - 6/29/71
Operation Grommet	7/10/71 - 5/19/72
Operation Toggle	7/20/72 - 6/28/73
Operation Arbor	10/12/73 - 6/19/74
Operation Bedrock	7/10/74 - 6/25/75
Operation Anvil	9/6/75 - 8/26/76
Operation Fulcrum	11/23/76 - 9/27/77
Operation Cresset	10/26/77 - 9/27/78
Operation Quicksilver	11/2/78 - 9/26/79
Operation Tinderbox	11/29/79 - 9/25/80
Operation Guardian	10/24/80 - 9/24/81
Operation Praetorian	10/1/81 - 9/29/82
Operation Phalanx	11/1/82 - 12/10/82

APPENDIX L

SNLA OFF-SITE TESTING LOCATIONS (Continued)

Location	Date
Lancelin, Australia	NA
TERLS Range, India	NA
Kwajalein Missile Range	NA
Rio Grande de Sol, Brazil	NA
Kenya	NA

Sources: DOE-AL, 1987; Pastorius, 1966; SNLA, 1984c; SNLA, 1985b

NA - Not Available

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