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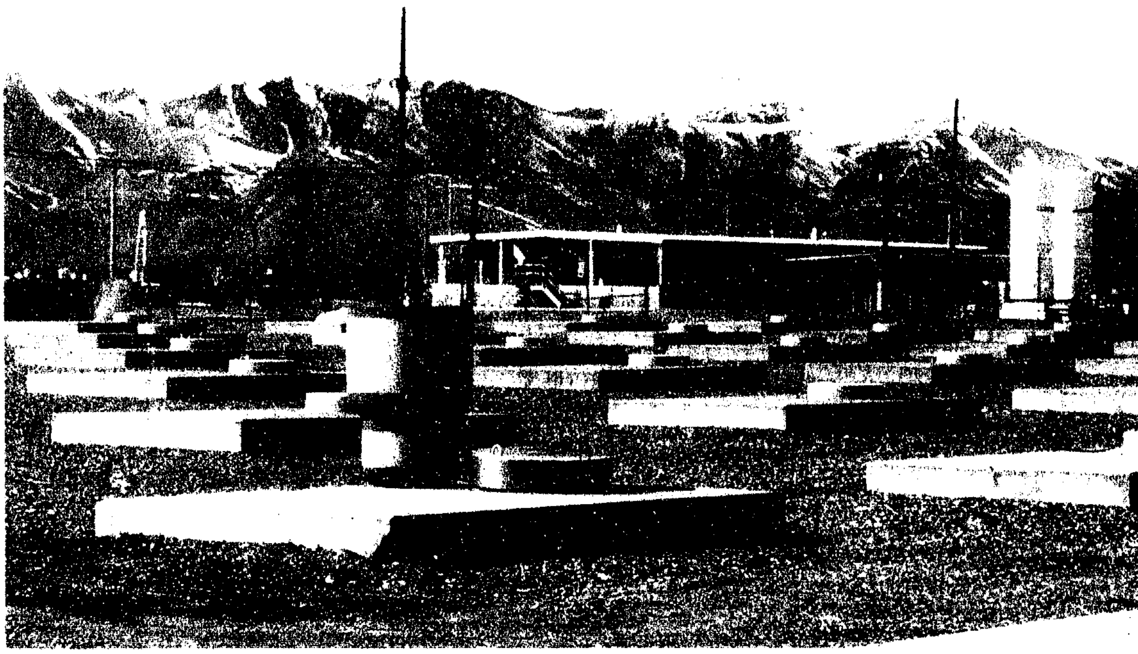
SPENT FUEL WORKING GROUP REPORT



on

INVENTORY AND STORAGE
OF THE DEPARTMENT'S SPENT NUCLEAR FUEL
and other
REACTOR IRRADIATED NUCLEAR MATERIALS
AND THEIR ENVIRONMENTAL,
SAFETY AND HEALTH VULNERABILITIES

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

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SPENT FUEL INITIATIVE

VOLUME II

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INTRODUCTION

This volume is divided into three major sections. Section 1 contains the Working Group Assessment Team reports. Section 2 contains the Vulnerability Development Forms. Section 3 contains the documents used by the Working Group in implementing this initiative.

Materials contained in this volume consist of information, data and working documents. They are unedited.

SPENT FUEL INITIATIVE

VOLUME II

SECTION 1

WORKING GROUP ASSESSMENT TEAM REPORTS

SPENT FUEL INITIATIVE

Hanford Site

WORKING GROUP ASSESSMENT TEAM REPORTS

HANFORD WGAT

Preface

The Secretary of Energy's memorandum of August 19, 1993, established an initiative for a Department-wide assessment of the vulnerabilities of stored spent nuclear fuel and other reactor irradiated nuclear materials. A Project Plan to accomplish this study was issued on September 20, 1993 by U.S. Department of Energy, Office of Environment, Health and Safety (EH) which established responsibilities for personnel essential to the study. The DOE Spent Fuel Working Group, which was formed for this purpose and produced the Project Plan, will manage the assessment and produce a report for the Secretary by November 20, 1993.

This report was prepared by the Working Group Assessment Team assigned to the Hanford Site facilities. Results contained in this report will be reviewed, along with similar reports from all other selected DOE storage sites, by a working group review panel which will assemble the final summary report to the Secretary on spent nuclear fuel storage inventory and vulnerability.

Executive Summary

The Working Group Assessment Team's review of the Hanford Site was conducted over the period of October 11-15, 1993 and included an evaluation and validation of the site's responses to the Working Group's request for information. Ten individual storage facilities were included in the review. Assessment walkdowns of these facilities were also conducted. The facilities included KE-and KW-Basins; Pacific Northwest Laboratory Buildings 324/325/327; Fast Flux Test Facility; Building 308 Annex; PUREX; T-Plant; and the 200 West Burial Grounds.

As a result of the Working Group Assessment Team review, 36 vulnerabilities were identified for further consideration by the Working Group Review Panel. All 36 vulnerabilities were discussed, and general agreement with the respective site team members and facility experts was reached. The following issues, although not explicitly Environment, Safety and Health vulnerabilities, represent institutional issues which have led to many of the identified vulnerabilities:

1. Lack of characterization of reactor irradiated nuclear material.
2. Lack of classification of the reactor irradiated nuclear material and recognition of the consequences (rules, regulations, and laws) associated with the resulting classification (NEPA, RCRA, CERCLA, etc.).
3. Lack of management plans and path-forward for the ultimate disposition and disposal of reactor irradiated nuclear material. Figure 5 in Section 5.0 provides a graphic summary of the Hanford path-forward uncertainties.

Two site-wide vulnerabilities were identified by the Working Group Assessment Team that were not associated with any one specific facility but which are closely tied to the above institutional issues. They are summarized as follows:

<u>HAN-S-1</u> Classification of DOE Spent Nuclear Fuel (SNF) as hazardous waste. Over 80% of DOE's spent nuclear fuel is stored in various facilities on the Hanford site. If this material is not officially declared as spent nuclear fuel to be held for future reprocessing and use, the public and its intervenors may request its classification as waste and require that its treatment follow the environmental regulations of EPA, RCRA, and CERCLA.

<u>HAN-S-2</u> Classification of fuel materials is undetermined in the 200 West Area Burial Grounds. The classification and planned ultimate disposition of the fuel and test specimen materials temporarily stored in the 200 West Area, or stored in other Hanford facilities awaiting shipment to the 200 West Area, is based on an unapproved interpretation of DOE Order 5820.2A. Also included in this interpretation is the assumption that the Waste Isolation Pilot Plant (WIPP) is a viable and proper repository for such materials.

The remaining vulnerabilities identified by the Working Group Assessment Team are listed below. No ranking or priority is implied by the order in which they are listed.

HAN-1-1 Corrosion of Fuel in Unsealed Canisters, and Its Release, with Fission Products, into KE-Basin Environment.

HAN-1-2 Worker Exposures and Releases to the Environment During Encapsulation of Corroding Fuel in KE-Basin.

HAN-1-3 Basin Leakage Due to Deterioration and Seismic Inadequacy of KE- and KW-Basin Discharge Chute Construction Joint.

HAN-1-4 Concern of the Institutional Control of Stored RINM at K-Basins.

HAN-1-5 USQ Due to Excessive Plutonium-239 Accumulation in the Sand Filter Backwash Pit of 105 KE-Basin.

HAN-1-6 Creation of TRU Waste Associated with the KE-Basin Operations.

HAN-1-7 Tritium in Monitoring Wells Near the K-Basins.

HAN-1-8 Uncharacterized Fuel Stored in Sealed and Unsealed Canisters in KW-and KE-Basins.

HAN-2-1 Uncharacterized Mixed Fission Product Accumulation in the Hot Cell Ducts in the Battelle Pacific Northwest Laboratory (PNL) 327 Building (Hot Cells D, F, SERF).

HAN-2-2 Isolation of Radioactive Liquid Waste (RLW) System in Building PNL-327 Due to Inability to Send RLW to the 300 Area RLW Collection Building (Bldg. 340).

HAN-2-3 Significant Quantities of Hazardous Materials (HAZMAT)/Special Case Wastes Temporarily Stored (Co-Located with RINM) in Hot Cells in Building PNL-324.

HAN-2-4 Unresolved USQ from 1986 Radioactive Spill in Building PNL-324, B-Cell.

HAN-2-5 Lack of Approved Disposal Pathway for RINM Causing a Backlog of RINM at all three Hot Cell Facilities at PNL (Building 324/325/327).

HAN-2-6 Lack of an Approved Integrated Facility SAR for Building 324 Radiochemical Engineering Cells (REC) and Shielded Material Facilities (SMF).

HAN-2-7 Lack of an Approved Integrated Facility SAR for Building 325 High-Level Radiochemistry Facility (HLRF) and Shielded Analytical Laboratory (SAL).

HAN-2-8 Lack of an Updated Integrated Facility SAR for the PNL Building 327 Postirradiation Testing Laboratory.

HAN-2-9 Lack of a Current Building 327 Seismic Analysis.

HAN-3-1 Potential for Inadequate Funding for Removal and Interim Storage of Fast Flux Test Facility (FFTF) Spent Fuel.

HAN-3-2 Inadequate Technical Safety Requirements for Storage of TRIGA Fuel in the 308 Building Annex.

HAN-3-3 No available Transport/Storage Casks for Removing the Irradiated Fuel from the Neutron Radiography Facility (NRF) TRIGA Storage Basin in the 308 Building Annex.

HAN-4-1 EBR-II Waste Containers May Exceed Expected 25-Year Life Analyzed in the SAR of the 200 W Burial Ground.

HAN-4-2 No Analysis in the SARs for Containers, Other Than EBR-II Casks, for Fuel Storage Containers in the 200-W Burial Grounds.

HAN-4-3 The Inventory of RINM Cannot Be Determined or Verified at the Hanford Burial Grounds or in Basins at F- and H-Reactors.

HAN-4-4	Fuel Stored on Interim Basis in Burial Ground May Exceed Expected Storage Period in the 200 West Area Burial Grounds.
HAN-4-5	Susceptibility of the T-Plant Fuel Pool to Seismic Damage.
HAN-4-6	Lack of Path-Forward for Removal and Ultimate Disposition of the Fuel Currently Stored in the T-Plant Spent Fuel Pool.
HAN-4-7	Poor Housekeeping in the T-Plant Canyon.
HAN-4-8	T-Plant Fuel Pool Cooling System Pump not Qualified for Current Environmental Service Conditions.
HAN-4-9	Frequency of Fuel Pool Level Monitoring at PUREX.
HAN-4-10	Inaccessibility of Fuel for Inspection at PUREX.
HAN-4-11	Inadequate Support (one rail only) of the Four Fuel Baskets at the PUREX Fuel Pool.
HAN-4-12	Corroded Fuel, Fuel Baskets, and Yoke Assemblies at PUREX Fuel Pool.
HAN-4-13	N- and K-Reactor Fuel Elements, Both Intact and Broken, Located on Dissolver Cell Floors at PUREX.
HAN-4-14	No Path-Forward for Ultimate Disposal of Fuel Stored at PUREX.

1.0 Objectives

The primary objective of the Hanford Working Group Assessment Team (WGAT) was to receive, evaluate, and validate information presented in the Draft Site Report. This report was assembled by DOE and Contractor staff responsible for the management of the ten Spent Nuclear Fuel (SNF) storage facilities to identify vulnerabilities relative to the storage of these materials. The WGAT conducted this assessment according to the direction of the Spent Fuel Working Group using the criteria provided in the Project Plan and the Assessment Plan. Thus, the conclusions and identified vulnerabilities will provide a consistent level of definition, description, and detail as those of the other working group assessment teams. Another objective of the WGAT visit was to ensure that site representatives play an important role in the process and are, therefore, fully cognizant, if not in full accord, with conclusions reached by the WGAT.

2.0 Facilities and Inventories

The following is a brief description of facilities and corresponding inventories of spent nuclear fuel. A more detailed inventory of the various fuels is provided in the following reports: "Hanford Irradiated Fuel Inventory Baseline," WHC-SD-CP-TI-175, Revision 1, dated 2-1-93, and the "EM-37 Spent Fuel Inventory Data Sheets."

2.1 105-KE Basin

Description

125-feet long x 67-feet wide x 21-feet deep enclosed water pool, unlined concrete with asphaltic membrane under basin.

Purpose

Interim storage (up to 20 years) of N-Reactor and Single Pass Reactor (SPR) Fuel.

Operations

Fuel encapsulation, maintenance and inspection. Consolidation of KE inventory into KW under evaluation.

Inventory

N-Reactor Fuel - 1233 MT (1152 MTIHM)
SPR Fuel - 0.4 MT (0.4 MTIHM)

2.2 105-KW Basin

Description

125-feet long x 67-feet wide x 21-feet deep enclosed water pool, unlined concrete with an epoxy coating and asphaltic membrane under basin.

Purpose

Interim storage (up to 20 years) of N-Reactor and Single Pass Reactor fuel.

Operations

Maintenance/inspection only. Possible fuel consolidation from 105-KE and/or PUREX under evaluation.

Inventory

N-Reactor fuel - 1038 MT (961 MTIHM)
SPR fuel - 0.1 MT (0.1 MTIHM)

2.3 Pacific Northwest Laboratory (PNL)-Building 324

Description

A chemical processing laboratory which also permits examination and mechanical testing of irradiated fuel specimens. It houses four stainless steel-lined hot cells (A, B, C & D) in the Radiochemical Engineering Cells (REC) area and two hot cells (East & South) in the Shielded Material Facility (SMF).

Purpose

Radiochemical process development and demonstration in the REC and non-destructive examination and testing of irradiated fuel and materials in SMF.

Operations

Interim storage of fuel in A-through D-cells. Multiprogram national laboratory asset used in the past to support various DOE and NRC projects.

Inventory

LWR Fuel - 3.1 MT (2.4 MTIHM)

2.4 PNL-Building 325

Description

Radiochemical Facility and Shielded Analytical Laboratory which houses nine stainless steel lined hot cells (A, B & C in radiochemical facility, six hot cells in shielded analytical laboratory).

Purpose

Radiochemistry facility and shielded analytical laboratory for radiochemical research. Now used almost exclusively to support waste tank characterization for tank waste remediation systems.

Operations

Interim storage of spent fuel pieces in B-Cell and in the shielded analytical laboratory cells. Tank waste characterization and analytical sampling of waste tank contents.

Inventory

7.1 kg of U in B-Cell, 4.9 kg of U in shielded laboratory cells. Several pieces of FFTF fuel, EBR-II fuel, and LWR fuel pins.

2.5 PNL-Building 327

Description

Post-irradiation Testing Laboratory which houses 11 high density iron- or steel-shielded hot cells (A through I, SERF and Dry Storage) and two interconnected water basins.

Purpose

Facilities provided for physical and metallurgical examination and testing of irradiated fuels, concentrated fission products, and structural materials.

Operations

Interim storage of fuel in A- through E- and SERF Cells, large pool, dry storage cell, and one EBR-II cask prepared for shipment and awaiting transport to the 200 West Area since 1990. Multiprogram national laboratory asset used in the past to support various projects for DOE and NRC.

Inventory

24.5 kg of irradiated fuel. Several pieces of FFTF fuel, LWR fuel pins, and miscellaneous test reactor fuel pin pieces.

2.6 Fast Flux Test Facility (FFTF)

Description

The FFTF is a liquid-sodium cooled nuclear reactor capable of operating at power levels up to 400

MW. The facility is the DOE's newest and highest power test reactor. The facility was constructed to test fuels and materials for the liquid metal reactor program.

Purpose

The purpose of the FFTF was to provide testing capability to satisfy the diverse technology development needs of the United States Advanced Reactor Programs. The mission includes irradiation and evaluation of different types of fuel assembly designs and different materials for fuel assembly construction. The reactor also irradiates targets for production of isotopes for medical and industrial use.

Operations

The FFTF operated for 12 years. In April 1992, DOE placed the FFTF in a hot standby condition. The capability to operate has been maintained, but future operation will depend on a sustainable mission for the facility. A decision is pending on the future use of FFTF.

Inventory

The RINM inventory at FFTF consists of 220 Driver Fuel Assemblies, 73 Fueled Experiments, six Core Characterizer Assemblies, two Fueled Open Test Assemblies, and 40 Fuel Pin Shipping/Storage Containers. Seventy-four of these assemblies are located in the reactor core, 46 in the In-Vessel Storage Modules; 59 in the Interim Decay Storage Vessel; two in the Interim Examination and Maintenance Cell; and 160 in the Fuel Storage Facility. The total inventory consists of about 13.0 metric tons of heavy metals. With the exception of two Fuel Pin Shipping/Storage Containers in the Interim Examination and Maintenance (IEM) Cell, all irradiated elements are currently stored under sodium.

2.7 308 Building Annex

Description

The 308 Building Annex houses the Neutron Radiography Facility (NRF) and the Mark I Training, Research, Isotopes, General Atomics (TRIGA) reactor. The TRIGA reactor was used as a source of neutrons in neutron radiography. The defueled TRIGA core and the spent fuel currently stored in the reactor basin represent fuel assemblies received from several research reactors off-site that were initially used to fuel the TRIGA.

Purpose

The 308 Building was used for the manufacture and evaluation of FFTF fuel assemblies. The NRF TRIGA, located in the 308 Building Annex, was used for the neutron radiographic, non-destructive testing of irradiated and non-irradiated fuel. The reactor was also used for training nuclear operators from N-Reactor and from the Washington Public Power Supply System.

Operations

The facilities were operational from the late 1970s until May 1989. The reactor core has been defueled and the reactor pool is providing storage for the 101 irradiated and three unirradiated fuel assemblies.

Inventory

The reactor pool has a total of 101 irradiated fuel assemblies representing a total mass of 0.24 metric tons. The total MTIHM is 0.02 metric tons.

2.8 T-Plant

Description

The main facility in T-Plant is the 221-T Canyon Building, which is 850-feet long by 68-feet wide by 74-feet high. The canyon consists of 37 cells and one railroad tunnel entrance and exit. The canyon deck is about 40-feet below a 3-feet thick concrete roof.

One of the cells adjacent to the railroad tunnel is 13-foot wide by 27.5-foot long by 28-foot deep. It was modified to serve as a spent fuel pool for storage of Shippingport Pressurized Water Reactor (PWR) Core II irradiated fuel. It has a capacity of about 50,000 gallons when filled to the 19-foot level. A demineralizer provides makeup water to replenish pool water lost by evaporation. An ion exchange column is provided for removal of radioactive contamination from the pool water and for maintaining water quality. Two chillers are installed near the pool for temperature control. The fuel pool wall has a fabric liner between white concrete and grey reinforced concrete walls.

Purpose

The T-Plant complex was constructed in the mid-1940s to extract plutonium from SNF using the Bismuth Phosphate process. In 1957, T-Plant was placed in service as a beta-gamma decontamination facility.

The cell that was cleaned and coated is now used for storage of PWR Core II irradiated fuel.

Operations

Equipment decontamination and interim storage of irradiated fuel. Decontamination activities have been suspended for about two years.

Inventory

PWR Core II fuel from the Shippingport Reactor: Total of 72 PWR Core II blanket assemblies; 38.4 MT total mass (16.4 MTIHM), including uranium and plutonium.

2.9 PUREX

Description

The PUREX Plant (202-A building) was constructed in the early 1950s to recover uranium and plutonium from irradiated nuclear fuel. Irradiated fuels from the Single Pass Reactors and N-Reactor were processed. The storage basin was designed for once through cooling with untreated discharge. Fuel is stored in two locations:

- Slug Storage Basin: Aluminum clad Single Pass Reactor fuel is stored in an unlined concrete pool loc. .ed at the east end of the 202-A Building. he cell is 31-feet long x 20-feet wide x 17-feet deep and filled with water (unlined concrete).

- Dissolver Cells: Three process cells with floors and walls constructed of reinforced concrete. Spilled N-Reactor fuel and some SPR fuel is lying on the floor of the cells in an air environment.

Purpose

Recovery of uranium and plutonium from irradiated fuel. It presently serves as an interim fuel storage facility.

Operations

Currently the facility is shutdown and about to undergo transition to D&D activities. Plans are being developed to package and transfer fuel to 105-KE or 105-KW basins.

Inventory

SPR Fuel - 2.8 MT (2.8 MTIHM)-an estimated 779 aluminum clad fuel elements (total) stored in four stainless steel fuel baskets hanging in the slug storage basin.

N-Reactor fuel - 0.3 MT (0.3 MTIHM)-27 zircaloy-clad inner N-Reactor fuel elements, and 11.5 outer N-Reactor fuel elements located on dissolver cell floors.

PUREX Cell A - 26 kg U.

PUREX Cell B - 230 kg U.

PUREX Cell C - 4 to 8 kg U.

2.10 Burial Grounds

Description

RINM is stored in retrievable storage in the 200 West Area. 218W-3A is a trench with a V-shaped gravel bottom. 218W-4C is a trench with a flat asphalt bottom. Fuel is stored in sealed containers of the following types: Concrete casks, EBR-II casks, a zircaloy hull container, or lead-lined concrete-filled 55-gallon drums. Thirty-five EBR-II casks are stored above ground, the others are buried.

While other burial grounds were not expected to be evaluated by the WGAT it was identified that fuel material pieces exist in caissons in other areas.

Purpose

Interim storage of transuranic (TRU) waste, including irradiated fuel. Fuel consists of intact fuel elements as well as partial assemblies and fuel pieces.

Operations

Interim storage of transuranic wastes, including irradiated fuel.

Inventory

FFTF fuel - 0.03 MT (0.02 MTIHM).

TRIGA fuel - 0.22 MT (0.02 MTIHM).
LWR fuel - 0.1 MT (0.1 MTIHM).
Misc. Test Reactor Fuel - 0.3 MT (0.3 MTIHM).

3.0 Conclusions from Review of Site Report

In order to review the Hanford Site facilities and to validate the content of the ten Hanford Draft Site Reports, the WGAT was divided into the following four sub-teams:

- Sub-Team 1 - KE-/KW-Basins
- Sub-Team 2 - PNL Laboratory Buildings 324, 325, 327
- Sub-Team 3 - FFTF/308 Building Annex
- Sub-Team 4 - T-Plant, PUREX, 200 West Area Burial Grounds

The sub-teams met with contractor counterparts including facility managers, report authors, and other experts to address Draft Site Report issues. These efforts included a review and validation of issues, material conditions, environmental controls, facility conditions, ES&H open items, and vulnerabilities.

A summary evaluation of each draft facility report is provided below:

3.1 105 KE-Basin

The Draft Site Report was found to contain incorrect information regarding the inventory of RINM for the KE-Basin. This discrepancy was resolved, and the Site Report will incorporate the corrected quantity of plutonium into the inventory for Initial Heavy Metal (IHM). The fuel physical condition, water quality, facility conditions, ES&H open items, and current authorization basis were found to be as stated. However, vulnerabilities were found to be understated in terms of seriousness with regard to material corrosion and its potential impacts, release of tritium and fission products to the environment due to basin leakage, and creation of TRU waste in the ion exchange and filter cartridge packages. Following discussions with the WGAT, the site team agreed with the potential impacts identified.

The WGAT agreed that funding must be in concert with required operations, some facility upgrades, encapsulation, and characterization programs. It found, however, that the lack of a comprehensive and integrated plan, to which the contractor, DOE-RL, DOE-EM, and the Washington Department of Ecology can agree, is a significant institutional failure. This is a significant vulnerability and may prevent correction of the many serious problems associated with storage of the large quantities of irradiated fuel in this aged facility.

The WGAT also found that the encapsulation plans were based upon prior similar activities ten years ago. Such factors as basin leakage, increased fuel damage and corrosion, basin radionuclides, personnel exposure guidelines, and waste generation have not been given sufficient attention in planning the future encapsulation.

3.2 105 KW-Basin

The Draft Site Report was found to have incorrect information regarding the inventory of the KW-Basin. This discrepancy was resolved, and the Site Report will incorporate the corrected quantity of plutonium into the inventory for IHM. The facility physical conditions, water quality, ES&H open items, and current authorization basis were found to be as stated during a facility walkdown and interviews with contractor personnel. Minor issues identified include cracking of seal-locking bars and deficiencies in roof components. The major vulnerability identified in the Draft Site Report was the need for increased rigor in conduct of operations for a KW-Basin intermediate-term mission as a fuel storage facility.

The WGAT concluded that the major vulnerability for KW-Basin is conduct of operations, and also agreed that a characterization program to determine the condition of the stored fuel is essential for planning to vacate this facility in the next decade. Should funding for operations or the characterization program be insufficient, a vulnerability would develop.

3.3-3.5 PNL Buildings 324/325/327

Based on its review, the WGAT considers the PNL facility reports to provide a factual description of facility conditions, status of materials, inventories, and some vulnerabilities. These vulnerabilities included: the 324 B-Cell USQ; the backlog and lack of path-forward for placing RINM in long-term retrievable storage; and the lack of an approved safety authorization basis. The WGAT generally concurs with the identified potential vulnerabilities; however, it also concludes, that several additional potential vulnerabilities exist beyond those identified in the facility reports for

Buildings 324/325/327. These additional vulnerabilities have been discussed with, and acknowledged by, the appropriate facility representatives and DOE-RL.

These additional vulnerabilities include: isolation of the Radioactive Liquid Waste (RLW) system in Building 327, the buildup of mixed fission products in the ducts of hot cells in Building 327, and the lack of a seismic analysis for Building 327. The WGAT also concludes that there is a clear and immediate need for DOE and Contractor management attention and emphasis relative to facility SAR upgrades and the provisions of requisite funding for these upgrades. Finally, a review was conducted of the DOE-HQ Hot Cell Study Group (HCSG) documents, including a PNL presentation to the HCSG on June 28-30, 1993. This report further validates those vulnerabilities identified above.

3.6 Fast Flux Test Facility (FFTF)

The WGAT sub-team concluded that the Draft Site Report is an adequate and accurate response to the Spent Fuel Working Group information request.

FFTF is a liquid metal sodium-cooled reactor currently in "hot standby". All irradiated fuel is stored in liquid sodium metal which is kept in circulation at 400°F. An inert atmosphere is maintained above the sodium level using argon. A cesium trap has effectively removed cesium fission products from circulating sodium in the reactor coolant system. Any other fission products from various storage locations are removed via cold traps. The draft site report identifies a large amount of sodium as co-located hazardous material. The hazards associated with sodium have been addressed in the FSAR. Historically, there has been no leakage of sodium from the stainless steel or carbon steel storage vessels that house the spent fuel. Cover gas is periodically sampled to determine the presence of fission gases as an indicator of leaking assemblies. The FFTF and its Fuel Storage Facility (FSF) have up-to-date Final Safety Analysis Reports and Technical Specifications. The conduct of operations is good, and institutional controls are in place. There are no significant ES&H open items, and no major ES&H concerns have been identified. The WGAT sub-team was concerned that decreases in FFTF funding, as a result of shutdown, could increase the vulnerability of the fuel presently stored in liquid sodium.

3.7 308 Building Annex

The WGAT sub-team concluded that the Draft Site Report is an adequate and accurate response to the Spent Fuel Working Group information request. No major ES&H concerns were identified in the Draft Site Report. The WGAT sub-team, however, does not agree with the assertion made in the Draft Site Report that the use of the TRIGA pool for continued storage of spent fuel will not require any Technical Specifications or Operational Safety Requirements (OSR). The reason given for not requiring Technical Specifications and OSR is that an Interim Safety Basis has been prepared and is expected to be approved. The team considers lack of OSRs for the facility, while it is storing fuel, to be an ES&H vulnerability.

The NRF TRIGA has been defueled and the spent fuel assemblies are placed in storage racks located around the periphery of the reactor pool. The fuel assemblies are intact, and no leaks have been detected. Pool water is analyzed once a month for leak detection and maintenance of water quality. Beta-gamma continuous air monitoring over the reactor pool and alpha monitoring in the reactor hall are in place. Pool water is clear and clean. None of the fuel assemblies has been repackaged. The reactor tank is lined with aluminum. The conduct of operations is good, and the institutional controls are in place.

All stored 104 assemblies are proposed to be transferred (pending completion of review under the National Environmental Policy Act) to dry storage in the 200 Area in FY 96. The WGAT sub-team was concerned that the casks to transport and store the fuel had not yet been designed, fabricated, or certified, yet are expected to be available for use in FY 96.

3.8 T-Plant

The WGAT sub-team concluded that the Draft Site Report provides an adequate response to the information requested. No vulnerabilities were reported by the site team. However, several concerns were discussed in the T-Plant response. This includes a discussion of a hairline crack in the pool wall, and the related seismic analysis. Seismic analyses for a moderate hazard facility indicate pool wall cracking. The spent fuel pool water is being cleaned at this time, suspended solids are being removed.

T-Plant is in the process of resolving a prior DOE finding related to the lack of a program for monitoring pool water chemistry or unique process data. The finding also cited a lack of close coordination between operations, chemistry, and process (safety) departments. The plant is in the early stages of implementing DOE Recommendation 90-2.

Discussions with facility and other site personnel focused on two main areas, including seismic structural response and planning for long-term storage of the fuel currently in the facility. Vulnerabilities were identified in each of these two areas.

3.9 PUREX

The WGAT is in general agreement with the PUREX Draft Site Report. However, the WGAT was unable to validate all the information contained in the Draft Site Report because the PUREX canyon is inaccessible due to high radiation levels and other worker health and safety hazards.

The WGAT was unable to precisely account for all the RINM inventory reported in the Draft Site Report. It was not possible to count the number of aluminum clad Single Pass Reactor fuel elements in the four fuel baskets hanging in the slug storage basin, because only the fuel in the outer layer can be counted. In addition, due to poor visibility in the cell, conditions at the bottom of the pool are unknown.

It was not possible to count all of the fuel elements and fuel pieces on the dissolver cell floors just by viewing the video tape. PUREX personnel stated that when fuel was dumped into the dissolver during operations, some fuel elements spilled onto the floor. Crane operators would retrieve as many spilled elements as possible, but could not get them all. Operators kept a log to track the number of elements spilled versus the number retrieved. The WGAT was willing to accept the reported inventory as being reasonably correct.

The WGAT generally agrees with the description of fuel conditions in the Draft Site Report, except that the aluminum clad Single Pass Reactor fuel elements had visible corrosion, most likely from the aluminum in contact with the stainless steel fuel baskets. There is a reasonable possibility that pitting of the aluminum clad has occurred and a release of fission products, uranium or plutonium has occurred. In addition, there are signs of cladding damage and possible chemical attack on the N-Reactor fuel in the dissolver cells (Figure 3.9a). There is a likelihood of fission product release. The material condition of the Single Pass Reactor and N-Reactor fuel continues to degrade.

The Draft Site Report neglected to mention that the PUREX canyon is inaccessible for purposes of the Spent Fuel Working Group. It neglected to mention that the fuel basket yoke assembly hooks were visibly corroded (Figure 3.9b) and one vertical member was bent. It also neglected to mention that the fuel baskets are suspended by yoke assemblies supported only by one cell wall ledge. These conditions raise a concern for continued storage and future handling of the fuel. PUREX personnel are convinced that the fuel baskets should only be handled one more time.

Due to canyon inaccessibility, slug storage basin water quality could not be physically verified by the WGAT. The water is neither treated nor routinely monitored. There is no cooling water system per se and no demineralizers or ion exchange columns. However, the WGAT was willing to accept the 1993 sample results reported in the Draft Site Report.

The WGAT is concerned that the basic PUREX assumption, that the fuel at PUREX will be retrieved and shipped to the K-Basins within the next three to four years, may not be valid. Unless the pathway forward for the PUREX fuel is made more certain, the fuel could remain indefinitely.

Based on review of the Draft Site Report and resulting table-top discussions with facility personnel, the WGAT identified a number of ES&H vulnerabilities, including: inaccessibility of fuel for inspection; the four fuel baskets are only supported from one rail in the fuel pool; fuel and fuel basket yoke assemblies are corroded in the fuel pool; N-and K-Reactor fuel elements, both intact and broken, are located on dissolver cell floors; and no path-forward for ultimate disposal of fuel stored at PUREX.

3.10 Burial Grounds

The WGAT review of the Draft Site Report for the 200 West Area Burial Grounds concluded that it accurately identified concerns with the 200 West Area except in the area of accurately quantifying the amount of RINM stored. The Draft Site Report did not reflect that fuel materials had been disposed of in Burial Grounds other than 218-W. The failure to include these materials is a result of disposal practices and the status of record keeping prior to 1970. Also, the Draft Site Report did not

Figure 3.9a Damaged and Corroded N-Reactor Fuel Elements on Bottom of PUREX Dissolver Cell

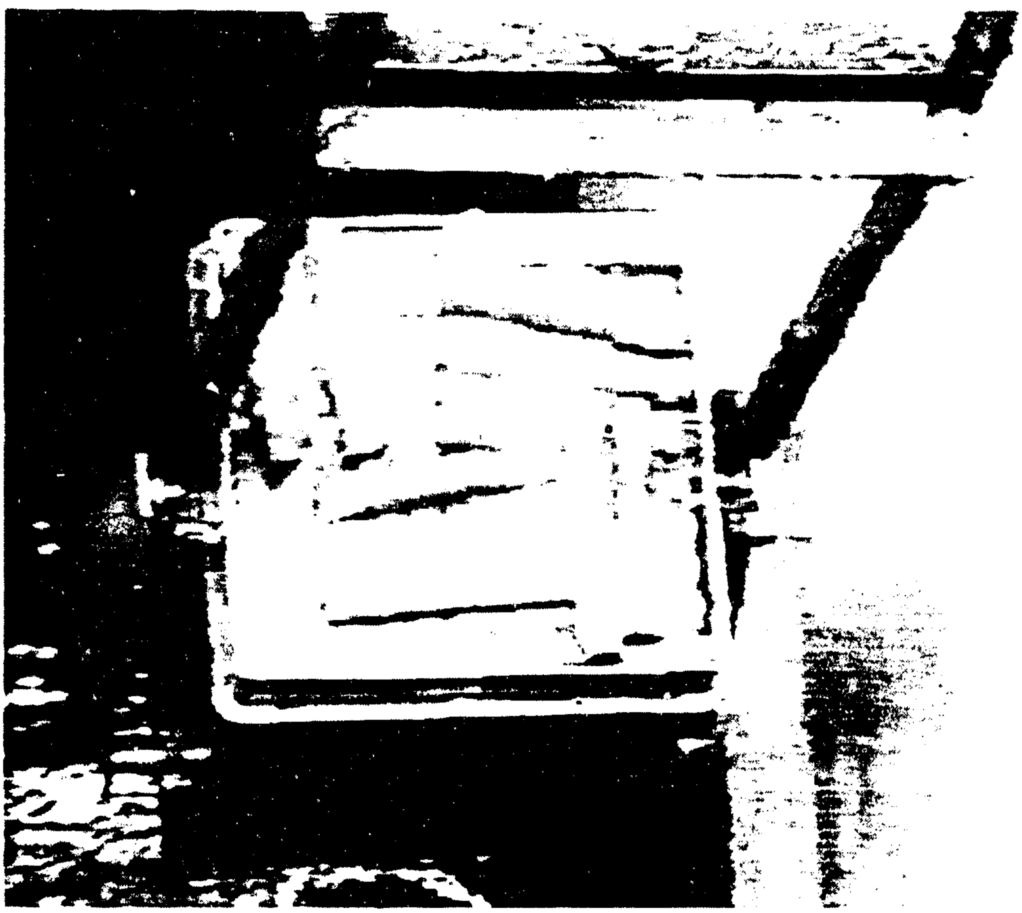

Figure 3.9b Corrosion of SPR Fuel and Yoke Assembly in PUREX Pool

reflect an uncertainty in the number of TRIGA elements which are located in the 200 West Area Burial Grounds (could vary between 79 and 90) as stated in the EM-37 inventory.

Discussions with the facility personnel centered on three items concerning the report and facility.

The first item deals with the length of time that materials have been stored in the burial grounds and the potential that the materials would remain for an indeterminate time period. The facility had identified in the Draft Site Report that containers used at the Burial Grounds were designed for a minimum of 20 years, but considered that the containers will last beyond the design lifetime. The WGAT questioned whether safety analyses exist to support the containers that were being used. A Safety Analysis Report (SAR) exists for the EBR-II casks used; but not for other containers used at the Burial Grounds. The SAR for the EBR-II containers is based on a design lifetime of 25 years. Facility personnel indicated that a revised SAR is in development for the Burial Grounds.

The WGAT questioned facility personnel whether additional fuel could be located at other burial grounds. Facility personnel indicated that the method of tracking buried material changed in 1970. Therefore, fuel material could have been buried at other burial grounds as radioactive waste. This is further complicated by the significant difference in records available for the active burial grounds verses the inactive (618) burial grounds. Further investigation by DOE-RL personnel indicated that irradiated fuel pieces from the 300 Area laboratories have been disposed of in the 618 Burial Grounds. Additional review of information concerning disposal of materials from the 300 Area indicated that irradiated fuel materials had been disposed of in four areas prior to 1970, including the burial grounds adjacent to the 300 Area, two disposal areas in the 618 Area; and burial areas in the 200 Area.

The last area discussed was the classification of some fuel material as remote- handled transuranic waste (RH-TRU). The 200 West Area active facilities do not meet the requirements for storage of RINM, and therefore can not accept it. However, RH-TRU can be stored in the 200 West active areas. DOE-RLs position is that fuel material stored in the 200 West Area is either fuel from research reactors or commercial reactor fuel that had been used for research. Therefore, such material meets the definition of DOE 5820.2A for RH-TRU. The facility personnel told the WGAT that letters stating this position were sent to DOE Headquarters in 1991, but there has been no response. Copies of the letters were furnished to WGAT.

Vulnerabilities were identified by the WGAT for each of these three discussion areas.

4.0 Conclusions from Walkdowns

Each of the ten storage facilities were visited by the assigned WGAT sub-team members. Facility walkdowns included discussions with facility managers, operators, technicians, operations managers, and DOE-RL facility representatives. The following summarizes the walkdown activities for each facility:

4.1 105 KE Basin

A walkdown of the facility was conducted by the sub-team with the Facility Operations Manager. Open fuel canisters were stored in steel racks on the floor of the storage basin. Canisters were identified by location coordinates marked on the personnel grating above the pool level. The water in the pool was murky, occasional gas bubbles were seen rising to the surface. The condition of the fuel could only be inspected when illuminated below the water surface. At the one location where a light fixture was installed the sub-team saw that the fuel was visibly corroded, damaged, and unevenly distributed in the open fuel canisters. Some fuel rods had collapsed, so that the inner element was no longer concentric with outer element or of the same length as the outer one (Figure 4.1a). Lots of junk and debris, such as pipes, lifting hooks, light fixtures, empty canisters, tools, were piled on top of the canisters. Sludge could be seen around the canisters and on the floor in the discharge chute (Figure 4.1b). Basin housekeeping was poor. One of the drainage sumps (on the west side of the discharge chute) was examined. It showed water at its bottom, however, it was impossible to tell the depth of the water. Radioactive areas were properly marked off, and safety information signs were evident around the basin. Basin radiological profiles have been prepared, Figures 4.1c and d. Basin radionuclide content has been monitored since 1977 (Figure 4.1e). The reported number of stored fuel elements in the KE-Basin pool could not be confirmed by a direct count.

The walkdown verified the conditions presented in the Draft Site Report. It more than emphasized the need for encapsulating the fuel in the open storage containers in the KE-Basin. However, the sub-team is doubtful that the projected encapsulation time of two to three years for the 3,666

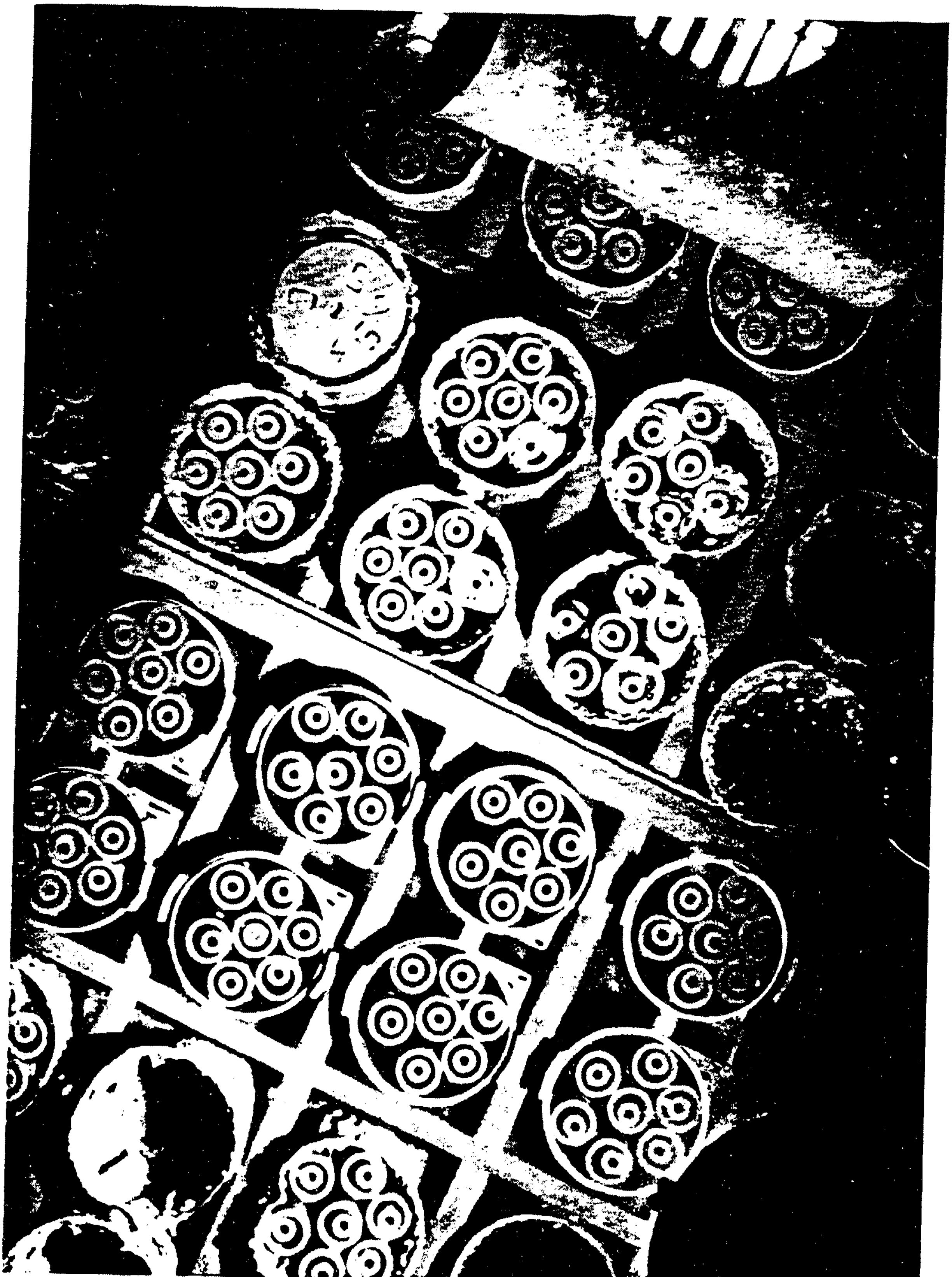

Figure 4.1a Corroded N-Reactor Fuel Stored in Open Canisters in the K-East Basin

Figure 4.1b Sludge and Miscellaneous Items on the Bottom of the K-East Basin

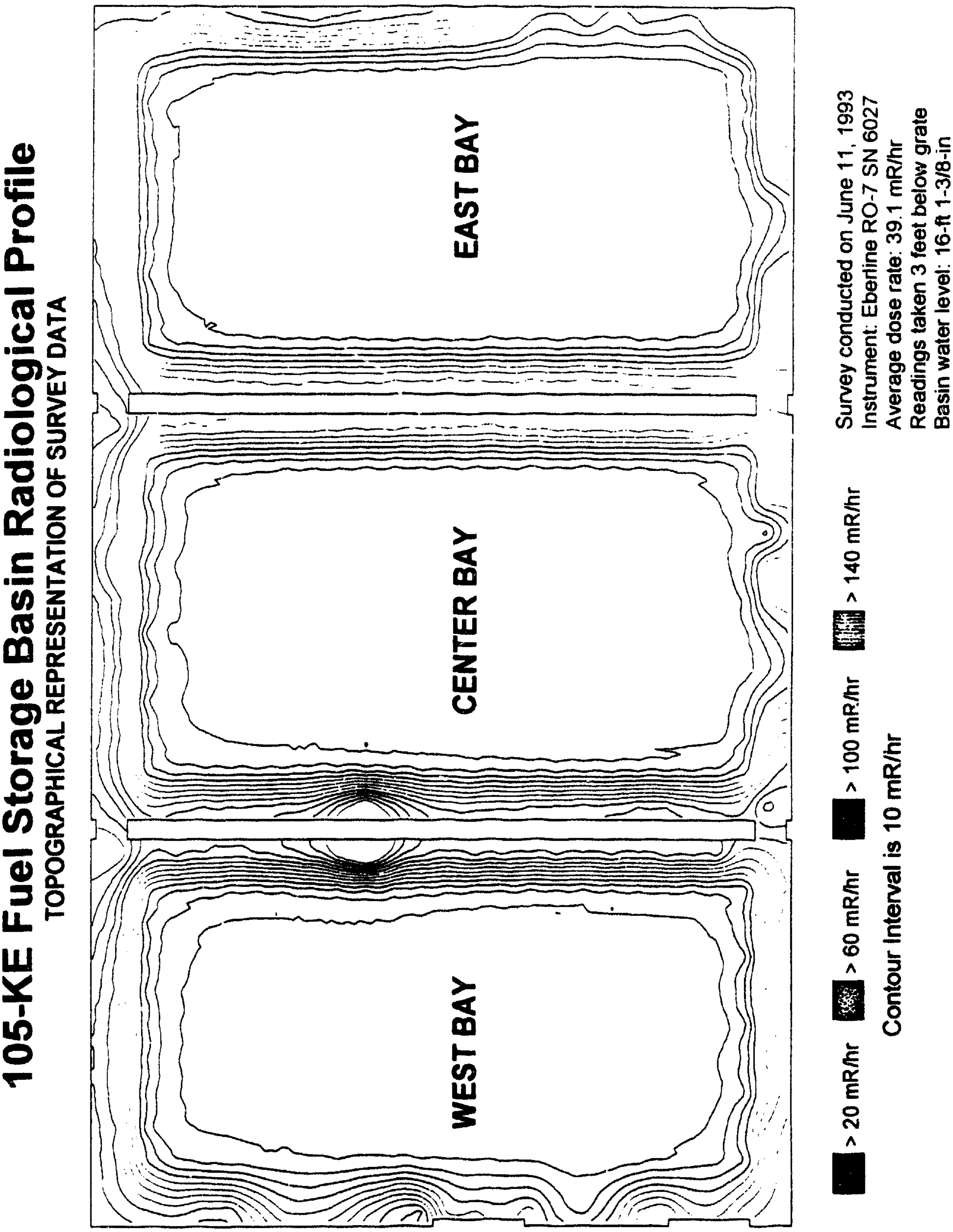

Figure 4.1c Topographical Representation of Radiological Survey of K-East Basin

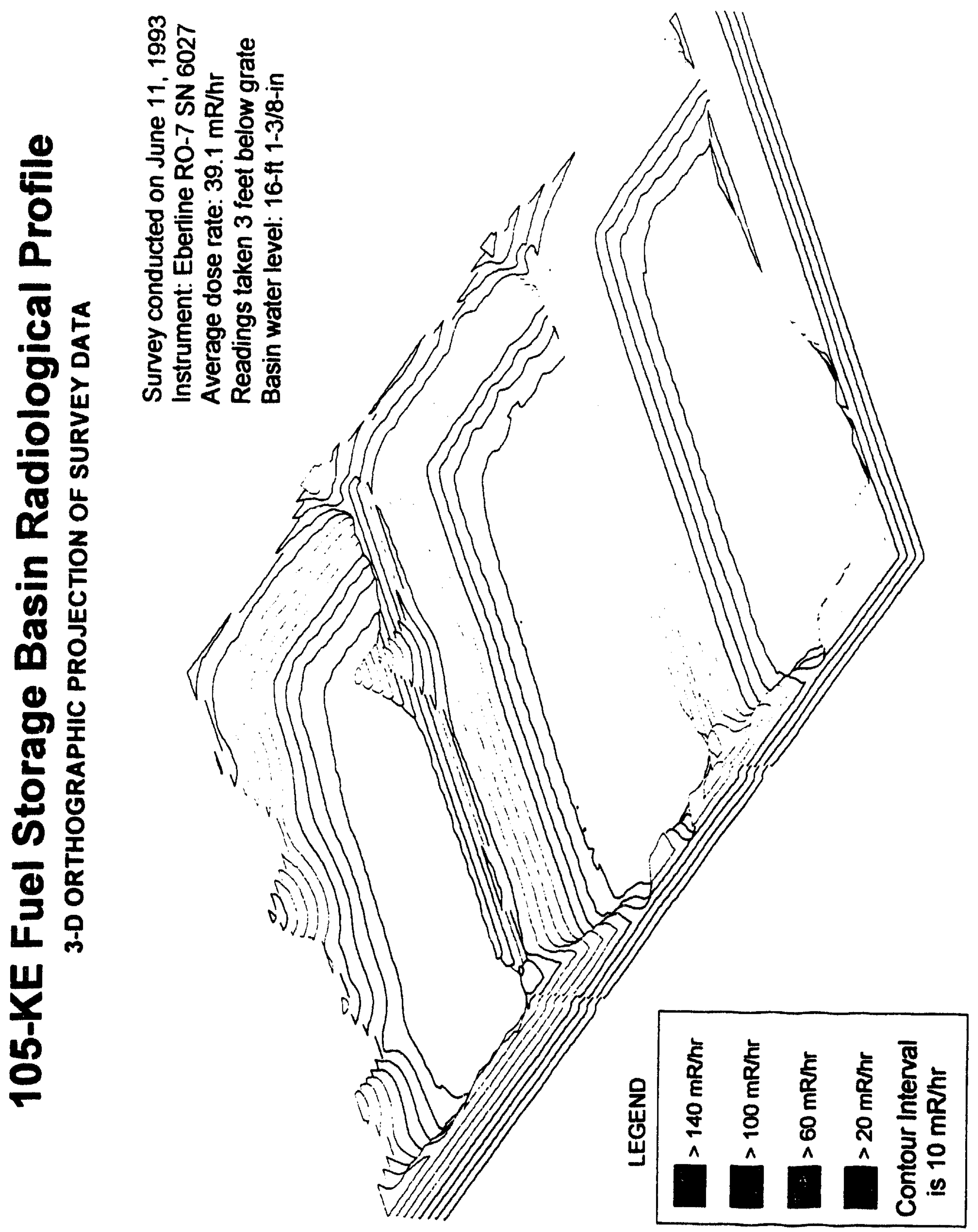

Figure 4.1d Orthographic Projection of Radiological Survey of K-East Basin

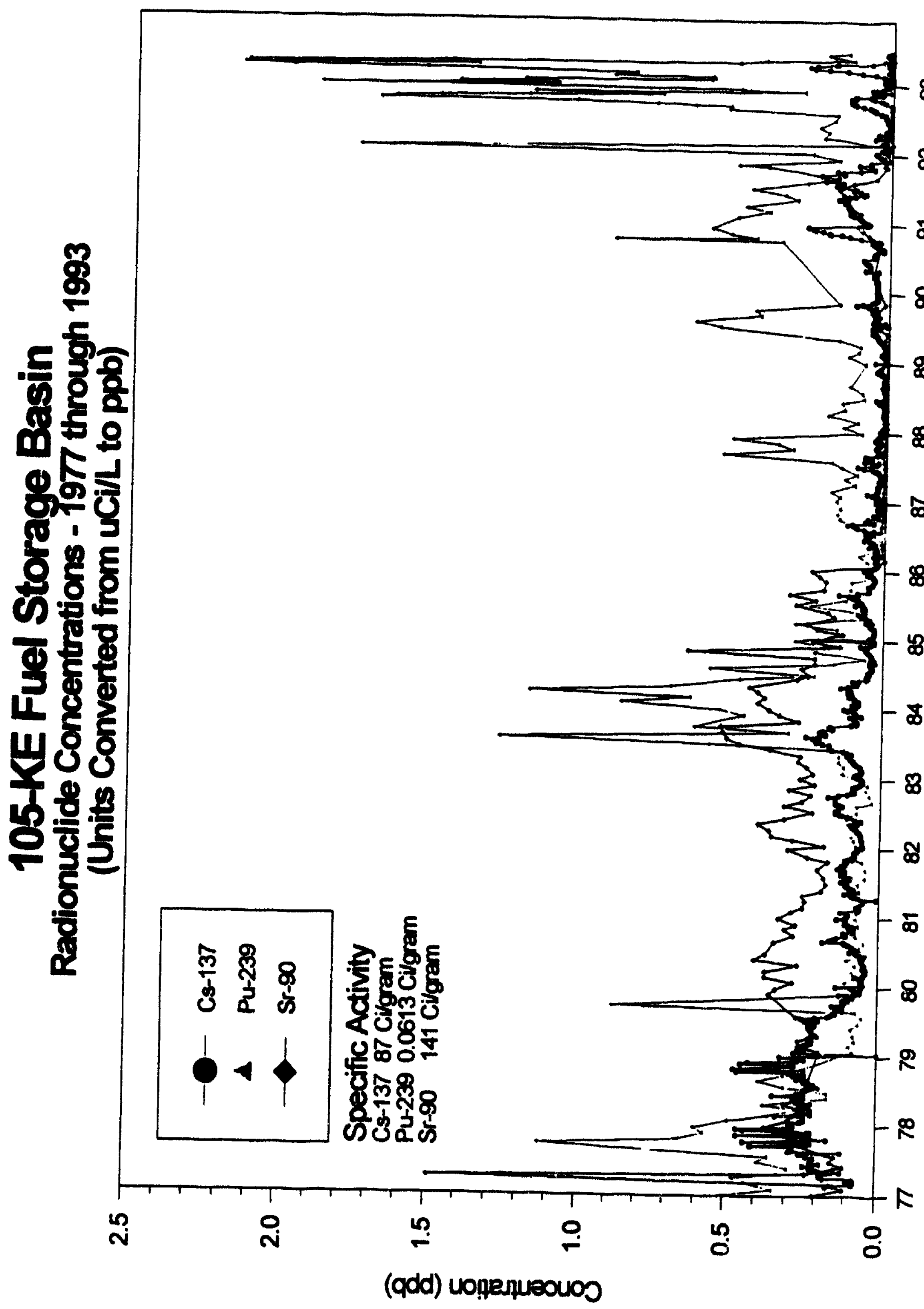

Figure 4.1e History of Selected Radionuclide Concentrations of K-East Basin Water

fuel canisters presents a reasonable timetable with the currently engineered solution. The team also feels, that, based on the severe corrosion (>50% of the fuel elements), this activity may extend longer than presently scheduled. The sub-team also believes, that, given the problems of handling that much corroded fuel, the increased radiation exposure to the workers presents an additional vulnerability. A simpler encapsulation plan should be evaluated.

4.2 105 KW Basin

A walkdown of the facility was conducted by the sub-team with the Facility Operations Manager. Capped fuel canisters were stored in steel racks on the floor of the storage basin. Canisters were identified by markings on the container lids as well as by location coordinates on the personnel grating above the pool (Figure 4.2). The water clarity in the pool was good, and the fuel storage containers appeared to be in excellent condition. No corrosion was visible in the illuminated areas below the pool surface. Likewise, the cracked locking bars on some containers (as described in the Draft Site Report) were not seen. There was no debris piled on top of the storage containers. Housekeeping and cleanliness of the facility were excellent. Areas were clear of obstructions, and safety information signs and labels were clearly posted. Radioactive areas were roped off and clearly marked. Basin radionuclide content has been monitored since 1981.

The walkdown verified the conditions presented in the Draft Site Report. The clean conditions of the basin pool and surrounding structure emphasized to the sub-team the importance of fuel encapsulation and its feasibility for long-term interim storage. The reported number of fuel elements could not be confirmed by a direct count.

4.3 PNL Building 324

A walkdown of the facility with the Manager of Nuclear Engineering and Testing, the Group Leader, and the DOE-RL Facility Representative was conducted. Discussions were also held with a senior hot cell technician and the building manager. Overall building condition (outside of hot cells) was excellent. Indications of a labelling program, configuration management, and conduct of operations (procedures posted, criticality limits posted, emergency actions posted, systems operable, inventory tags in place) were evident. In addition, interviews with management and operators confirmed a commitment to conduct of operations principles. Facility upgrades are scheduled and funded (fire safety improvements, seismic qualification, alarm deficiencies, public address system deficiencies). One issue discussed and common to all personnel was the lack of disposal path for RH-TRU.

Hot cells in the Shielded Materials Facility were in generally good condition with some hazardous materials co-located with mixed fission products (400 lead bricks). The Radiochemical Engineering Cells (REC) however, exhibited very poor housekeeping. A-Cell stores 32 canisters of radioactive glass containing significant radiation (>10^6 R/hr), causing damage to cell wall paint which is flaking. Additionally, equipment and debris are strewn throughout A-, B-, and D-Cells. In D-Cell, fuel pieces are stored in glass containers in

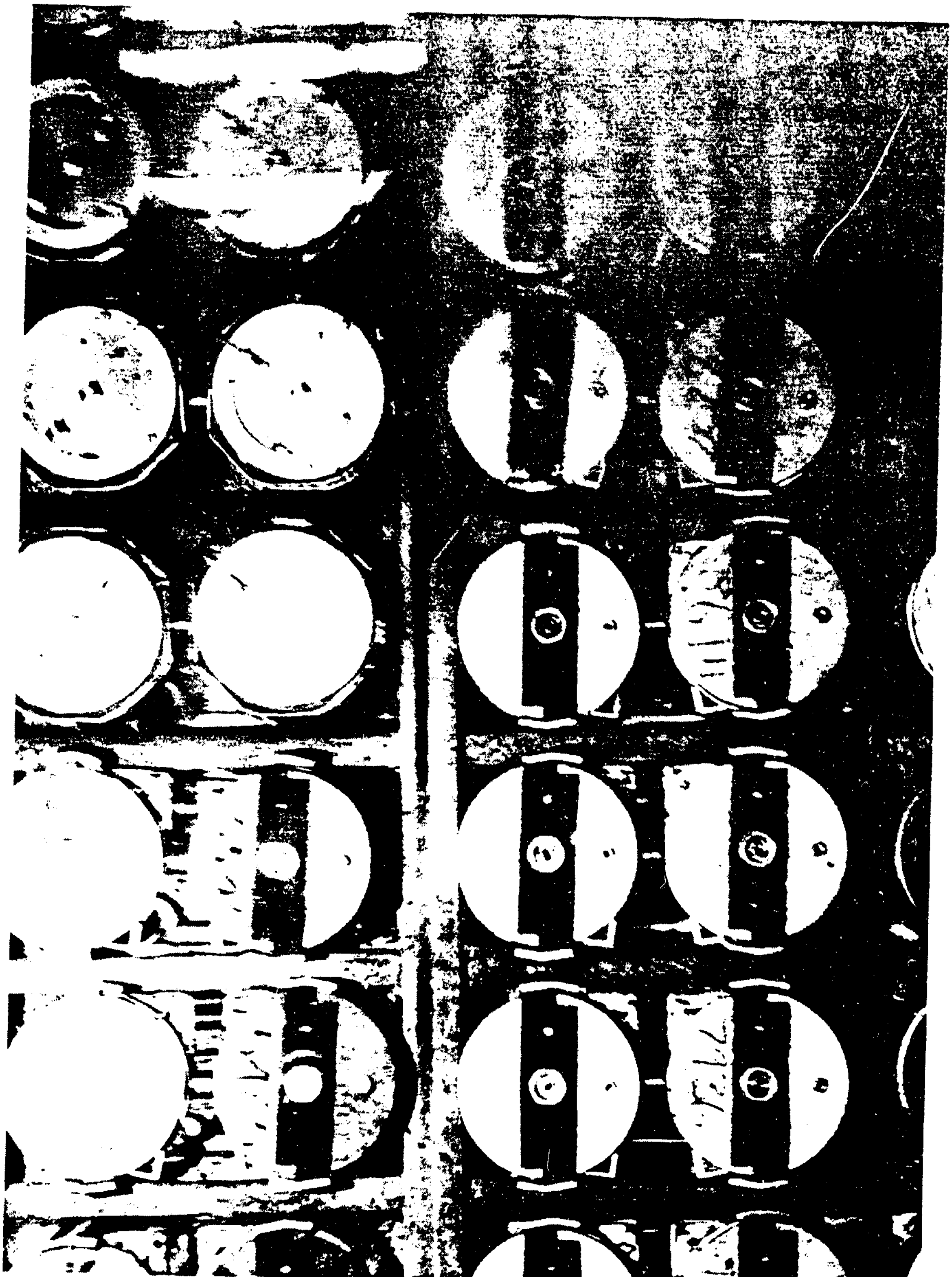

Figure 4.2 Sealed Fuel Storage Canisters in the K-West Basin

racks on top of debris piled on the floor. Equipment removal and renovation are in progress in B- and D-Cells.

4.4 PNL Building 325

A walkdown of the facility with the Manager, ES&H & Compliance Programs, the Group Leader, and the DOE-RL Facility Representative was conducted. Overall housekeeping (outside of the hot cells) was excellent. Indications of a labelling program, configuration management, and conduct of operations (procedures posted, criticality limits posted, emergency actions posted, systems operable, inventory tags in place) were evident. In addition, interviews with management confirmed a commitment to conduct of operations principles. Facility upgrades are planned and funded (RLW system, antiquated equipment replaced).

One cell in the Radiochemistry Laboratory, B-Cell, was overcrowded with debris and equipment, etc., and characterized by poor housekeeping practices. The Shielded Analytical Laboratory (SAL) Hot Cells were in generally good condition with the exception of the left-most cell. This cell is overcrowded with debris and cans of waste and TRU haphazardly stacked in the cell.

4.5 PNL Building 327

A walkdown of the facility with the Manager of Nuclear Engineering and Testing, the Group Leader, and the DOE-RL Facility Representative was conducted. Overall housekeeping (outside hot cells) was excellent. Indication of labelling program, configuration management, conduct of operations (procedures, OSL/OSR limits posted, systems operable, material condition excellent, inventory tags are in place) was evident. In addition, interviews with management confirmed a commitment to conduct of operations principles. Facility upgrades are planned and funded (stack monitoring, fire safety improvements, seismic analysis in progress). Building RLW system is isolated.

Overall hot cell housekeeping is satisfactory except in F-Cell. Excessive debris, waste, and equipment clutter are evident. Also high-radiation levels in accessible areas of the basement have resulted from a buildup of mixed fission product activity in the ventilation duct work from cells D, F, and Special Environmental Radiometallurgical Facility (SERF). Water quality of the pool basins is maintained to better than drinking water specification but basin levels are not monitored during off-shifts and weekends. Overall cleanliness is evident. Equipment is monitored and in excellent condition and all materials are properly stored in basin racks.

4.6 Fast Flux Test Facility (FFTF)

The Deputy Facility M--ager and the DOE site staff accompanied the sub-team on a walkdown tour of the FFTF area. All fuel storage facilities were toured with the exception of the Interim Examination and Maintenance Cell (IEM) which was experiencing a temporary electrical outage. All fuel transfers in the reactor vessel, i.e., within the core and between the core and In-Vessel Storage Modules, are accomplished by three fuel handling machines. Transfers between the reactor vessel, the Interim Decay Storage Vessel, the IEM cell, and Fuel Storage Facility are performed in an inert argon atmosphere with bottom loading fuel transfer casks. Only a single assembly is transferred at a time. Criticality control is provided by mechanical means in that storage locations in storage vessels maintain a critically safe fixed geometry. Therefore, even if all storage locations were filled, a criticality event would not occur. The reactor and fuel storage facilities, storage modules, overhead and polar cranes are seismically qualified for the design basis earthquake for the FFTF (0.25 g horizontal acceleration).

The facility walkdown included observation of the in-containment areas which included the reactor operating floor, fuel handling machines, transfer casks, interim decay storage vessel access plugs, instrument trees, and polar crane. Outside the containment, the Fuel Storage Facility and the Maintenance and Storage Facility were toured. All facilities were exceptionally well maintained and clean. During the operating history of FFTF, there have been 13 fuel failures. Of these, 12 have been in test assemblies and only one was in a Driver Fuel Assembly. These fuel assemblies have been removed from the core. The spent fuel assemblies in their current storage locations pose no ES&H vulnerability and the proposed transfer to dry interim storage will also pose no vulnerability since they will be placed in sealed, inerted containers.

4.7 308 Building Annex

The sub-team toured the Neutron Radiography Facility in the 308 Building Annex that contains the TRIGA reactor. All the fuel has been removed from the core and placed in aluminum storage racks located either on the walls of the pool or on the bottom of the pool. There are 99 irradiated fuel elements, two irradiated fuel-followed control rods, along with two unirradiated fuel-followed control rods, and one unirradiated fuel element located in the storage racks. These racks provide a critically safe geometry. Water clarity was good and pH, conductivity, and activity are being monitored. Alpha, beta, and gamma monitoring above the storage pool was also in place. In general the facility was in good condition. Shielding blocks over the core prevent any large objects from falling on the stored fuel. Records identifying the history and location of each fuel element are maintained in the control room. The walkdown verified the information provided in the Draft Site Report.

4.8 T-Plant

The sub-team performed a walkdown of the T-Plant canyon, specifically to observe the spent fuel pool. The sub-team was accompanied by operations staff under the direction of the Operations Manager. The T-Plant canyon is a radiation and airborne contamination area.

Housekeeping in the canyon and around the pool was poor. Pieces of equipment, tools, bags of trash, combustible materials, and considerable debris were present in the canyon and close to the edges of the pool. There was also debris on the pool surface and debris hanging from the pool cooling system above the pool surface. Facility personnel commented that considerable effort had been spent on the cleanup of T-Plant canyon during the previous two years. This effort includes upgraded level and temperature indications. Cleanup of the pool is currently underway and cleanup of the canyon continues.

The WGAT sub-team identified two vulnerabilities during the walkdown. The vulnerabilities were discussed with and acknowledged by the appropriate facility DOE-RL representatives.

4.9 PUREX

Due to high radiation levels and other worker health and safety hazards, the facility personnel recommended that the WGAT defer its walkdown of the PUREX canyon, where the slug storage basin and the dissolver cells are located. The WGAT agreed and did not walkdown the canyon, but did tour other portions of the facility with one of the lead process engineers.

The WGAT toured the main control room and other control stations. The WGAT observed the slug storage basin level instrumentation in a gallery adjacent to the canyon and alarm module in the control room. Water level is read quarterly from the gauge in the gallery. The WGAT thought that quarterly readings did not provide timely information about pool level.

The basin level alarm module in the control room was in an alarmed condition, and had been for some time. There was no tag or note on the module explaining the alarming condition. Water level in the slug storage basin is expected to decrease over time due to evaporation. Daily walkdowns of the compartments adjacent to the basin verify that basin water is not leaking. The alarming condition in the control room was due to an improper alarm setpoint.

Based on the walkdown, the WGAT identified a vulnerability due to the frequency of fuel pool level monitoring at PUREX. The WGAT also noted poor administrative controls regarding system status.

PUREX personnel indicated that the frequency of slug storage basin water level readings will be changed from quarterly to daily, and that the setpoint be re-evaluated to better account for evaporation and fuel uncovering considerations.

4.10 Burial Grounds

A walkdown of the Burial Grounds was limited to viewing the EBR-II casks that were not backfilled. The remainder of the RINM is stored in containers that have been covered with soil. Due to the materials being stored in casks or buried, the team was unable to verify the amount of material stored. The WGAT did not identify any vulnerabilities during the walkdown.

5.0 Conclusions

Vulnerabilities identified by the WGAT and site team are described below and included as Attachment 1 (Vulnerability Development Forms). They are presented by facility, and do not represent a prioritization of the identified vulnerabilities.

The following issues, although not explicitly ES&H vulnerabilities, represent institutional issues which have led to many of the identified vulnerabilities:

1. Lack of characterization of RINM.

2. Lack of classification of RINM and recognition of the consequences (rules, regulations, and laws) associated with the resulting classification (NEPA, RCRA, CERCLA, etc.).

3. Lack of management plans and path-forward for the ultimate disposition and disposal of the RINM.

Two site-wide vulnerabilities were identified by the WGAT that were not associated with any one specific facility but which are closely tied to the above institutional issues. They are summarized as follows:

HAN-S-1 Over 80% of DOE's spent nuclear fuel is stored in various facilities on the Hanford site. If this material is not officially declared as spent nuclear fuel to be held for future reprocessing and use, the public and its intervenors may request its classification as waste and require that its treatment follow the environmental regulations of EPA, RCRA, and CERCLA.

HAN-S-2 The classification and planned ultimate disposition of the fuel and test specimen materials temporarily stored in the 200 West Area Burial Grounds, or stored in other Hanford facilities awaiting shipment to the 200 West Area is based on an unapproved interpretation of DOE Order 5820.2A. Also included in this interpretation is the assumption that WIPP is a viable and proper repository for such materials.

At Hanford, the path-forward for the ultimate disposition or disposal of spent nuclear fuel and reactor irradiated nuclear material is uncertain. Figure 5 shows a simple diagram depicting possible flow paths for these materials. A brief discussion of Figure 5 concerns are provided below:

- Two examples of basic types of RINM include: 1) RH-TRU (fuel pieces or test specimens stored in hot cells or the 200 West Area Burial Grounds); and 2) SNF (e.g., fuels from N-Reactor, Single Pass Reactors, and some commercial reactors stored as spent fuel).

- There is an underlying assumption at Hanford that RH-TRU can be placed in interim retrievable storage and ultimately shipped to the Waste Isolation Pilot Plant (WIPP). This is depicted by the top flow path in Figure 5. However, this path-forward is not guaranteed, because appropriate shipping containers and the WIPP itself are not yet available.

- Another assumption is that spent fuel can be stored in existing locations and ultimately shipped to a geological repository, e.g., Yucca Mountain. This is depicted at the bottom of Figure 5. However, this path-forward is not guaranteed, because appropriate shipping containers and a geological repository are not yet available. In the

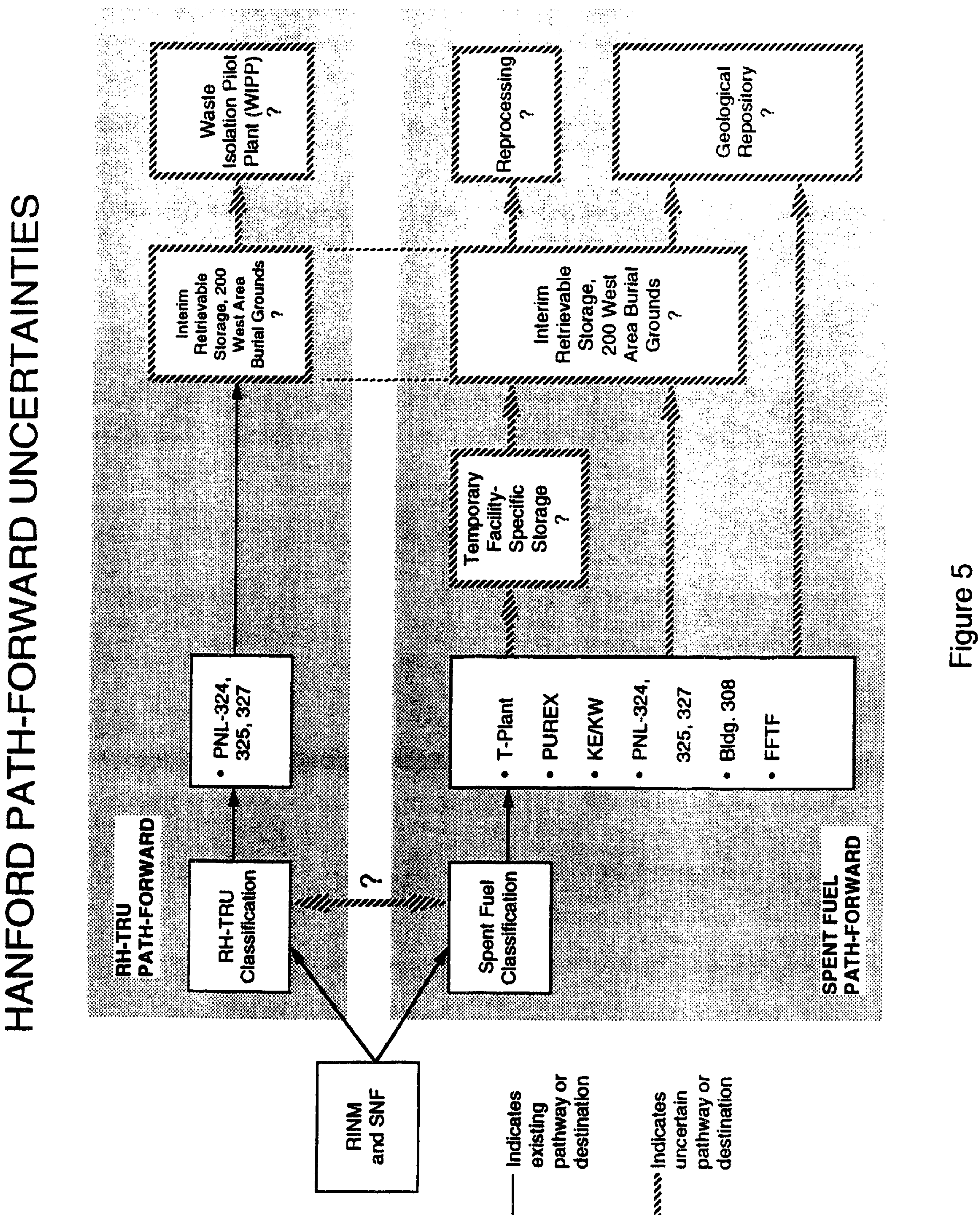

Figure 5 Hanford Path-Forward Uncertainties

meantime, it has been assumed that spent fuel from facilities such as PUREX, will be packaged and shipped to the K-basins. This is a risky assumption because the K-Basins are no longer desirable for additional fuel storage considering existing conditions.

- Another uncertainty involves individual facility plans for interim RINM storage. To cope with such path-forward uncertainties, some facilities are considering interim, facility-specific storage. For example, T-Plant is considering interim, dry storage of the PWR Core II fuel until such time as an assured path-forward is identified.

- The reprocessing pathway represents another uncertainty. Reprocessing before final disposal can no longer be assumed due to current restrictions, intervenor litigation, and facility status.

- There appears to be a tendency at Hanford to declare fuel materials RH-TRU because the pathway to WIPP offers more certainty. This approach is based on an interpretation of DOE Order 5820.2A that has not obtained DOE-HQ concurrence. Notwithstanding, at the Hanford Site, RH-TRU is perceived to be a preferable classification. This could be due to the Record of Decision for the Hanford Waste Environmental Impact Statement (EIS) which says post-1970 stored TRU would be retrieved and sent to WIPP for disposal.

- Interim retrievable storage also has limitations on temporary storage of the RINM managed as RH-TRU. Without a specified length of time for interim storage, assumptions have been made that identified 20-25 years as the design life for most RH-TRU waste packages. With this time frame nearing an end for some of the first waste packages, additional vulnerabilities and uncertainties are added. There are also shipping concerns and limitations on transport of RINM among the Hanford facilities.

These path-forward uncertainties form the basis for the two site-wide ES&H vulnerabilities identified above. Information from the other WGATs indicate that lack of a clear path-forward may be a DOE-wide vulnerability. DOE will continue to be vulnerable until a clear path-forward policy is articulated, and policy decisions are made.

A summary of the ES&H vulnerabilities are provided below. They are grouped by the facilities assessed by the WGAT. No ranking or priority is represented by the order in which they are listed.

5.1-5.2 100 Area K-East and K-West Basins

Vulnerabilities associated with activities in the K-East and K-West Basins arise largely from the use of these basins for long-term storage of spent nuclear fuel and the decision by DOE to cancel plans for fuel reprocessing. The original purpose of these basins was temporary storage of spent fuel prior to reprocessing. They were not designed (nor upgraded) for the long-term storage of the spent fuel.

No overall plan describes the available options for the ultimate disposal of this spent fuel. Meanwhile, the spent fuel continues to deteriorate during storage, and its precise condition and radionuclide composition are unknown. The basins are contaminated, and the K-East basin has leaked contaminated water to the underlying soil column on more than one occasion. TRU waste is accumulating on the basin floor and in the filters and demineralizers.

While an encapsulation plan has been developed based upon previous experience, the WGAT believes a more efficient method of encapsulation should be evaluated to avoid additional radionuclide release, high worker exposures, and creation of significant waste (some TRU).

Eight vulnerabilities have been identified for the operations at the K-East and K-West Basins.

The institutional control of stored fuel is a concern at both K basins. The lack of clear planning and priorities for the final disposition of the spent fuel material, the frequent organizational and personnel changes, and the lack of a project organization with accountability for the eventual resolution of ES&H concerns, present a significant vulnerability.

The condition of the spent fuel stored in the sealed and unsealed containers in the K-East and K-West Basins is not known. As there are strong indications of fuel damage during discharge from the N- and Single Pass Reactors, characterization of the fuel's condition is needed in order to minimize worker exposure and environmental damage during final disposal.

Corrosion of spent fuel stored in unsealed cylinders in the K-East Basin causes increasing amounts of uranium, TRU, and fission products in the pool and pool sludge. This condition poses risks of exposure to workers, accidental criticality, and radionuclide release to the environment.

The recent OSR violation of the 225 g of ^{239}Pu accumulation in the sand filter backwash pit of 105 K-East Basin and the ensuing USQ have created a major concern regarding the likelihood of a criticality event. The resolution of the USQ is a key to the initiation of the encapsulation program.

The high concentration of plutonium in the K-East Basin results in the creation of TRU waste from the ion exchange packages. Hydrogen generation through the degradation of organic resins and hydrolysis of water may lead to possible flammable or explosive concentrations. The lack of a disposal plan and method of storing these packages results in a significant hazard to the workers.

The planned encapsulation of the corroding fuel has the potential for increased exposure to workers and releases to the environment. Increased burdens on filters and demineralizers and on their cleanup and disposal would result if alternative plans to minimize the spread of contaminants are not developed.

Basin leakage due to the deterioration of the K-East Basin discharge chute construction joint has occurred between 1975 and 1980 and again in 1993. Failure of the original waterstop in this joint and the seismic inadequacy of this construction joint in both the K-East and K-West basins present a vulnerability to the environment by the release of radioactive materials.

Tritium concentrations in monitoring wells adjacent to the K-East Basin and near the Columbia River shoreline are approaching the Drinking Water Standard source limit of 20,000 pCi/ℓ. It is reasonable to assume that the K-East Basin is a source. With observed ^{137}Cs and ^{90}Sr radionuclides which accompany leaching coolant from the K-East Basin, a resulting vulnerability exists to the public and the environment.

5.3-5.5 PNL 324/325/327

Eight of the nine vulnerabilities associated with activities in the PNL facilities (Buildings 324/325/327) can be traced to two underlying causes. The first is the lack of an updated approved safety basis. The second cause is the failure to have a defined path for final disposition or disposal of RINM and other hazardous materials currently temporarily stored in Buildings 324/325/327.

Six vulnerabilities identified in this review could be traced to the lack of an updated, approved safety authorization basis. The first vulnerability is due to the unresolved USQ in Building 324, B-Cell from a spill in 1986 which went uncharacterized until 1993. The most recent accident analysis concluded that doses to workers and the public were, respectively, 1.5 and 3 times PNL accident guidelines for a postulated seismic event as a result of the 1986 spill.

Additional vulnerabilities as a result of the lack of an updated and approved safety basis involve all three facilities. Since the facility draft SARs for 324/325 are currently unfunded for completion or implementation, PNL has unilaterally implemented revised OSRs associated with the draft SARs. While the revised OSRs are most likely more conservative, without formal independent review all ES&H elements may be potentially impacted. In Building 327, PNL has committed to providing TSRs, but there is no commitment for an updated SAR. The final vulnerability associated with this underlying cause is the lack of a completed seismic analysis for Building 327 which could lead to uncharacterized consequences not covered by the current authorization basis.

The second underlying cause which has led to three vulnerabilities is the failure to have a defined path for final disposition or disposal of RINM and other hazardous materials. The isolation of the Radioactive Liquid Waste (RLW) System in Building 327 has resulted in a reduction in decontamination efforts and a potential threat to the environment from the runoff of potentially contaminated water. While Buildings 324/325 are also affected, they each have temporary holding tanks which preclude this vulnerability.

The second vulnerability associated with the lack of a disposal pathway involves the significant quantities of fission products in dispersible forms (Cs and Sr) temporarily stored (co-located with RINM) in Hot Cells in Building 324. These materials represent a potential release hazard to the environment, public, and worker since they are not packaged or containerized.

The third vulnerability associated with a lack of approved disposal pathway for RINM has caused a backlog of RINM at Buildings 324/325/327. Coupled with the backlog is a lack of institutional controls which has resulted in unsatisfactory storage conditions of RINM and other HAZMAT in the hot cells. Materials haphazardly stored in hot cells may compromise some aspect of the authorization basis such as blocked floor drains, blocked ventilation ducts, etc. As a result, all ES&H elements may be potentially suspect.

Finally, one additional unrelated vulnerability was identified as a result of the assessment. Uncharacterized mixed fission products have accumulated in the hot cell ducts in Building 327 (D-, F-, and SERF Cells). This accumulation of uncharacterized mixed fission products has resulted in excessive radiation levels in accessible areas. Additionally, a possible criticality event could exist since the accumulation has not been characterized.

5.6 Fast Flux Test Facility (FFTF)

Should FFTF be shutdown due to lack of mission, adequate funding must be provided to maintain the spent fuel storage system in a safe condition until the spent fuel is transferred to dry storage casks. The lack of proper funding could result in operational breakdowns of systems maintaining the spent fuel molten sodium. These breakdowns could lead to an increase in vulnerability to fires and to releases of fission materials.

5.7 308 Building Annex

The NRF TRIGA will be a spent fuel storage facility until the stored fuel is transferred to dry storage and shipping casks. The facility will not have mandated safety requirements since the Technical Specifications for the TRIGA reactor do not apply to spent fuel storage. The facility must have approved OSRs or Technical Safety Requirements (TSRs) for continued safe operation. Due to lack of mandated operation requirements, system failure is possible.

TRIGA fuel is proposed to be shipped in dry storage casks to the 200 Area for interim storage on a concrete pad. No agreements or approvals are in place that verify that the shipping and storage casks would be acceptable at the 200 Area.

5.8 T-Plant

Because no viable path-forward exists for the PWR II spent fuel, T-Plant is forced to plan for continued, extended storage. T-Plant utilizes a process cell that was not originally designed or analyzed for spent fuel storage, e.g., pool structures and systems. Because of hazardous conditions in the canyon, T-Plant managers are forced to make decisions considering the balance between ALARA, worker health and safety, and the proper care and handling of spent fuel. Unless DOE can provide a viable path-forward and clear policy for retrieval, packaging and shipment of such fuel, DOE and T-Plant will continue to be vulnerable in the ES&H area.

The WGAT identified four ES&H vulnerabilities. The primary concern is for the structural soundness of the fuel pool walls during a seismic event. Leakage has already been identified due to a crack in the wall between the fuel pool and the railroad tunnel. The crack runs from the top to the bottom of the wall, and a puddle periodically accumulates at the base of the wall. Also, a seismic analysis of the fuel pool walls indicates that the structure is susceptible to damage from the level of earthquake expected at Hanford.

A walkdown of the canyon identified debris, extraneous equipment, and tools located in the pool area. The amount of equipment and debris in and around the pool indicate a failure of the facility to establish controls to prevent foreign matter from entering the pool.

5.9 PUREX

Because no viable path-forward exists for the Single Pass Reactor and N-Reactor fuel, PUREX is forced to plan for continued, extended storage. PUREX utilizes a process cell that was not originally designed or analyzed for spent fuel storage, e.g., pool structures and systems. Because of hazardous conditions in the canyon, PUREX managers are forced to make decisions considering the balance between ALARA, worker health and safety, and the proper care and handling of spent fuel. Unless DOE can provide a viable path-forward and clear policy for retrieval, packaging and shipment of such fuel, DOE and PUREX will continue to be vulnerable in the ES&H area.

The WGAT identified several ES&H vulnerabilities. The WGAT was told that the frequency of monitoring slug storage basin water level is being changed from quarterly to daily, and that the low-water level setpoint is being re-evaluated. The four baskets of Single Pass Reactor fuel are only supported from one rail and the yoke assemblies are corroded. These conditions convince PUREX personnel that the fuel can only safely be moved once more. Both the Single Pass Reactor and N-Reactor fuel appear to be damaged and corroded, and it is apparent that fission product, uranium or plutonium material could have been released.

5.10 Burial Grounds

Because no viable path-forward exists for fuel elements, fuel fragments, and test specimens, the Burial Grounds are forced to plan for continued, extended storage. Unless DOE can provide a viable path-forward and clear policy for retrieval, packaging and shipment of such fuel, DOE and the Burial Grounds will continue to be vulnerable in the ES&H area.

From a review of RINM storage in the Burial Grounds, it was concluded that the vulnerability is primarily in determining the length of time that material will be stored and verifying, through conduct of safety analysis, that containers and methods used will assure an adequate level of safety. Discovery of fuel materials stored in other Burial Grounds supports the conclusion that an accurate inventory of RINM does not exist for Burial Grounds at Hanford, representing another vulnerability.

SPENT FUEL INITIATIVE

Idaho National Engineering Laboratory Site

WORKING GROUP ASSESSMENT TEAM REPORTS

IDAHO NATIONAL ENGINEERING LABORATORY

PREFACE

The Secretary of Energy's memorandum of August 19, 1993, established an initiative for a Department-wide assessment of the vulnerabilities of stored spent fuel and other reactor irradiated nuclear materials (RINM). A Project Plan to accomplish this study was issued on September 20, 1993, by the Office of Environment, Safety, and Health (EH-10). This plan established responsibilities for laboratories and personnel essential to the study, and created a Department of Energy (DOE) Spent Fuel Working Group (SFWG) to manage the study.

This report was prepared by the Working Group Assessment Team (WGAT) assigned to the Idaho National Engineering Laboratory (INEL). Results contained in this report will be reviewed, along with similar reports generated by other SFWG members assigned to other selected DOE sites. The DOE SFWG will assemble the final report to the Secretary on spent fuel storage inventory and vulnerabilities by November 20, 1993.

EXECUTIVE SUMMARY

A large fraction of the non-production and naval spent nuclear fuel, under the control of the Department of Energy, is currently stored at the INEL. The hundreds of metric tons of spent fuel comes from university reactors, commercial and industrial reactors, DOE-owned and operated reactors, other U.S. Government owned reactors, and foreign reactors which have used U.S.-origin fuel. The variety of fuel and cladding types are considerable and include zirconium clad, stainless steel clad, graphite matrix, and aluminum clad. Specific sources include the fuel from the damaged TMI-2 nuclear power plant, graphite fuels from Fort St. Vrain and Peach Bottom nuclear power plants, and fuel from the Light Water Breeder Reactor. The fuels also vary in enrichment and burnup; some fuel in damaged. In addition, the storage facilities vary significantly from modern dedicated fuel storage pools to facilities originally not designed for fuel storage, built 40 years ago. These variables offer a unique challenge for storage management and for storage vulnerability assessment.

The INEL Working Group Assessment Team (WGAT) visited the site during the week of October 18, 1993, where it conducted an evaluation and validation of that site's responses to the WGAT's Request for Information on spent fuel storage vulnerabilities. Sixteen facilities, managed and operated by the site's three contractors, EG&G Idaho Inc. (EG&G), Argonne National Laboratory - West (ANL-West), and Westinghouse Idaho Nuclear Company (WINCO), were considered in the review. As part of the assessment, the WGAT conducted walkdowns of all 16 facilities, performed document reviews and held extensive discussions with site personnel. As a result of the WGAT evaluations, discussions, and walkdowns, a number of facility-dependent vulnerabilities were determined. Many of these vulnerabilities were previously highlighted in the two Site Team Reports that were reviewed by the WGAT. The Site Team Reports were found to be complete, factual, and quite helpful to the WGAT. Suggestions for improvements to the Site Team Reports will be incorporated into the revisions to the reports to be published subsequent to the publication of this WGAT report.

From consideration of these specific vulnerabilities, the following broad conclusions regarding spent fuel storage at INEL can be drawn:

> While there appear to be no immediate and clearly significant safety concerns for Department workers or the general public nor any immediate and clearly significant environmental concerns arising from any of the facility vulnerabilities, there is a general theme of increasing vulnerabilities at the INEL site. These stem from a combination of concerns in performing day-to-day facility activities: (1) without an over-riding mission and (2) without a clearly understood plan for disposal and/or conditioning. Without an over-riding mission, there is no programmatic ownership of some of the spent fuel and therefore reduced visibility, priorities, and resources. Without a clearly understood plan for disposal and/or conditioning, ambiguities arise that make decision-making and effective management problematic. Components of this ambiguity include: fuel disposition requirements that are uncertain, incomplete characterization of spent fuel waste types, and ill-defined

processing options and fuel transportation mechanisms.

There has been a gradual, but significant deterioration of those barriers designed to prevent the release of radionuclides into the worker and public environment, principally from corrosion of barrier materials, especially aluminum cladding. A number of facilities are also not seismically qualified and were not designed to be long-term storage facilities, thereby, raising the level of general concern. Of the potential adverse conditions considered during this Spent Fuel Initiative, namely, criticality, radionuclide material release, radiation exposure, and institutional control failures, the most significant appear to be radionuclide material release (and its effect on the worker and the environment) and institutional control failures. Over the next decade, the considerable effort to prevent the former will require significantly more attention to and resources for the latter.

While the WGAT recognizes that planning for the resolution of spent nuclear fuel issues for the INEL site, involving the three M&O contractors, is in progress (Note, for example,"Interim Report of the INEL Spent Nuclear Fuel Consolidation Task Team", a Predecisional Draft Report, WIN-367, October 1993), WGAT also notes that this planning focus is long-term and in some cases, not directed to addressing the adverse conditions that need to be addressed in the 1-5 year timeframe, which is the timing focus of this vulnerability assessment. Long-term planning (40 years) will be developed in concert to assure that decisions made in the 1-5 year timeframe are being driven by sound long-term strategy in the spent nuclear fuel (SNF) management and resource allocations.

1.0 OBJECTIVES

The objective of this visit by the WGAT to the INEL was to receive, evaluate, and validate information assembled by representatives of the site with respect to storage of spent fuel and RINMs at each of the 16 storage facilities at INEL. From this information and from observations made at the site, the WGAT was to determine potential vulnerabilities associated with the present storage of RINM (see Appendix A), and report their findings for Department consideration. In doing so, the WGAT also had the objective of conducting this assessment according to the protocol of the SFWG as described in its Project Plan and in its Assessment Plan so that the summary conclusions and identified vulnerabilities are comparably detailed, defined, and described with the summary conclusions of other teams at other sites. The WGAT is chartered in its final responsibilities to assemble a vulnerability report for the Secretary. Another objective of the WGAT visit is to ensure that site representatives play key roles in the process and are therefore fully cognizant, if not in full accord, with all conclusions.

2.0 FACILITIES AND INVENTORIES

Generally speaking, many of the INEL SNF storage facilities, were built in the 1950's. These facilities are currently candidates for near-term retirement. Figure 1 depicts the general layout of all the wet and dry storage facilities at INEL. In Appendix B, Table B-1 provides a general overview of these facilities along with retirement dates assumed by INEL. This table also delineates whether or not the facilities can be upgraded to extend their design life and whether or not the facility meets present standards. Table B-2 summarizes the existing inventory and the storage capacity for all SNF storage facilities at INEL.

Both kinds of facilities are operated by EG&G and WINCO. ANL-W only maintains dry facilities for SNF storage. For each of the INEL contractors, the following facilities were visited by members of the WGAT. Fuel and RINM inventories were checked and the potential for vulnerabilities were examined.

2.1 EG&G (EG&G IDAHO, INC.)

2.1.1 TAN Pool (Test Area North Pool)

Description:

At the Test Area North (TAN), two areas are in use for storage of spent nuclear fuel. These are the TAN-607 storage pool and the TAN-607 storage pad (Spent Fuel Cask Testing Storage Pad) located close to the TAN-607 Hot Shop. There are several other facilities at TAN that have been used or can be used to support spent fuel storage activities, including the TAN-607 Hot Cells.

The TAN-607 pool for storing radioactive materials is located adjacent to the Hot Shop. This facility was constructed in the 1950's. The pool is unlined and is 21 m (70 ft) long by 14.6 m (48 ft) wide by 7.3 m (24 ft) deep. It does not comply with

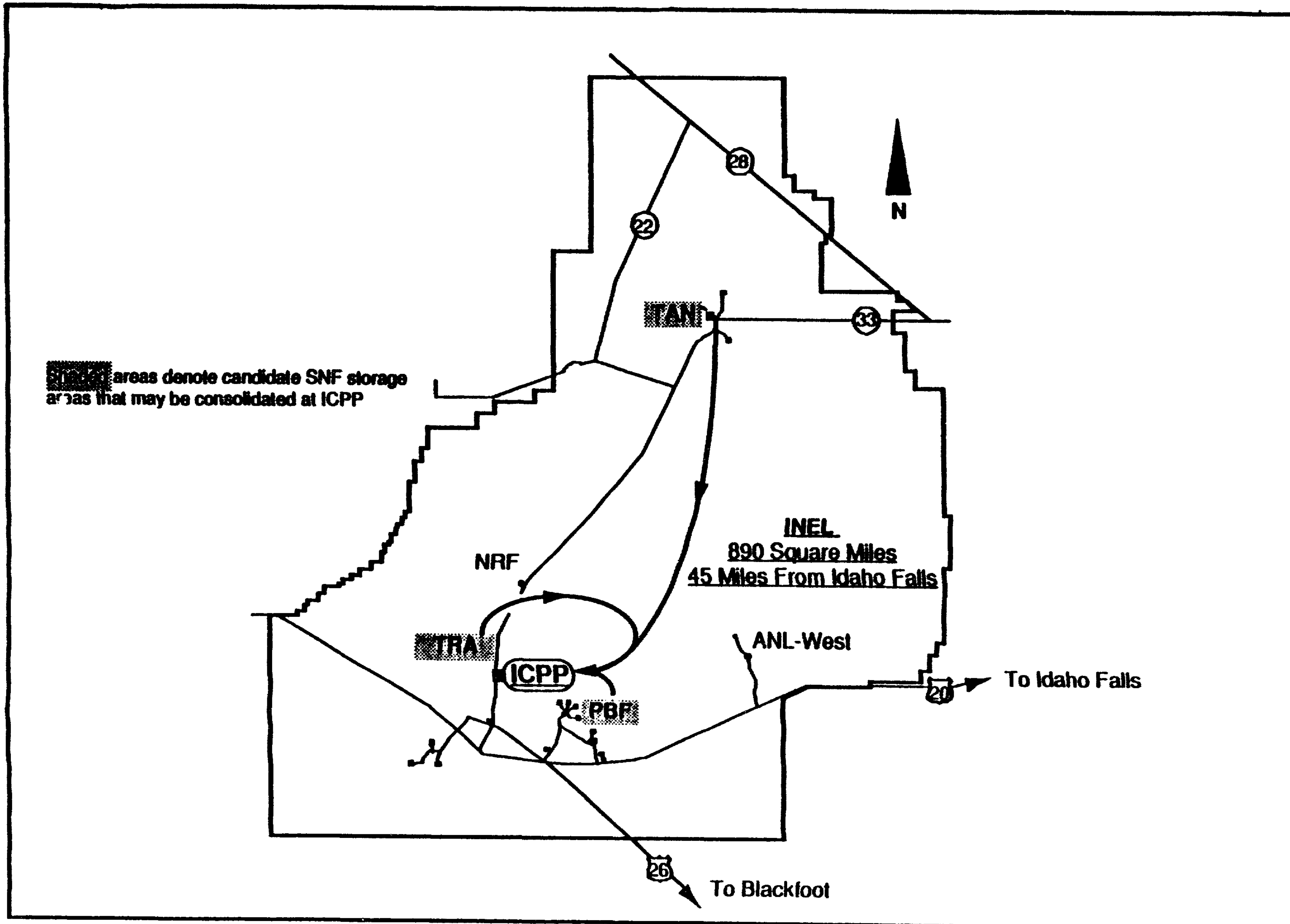

Figure 1: Idaho National Engineering Laboratory Plan View

leak detection and control requirements specified for new pools. The pool is connected by an underwater passageway to the pool vestibule located in the Hot Shop. The wall of the Hot Shop extends down 1.5 m (5 ft) into the pool to shield the pool from radioactive sources in the Hot Shop. Radioactive materials can enter the pool by underwater transfer or by being lifted by crane through double doors on the west side of the facility. A pool transfer truck, measuring 4 m (13 ft) long by 3.4 m (11 ft) wide, is used to transfer radioactive materials between the pool vestibule in the TAN Hot Shop (THS). Materials are loaded on or off the transfer truck using the Hot Shop overhead crane and manipulator or cranes within the pool facility.

Purpose/Operation

At present, the TAN storage pool is loaded to about 80 percent of available capacity with Three Mile Island - 2 (TMI-2) fuel debris, commercial fuel and other materials. A structural analysis for limits on pool floor loading performed at the start of the TMI-2 core debris canister storage activity indicates present floor loading approaches allowable limits.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- TMI-2 Core Debris
- LOFT (Center, Square, Corner & Fines)
- Loose Fuel Rod Storage Basket (LFRSB)
- Dresden
- Peach Bottom
- H. B. Robinson

In the TAN pool there are 342 canisters of TMI core debris; 14 PWR-like LOFT fuel assemblies and fines and test assemblies of partial fuel rods and pieces of commercial BWR and PWR fuel.

Total End of Life Uranium for this facility is 85414.4 Kg (85.4 MTHM)

2.1.2 TAN Dry Storage Test Pad

Description

The TAN dry storage pad was constructed in 1985. The pad dimensions are 12.2 m (40 ft) by 28.7 (94 ft). The current layout is for 8 spent fuel storage casks.

Purpose/Operation

A recent review indicates the layout might be revised to locate a total of approximately 12 casks. Five casks are presently located on the pad. It should be noted that the fuel in these casks cannot be transported to another location, except locally at TAN with the transporter. To transport the fuel requires unloading from the storage cask and placement of the fuel in a transport cask. The continued ability to use the THS is considered important for future RINM consolidation plans.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- VEPCO
- DRCT
- EMAD
- Turkey Point B-17

The fuel is characterized as 38 fuel assemblies and 24 consolidated canisters from Surry and Turkey Point.

Total End of Life Uranium for this facility is 38099.957 Kg. (38.1 MTHM).

2.1.3 MTR - Canal (Materials Test Reactor Canal)

Description

The Test Reactor Area (TRA) has spent fuel stored at three locations. These are TRA-603 Materials Test Reactor (MTR), TRA-660 Advanced Reactivity Measurement Facility (ARMF) and the Coupled Fast Reactivity Measurement Facility (CFRMF), and the TRA-670 Advanced Test Reactor (ATR).

TRA-603 MTR stores spent fuel in a canal located in the basement of the Materials Test Reactor. The canal is 2.4 m (8 ft) wide, 5.5 m (18 ft) deep, and extends in length for 24.7 m (81 ft). The canal is stainless steel lined, is not seismically qualified, and does not have any radiation leakage measurement capabilities. Most of the canal is accessible only to a 2-ton crane for transport.

Purpose/Operation

The MTR canal is an older facility designed to support MTR Operations mission. After completing the MTR mission, the canal was used as an experiment handling/working facility for Power Burst Facility (PBF) support.

The canal was used as a test inspection and assembly area for the PBF Severe Fuel Damage Test Program. The experiments were made of commercial fuel pins, PBF Driver Core Rods and other experimental fuel and were occasionally shrouded in materials now classified as hazardous. The tests damaged the fuel to the extent that the test constituents could only be separated by chemical methods. Products of the damaged-fuel experiments are stored in the canal.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

107 canisters of scrap fuel from PBF tests that include fuel of the following types:

- Severe Fuel Damage
- CANDU
- Halden
- MAPI
- PBF
- Saxton
- Peach Bottom
- HBR
- PCM
- LOFT
- LLR
- Metallurgical Mounts
- LOCA
- NPR compacts
- RIA
- WFRP
- OPTRAN
- Gap Con
- TC
- EI

Total End of Life Uranium for this facility is 256.4 Kg (0.26 MTHM).

The fuel can be characterized as rods or pieces of rods from special test reactor and some commercial fuel used in PBF experiments. Approxima/tely 30 different fuels are stored in the MTR canal.

2.1.4 ARMF/CFRMF Canal (Advanced Reactiv'ty Measureme Measurement Facility Canal)

Description

ARMF and CFRMF are similar critical facilities used for precision measurements of reactor physics parameters. They are designed to have large statistical weights for fuels and poisons, to be mechanically stable enough to provide reproducible reactivity measurements, and to have sensitive instrumentation for measuring very small reactivity effects. The facilities are swimming pool reactors with light water moderated cores made up of plate type fuel elements containing highly enriched U-235.

These reactors, along with the neutron radiography facility, share a single canal inside a high-bay building. The roof i: composed of steel deck, the walls are 8 inch hollow-concrete block and the floor is reinforced concrete. The two small reactors with fueled cores and the neutron radiography facility occupy most of the canal space.

Purpose

The ARMF was used for measuring reactor spectrum and resonance integral cross sections of a wide variety of materials, and also for nondestructive testing of reactor fuel and control rods.

The CFRMF was used to measure fast neutron fission product capture effects and for fast reactor dosimetry development. Associated with the CFRMF is a precision neutron radiography facility and a capsule transfer (pneumatic rabbit) facility for performing neutron activation experiments with short lived isotopes and for assaying for nanogram levels of fissile material using a delayed neutron detection system.

Operation

The ARMF typically operated at a power level of 1.0 kW or less. The CFRMF typically operated at 100 kW. However, no programmatic use is planned for these reactors. In FY-1995, the facility is scheduled for inactivation, which will include removing the highly enriched, aluminum clad, MTR-type reactor fuel. The ARMF core loading contains 28 fuel elements, and the CFRMF contains 32 fuel elements. There are also some miscellaneous fuel bearing experiments and two spare core elements stored in the canal grid and one spare fuel insert in the experiement holder.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- ARMF Fuel

- CFRMF Fuel
- Fuel Element Inserts
- U Metal from CFRMF Core
- Misc. Fuel Capsules

The total End of Life Uranium for this facility is 231.2 Kg (0.23 MTHM)

2.1.5 PBF Canal (Power Burst Facility Canal)

Description

The PER-620 Power Burst Facility is a high-bay, one story building equivalent to two stories in height. The roof is composed of steel deck on steel columns with insulation. The walls are 8-inch hollow-concrete block with a concrete and steel frame. Seismic analysis of the building and canal show that both meet seismic code for Zone 3 events. The canal is connected to the open top reactor vessel through a removable door, which is equipped with an inflatable seal. The canal has a deep section (37 feet) to provide shielding for cask loading and routine operations for the in pile tube, which held test specimen in the PBF core. The canal is 16 feet long, 8 feet wide, and 19 feet deep. The PBF driver core, composed of 2,415 SS clad uranium dioxide and zirconia fuel pins, is stored in two fuel storage racks in the PBF canal. The fuel pins are stored in various-sized canisters. The two storage racks with their associated seismic restraints occupy the entire floor space of the shallow section of the canal. The canal is in compliance with the requirements of DOE Order 5480.6 which refers to DOE Order 5480.5 for a fuel storage facility.

Purpose

The PBF was initially developed to perform tests of reactor fuels in conditions other than normal reactor operations (off-normal events). Since the mid 1980s, several of the facilities at the PBF area have been decontaminated and modified to support waste management activities.

Operation

The facility has been placed in operational shutdown.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- PBF Driver Core

This is composed of 2415 intact rods from the driver core. Total End of Life Uranium for this facility is 561.6 Kg (0.56 MTHM).

2.1.6 ATR Pool (Advanced Test Reactor Pool)

Description

The ATR working and storage canal, transfer canal, and the Advanced Test Reactor Critical (ATRC) Facility canal are all connected with separation bulkheads with inflatable seals. All of these canals will be 100 percent utilized with fuel from ATR and for experiment and shipping-cask handling as long as ATR is in operation, projected through the year 2014. The ATR working and storage canal is 2.4 m (8 feet) wide and 3.7 m (12 feet) long and adjacent to the reactor vessel. The ATRC canal is 3.0 m (10 feet) wide and 9.1 m (30 feet) long. All canals have a 6.1 m (20 feet) working depth, except for a deep section in one end of the ATR working canal that is 5.8 m (19 feet) deeper than the bottom of the working canal.

Purpose/Operation

The ATR creates a reactor environment to study the effects of radiation on materials and fuels. These tests determine how fuels and materials react when bombarded by streams of neutrons and gamma rays in high-pressure and high-temperature conditions.

Inventory

This facility contains the following types of SNF:

- ATR Fuel Elements
- Experiment Trains

The total end of life uranium for this facility is not well defined since it is an operating facility that does not store spent fuel. The amount of uranium not in the active fuel cycle is typically less than 100 Kg.

2.2 ANL-W (ARGONNE NATIONAL LABORATORY - WEST)

The programmatic mission for Argonne National Laboratory - West includes developing advanced reactors, fuel for advanced reactors, characterizing fuel types, and developing/demonstrating technologoes for processing/recycling metallic reactor fuel.

2.2.1 HFEF (Hot Fuel Examinations Facility)

Description

HFEF, which went into operation in 1975, consists of two heavily shielded cells of high-density concrete, 21 workstations equipped with master/slave manipulators, and four-foot thick lead glass windows. The main cell, which has an argon atmosphere, is used for work with such materials as plutonium and sodium that could react chemically in air. The cell is designed for vertical handling, cutup, and examination of experiments up to 30 feet in length. All in-cell equipment has been designed to permit remote operation and maintenance.

A 250 kW TRIGA reactor is located in the basement of HFEF for neutron radiography or tomography of hot or cold materials. Other features of HFEF include a data acquisition system, a microdensitometer, and facilities for decontaminating and repairing hot cell equipment.

Purpose

Examinations conducted in the HFEF provide data that are essential for determining the performance of fuels and materials irradiated in the EBR-II, TREAT, Fast Flux Test Facility (FFTF) at Hanford, Washington, and other DOE reactor facilities.

Operation

Nondestructive in-cell examination capabilities include macro viewing and photography, weighing, precision dimensional surveys, gamma-ray spectroscopy, eddy-current testing, neutron radiography, and fission-gas sampling and assay. Destructive examination capabilities include in-cell equipment for cutting specimens from irradiated hardware or fuel as well as preparation of samples for physical testing, chemical analysis, or microscopic examinations.

Most recently the air-atmosphere decontamination cell has been used to examine and characterize waste destined for the Waste Isolation Pilot Plant (WIPP) in New Mexico. A new waste characterization chamber located above the hot cells will be available for use in 1994.

Inventory

This facility contains the following types of SNF:

- EBR II Fuel
- FFTF

Fuel stored in HFEF can be categorized as:

- 90 EBR II Subassemblies
- 1700 EBR II Elements
- 257 FFTF Elements

Total End of Life Uranium stored in this facility is about 1.0 MTHM.

2.2.2 RSWF (Radioactive Scrap and Waste Facility)

Description

The RSWF consists of a rectangular array of about 1200 vertical, carbon-steel lined pits in the ground. A wide variety of radioactive scrap and waste, packaged with an equally wide variety of packaging schemes, is in storage in about 700 of the pits. Occupied pits are seal-welded closed.

Purpose/Operation

Presently, about 1000 EBR-II fuel elements and 500 blanket elements are in RSWF awaiting reprocessing. Planned fuel storage capacity is about 400 subassembly equivalents. The RSWF has an interim RCRA permit to store mixed hazardous waste and is being upgraded. The facility is being provided with new carbon-steel liners and cathodic protection. Also, the contents of some pits are being repackaged. Active cooling is not required in RSWF.

Inventory

This facility contains the following types of SNF:

- EBR I
- EBR II/LMR

Fuel stored in facility can be categorized as:

- Canisters, Subassemblies, Elements, Rods - Approximately 15,000 Units

Total End of Life Uranium in this facility is 7 MTHM.

2.2.3 TREAT (Transient Reactor Test Facility)

Description

The Transient Reactor Test Facility is a uranium-oxide-fueled, graphite-moderated, air-cooled reactor designed to produce short, controlled bursts of neutrons.

The TREAT reactor contains about 360 zirconium clad fuel elements, each 10.1 cm (4 inches) square and approximately 2.4 m (8 ft) long, made of graphite with enriched uranium oxide particles dispersed through the graphite matrix. The TREAT facility has 446 storage pits (dry) in the floor, each of which can accommodate one fuel element. At present, part of this storage space contains unirradiated fuel which would need to be moved to another location to accommodate a full core load of irradiated fuel. Active cooling is not required. In addition to storage pits dedicated to TREAT fuel elements, the facility has 17, 10-inch diameter and 20, 24-inch diameter floor pits for storing test devices that often contain irradiated fuel.

Purpose/Operations

The TREAT reactor is designed to simulate accident conditions leading to fuel damage, including melting or even vaporization of test specimens, while leaving the reactor itself undamaged.

Inventory

This facility contains the following types of SNF:

- TREAT Fuel Assembly

390 Fuel assemblies are stored at this facility.

Total End of Life Uranium stored in this facility is .014 MTHM.

2.2.4 EBR - II (Experimental Breeder Reactor-II)

Description

The EBR-II plant consists of a sodium-cooled reactor with a thermal power rating of 62.5 megawatts (MW), an intermediate closed loop of secondary sodium, and a steam plant that produces 19 MW of electrical power through a conventional turbine generator. The EBR-II core can accommodate as many as 65 experimental subassemblies for irradiation and operational reliability tests, fueled with a variety of metallic and ceramic fuels--the oxides, carbides, or nitrides of uranium and plutonium, and metallic fuel alloys such as uranium-plutonium-zirconium fuel for the IFR. Other subassembly positions may contain structural-material experiments.

Purpose

The original emphasis in the design and operation of EBR-II was to demonstrate a complete breeder-reactor power plant with on-site reprocessing of metallic fuel. The demonstration was successfully carried out from 1964 to 1969. The emphasis was then shifted to testing fuels and materials for future, larger, liquid metal reactors in the radiation environment of the EBR-II reactor core. It is now operating as the IFR prototype.

Operations

Typical EBR-II fuel subassemblies contain about 4.5 kg of total heavy metal in 61 elements. Normally about 100 fueled subassemblies are in the reactor. Reference alloy compositions are uranium-10 wt.% zirconium, uranium-20 wt.% plutonium-10 wt% zirconium, or uranium-5 wt% fissium. Present operating plans are to discharge about 60 subassemblies per year, with reactor operations continuing through the year 2005. EBR-II also has about 330 depleted-uranium blanket subassemblies that are discharged as they reach their fluence-determined end of life. In addition, many experimental fuels have been and are being irradiated in EBR-II as part of a wide variety of programs, including programs outside ANL. When experiments are completed, these fuels are discharged, normally for subsequent examinations.

Ongoing EBR-II tests of metallic IFR fuels are part of the IFR program that involves a demonstration of advanced spent fuel processing.

Inventory

This facility contains 85 full/ 36 half EBR II/LMR subassemblies.

Total End of Life Uranium stored in this facility is 17.5 MTHM.

2.2.5 ZPPR Storage (Zero Power Physics Reactor Storage)

The ZPPR reactor is a split-table critical assembly that has been placed in non-operational standby status. The facility has a substantial inventory of fuel in an adjacent storage vault. The ZPPR fuel is clad in stainless steel. The fuel has essentially no-fission-product content. Most of the fuel is a plutonium-depleted uranium-molybdenum alloy. In addition, some fuel contains enriched-uranium metal and some contains a combination of uranium oxide and mixed uranium-plutonium oxide. The metal fuel is in the form of small plates, and oxide fuel is in the form of small rods. Fuel is stored in canisters, and the canisters are placed in openings in concrete blocks. The present storage vault is able to accommodate all the ZPPR fuel. Active cooling is not required.

Purpose

The Zero Power Physics Reactor provides reactor physics and safety data for any type of fast neutron spectrum reactor, from small space-power reactors to large breeder reactors. Each nuclear reactor to be studied is constructed in ZPPR in a large lattice framework that is split at the center. The reactors are built full-size, with the proper reactor fuels and other materials, so that extrapolation from the zero-power measurements to full-power conditions is readily achievable.

Operations

The facility has been placed in non-operational standby status.

Inventory

This facility contains classified Plutonium and Uranium Fuel units.

Fuel stored in this facility can be categorized as:

- 21,200 Pu Plates (Approx.)
- 20,500 Pu Rods (Approx.)
- 7,700 U Plates (Approx.)
- 16,200 U Rods (Approx.)

Total End of Life Uranium for this facility is approximately 5 MTHM.

2.3 WINCO (WESTINGHOUSE IDAHO NUCLEAR COMPANY)

The Idaho Chemical Processing Plant (ICPP) facilities, operated by WINCO, contain five facilities for SNF. ICPP has identified 93 different spent fuel types at the INEL and have grouped them unto 19 potential waste forms. These forms along with their present locations are given in Table B-3 in Appendix B.

2.3.1 CPP-603 FSF (Underwater Fuel Storage Facility)

Description

The CPP-603 underwater storage facility consists of three storage basins and the associated water treatment system and fuel handling equipment. The CPP-603 Basins consist of three unlined concrete pools (north, middle, and south) filled with water to a depth of approximately 20 feet, which provides shielding against radiation sources in the pools. The north and middle basins have concrete dividers to isolate fuel in adjacent rows and a manually operated monorail system to support and transport fuel handling units underwater from cask unloading stations to storage locations and elsewhere. They are 40 by 60 feet and 21 feet deep, and are covered with fiberglass floor grating. Aluminum-clad lead plate is installed over the grating for radiation shielding. The two basins are divided into channels by concrete beam spacers supported on piers. The spacers are 2 feet high and 1 foot wide on 2-foot centers. Fuel is suspended from the monorails in these channels.

Engineered safety features are installed in the monorail system to prevent accidental criticality. Engineered safety features include bumpers on the crossbars of the fuel yokes (hangers) to maintain a sufficient distance between adjacent fuels to prevent criticality. There is another set of bumpers above water. Although improbable, it is possible for fuel handling units to come in contact when underwater components are broken, bent, or severely corroded because of the long pendulum swing of the hanger arm.

The south basin is an open pool, 45 by 88 feet by 21 feet deep. This basin uses aluminium and stainless steel compartmental racks resting on the basin floor to hold the fuel. These racks store the fuel elements in a critically favorable array by providing adequate spacing and isolation between the fuel elements. Each aluminium rack which contains aluminum clad fuel has 92 storage positions that are made of six-inch schedule 40 aluminum pipe. Heavy aluminum structural members fix the array of storage positions vertically. Center to center spacing between positions is greater than eight inches. The sides of each rack are covered with aluminum mesh tack welded to the structural members.

The stainless steel racks containing stainless steel and zirconium clad fuel has 15 storage positions made of 7.75 inch square tubes. The edge to edge spacing between positions is greater than eight inches. Each tube has a lid. The sides of each rack are covered with stainless steel screen welded to the structural members.

The facility is unlined and does not have a leak detection system or HVAC system for radionuclide confinement.

Purpose

The CPP-603 Underwater Fuel Storage facility was initially built in 1951 and later added to in 1959 for interim storage of spent nuclear fuel.

Operations

Fuel movements at CPP-603, with the exception of movements required to recover from recent USQs, have been suspended since 1992 pending a Type 2 restart authorization. Fuel movements were suspended because of corrosion and inventory management problems. Prior to these recent occurrences, operations in CPP-603 had been minimal since 1986 because another fuel storage area (CPP-666) began operation in 1984. Presently, FSF is loaded to about 52% of capacity.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

South Basin

- GETR filters
- HFBR
- MURR
- ORR
- Pulstar Buffalo
- SNAP
- TRIGA (FLIP)
- Tory-IIA
- AI
- ATR
- EBR-II
- Naval

Middle Basin

- Pathfinder
- SNAP
- SM-1A
- SPEC (Orme)
- SPSS
- TRIGA (A1)
- TRIGA (SS)
- VBWR
- APPR (AGE-2)
- BMI
- BORAX V
- Naval

North Basin

- GCRE
- Naval

Total End of Life Uranium for this facility is 1959.76 Kg (1.96 MTHM) which does not include naval fuel.

The inventory of fuel stored in the CPP-603 Basins can be categorized as:

- 41 different types
- Cladding Zr, SST, Al, canned and uncanned scrap
- Received as early as 1959
- Fuel is hydride, metal, oxide and alloy type
- Several different fuel matrices
- 6.8 E7 total curies
- 3.6 E3 Kg total uranium

2.3.2 CPP-666 FSA (Underwater Fuel Storage Area)

Description

The CPP-666 FSA is a modern underwater fuel storage facility. Built and brought on line in 1984, it has: (a) Stainless Steel (SS)-lined fuel storage basins with leak detection sumps; (b) a HVAC system; (c) basin water treatment systems with filtration, cation and anion exchange, chillers and ultraviolet light systems; and (d) adequate seismic capability. The FSA has six 31 ft x 46.5 ft pools, two unloading pools, two isolation pools, a 10 ft wide transfer channel and an enclosed 16 ft x 43 ft fuel cutting pool. All pools are 31 ft deep except for two storage pools (41 ft deep) and the two unloading pools (36 ft and 46 ft deep). The pools contain free-standing spent fuel storage racks, which provide critically safe spacing (at least 8-in between all adjacent positions). The cutting pool is currently empty. The 2556 fuel storage positions are currently 46% full.

The Spent fuels stored here are from the naval reactors, Advanced Test Reactor, High Flux Beam Reactor, EBR-II, and Fermi Driver spent fuels.

The adjacent Flourinel Dissolution Process (FDP) hot cell is fitted with stainless steel liner, overhead remote crane and remote manipulator, several shielding windows, and associated master/slave manipulators. The cell is 20 ft wide x 50 ft deep x 100 ft long and has direct access to the FSA. The FDP is considered a candidate for a spent fuel canning and characterization mission.

Operations

The FSA currently receives spent fuel by truck. Provisions for rail receipts were designed into the FSA, and the 130-ton overhead crane can handle rail car-sized shipping containers. However, the rail spur needs to be constructed before rail shipments can be made. Two 10-ton cranes are used for spent fuel and rack movements.

Naval and other SNF fuel receipt projections have identified the need for significantly more storage capability through FY 2042. Projects are now underway to rerack three of the storage pools before the first pinch point in FY 1996 using taller racks with increased fuel density. Additional storage may be needed before a second pinch point in FY 2002.

Also, studies are currently underway to evaluate FDP hot cell conversion into a canning facility with both underwater and dry transfer capabilities.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- ATR
- ARMF
- HFBR
- Fermi Core I & II
- Univ. of Washington
- MURR
- Shippingport PWR-C2-S1
- Shippingport PWR-C2-S2
- Navy
- Shippingport PWR-C1-S4
- EBR-II

Total End of Life Uranium for non-naval fuels stored in this facility is 5618.37 Kg (5.62 MTHM).

Fuel stored in CPP-666 Basins can be categorized as:

- 16 different type
- Cladding Zr, SST, Al
- Several different fuel matrices

2.3.3 CPP-603 IFSF (Irradiated Fuel Storage Facility)

Description

The IFSF is a remotely-operated dry storage facility that was built in 1974. It was designed to: (1) meet interim fuel storage requirements prior to reprocessing or final disposal, (2) provide dry safe storage for fuels, and (3) maximize use of existing equipment and facilities. To meet the last design requirement, the IFSF was built as an extension to the CPP-603 Underwater Fuel Storage Facility. The IFSF is a canyon-type dry storage facility. This dry storage facility is designed to provide safe storage for spent fuel from two commercial high-temperature gas-cooled reactors (HTGRs) and from the ROVER Nuclear Rocket Program.

The spent fuel is stored in 636 steel canisters, which are approximately 18 in. in diameter and 11 ft long. The canisters are constructed of 1/4-in.-thick carbon steel. The canisters are stored in an enclosed storage rack in a staggered arrangement, on a 2-ft center-to-center spacing. The decay heat is removed by a forced-flow single-pass air system that is capable of supplying a cooling airflow ranging from 0 to 17,000 cfm. The inlet air passes through roughing filters to remove dust and foreign materials before entering the storage area. The exit air passes through prefilters and HEPA filters to remove any particulate matter, and is monitored to detect radioactivity before being discharged through the facility stack.

Operations

To facilitate the required fuel handling and storage tasks, the storage facility is divided into several functional areas, including a cask receiving area, a cask transfer pit, a fuel-handling cave, a crane maintenance area, a control room, and a fuel storage area. Special equipment in this facility for performing specific fuel-handling operations includes a cask transfer car, a 15-ton crane, a manipulator, and a fuel transfer cart.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- FSVR
- TRIGA Ber II
- Peach Bottom Core 2
- Tory-IIC
- PARKA

Total End of Life Uranium for this facility is 502.1 Kg (.50 MTHM)

The fuel stored in the CPP-603 IFSF can be categorized as:

- 5 different fuel types
- Cladding SST and graphite
- Fuel is carbide, hydride and oxide
- Fuel received as early as 1974

2.3.4 CPP-603 FECF (Fuel Element Cutting Facility)

Description

The FECF is contiguous with the south basin of CPP-603. The FECF is a shielded hot cell with an L-shaped cavity measuring 19 ft long by 6 ft wide at the narrow end and 9 ft wide at the wide end and 14.5 ft high.

Purpose/Operation

The purpose of the FECF was to prepare stored fuel for subsequent processing. The facility has not been used since the mid 1960's, except for temporary storage of miscellaneous fuels.

Inventory

Two Peach Bottom Fuel Elements

2.3.5 CPP-749 UGSF (Underground Dry Vault Storage Facility)

Description

The CPP-749 UGSF consists of 218 underground dry vaults that were built in seven separate projects between 1971 and 1987.

One hundred and ninety-seven vaults are approximately 30 in. in diameter x 20 ft deep.

The CPP-749 facility, consists of 47 Peach Bottom; 14 Fermi; and 157 newer-type, second-generation 136 30-in and 21 12-in storage vaults for irradiated fuel storage.

Purpose

Irradiated Peach Bottom I Core 1 fuel has been stored in the facility since September 1971; irradiated Fermi I Blanket subassemblies have been stored since January 1975. All Peach Bottom and Fermi storage vaults are now filled, except one spare vault. Any further fuel handling in these vaults will be only for inspection or moving these fuels to other locations. The safety analyses for Peach Bottom and Fermi fuels and for LWBR storage in newer-type storage vaults envelope the storage of Peach Bottom and Fermi fuels in the newer-type vaults. Periodic radiation monitoring and sampling of the air atmosphere within the vaults are performed to detect any changes that may alter the fuel containment.

Operations

Sixty-one first-generation, dry vaults were built using carbon steel casing and a grout-bottom plug. Over the years, moisture has seeped through the grout (via evaporation resulting from the spent-fuel-decay heat and consequent condensation on the metal cover plate) and possible "wicking" through the grout and has caused significant corrosion on the Peach Bottom fuel aluminum canisters. Current plans are to recan the Peach Bottom fuel in the IFSF handling cell, as needed, and move the fuel to the existing second-generation empty dry vaults. The Fermi fuel would be moved also, although no corrosion to the stainless steel storage canisters is suspected. The Peach Bottom and Fermi dry vaults will then be renovated.

The last five dry vault projects employed an improved second-generation design which provided an all-metal storage vault encased in grout. The design also provided capabilities for purging and sampling the dry vault interior. There are 136 30-inch and 21 12-inch second-generation vaults.

Inventory

This facility contains the following types of Spent Nuclear Fuel:

- Fermi I Blanket
- Shippingport LWBR
- Peach Bottom Core 1

Total End of Life Uranium for this facility is 34938.84 Kg (34.94 MTHM)

The fuel stored in CPP-749 Dry Storage can be categorized as:

- 3 different types
- Cladding Zr, SST, and graphite
- Fuel is oxide and carbide
- Received as early as 1971

3.0 REVIEWS OF SITE TEAM REPORTS AND SUMMARY OF WALKDOWNS

The WGAT met with those who prepared the Site Team draft reports on Monday October 18, 1993. Two reports were prepared by the Site Teams. One report was prepared collectively by WINCO, EG&G, and B&W, "INEL SPENT NUCLEAR FUEL INVENTORY AND VULNERABILITY SITE ASSESSMENT REPORT". It covered the WINCO and EG&G facilities and the other, prepared by Argonne-West, "SITE TEAM REPORT, Spent Fuel Vulnerability Assessment," covered the Argonne-West facilities. The two reports described the spent fuel facilities and fuel inventories and addressed the eight questions posed by DOE-EH. On Tuesday and Wednesday, October 19 and 20, 1993, the WGAT broke out into subteams and performed walkdowns of the various spent fuel storage facilities. The combination of the Site Team Reports and walkdowns allowed the WGAT to become sufficiently knowledgeable of the facilities and the issues associated with the spent fuel storage to proceed with the vulnerability assessments. During debriefing meets, subsequent to the Tuesday and Wednesday walkdowns, the WGAT requested some additions, clarifications, and format changes to the two Site Team Reports. Below is a summary of the WGAT review of the Site Team Reports and associated walkdowns for each facility.

3.1 EG&G

The Site Team Report, Rev. 2, identified six facilities where RINM is present. These facilities were described in section 2.1 of the previous chapter. The Site Team Report identified the following generic vulnerabilities. The report largely states that:

- Wet storage facilities are not designed or documented for long term (40 year) storage of SNF. These facilities have not been fully assessed for long term storage because that was not part of the intended mission for those facilities.
- There is little programmatic ownership or funding for facilities upgrades, documentation, and analyses for long-term SNF storage. Configuration control for these facilities (safety documentation, drawings, etc.) is an issue.

Based on formal presentations by and interviews with EG&G site personnel, the WGAT is inclined to agree with these generic Site Team Report findings. However, in the case of the second generic vulnerability does not always translate into an ES&H vulnerability for all EG&G storage facilities.

3.1.1 TAN Pool

In the Site Team Report, the following deficiencies at the TAN Pool are discussed:

- Seismic qualification,
- Leak detection capability,
- Lack of pool liner, and
- Positive pressure ventilation.

The WGAT largely concurs with this assessment. The vestibule pool is the weakest part of the TAN Pool design. An earthquake of approximately 0.19 g ZPA could lead to concrete wall cracking in the region of overstressed areas. Complete draining of the pool water could lead to the direct radiation exposure to workers and contamination of soil.

However, the TAN Pool did survive the two major earthquakes that dominated the historical seismicity of the region, viz., the August 18, 1959 M_s 7.5 Hebgen Lake and October 28, 1983 M_s 7.3 Borah Peak earthquakes. Note the 1959 earthquake had a reported maximum Modified Mercalli (MM) intensity of X and the 1983 Borah Peak earthquake had a maximum intensity of MM IX. The sloshing wave motion was observed to exceed the height of the freeboard of the pool; but, no cracks on the pool wall were observed. The overhead crane resisted the earthquake loads. Thus, falling of the overhead crane is not expected to occur. Tipping of the storage racks was also analyzed. The results showed that no tipping should occur at 0.19 g earthquakes.

It was not possible for the team to verify the inventory presented in the Site Team Report since the majority of the RINM is containerized. However, the condition of the pool, as well as the facility in general, was considered good.

Water quality at the TAN Pool is monitored on a monthly basis. Specifically, pH, conductivity, chlorides, flourides, suspended solids are monitored and controlled. The pool is vacuumed, and filtration and ion exchange are employed to maintain water quality.

There are no significant open ES&H items for the TAN facility (pool) and the conduct of operations was judged to be good.

The facility is committed to preparing an SAR consistent with the recently issued DOE SAR Order. However, given the known deficiencies of the facility, this SAR is unlikely to provide an authorization basis for the long-term storage of RINM.

In addition to the vulnerabilities identified in the Site Report, the WGAT found several additional ES&H concerns. These are documented in VDFs and can be found in Appendix A. The four vulnerabilities are:

- Corrosion monitoring
- Pool water level trending
- Seismic
- Long-term mission

EG&G has not installed corrosion coupons (including dissimilar metal couples and welds) in the storage pools at TAN. This storage area was originally designed as short-term or interim storage. In some instances, fuel has been in storage for many years. This is no longer short-term storage. Since fuel reprocessing is currently not a viable option, the necessity of long-term storage becomes increasingly imperative. This coupled with the difficulties encountered in the CPP facilities (wet storage) indicates that the fuel currently stored at TAN may continue to be in storage for extended time periods.

Visual inspection of the affected basins show visible corrosion of aluminum alloys in contact with stainless steel. Although the contractor checks water chemistry and performs limited inspections of the racks, these inspections do not give adequate representation of the various corrosion processes which may be occurring. These observations coupled with the fact that most of these facilities do not have leak detection equipment indicate a distinct vulnerability especially when highlighted by the "lessons learned" at CPP-603.

Since the TAN Pool is unlined and has no leak detection, the trending of the pool make up water additions could serve as an indicator to detect leakage from the TAN Pool. (The Site Team Report stated that a recent study of evaporation accounts for water loss in the TAN Pool. Hence, a baseline for trending has already been established.)

The last vulnerability identified ownership of the TAN Pool in the long term. A five year program to remove and to transfer all of the pool inventory is expected to commence in FY-94.

3.1.2 TAN Dry Storage Test Pad

The Site Team Report identified no facility specific vulnerabilities for the TAN dry storage facility.

Observations made by the WGAT during their walkdown largely parallels the Site Team conclusions. The WGAT observed nothing that elicited concern. There was no visible indication corrosion problems with the casks nor any cracking of the concrete pad. The TAN dry storage pad meets the current seismic standards, and hence no seismic problems are anticipated.

From the information provided, the WGAT concluded that the Site Team Report provided adequate response to the question set.

3.1.3 MTR Canal

The Site Team Report identified some general and specific ES&H vulnerability concerns associated with the Material Test Reactor (MTR) Canal. The following two items in the report were noted.

- The MTR Canal storage facilities were not designed for long-term storage of SNF. Design deficiencies exist with regard to leak detection, monitoring, seismic design, canal cleanup, etc., increasing the risk of an event.

- There is no programmatic ownership for the MTR Canal facility. The facility cannot adequately perform upgrades, documentation, configuration control, and analyses for long-term storage. Funding to clean up the material left after closure of the experimental program is limited.

The WGAT considers the MTR facility reports to provide a factual description of the conditions of the facility, the status of materials and inventories, and a valid assessment of the vulnerabilities. The WGAT walked down the MTR Canal area examining the facility and interviewing management and maintenance personnel. The canal was visually examined for its condition and its content.

Most of the fuel elements are encapsulated in stainless steel or aluminum tubes and are placed in an aluminum canister. Minor corrosion was visually noted on the top of the fuel element canisters. These canisters are randomly inspected on a semi-annual basis, verifying their location and condition.

The water seemed to be in relatively good condition with a fine sediment lying on the bottom of the canal. It is unknown if the sediment contains any radionuclide material. Various hardware pieces and other items such as buckets with loose heavy weights were also in the MTR canal, indicative of limited preventive maintenance.

Periodic maintenances were routinely done on the electronic equipment which monitors the criticality. However, personnel have indicated that the monitors themselves are inoperative.

PBF fuels are stored in the MTR canal. The MTR canal, designed for a ZPA of 0.10 g, survived the 1959 and 1983 earthquakes. There is a bridge over the canal supported by four rubber wheels and has no running rails. The possibility of the bridge falling into the canal does exist. However, the weight of the bridge is so light that no severe damage on the canal contents is expected. The fuels are free standing. Analysis showed that tipping will not occur at 0.10 g earthquake excitations. The fuels stored in the canal have very low radiation dose rate. Thus, the activity is very low. Failure of canal wall due to beyond design basis earthquakes will potentially affect the environment.

3.1.4 ARMF/CFRMF Canal

The Site Team Report identified specific ES&H vulnerability concerns associated with the Advanced Reactivity Measurement Facility (ARMF) and Coupled FAST Reactivity Measurement Facility (CFRMF):

- There is no programmatic ownership for the ARMF/CFRMF facility . The facility cannot adequately perform surveillance and maintenance and lacks qualified operating staff personnel. The facility is not designed for long-term fuel storage, deficiencies exist with regard to leak detection, water cleanup, chemistry control, etc.

Based on its review, the WGAT considers the site team facility report a factual description of facility conditions, status of materials, inventories and vulnerabilities. The WGAT walked down the ARMF/CFRMF area examining the facility and interviewing management and maintenance personnel. The pool and the reactor cores were visually examined for their condition and content. For both reactors the fuel elements are stored in the core with the control and scram rods inserted. A fuel rack containing two fuel elements in storage was identified and visually inspected.

The facility is scheduled for inactivation, which will include removing the highly enriched, aluminum clad fuel. The water in the pool was relatively clear with some visible algae growth. The fuel elements were not fully visible, but seemed to be in good condition without any visible corrosion effects. The radionuclide content of the pool is insignificant since the facilities were operated at low power level and the fuel does not contain appreciable fission products.

The canal chemistry is periodically monitored and corrected as necessary. Minimal preventive maintenance is performed on equipment required to maintain the present status of the facility. The ARMF/CFRMF canal has no qualified operational personnel to operate the facility or to handle fuel or storage grid movements.

The canal was designed for a ZPA of 0.22 g.

3.1.5 PBF Canal

The site report has identified a generic vulnerability concern associated with the Power Burst Facility (PBF):

- The facility is not designed for and cannot perform upgrades and prepare documentation related for long-term SNF storage.

Based on its review, the WGAT considers the PBF facility report to provide a factual description of facility conditions, status of materials, and inventories. The WGAT walked down the PBF examining the facility and interviewing management and maintenance personnel. The reactor pool was not accessible for visual examination.

The PBF fuel is clad in stainless steel. The water chemistry is maintained in accordance with

PBF Technical Specifications. Sampling is performed on a weekly basis and the present radioactivity content is very low, 1.E-06 micro Ci/ml.

The pool liner is constructed of stainless steel welded to carbon steel. This combination in a wet environment can lead to galvanic coupling.

The PBF canal was designed for a ZPA of 0.22 g. The bottom of the canal has two elevations. The fuels stored in the canal are free standing. They have seismic restraints at the top. No known failure of fuel cladding has been observed. At the present time, no mission was assigned. Removing of fuels out of the canal is being planned.

The WGAT agrees with the site report that the lack of clear programmatic ownership is a concern, but it is not as yet an ES&H vulnerability.

3.1.6 ATR Canal

The site team report identified no ES&H vulnerabilities associated with the Advanced Test Reactor (ATR) canal.

The WGAT walked down the ATR canal examining the facility, interviewing both management and operating personnel. The pool is divided into a loading and storage bay separated by a bulkhead. This arrangement was designed to prevent the total loss of the canal water in the fuel storage part of the canal if dropping of a fuel cask caused the canal wall to fracture. Used ATR fuels are stored in the pool temporarily for a cooldown period of 170 days, and subsequently transfered for storage to the CPP facility. The ATR pool is not utilized for long-term fuel storage. The WGAT concluded that there is no major vulnerability for the ATR pool.

ATR was designed for a ZPA of 0.24 g. The ATR canal is steel lined. Failure of the canal wall due to earthquakes is not expected. The overhead crane is strong enough to resist earthquake accelerations. Falling of the overhead crane can be ruled out. The SAR did consider the dropping of a cask during loading and unloading of casks.

3.2 ANL-W

3.2.1 HFEF

The site team report identified no ES&H vulnerabilities associated with the HFEF. At the in-briefing, ANL-W personnel mentioned as a concern the lack of a DOE-approved Safety Analysis Report (SAR) for the HFEF and their plans to update the existing Facility Safety Report (FSR).

The WGAT walked down the HFEF and interviewed maintenance, operations, and management personnel. The hot cell windows and in-cell storage locations and processing stations were examined. Fuel mockups were described by facility personnel so that team members could better understand the Experimental Breeder Reactor-II (EBR-II) fuel form present at the HFEF. Though the HFEF has handled fuel from other facilities in the past, the current inventory consists exclusively of EBR-II fuel elements in process and Fast Flux Test Facility (FFTF) fuel elements in storage.

Discussions with facility management disclosed that the facility authorization basis is documented in a 1975 Facility Safety Report and in Operational Safety Requirements (OSRs) approved by DOE in 1985. The FSR was submitted to DOE for comment and was considered approved when DOE had none. Though this was the accepted practice at the time, the team and facility management feel strongly that the FSR should be updated to meet current DOE SAR requirements and include proper levels of review and approval.

The EBR-II fuel is not by definition, "spent", but fuel in process awaiting the completion of the Fuel Cycle Facility (FCF) where the EBR-II fuel will be reconstituted for use in the EBR-II. The HFEF was noted to be well maintained and in excellent condition for the age and use of the facility. "Housekeeping" was judged to be excellent.

The team noted that the hot cell structure was constructed of reinforced concrete and would demonstrate significant seismic resistance. The surrounding building walls were constructed of concrete blocks which may be damaged during a seismic event, though this does not pose a vulnerability to the fuel stored in the cells. The facility is in the process of developing a plan to add seismic restraints to critical components.

3.2.2 RSWF

The site team report identified no ES&H vulnerabilities associated with the RSWF. Though total quantities and general descriptions of the spent fuel stored were provided, the site team report did not provide enough detail in describing the exact nature of the fuel stored at the RSWF. At the in-briefing and the presentation of the site report, ANL-W personnel identified the potential for releases from old, corroded liners.

The WGAT walked down the RSWF site with the facility manager, representatives from ANL-

W, and a subcontracting electrical engineering firm representative responsible for the installation of the cathodic protection system. The WGAT observed the following:

- The general RSWF site with associated rows of carbon steel containment liners.
- An open trench with the cathodic protection system installed, and exposed (pending trench closure).
- New empty liners that were opened and inspected.
- Old, removed. and heavily corroded carbon steel liners stored pending disposition.

The team took note of the extensive effort at replacement and upgrade of the old liners in progress and noted that this facility possessed no seismic vulnerability. According to site personnel, all old liners (pre-1978) contain single-walled carbon steel canisters and the newer liners contain double-walled (with stainless steel outer shell and carbon steel inner shell) canisters. While walking down the facility, the WGAT identified an environmental vulnerability associated with the storage of on-site stainless steel clad fuels in carbon steel liners where moisture has been found in 2 out of 500 liners removed. Heavily corroded, breached, and even failed carbon steel liners have been removed from the RSWF. One-third of these liners (about 218) still remain in the ground. No inspection process exists for the materials contained inside the liners and there is no method to detect environmental releases. The older liners are highly susceptible to galvanic corrosion and potential environmental release. The goal is to install new cathodically protected liners such that the old liners are contained.

3.2.3 TREAT

The site team report identified no significant ES&H vulnerabilities associated with the TREAT facility.

The WGAT walked down the TREAT reactor facility with the site manager and a representative from ANL-W. The reactor building structure, the test loop area, the reactor itself, the control room, and the dry storage in-floor pits were examined. The facility was originally built 30 years ago and thus does not meet current structural requirements with respect to seismic events. The reactor structure, and the sub-floor fuel storage pits constructed of massive reinforced concrete represent a structure with significant seismic resistance and thus there is no vulnerability of the fuel due to seismic events. The TREAT facility has been recently upgraded and the facility was observed to be well maintained and in excellent condition.

TREAT stores a very limited amount of spent fuel from other sources in the floor pits. TREAT is a pulsed reactor and thus its fuel has a very low burnup and a correspondingly low fission product inventory. TREAT fuel not in the reactor is not "spent" but is stored in shielded floor pits awaiting future use in varying configurations in the reactor. TREAT fuel has been in use for over 30 years and current measurements indicate that approximately 1/15 of the fuels usable life has been consumed. TREAT will not produce "spent" fuel until it is shut down.

3.2.4 EBR-II

The site team report identified no ES&H vulnerabilities associated with the EBR-II complex and additionally noted that all EBR-II fuel is not spent, but fuel in process awaiting the completion of the Fuel Cycle Facility (FCF) in which the fuel will be reconstituted for reuse in the EBR-II reactor.

The WGAT walked down parts of the EBR-II complex with a representative from ANL-W. The reactor was undergoing a routine refueling so the reactor floor was inaccessible. The reactor building was built with reinforced concrete and would resist seismic forces, thus no vulnerabilities of the fuel from seismic events was identified. The WGAT walked through the turbine building and the heat exchanger building and noted that the facility appeared to be in excellent condition especially considering its 28 years of operation.

Though the current EBR-II fuel will be reused in the facility, the team noted that, should the reactor be shut down, there is inadequate space onsite for the storage of the entire EBR-II core.

3.2.5 ZPPR - Storage

The site team report identified no vulnerabilities associated with the ZPPR facility, but the report and discussions at the in-briefing did identify problems with uranium fuel corroding and causing delamination of the cladding.

The WGAT walked through the ZPPR operating room and fuel storage vault. The building is essentially a heavily reinforced concrete bunker and would exhibit exceptional resistance to seismic forces. No vulnerabilities to the fuel from seismic events was identified. An empty fuel storage "canister" was examined and fuel plates were also observed at the fuel handling station. The fuel "canisters" are stored in the fuel vault in large concrete cabinets with locked steel doors. The ZPPR fuel is unique in that there is almost no fuel burnup and thus a minute fission product inventory. The fuel is loaded into the test containers by hand. The radiological hazard associated with this fuel is thus minimal. The fuel does have the potential to pose a hazard as a heavy metal. Approximately 25% of the Uranium fuel is suffering from cladding corrosion and delamination due to poor design of the cladding. Because of the extensive security measures and administrative controls associated with the handling of ZPPR fuel, a criticality accident is not credible.

3.3 WINCO

The WGAT walked down the following WINCO-operated facilities:

(1) CPP-603 Underwater Fuel Storage Facility (FSF)
(2) CPP-666 Underwater Fuel Storage Area (FSA)
(3) CPP-603 Irradiated Fuel Storage Facility (IFSF)
(4) CPP-603 Fuel Element Cutting Facility (FECF)
(5) CPP-749 Underground Dry Vault Storage Facility (UGSF).

The team members met with facility managers and other cognizant staff to address the findings of the site team report.

Overall, the maintenance of these facilities exhibits an improving trend. A maintenance improvement plan is being used to manage the programmatic deficiencies identified by both external and internal assessments. The individuals interviewed were knowledgeable of the equipment. Although there is currently a four month backlog in maintenance work orders, a newly implemented maintenance "Core Team" concept has been initiated using a multi-discipline approach to planning and scheduling the work. Using this team approach, representatives from each of the work groups involved with maintenance meet daily to ensure that there is adequate planning, that preventative maintenance is being performed, that priorities are assigned to work order packages and that work is being completed.

The housekeeping in each of the facilities was generally good. Floors were clean, and there were few examples of excess materials being left in the area. Some minor safety violations were noted during the walkdown. A second trip to the facility on a subsequent day showed that the items found on the previous trip had been corrected. Operators were familiar with the testing and operation requirements of the cranes. All individuals interviewed were open and responsive to questions.

The following sections describe the specific findings of the WGAT, based upon their reviews of the site reports and observations/information obtained during the walkdowns.

3.3.1 CPP-603 FSF

The CPP-603 staff have identified three vulnerabilities. These vulnerabilities were a consequence of: material corrosion, failure to implement administrative safety controls, and inadequacy in seismic design.

WINCO personnel have stated that carbon steel hangers are at the end of their service life and should be replaced. A vulnerability noted here is that 36 carbon steel fuel storage units (FSUs) have not been rigged (rigging added to original design to prevent dropping of the fuel). In addition, various parts of lower bumpers of FSUs are corroded off and other parts of the buckets, hooks, and hanger assemblies are severely corroded. At least two hanger assemblies have broken due to corrosion.

WINCO has established a corrosion inspection/monitoring program for these FSUs. The program relies on visual and video inspections and the use of submerged corrosion coupons to evaluate the ongoing corrosion processes. A second vulnerability associated with the pool is the active corrosion of aluminum clad fuel and fuel stored in aluminium canisters (cans) currently in underwater storage.

WINCO has been performing a three phase scoping study on the seismic adequacy of the facility. Phase I study which includes the superstructure of the north and middle basins, has been completed. The dynamic analysis of the finite element model using the soil-structure interaction indicated overstress conditions at several locations of the superstructure. Although the model includes the total mass of the pool water, it does not consider the sloshing effect. Since the pools do not have any steel liners, there exist a potential for cracking the concrete at the wall and floor joints or collapsing the walls due to water sloshing and movements of lead covers over the north and middle basins during a seismic event. The south basin superstructure, the pools, the cranes, the ion exchange room, and other structures within the facility are being analyzed in this scoping study. The study is expected to be completed by the end of this calendar year. Based on the results of this analysis, recommendations for remedial actions will be suggested. Further actions to mitigate the seismic effects will be carried out, provided there will be a long term mission to keep this facility operational. Until this is completed and consequences are evaluated, the facility will remain vulnerable to seismic-induced ground motions.

3.3.2 CPP-666 FSA

No vulnerbilities of an unmediable nature are identified in the Site Team Report and the WGAT concurs. CPP-666 was placed in service in 1984; it has stainless steel-lined basins, a leak detection system, and an HVAC system. Water treatment systems are included in the complex which is adequately designed for seismic events.

The WGAT did note potential vulnerabilities associated with contemplated fuel movements from CPP-603 to CPP-666. These largely relate to the potential degradation of the CPP-666 complex resulting from the planned storage of aluminum-clad fuel presently stored in CPP-603. WGAT believes that current state-of-the-art wet storage facilities are not appropriate for the long-range storage of aluminium clad fuel, because there is some indication of the initiation of microbiologically-induced corrosion (MIC) on aluminium clad fuel. The contractor plans to can the corroded and aluminium-clad fuel prior to transfer to CPP-666, should alleviate this vulnerability.

This facility is a modern facility and is seismically qualified for a high hazard facility category per UCRL-15910. The pool has steel liners and the roof structure along with crane supports seem to be adequately designed to withstand a design basis earthquake. Although the piping and equipment are fastened to survive a seismic event, the safety components are not seismically qualified to provide assurance of their functions during and after an earthquake. However, this is not considered to be a vulnerability since the equipment failure will not result in a criticality.

WINCO plans to re-rack the existing fuel racks in order to store additional naval receipts and canisters from CPP-603. This change will increase the load on the pool floor by approximately 1100 lbs/sq. feet. A separate analysis to study the effect of this additional load on the foundation and the overall structure response to seismic is being considered by the contractor.

3.3.3 CPP-603 IFSF

No vulnerabilities are noted in the site team report. However the WGAT identified three vulnerabilities including; seismic qualification of the structure, lack of engineering evaluation for the potential of a fire in the IFSF and a lack of a path forward for ultimate disposal of the fuel in storage.

No corrosion concerns were noted for this facility.

The facility was designed to withstand a design basis earthquake based on criteria in effect at the time of design and construction (early 1970). A recent scoping study by EQE using a 2-D finite element analysis revealed overstress conditions at the roof/crane connections to the foundation columns. EQE also will walkdown the facility and examine the seismic capacity of all safety equipment. EQE will also recommend appropriate fixes to withstand an earthquake event. As currently configured, the building is not seismically qualified and therefore is not an acceptable long term storage facility for fuel. This situation compounds the fact that there is no ultimate disposal plan for the fuel in the facility. In addition, the potential for spontaneous combustion in fuel containers due to embrittled cardboard has not been analyzed. Should elevated, localized temperatures create the conditions necessary for combustion a fire could result which could affect worker safety.

3.3.4 CCP-603 FECF

The Site Team Report does not address the long term plans for the fuel stored in this facility. The WGAT identified two vulnerabilities related to the FECF. The FECF facility has not been used since the mid 1960's, except for temporary storage of miscellaneous fuels. However, two spent fuel elements from Peach Bottom are still stored in this cell. In FECF there is a underwater canal to the CPP-603 south basin which can provide a moist environment. Previous corrosion of the fuel cans for this type of fuel has been linked to moisture-induced corrosion. These two elements have not been inspected for 10 plus years. The lights inside the cell have not been operable for over 6 years and no one seems to know the material condition of these two elements. The cognizant WINCO staff has not yet developed a plan to recover these elements from this cell, nor has any future plan been developed for assessing the conditions of these two fuel elements.

This area of CPP-603 is also not qualified to current seismic criteria, and therefore is not a suitable long term storage facility for spent fuel. There is as yet no viable plan for the future disposition of this fuel, which leads to the second vulnerability identified.

3.3.5 CPP-749 UGSF

The Site Team Report identified two corrosion-related vulnerabilities for this facility, dealing with potential carbide-water reaction and the possible accelerated corrosion of aluminum bucketed fuel from Peach Bottom in contact with the carbon steel liner in the moist storage environment. The possible deterioration of the aluminum buckets can result in dropped fuel and concurrent breaching of the fuel cans during transfer. WINCO plans to relocate this fuel over the next two years. This relocation will be to a newer designed storage unit. However, based on the current conditions of the facility, it is also not suitable for long term storage of fuel.

WINCO claims that these underground vaults are seismically qualified for ground acceleration of 0.24g using the UBC Zone III level. The design of these vaults presents no concern during a seismic event. A cathodic protection system has been installed to reduce the rate of corrosion of the casings in the storage units. WINCO also indicated that there were no criticality safety concerns at this facility, in part because of the nature of the fuel.

4.0 SUMMARY AND CONCLUSIONS

At the present time there appear to be neither any immediate nor clearly defined ES&H concerns associated with the storage of RINM at the INEL site. However, the conditions of some of the wet storage facilities, the lack of a clearly-defined mission at others, and the incompatibility of the older facilities with current regulations are all harbingers of potential ES&H concerns at the INEL complex. There is, at INEL, a general theme of increased vulnerabilities stemming from a combination of performing day-to-day facility maintenance activities without an over-riding facility mission or a well devised plan for disposal and/or reprocessing of SNF. Without a clearly understood plan for disposal and/or reprocessing, ambiguities arise that make decision-making and effective management problematic. Components of this ambiguity include: fuel disposition requirements that are uncertain, incomplete characterization of spent fuel waste types, and ill-defined processing options and fuel transportation mechanisms.

There appears to be a gradual, but significant deterioration of barriers designed to prevent the release of radionuclides, especially aluminum cladding and canisters. Some facilities are not seismically qualified and/or were not designed to be long-term storage. All of these factors raise the level of general concern. Of the potential adverse conditions under investigation during this Spent Fuel Initiative, namely, criticality, radionuclide material release, radiation exposure, and institutional control failures, the most significant appear to be radionuclide material release (and its effect on the worker and the environment) and institutional control failures. Over the next decade, the considerable effort to prevent the former will mean significantly more attention to and resources for the latter, that is, institutional control of the spent fuel facilities. While the WGAT recognizes that planning for the resolution of spent nuclear fuel issues for the INEL site, involving the three M&O contractors, is in progress (Note, for example, "Interim Report of the INEL Spent Nuclear Fuel Consolidation Task Team", a Predecisional Draft Report, WIN-367, October 1993), the WGAT also notes that this planning focus is long term and not directed to addressing the adverse conditions that need to be addressed in the 1-5 year timeframe, which is the timing focus of this vulnerability assessment.

The vulnerabilities identified through the Assessment Process are described below. In addition to conclusions that are generic for the whole laboratory; conclusions are presented for each of the 16 spent fuel storage facilities. Their order does not represent a prioritization of the identified vulnerabilities. The conclusions drawn are those of the WGAT, which are reasonably consistent with the vulnerability concerns raised by the M&O staffs through their Site Team Reports and through discussions during the week-long visit by the WGAT.

4.1 EG&G

The site team report and the WGAT reviewed six facilities, distributed between the Test Area North and the Test Reactor Area, which were previously identified as storage locations of RINM. The following subsections provide summary conclusions by facility.

4.1.1 TAN Pool

The TAN pool facility is approximately 40 years old. Its current mission is the temporary storage of RINM. The majority of RINM being stored in the TAN pool is TMI core debris. The vulnerabilities that have been identified for the TAN pool are listed below:

1. The TAN pool was not designed nor documented for the long term storage of RINM.

2. The TAN pool is not seismically qualified to current standards. The TAN pool was designed for UBC Zone 2 requirements. The structure is vulnerable if the magnitude of earthquake exceeds the design (UBC) loads. VDB # ID.E.1.4 deals with the use of the outdated seismic design criteria in the original design and the lack of revised updated seismic analysis in the determination of the response of the storage pool to severe earthquake conditions. Based on the available information, an earthquake of approximately 0.19 g zero peak acceleration could lead to the pool wall cracking, and the complete draining of pool.

3. The TAN pool has no pool liner nor provision for the detection of leakage.

4. The positive pressure maintained by the ventilation system is inconsistent with current design criteria.

5. The TAN pool does not have corrosion surveillance coupons. Fuel elements/bundles are not removed for evaluation. Corrosion coupons are necessary to assess the extent of corrosion/stress corrosion which may be occurring to the stored fuel.

6. The TAN facility has no leak detection capability and currently does not trend the amount of makeup water. Implementation of a trending program can provide an indirect means of leakage detection.

4.1.2 TAN Dry Storage Test Pad

No vulnerabilities for the TAN dry storage were identified in either the site team report or in the course of the WGAT review.

4.1.3 MTR - Canal

The MTR canal originally supported the operation of the MTR. Subsequently, the facility provided support to PBF experimentation. The MTR canal now provides temporary storage for PBF fuel and a variety of fuels tested in the PBF. The vulnerabilities associated with the MTR canal are summarized below:

1. The MTR canal currently has no mission and no clear ownership. The limited surveillance and preventive maintenance budgets are being reduced yearly. Loss of water quality will enhance corrosion and could lead to failure of the aluminum containers containing fuel elements. There is no imminent hazard, but the potential exists for fission product releases, until the fuel can be transferred to a long term storage facility.

2. There are no corrosion coupons installed at the MTR canal. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Not all fuel elements are removed for evaluation (visual), so some areas are not evaluated.

3. The MTR canal has no leak detection capability. Draining the water inventory due to a pool failure incident presents a vulnerability to the environment. The potential exists for increased corrosion of stored fuel which could result in increased fission product release to the canal. The canal has experienced leakages in the past.

4.1.4 ARMF/CFRMF Canal

The two ARMF/CFRMF reactors are located in a single pool in the TRA-660 building. The ARMF/CFRMF pool now provides temporary storage for the cores of both fueled reactors and additional racked fuel elements and experimental fuel. The vulnerabilities associated with the ARMF/CFRMF canal are summarized as follows:

1. The ARMF/CFRMF facilities currently have no current or foreseeable programmatic mission and no clear ownership. The limited surveillance and preventive maintenance operations are not funded. Loss of water quality will enhance corrosion and could lead to failure of the aluminum clad fuel elements. There is no imminent hazard, but the potential exists for fission product releases, until the fuel can be transferred to a long term storage facility.

2. There are no corrosion coupons installed at the ARMF/CFRMF canal. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Fuel element are not removed for evaluations (visual), so some areas are not evaluated.

4.1.5 PBF Canal

The PBF canal now provides temporary storage for the core of the PBF reactor consisting of stainless steel clad fuel pins. The fuel pins are stored in canisters in two seismically designed storage racks. The canal has a stainless steel liner and is equipped with a leak detection system. The vulnerabilities associated with the PBF canal are summarized as follows:

1. There are no corrosion coupons installed at the PBF canal. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Fuel element are not removed for evaluations (visual), so some areas are not evaluated.

4.1.6 ATR Canal

No vulnerabilities for the ATR canal were identified in either the site team report or in the course of the WGAT review.

4.2 ANL-W

4.2.1 HFEF

Current safety philosophy and DOE requirements call for a rigorous process of validation, review, and approval of a facilities safety basis as captured in the Safety Analysis Report. The HFEF FSR has several addenda which have been added over the years to address changes in the facility mission. Without a full revision and upgrade to current standards, the FSR does not accurately capture the combined effects which could result from the modification to the facility. Although unlikely, the worst case accident and the limitations imposed by the OSRs may not possess enough conservatism. The current document may be adequate, however, rigorous review is necessary to ensure that the safety basis is adequately enveloped. As such, the vulnerability at HFEF is the following:

1. The WGAT in concert with ANL-W management identified the lack of a DOE approved SAR as an ES&H vulnerability associated with the HFEF. The HFEF operates under a 1975 FSR that was submitted to DOE for comment. Under the requirements in force in 1975, the FSR was considered approved "by default" when DOE had "no comment."

4.2.2 RSWF

The WGAT recognizes the extensive efforts at upgrade and replacement being undertaken by ANL-W at the RSWF. The issue of adequately characterizing, monitoring, or protecting against material degradation due to corrosion is a generic concern found at nearly every site examined. However, at RSWF the vulnerabilities and concerns are:

1. Many of the heavily corroded, breached, and even failed carbon steel liners have been removed from the RSWF, though about 218 of these liners still remain in the ground. Of the 218 liners 10 contain fuel and the rest contain low level waste. Because of the shielding problem, the detailed condition of single-walled carbon steel canisters inside these liners was not assessed during the excavation. However, according to site personnel the overall condition of these canisters is good. The present conditions of the existing 218 liners with carbon steel canisters inside present a vulnerability to galvanic corrosion of liners as well as the canisters. This could result in environmental release and soil contamination.

2. No inspection process exists for the materials contained inside the liners. There is no method to continuously monitor the environmental releases. However, on a periodic basis the top of all liners are monitored for the radition levels.

4.2.3 TREAT

The TREAT fuel was found to have one of the best designs with respect to maintaining fuel integrity in useful form for an extended period. The facility also demonstrated some of the most advanced upgrades in the form of the reactor control and diagnostic system. Though the controls were recently upgraded to provide a state-of-the-art system, the reactor building, though excellently maintained, demonstrated some of the lowest apparent seismic resistance. This condition indicates a lack of balance in the distribution of resources for the maintenance and upgrade of facilities across the DOE complex.

Therefore at TREAT, no ES&H vulnerabilities were identified with respect to the spent fuel stored at the TREAT facility.

4.2.4 EBR-II

The team noted, however, that, were the EBR-II forced to shut down because of a lack of program funding, adequate storage for the entire EBR-II core would not be available. The team noted a generic issue with facilities that have been "starved to death" by a lack a program funding in that these facilities were often the least prepared, the most poorly maintained, and posed the greatest vulnerabilities once programmatic funding was cut off.

No ES&H vulnerabilities were identified with respect to the fuel at the EBR-II.

4.2.5 ZPPR - Storage

The WGAT noted the excellent condition and the careful control of personnel access, monitoring, and surveillance of the ZPPR storage facility, which is appropriate for a facility storing large quantities of plutonium and enriched uranium. Two vulnerabilities were identified by WGAT with respect to the ZPPR storage facilities.

1. A large number of enriched uranium fuel plates in storage have corroded to the point that the stainless steel cladding is bulged or breached. Although there is a negligible fission product content in these fuels, the corrosion has led to an extensive program of inspection and repackaging of the uranium fuels in inert gas to retard corrosion. This results in additional potential for worker radiation exposure. In addition, there is some increased probability for a uranium fire, with the potential for plutonium involvement in the fire. A permanent solution to the uranium corrosion problem should be developed and implemented.

2. There is no approved path forward for ultimate disposition of the stored ZPPR fuel. ZPPR may be reactivated to support the Integral Fast Reactor (IFR) or the breeder reactor program, in which case some of the fuels would be required for physics tests. However, long-range plans should be developed for the ultimate disposition of the fuels. Indefinite storage of the fuels in the ZPPR vault will lead to continued degradation of the fuels, causing greater risk to the workers, and seriously complicating ultimate disposition.

4.3 WINCO

WINCO recognizes, and WGAT concurs that the vulnerabilities associated with the storage of spent nuclear fuels is largely a consequence of the age of the storage facilities, current design criteria, and the change in role of some of this facilities, e.g. interim to longer term storage. The following delineates our observations and conclusions thereof concerning the operation of SNF facilities by WINCO.

4.3.1 CPP-603 FSF

The vulnerabilities associated with this facility are summarized as below:

1. Continuing corrosion of fuel, some clad with aluminum or in corroded aluminum canisters can result in increased exposure to workers, accidental nuclear criticality, and release of radionuclides to the environment.

2. Fuel now stored in containers or to be encapsulated should be dried to avoid corrosion, overpressurization and release of radionuclides to the environment, or criticality concerns may arise when it is transferred to a dry storage facility. However, the thermal repackaging facility may not be operational until 2002 and there is an urgent need to repackage aluminium clad fuel and fuel in aluminium canisters. Risks are exposure to workers, accidental criticality, and release of radionuclides.

3. Some fuel containers and engineered safety features providing criticality safety control have degraded and not all administrative controls were implemented. The facility was far outside its safety basis and compensatory measures were inadequate and under-analyzed.

4. Significant corrosion of fuel assemblies, the fuel containers and the yoke assemblies was observed. This corrosion, which has already resulted in breached fuel, disintegrated canisters, and yoke failures, will continue. Interim measures to protect against yoke failures are being implemented. No repackaging capability for the damaged

fuel will be in service any sooner than 1995. Since the repackaging of fuel, when containers and cladding fail, is a costly activity that will impact the movement of fuel, not having a repackaging capability presents a vulnerability issue.

5. Although WINCO is developing plans and technology for disposition of fuels, there is no defined ultimate disposal for fuel stored in this facility. Underwater storage is not considered to be a long-term solution for spent fuel storage, so this is considered to be an institutional failure. A planned program for the final disposition, conditioning, and packaging of the spent fuel at this facility should be developed.

6. Excessive corrosion and cracking have occurred on carbon steel yokes/buckets which contain nuclear fuel. Various yokes are severely corroded and there is no way to quantify when or if these yokes will fail. Failure of these units could present a criticality problem for the facility.

7. The facility does not have a leak detection system or a leak trending program for the pool water leakage. Although there are a number of wells outside the facility used to detect leakage, it is unclear how effective and timely these wells are in identifying leakage. Consequently, there is insufficient information to determine the integrity of these basins. A review of the operating logs to identify unexplained changes in water usage should be performed. In addition, an ongoing routine water balance program should be initiated to detect leakage from the basins.

8. Related to 1 are risks associated with encapsulating or re-encapsulating aluminum clad fuel. Vulnerabilities can only be developed upon review of the design and operational approach to this process which is now in the planning stages.

9. This facility was not originally designed for seismic acceptability. The ongoing scoping study for determining the seismic capacities of the superstructure has indicated that there are some overstressed structural elements which could fail due to a design basis earthquake. The unlined pool walls were not considered in this evaluation. There is a potential that these walls could also fail or collapse under a seismic load. The consequences of this would present direct exposure from the uncovered fuel and contamination of the environment in the release of fissionable materials.

10. Thirty-six carbon steel hangers (34 double yoke and 2 single) containing fuel have not been rigged at the time of this visit, although rerigging of the fuel is in process. Excessive corrosion and cracking of these hangers present a potential for criticality.

Notwithstanding the above list of concerns and vulnerabilities, WINCO has improved the criticality safety posture at the CPP-603 Basins by rigging and rerigging hangers, increasing spacing between fuel handling units, replacing worn and bent components, and by applying special administrative controls for the recovery actions to compensate for degraded engineered safety features.

The path forward to resolve the CPP-603 Basin criticality safety issues has been given top priority by WINCO, but some actions are not fully developed. The following points are vulnerabilities or their symptoms affecting criticality safety: Visual inspections of fuel and racks in the South Basin are incomplete; depending upon the results, the schedule to relocate or repackage aluminum fuels may need to be accelerated. WINCO plans to perform interim and final repackaging as necessary; vulnerabilities in performing these operations are yet to be developed because designs and operational techniques are embryonic. WINCO should assign a high priority to developing a method to verify water content of encapsulated fuel that is highly accurate and reliable.

4.3.2 CPP-666 FSA

This facility is a modern underwater fuel storage facility built in 1984. The pools contain free-standing spent fuel storage racks, which are critically safe by geometry. The 2556 fuel storage positions are currently 46% full. Three vulnerabilities associated with this facility are discussed below:

1. Potential for corrosion of aluminum clad fuels is much lower than at CPP-603; however, long term storage of aluminum clad fuels is a potential vulnerability.

2. Susceptibility and downgrading of engineered safety features is an institutional vulnerability. Analyses involving engineered safety features were flawed or incomplete.

3. The spent fuel stored in this facility was not intended for long term storage. Leaving the spent fuel in this facility potentially increases risk of release of fission and activation products in future. Since the ultimate disposition of these fuels is not known, this presents an institutional failure.

There are no present concerns regarding criticality safety at CPP-666 Basins. Eventually, aluminum clad fuel will become a concern unless it is completely dried and encapsulated in stainless steel. Vulnerabilities of repackaging aluminum clad fuel cannot be developed until the design of the facility is available. The institutional vulnerability the team developed regarding under-utilizing the safety review process has not reduced the margin of criticality safety. Reracking to increase storage capacity should not create a vulnerability if qualified criticality safety personnel are adequately involved in the review and approval process for these changes.

Accordingly, criticality safety can be maintained at the CPP-666 Basins indefinitely provided the criticality safety ramifications of aluminum clad fuel, water chemistry, and rack modifications are properly managed.

4.3.3 CPP-603 IFSF

This facility is a remotely-operated canyon-type dry vault storage facility. This is designed to provide safe storage for spent fuel from two HTGRs and the ROVER Nuclear Rocket program. The facility was seismically designed according to the code requirements at the time. Five types of fuel in carbon steel liners are currently stored. Two vulnerabilities were determined to be associated with this facility.

1. The ventilation system is such that a loss of forced cooling (due to a loss of AC power) could result in ignition of the brittle cardboard fuel containers stored inside this facility. It is recognized that such an event is a remote possibility.

2. Based on the scoping study by the contractor and site visit by WGAT, there are possibilities of roof collapse in the storage vault area and equipment failure inside the control room due to a large seismic event. The presence of heavy cranes in the building further weakens the supporting structures in resisting the seismic loads.

4.3.4 CPP-603 FECF

Two vulnerabilities are identified for this facility.

1. The facility has no path for the ultimate disposal of fuel stored at this facility. The facility was not designed for long term storage. Additionally, multiple interim actions regarding worker handling of the spent fuel may be necessary. Each of these tasks has a risk associated with it. Lack of a plan defining disposition of the fuel presents an institutional vulnerability for the site.

2. Peach Bottom fuel has been stored in FECF for over 10 years. This facility no longer has manipulators installed and has not had working cell lights for over 4 years. The fuel has not been inspected for over 10 years. Worker safety in handling/disposing of this fuel may be compromised.

4.3.5 CPP-749 UGSF

This facility consists of 218 underground dry vaults that were built in seven separate projects between 1971 and 1987. Sixty-one first-generation, dry vaults were built using carbon steel casing and grout-bottom plug. Because of the water seepage problem in these vaults, the second generation units were built with cathodic protection and air-monitoring instruments. Two vulnerabilities associated with this facility are summarized below:

1. The spent fuel stored in this facility was not intended for long term storage. Leaving the spent fuel in this facility potentially increases risk of release of fission and activation products in future. Since the ultimate disposition of these fuel is not known, this presents an institutional failure.

2. Forty-six FHUs of Peach Bottom fuel are stored in the underground storage at this facility. These fuel elements are in aluminum cans in an aluminum basket lowered into a carbon steel cylinder. This environment is moist and could deteriorate the aluminum.

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APPENDIX A

VULNERABILITY DEVELOPMENT FORMS

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ID.W.1.11	CPP-603 Basin:	Basin wall failure and superstructure collapse due to a large seismic event
ID.W.1.12	CPP-603 Basin:	Carbon steel yoke not rigged associated with fuel at CPP-603 basin and potential for criticality
ID.W.2.1	CPP-666 Basin:	Corrosion of aluminum associated with fuel and release of fissile material and radionuclides into the CPP-666 basin environment
ID.W.2.2	CPP-666 Basin:	Susceptibility and downgrading of Engineered Safety Features at CPP-666 basins
ID.W.2.3	CPP-666 Basin:	There is no path for ultimate disposal of fuel stored in CPP-666 fuel storage facility
ID.W.3.2	CPP-603 IFSF:	Ignition of Brittle Cardboard Fuel Containers at IFSF
ID.W.3.3	CPP-603 IFSF:	Roof collapse and control room equipment failure due to a large seismic event
ID.W.4.1	CPP-603 FECF:	There is no path for the ultimate disposal of fuel stored in the CPP-603 fuel cutting facility
ID.W.4.2	CPP-603 FECF:	Possible degraded Peach Bottom Fuel
ID.W.5.1	CPP-749 USF:	There is no path for the ultimate disposal of fuel stored in the CPP-749 drywell storage area or the CPP-603 IFSF
ID.W.5.2	CPP-749 USF:	Potentially degrading aluminum fuel cans and baskets at ICPP-749

APPENDIX B

DATA SHEETS

FOR

SPENT FUEL STORAGE

AT INEL

Table B-1: FUEL STORAGE AREAS AT INEL

INEL SNF STORAGE AREAS - (WET)

INEL Location	Facility #	Planned Retirement Date	Physically Expandable/ Extended Life?	Regulatory Status*	Facility/Pool Dimensions W x L x D (ft)	Lined or Unlined	# of Pools	Max Depth (ft)	Future Available Capacity	Truck or Rail	Support C-Cranes S-Sampling M-Monitng
ICPP	CPP-666	2033	Yes/Probable	1	(31x46.5x31/41)	SS Lined	6	46	Taken	T(R)	C,S,M
ICPP	CPP-603-M & N	1996	No/No	3	(40x60x21)	Unlined	2	21	No	T	C,S,M
ICPP	CPP-603-S	2000	No/No	3	(45x88x21)	Unlined	1	21	No	T	C,S,M
TAN	TAN-607	2006	No/Probable	3	(48x70x24)	Unlined	1	24	100%	T	C,S,M
PBF	PER-620	2010	No/Probable	2	8x16x19/37	SS Lined	1	37	0	T	C-15 Ton
TRA	MTR-603	2000	No/Unlikely	3	8x81x18	SS Lined	1	18	90	T	C-2 Ton
TRA	ATR-Canal	2014	Yes/Probable	1	8x156x20/34	SS Lined	1	34	0	T	C-40 Ton
NRF	ECF Pools (a)	TBD	No/Probable	3		Unlined	4	30/45	0	T,R	C,S,M
TRA	ARMF/CFRMF	1995	No/Probable	1	8x28x18	SS Lined	1	18	0	T	C-15 Ton

(a) NRF functions as an inspection holding point only and are not part of the INEL storage system

*(1) Meets The Regulatory Compliance Standards Set Forth For Todays New Facilities

*(2) Could Be Upgraded To Meet Most Of Todays Regulatory Compliance Standards For New Facilities

*(3) Meets The Regulatory Compliance Standards Set Forth When The Facility Was Built

Table B-1: FUEL STORAGE AREAS AT INEL

INEL SNF STORAGE AREAS - (DRY)											
INEL Location	Facility #	AGE(Yr)/ Retirement Date	Physically Expandable/ Extended Life?	Regulatory Status*	Vault/Position Dimensions W x L x D (ft)	Lined or Unlined	# of Vaults	Max Over-Head (ft)	Future Available Capacity	Truck or Rail	Support C-Cranes S-Samplin g M-Monitng
ICPP	CPP-749	22-6/2014	Yes	1.2	2.5x20	Unlined	218(b)	NA	91	T	C,S,M
ICPP	CPP-603 (IFSF)	19/2014	Yes	2	1.5x11	NA	636(b)		320	T	C,S,M
TAN	Pad/Casks	2035	Yes/Yes	1	(40x94)(pad)	NA	12	NA	not limited	T	M
ANL-W	RSWF	TBD	Yes/Probable	1	Underground	Lined	1350(b)	open	TBD	T	--
ANL-W	HFEF	TBD	Yes/Probable	1	In cell pit/racks	Lined	100(b)	TBD	0	T	C,S,M
NRF	Pad/Casks(a)	TBD	Yes/Probable	1	--	Lined	--	open	TBD		--
ANL-W	TREAT	TBD	Yes/Probable	TBD	In floor storage	N/A	--	--	0	T	C,S,M
ANL-W	ZPPR	TBD	Yes/Yes	1	--	Lined	1	--	0	T	S,M
	(Possible Conversions)										
ICPP	CPP-601										
ICPP	FDP Cell										
ICPP	FPR Facility										
TAN	TAN Hanger	NOT VIEWED AS A PRACTICAL LOCATION FOR SNF STORAGE									
TAN	Hot Shop	2006	No/Probable	3	(51x160x67.5)	NA	NA	NA	100%	T	C,S,M
TAN	Hot Cell	2006	No/Probable	3	(10x35x20)	Lined SS	NA	NA	100%	T	C,S,M
ICPP	CPP-651-Cold Fuel Only		Yes	1	10x20	NA	7		Yes	T	S,M

(a) NRF functions as an inspection holding point only and are not part of the INEL storage system

(b) Number of positions in the vault

*(1) Meets The Regulatory Compliance Standards Set Forth For Todays New Facilities

*(2) Could Be Upgraded To Meet Most Of Todays Regulatory Compliance Standards For New Facilities

*(3) Meets The Regulatory Compliance Standards Set Forth When The Facility Was Built

TABLE B-2 (A): INEL SNF PROJECTED STORAGE CAPACITY (MTHM)

		EXCESS CAPACITY
PRESENT INVENTORY	225.67	
PROJECTED CAPACITY FOR 10 YEARS	249.78	+24.11
PROJECTED RECEIPTS	95.0	
PROJECTED INVENTORY	320.67	
PROJECTED CAPACITY	249.78	-70.89

TABLE B-2 (B): INEL SNF STORAGE SUMMARY

FACILITY	PRESENT INVENTORY (MTHM)	PRESENT CAPACITY (MTHM)	PROJECTED CAPACITY (MTHM)
CPP 603 FSF	1.96	2.9	0
CPP 666 FSA	5.62	12.22	12.22
CPP 603 IFSF	.5	1.03	1.03
CPP 749	92.94	160.23	160.23
TAN Pad	38.1	76.2	76.2
TAN Pool	85.4	106.7	0
TRA 603 MTR	.26	.48	0
TRA 670 ATR	.1	.1	.1
ARMF/CFRM	.23	.23	0
PBF	.56	.56	0
	225.67	360.70	249.78

Table B-3 : DATA RELATING TO SPENT FUELS AT INEL

Potential Waste Form	Fuel Name	Fuel Cladding	Number of Elements	Fuel Form	Storage Location
1. High uranium U-235 enrichment, uranium zirconium hydride fuel, low burnup, stainless steel, zirconium, and aluminum clad, some graphite plugs, minor Pu and Mo.					
	Al	None	12	Can	CPP 603
	EBR-II ANL-6	SST	4	Can	CPP 603
	Ber-II-TRIGA	Zr	21	Element	CPP 603
	SNAP	None	19	Can	CPP 603
	TRIGA alum	AL	570	Rod	CPP 603
	TRIGA FLIP	SST	7	Rod	CPP 603
	TRIGA sst	SST	263	Element	CPP 603
2. High uranium U-235 enrichment, Uranium oxide, SST matrix, range of burnup, SST clad, some TiO2, Pu in lower enriched					
	APPR (AGE-2)	SST	1	Can	CPP 603
	BMI	SST	3	Can	CPP 603
	BORAX V	SST	36	Assembly	CPP 603
	SM-1A	SST	93	Can	CPP 603
	SPSS (Spert)	SST	1	Can	CPP 603
	VBWR (Geneva)	SST	4	Can	CPP 603
3. High Uranium 235 enrichment, Uranium oxide fuel, Be Mg Ti Zr Y, ceramic, ternary fuel					
	GCRE can/pellets	Hast/none	2	Can	CPP 603
	Tory-IIA	None	146	Can	CPP 603
	Tory-IIC (crushed)	None	655	Can	CPP 603
4. High Uranium enrichment, Uranium oxide fuel, ZrO2 matrix, Zr clad, B, Pu					
	Shiport PWR C1-S4	Zr	4	Subassembly	CPP 666
	Shiport PWR C2-S1	Zr	19	Clust	CPP 666
	Shiport PWR NRF	Zr	1		NRF
	Shiport PWR C2-S2	Zr	20	Clust	CPP 666
5. High Uranium 235 enriched, oxide fuel, contains B4C, SST clad, thermocouple					
	Pathfinder	SST	417	Rods	CPP 603
6. High Uranium 235 enriched, SST filters unirradiated, U oxide					
	GETR filers	None	10	Basket	CPP 603
7. High Uranium 235 enrichment, UA1x fuel, range of burnup, A1 clad, P					
	ARMF ICPP	AL	15	Plate	CPP 603
	ARMF TRA	AL	68	Element	TRA
	ATR TRA	AL	700	Element	TRA
	ATR	AL	808	Assembly	TRA

Table B-3 : DATA RELATING TO SPENT FUELS AT INEL

Potential Waste Form	Fuel Name	Fuel Cladding	Number of Elements	Fuel Form	Storage Location
	HFBR	AL	240	Assembly	CPP 603/666
	MURR	AL	56	Assembly	CPP 603/666
	ORR	AL	17	Assembly	CPP 603
	U of Wash	AL	26	Bundle	CPP 666
8. High Uranium 235 enrichment, U-Mo alloy fuel, metallic Na, Zr clad, 1.9 kg Pu, possible MoH					
	Fermi core I&II	Zr	214	Assembly	CPP 666
9. High Uranium 235 enrichment, U metal fuel, metallic Na, SST clad, 4.2 kg Pu					
	EBR-II	SST	3688	Can	CPP 603/666
10. High Uranium 235 enrichment, uranium carbide fuel, UC ThC, SiC fuel pellets, graphite clad, minor Pu minor boron					
	FSVR	Graph	744	Blk	CPP 603
	Peachbottom	Graph	1603	Rod	TAN
11. Low Uranium 235 enrichment, oxide fuel, contains uranium 233, contains lots of Thorium, 10 Kg Pu					
	Shiport bla NRF	Zr	12	Mod	NRF
	Shiport bla NRF	Zr	Total		NRF
12. Low Uranium 235 enrichment, oxide fuel, contains uranium 233, contains 4.0 E4 Kg thorium, Zr02 CaO, Zr clad, 6.6 kg Pu, ceramic					
	Shiport LWBR	Zr	48	Element	CPP 749
13. Low Uranium 235 enriched, oxide fuel, Zr clad, Be, 2.6 Kg Pu					
	GAP CON TRA	Zr	20	Rod	TRA
	Halden pu Assy TRA	Zr	13	Rod	TRA
	Halden Assy TRA	Zr	5	Rod	TRA
	IE TRA	Zr		Rod	TRA
	LLR TRA	Zr	7	Rod	TRA
	LOC TRA	Zr	60	Rod	TRA
	LOFT TAN	Zr	14	Assembly	TAN
	MAPI TRA	Zr	12	Canist	TRA
	OPTRAN	Zr		Rod	TRA
	Pulstar Buff	Zr	24	Can	TRA
	RIA TRA	Zr	23	Rod	TRA
	Saxton TRA	Zr	21	Rod	TRA
	SFD TRA	Zr	143	Rod	TRA
	TC TRA	Zr		Rod	TRA
	PCM TRA	Zr	30	Rod	TRA
	CANDU	Zr	8	Rod	TRA
	GE	Zr	5	Rod	TAN

Table B-3 : DATA RELATING TO SPENT FUELS AT INEL

Potential Waste Form	Fuel Name	Fuel Cladding	Number of Elements	Fuel Form	Storage Location
14. Low Uranium 235 enrichment, oxide fuel, 160 kg Pu, Zr clad, Dy203					
	Dresden TAN	Zr	55	Rod	TAN
	Pch Bottom TAN	Zr	46	Rod	TAN
	Pch Bottom TAN	Zr	47	Rod	TAN
	H.B. Robin TAN	Zr	113	Rod	TAN
	TMI-2 TAN	Zr	342	Cans	TAN
	EMAD TAN	Zr	5	Assembly	TAN
	Surry TAN	Zr	12	Assembly	TAN
	DRTC TAN	Zr	24	Canister	TAN
15. Low Uranium 235 enriched, oxide fuel, 3.2 kg Pu, all part of BCD, SST rods and tubes					
	LFRSB TAN (LEU)	Zr	106	Tube	TAN
	Turkey Pt TAN (BCD)	Zr	1	Assembly	TAN
	Con Yankee TAN (BCD)	SST	1	Assembly	TAN
16. Low Uranium 235 enriched, oxide fuel, Zr02 CaO, SST clad, ternary fuel					
	PBF TRA	SST	2		TRA
	PBF damaged		1		TRA
	PBF plug		7	Can	TRA
	PBF scrap		91	Can	TRA
	PBF PBF irrad	SST	2425	Rod	PBF
	PBF Damaged TRA	Zr	3	Assembly	TRA
17. Low Uranium 235 enriched, U-Mo alloy, metallic Na, SST clad					
	Fermi blanket	SST	510	Assembly	CPP 749
18. Low Uranium 235 enrichment, U metal fuel, Mo, SST clad,					
	SPEC (Orme)	SST	1	Can	CPP 603
19. Depleted Uranium, possible U hydride					
	CFRMF TRA	None	1	Block	TRA

SPENT FUEL INITIATIVE

Savannah River Site

WORKING GROUP ASSESSMENT TEAM REPORTS

SAVANNAH RIVER SITE

Preface

This Working Group Assessment Report provides documentation pertaining to the August 19, 1993, Secretary's initiative to determine the Department of Energy's (DOE) inventory and Environment, Safety and Health (ES&H) vulnerability stemming from the storage of reactor irradiated nuclear materials (RINMs) consisting of spent nuclear fuel and irradiated targets from production and research reactors. The following report prepared by the Savannah River Site Working Group Assessment Team contains a discussion of the potential ES&H vulnerabilities at Savannah River Site (SRS). This report will be used along with similar reports from all other selected DOE sites in the development of the final report to the Secretary.

Executive Summary

This phase of the ES&H initiative, for identifing vulnerabilities of RNM storage was a two-part effort which first consisted of the Management and Operating (M&O) contractor Westinghouse Savannah River Company (WSRC) and Savannah River Operations Office personnel. The Site Team was selected for their knowledge about RINM at the site and was responsible for preparing the Site Team Report (Attachment A).

The second phase of the assessment consisted of a Working Group Assessment Team which included members of the Spent Fuel Working Group, Office of Environment, Safety and Health (EH) staff members, and consultants selected for their experience in areas important to the safe storage and handling of RINM.

During the weeks of October 4 and October 11, 1993, the Working Group Assessment Team visited the SRS and accomplished the following:

1. Reviewed the site's response to Office of Spent Fuel Management and Special Projects in the Office of Environmental Restoration and Waste Management (EM-37) questionnaire on inventory, material conditions, and facility missions.

2. Reviewed the Site Team's responses to the Spent Nuclear Fuel Working Group Question Set.

3. Validated the responses (data) via independent review, exploratory questioning, direct observation of facilities, and discussions with the Site Team and other WSRC personnel.

4. Evaluated the Site Team's list of potential vulnerabilities so as to continue the process of defining and characterizing vulnerabilities.

5. Explored the existence of other potential vulnerabilities based on facility tours, document reviews and discussion with SRS personnel.

The Working Group Assessment Team determined that the following ES&H vulnerabilities exist at Savannah River Site:

- Corrosion of fissile bearing RINM is significant and Uranium, Plutonium, fission products, and oxidized cladding are being released to the basins. This has resulted in technical issues associated with criticality, personnel exposure, and further mobility of fuel material.

- With the increased residence time of RINM in storage basins, which are not designed for long-term storage, new and potential credible events, including seismic capability, need to be fully analyzed to assure that consequences and mitigation requirements are defined.

Details of the SRS Working Group Assessment Team judgment of vulnerabilities are provided in the body of this report. The Working Group Assessment Team described its conclusions in terms of criticality, fission product release, radiation, and institutional controls. There were no significant unresolved disagreements identified by the Site team based on its review of the Working Group Assessment Team draft report.

The Working Group Assessment Team concludes that the site staff is relying on the processing to address the storage issues. The Working Group Assessment Team notes that the current site operational plans and program guidance continue to define a processing mission. The Working Group Assessment team also notes that programs have been initiated to inprove and better monitor the RINM storage environment and to reduce the consequences of further RINM degradation in anticipation of further processing delays. If processing is not resumed, the vulnerability to the environment, the workers, and possibly the public increases as a result of this situation. Completing and instituting plans to mitigate the identified corrosion problems in the event that processing is not resumed must be carried forward.

Table 1 is provided in Attachment 4 to highlight and compare the existing wet storage conditions at SRS with respect to corrosion of RINM.

The Working Group Assessment Team was provided excellent support and cooperation by Westinghouse and DOE Staff during the course of this assessment.

1.0 Objectives

The primary objective of the Working Group Assessment Team was to assess the ES&H vulnerability of stored RINM as it pertains to the environment, the workers, and the public. Another objective of the Working Group Assessment Team visit was to ensure that site representatives played key roles in the process and were, therefore, fully cognizant, if not in full accord, with all Working Group Assessment Team conclusions.

2.0 Identification of Facilities

The conditions in the following facilities were reviewed by the Working Group Assessment Team:

2.1 Receiving Basin for Offsite Fuel (RBOF)

RBOF as described in the Site Team Report (Attachment 1) is a stand alone fuel storage facility and contains a wide variety RINM from numerous sources. The Working Group Assessment noted that the fuels in storage and 6061 alloy storage racks, some of which have been in the basin for 30 years, show no visible signs of corrosion. Oxide and metal fuels are clad in stainless steel, Zircaloy, and aluminum. Most are packaged in storage cans. Currently the aluminum clad fuel stored longest in RBOF is an aluminum clad (Type 1100) experimental fuel has been stored since 1983 or about 10.5 years. Aluminum clad (Type 1100) Mk 31 uranium metal target slugs that were stored for two years in a disassembly basin have been subsequently stored since 1989 or for the last 4.5 years in RBOF.

This facility has had water chemistry control (filtration and deionization) since it began operation in 1963. Low conductivity and low ionic impurities are maintained at or near reactor grade quality. There is an on-going surveillance of water chemistry and no significant evidence of aluminum cladding corrosion.

2.2 H-Canyon Storage Basin

The storage basin is located in the basement of the Hot canyon of the H-Canyon Building.

H-Canyon basin is described in the Site Team Report (Attachment 1) and currently contains 13 aluminum-clad Mk 16B fuel assemblies consolidated in 5 bundles in wet storage. The fuel bundles are stored in free standing racks. The bundles were in reactor pool storage for 6 years and three have been stored in the canyon since May 1991 and two were placed there in July 1992.

2.3 F-Canyon Storage Basin

The storage basin is located in the basement of the Hot canyon of the F-Canyon Building.

F-Canyon storage basin is described in the Site Team Report (Attachment 1) and contains 34 stainless-steel buckets of aluminum-clad Mk 31A target slugs in wet storage in an elevated free standing "bath tub" structure..

2.4 L-Reactor Disassembly Basin

The L-Reactor Disassembly Basin description and inventory are detailed in the Site Team Report (Attachment 1). This basin has been in operation since about 1954. Operations in the past provided for residence time for the RINM of about 9 to 18 months. The RINM currently in the basin have been stored since about 1988. Corrosion is evident on the RINM and components. Water chemistry controls were initially designed and installed to maintain an environment suitable for short-term storage.

2.5 K-Reactor Disassembly Basin

The K-Reactor Disassembly Basin description and inventory are detailed in the Site Team Report (Attachment 1). This basin has been in operation since about 1954. Operations in the past provided for residence time for the RINM of about 9 to 18 months. The RINM currently in the basin have been stored since about 1988. Corrosion is evident on the RINM and components. Water chemistry controls were initially designed and installed to maintain an environment suitable for short-term storage.

2.6 P-Reactor Disassembly Basin

A description of the P-Reactor storage basin and the inventory are included in the Site Team Report (Attachment 1). This basin has been in operation since about 1954. Operations in the past provided for residence time for the RINM of about 9 to 18 months. The RINM currently in the basin have been stored since about 1988. Corrosion is evident on the RINM and components. Water chemistry controls were initially designed and installed to maintain an environment suitable for short-term storage.

2.7 C-Reactor Disassembly Basin

There is no RINM stored in this facility.

2.8 Building 773A

Building 773A is a hot-cell facility with the capability of destructively examining highly irradiated nuclear materials. This facility contains four partial sections of Mk 16B fuel material stored in a dry configuration since 1987.

2.9 Building 331M

331M Building is a steel warehouse structure and houses the uranium fuel elements discharged from the 305-M test reactor pile in dry storage.

3.0 Conclusion from Review of Site Team Report

The discussion in this section is based on a review of the Site Team report. (See Attachment 1)

3.1 RBOF

A filter-deionizer system is installed for water chemistry. Sample results show that conductivity is normally about 1 μmho/cm, pH is 7.4 to 7.5. Ions of interest (i.e., Cu and Hg) are in the ppb range and the beta-gamma activity is normally at 1 x 10E-4 uCi/ml. A corrosion monitoring program was initiated about a year ago that includes aluminum coupons. RBOF has a "thin dusting" of sludge on the floor. The Site Team reports that water chemistry control and minimal galvanic factors result in low corrosion rates on Al fuel and components, including Mk 31 target slugs.

Makeup water is added 1 to 2 times per month and compared with the calculated evaporation rate as a means of determining any leak in the basin. However, the absence of a leak detection system compromises the ability to quickly determine the existence of a leak and provide for mitigation of radionuclide release. The Site Team report identifies this as a potential concern.

Based on the information in the Safety Analysis Report (SAR) the RBOF building structure is designed to standard (non-nuclear) building code requirement for natural phenomena hazards (i.e., seismic and wind). A detailed structural assessment for the design basis hazards has not been completed; however, a program is planned to address this issue and is expected to be completed in two years.

Finally, the Site Team reports concerns derived from the need to store aluminum clad materials for extended periods, beyond those for which the RBOF was designed, and the fact that RBOF is approaching its storage capacity.

3.2 H-Canyon Storage Basin

The interim storage period of RINM in the canyon continues to be extended far in excess of that assumed in the facility design since the initial startup of the process in 1959 as a result of the unanticipated delays in processing operations which began in 1989.

Visual inspections of the 5 fuel bundles were performed in May of 1992 using a video camera suspended from the facility crane. The Site Team concluded that there are no significant ES&H items dealing with the fuel bundle storage basin in H-Canyon: however, the Working Group Assessment Team discussed with the Site Team that uncorrected corrosion of the fuel bundles during extended storage, could potentially create ES&H concerns during recovery of the remaining material.

This facility does not have the capability to establish, circulate, or maintain water chemistry.

The stagnant basin water is currently sampled and analyzed every 3 months. Recent sample results show a pH of 8.53, a conductivity of 171 μmho/ml, 6.4 ppm Cl, 0.28 ppm Al, and an activity of 8.5×10^{-4} μCi/ml. The addition of water to the basin is made by use of a dedicated line from the domestic water system by an operator using manual operated valves and this operation is monitored by the crane operator. The chance of an inadvertent transfer of canyon liquids or solutions to the fuel storage basin is considered incredible. Any airborne fission product releases due to RINM degradation would be disposed of through the canyon ventilation system.

The current authorization basis for the storage basis is the H Canyon SAR which, according to the site team report does not adequately address long-term storage of RINM.

3.3 F-Canyon Storage Basin

The storage basin is a concrete cell in the hot canyon. The target slugs are contained in bucket storage racks that sit in the bottom of the basin. Water level in the storage racks is checked twice daily.

The canyon basin was intended to store materials for a period of 12 to 18 months, thus, the capability to filter, purify, or mix the water to maintain water chemistry was not provided. Sampling and analysis of the stagnant pool is performed every 6 months. Currently, the results show a pH of 7.78, a conductivity of 200 μmho/cm, chloride at 10.7 ppm, and total gamma of 4.56 x 10E4 dpm/ml (2.03×10^{-2} μc/ml). This condition is more conducive to corrosion than the water chemistry condition that exists in H-Canyon.

Inspection of the aluminum-clad Mk 31 target slugs by video in May 1992 shows severe corrosion of the aluminum cladding and the uranium target material, much of which may or may not have been present when it was transferred to the canyon. water is added to the basin through a dedicated line from the domestic water system using manually operated valves. The chance of an inadvertent transfer of canyon liquids or solutions to the fuel storage basin is considered incredible. Any fission product airborne releases due to RINM degradation would be disposed of through the canyon ventilation system.

3.4 L-Reactor Disassembly Basin

The EM-37 inventory had not been completed for this facility at the time of the Working Group Assessment Team visit. The inventory provided by the Site Assessment Team to the Working Group Assessment Team did not include 305 lithium control rods in the reactor tank. The Working Group Assessment Team determined that the control rods do not fall into the scope of RINM, but are included for information.

The basin originally was intended to store RINM for short periods prior to processing. The water purity control system is not designed to maintain water quality that has mitigated corrosion in the RBOF basin. Therefore, visual evidence or corrosion radioactive inventories in the L-Basin water, and rapid development of pits on aluminum corrosion specimens attest to the aggressive character of the water. Corrosion phenomena include: pitting of vertically-stored Mk 16B assemblies at contacts with stainless steel hangers, severe pitting and corrosion of Mk 31A slugs stored in stainless steel buckets, and a milder form of corrosion on 6061 alloy horizontal storage racks, possibly indicating selective attack that galvanically protects the Mk 16B fuel with 1100 alloy cladding.

The Site Assessment Team reports discusses several ES&H issues which are either being addressed or are in the planning process. Significant among them is the that the original basin design includes a weir overflow which directed excess basin water the environment via a process sewer. This design was considered preferable to flooding the building operating floor. The weir overflow has not been used since the installation of the deionizer system. The weirs remained installed, with the exception of C Reactor Basin which has been blanked off, therefore, an unexpected rise in water level would result in flow through the weir piping to the process sewer. Conversely, a plug on restriction in the weir piping during an unintentional water level increase would result in flooding of the operating floor. In addition the report cites that the current authorization documents do not recognize the disassembly basin as a long-term storage site for RINM.

Collection and interim processing of low-level waste from the reactor basin sand filter settler tanks will continue and a review of the means to dispose of this low-level waste is underway and a plan as to future disposal should be available by January 1, 1994.

3.5 K-Reactor Disassembly Basin

The EM-37 inventory had not been completed for this facility at the time of the Working Group Assessment Team visit. The inventory provided by the Site Assessment Team did not include 305 lithium control rods and 81 Mk 60B target assemblies in the reactor tank. The Working Group Assessment Team determined that the Mk 60B target assemblies and control rods do not fall into the scope of RINM, but is included for information.

The K-Reactor Basin contains a variety of RINM including Mk 22 fuel assemblies in vertical and horizontal storage, Li-Al alloy control rods in vertical storage, and a limited number of Mk 31 target slugs contained in bucket storage. In addition, irradiated ^{60}Co slugs are stored in the basin.

The end region of Mk 22 fuel and target material stored vertically on stainless steel hangers is subject to pitting corrosion as a result of the galvanic couple created between aluminum and stainless steel. The corrosion appears to be limited primarily to the aluminum-stainless steel interface although there is evidence of corrosion of the cladding on the fuel that was apparently initiated at scratches and other penetrations of the protective aluminum oxide coating. Mk 22 fuel placed in horizontal storage in 6061 alloy racks appears to have minimal surface corrosion. Although it was not readily visible, it is likely that the Mk 31 target slugs stored in the stainless steel buckets are corroding severely as they are in the L-Reactor basin. Corrosion of the ^{60}Co control rod assemblies were not reviewed in detail by the Working Group Assessment Team.

According to the Site Team Report, radioisotopes of interest to this initiative present in the basin water included tritium (0.22 mci/ml) and ^{137}Cs (450 dpm/ml). There is concern that if the activity level in the basin increases as a result of an increasing number of fuel/ target cladding failures, the current ion exchange capacity will not be able to maintain the activity level below the administrative limit of 500 dpm/ml.

The Site Assessment Team reports discusses several ES&H issues which are either being addressed or are in the planning process. Significant among them is the that the original basin design includes a weir overflow which directed excess basin water the environment via a process sewer. This design was considered preferable to flooding the building operating floor. The weir overflow has not been used since the installation of the deionizer system. The weirs remained installed, with the exception of C Reactor Basin which has been blanked off, therefore, an unexpected rise in water level would result in flow through the weir piping to the process sewer. Conversely, a plug on restriction in the weir piping during an unintentional water level increase would result in flooding of the operating floor. In addition the report cites that the current authorization documents do not recognize the disassembly basin as a long-term storage site for RINM.

Collection and interim processing of low-level waste from the reactor basin sand filter settler tanks will continue and a review of the means to dispose of this low-level waste is underway and a plan as to future disposal is expected to be available by January 1, 1994.

3.6 P-Reactor Disassembly Basin

The EM-37 inventory has not been completed. An inventory is provided in the site team report (Attachment A).

The P-Reactor basin primarily contains Li-Al control rods in vertical storage and a significant number of Mk 16 and Mk 22 fuel tube assemblies and Mk 60B Li-Al alloy targets in horizontal storage. In addition, Mk 42 ^{242}Pu-producing assemblies contained in aluminum cans are hung in the vertical position on stainless hangers.

Chemistry control is maintained with deionizers and a sand filter and although the deionizers have not been operated since August 1992, the ^{137}Cs activity level (160 dpm/ml) has not increased during the last 8 months that samples have been taken.

Collection of low-level waste from the reactor basin sand filter sumps will continue and a review of the means to dispose of this low-level waste is underway and a plan as to future disposal should be available by January 1, 1994.

The Site Assessment Team report sites several ES&H issues which are either being addressed or are in the planning process. Significant among them is the decision to allow the basin to overflow into the environment via a process sewer in lieu of flooding the operating floor. In addition the report cites that the current authorization documents do not recognize the disassembly basin as a long-term storage site for RINM.

3.7 C-Reactor Disassembly Basin

The inventory provided by the Site Assessment Team did not include 141 lithium control rods in the reactor tank. The Working Group Assessment Team considers the control rods do not fall into the scope of this assessment. The inventory is provided for information.

Collection and interim processing of low-level waste from the reactor basin sand filter settler tanks will continue and a review of the means to dispose of this low-level waste is underway and a plan as to future disposal should be available by January 1, 1994.

3.8 Building 773A

The Site Team did not perform an assessment of this facility prior to the Working Group Assessment Team visit.

3.9 Building 331M

The Site Team did not perform an assessment of this facility prior to the Working Group Assessment Team visit.

4.0 Conclusions from Facility Tour

Discussions in this section include perspectives and judgments of the Working Group Assessment Team as a result of tours, discussions with the Site Team, review of documents, etc.

4.1 Receiving Basin for Offsite Fuel

Features of the construction were as described in the existing SAR except one of the two cask unloading basins have been converted into storage basins. Basins, cubicles, and shield walls are made of reinforced concrete. Some of the concrete basin walls which do not have metallic liners are protected by paint with no visible signs of degradation. Above grade structures are either steel framing with transite walls or masonry. The roof is of steel framing with steel decking. Only a limited portion of the decking includes a concrete slab.

Despite the quality of construction and maintenance of the facility, the facility has features resulting from its vintage that would not be found in current designs. The presence of masonry walls above the disassembly, inspection and repackaging basins creates the potential of damage to irradiated fuel in the pool from a seismically initiated collapse of the masonry. The presence of an unhardened roof creates a similar potential from tornado missiles. Additionally, the storage racks although anchored to the floor and wall of the basin, they are not seismically qualified and therefore, potentially vulnerable to the Savannah River Design Basis Earthquake (DBE).

Except for fire extinguishes, no other fire protection features have been provided, because the risk is considered minimal in the SAR.

4.1.1 Criticality

All fuel assemblies stored at the RBOF facility are first loaded into canisters, and then are placed in the eggcrate-type storage racks which ensures required spacing. Configurations for a particular fuel type are evaluated with SRS validated methods.

Movement of canisters over storage racks is not physically possible thereby avoiding the potential for dropping canisters in transit on the racks.

There is no significant evidence of corrosion and subsequent fissile material release, and only a "dusting" of sludge. There are some pinhole leaks in the cladding, and consequent coolant activity. Fuel element discontinuities are discussed in the Site Team Report.

To protect workers in the event of an accidental criticality, Nuclear Incident Monitors (NIMs) are located adjacent to the storage pool, and the work basins where assemblies are handled and packaged into canisters, including cutting operations to reduce the volume of material to be stored. The NIM's are located so as to ensure detection and response characteristics necessary for personnel safety. However, the NIM's are not seismically qualified.

4.1.2 Fission Product Release

The aluminum-clad fuels in storage and 6061 alloy storage racks that have been in the basin for 30 years show no visible signs of corrosion. The Working Group Assessment Team notes that an independent corrosion assessment on metallographic specimens from RBOF components (Kustas et al 1981), confirmed low corrosion rates on aluminum and stainless steel after service periods of 15 to 16 years.

4.1.3 Radiation

The portable ion exchange columns used to control water chemistry in the reactor disassembly basins and remove fission products are regenerated at RBOF. As the corrosion of RINM continues the number of regenerations will result in an increased radiation exposure to workers. SRS reports that it has initiated plans to obtain additional portable ion exchange capability from an outside vendor. This action should reduce the frequency of revitalization.

4.1.4 Institutional Controls

Potential vulnerabilities are limited to the inadequacies in the safety documentation. The Site Team indicated that plans and schedules are in place for the development of an improved SAR as a means of eliminating these inadequacies.

4.2 H-Canyon Storage Basin

The storage of RINM was viewed by the Working Group Assessment Team via a video provided by the SRS Site Team.

4.2.1 Criticality

The Working Group Assessment Team determined that there has been seismic analysis done in the recent past for the H-Canyon structure, but this analysis does not adequately support the seismic design basis for the canyon and the RINM storage basin which is integral with the canyon. Also, results of the analysis suggests that portions of the canyon structure are not adequate for DBE, but these portions of the structure are not located in the vicinity of the storage pools. Further calculations are being done to support a seismic authorization basis for the canyon and the storage basin. No seismic calculations have been done in the past to support an authorization basis for the equipment needed to safely store RINM, nor will such calculations be completed until the analysis of the structure is complete. Because the RINM support racks are not anchored to the basin, they are subject to damage by impact due to tilting/overturning during a seismic event. This work must be completed to support an authorization basis.

If corrosion continues unmitigated in the fuel assemblies, increased releases of fissile and radioactive materials are probable. The possibility for criticality will increase with increased release of these materials, however, the structure of the storage rack should retain intact assemblies at required conditions except under severe seismic events.

4.2.2 Fission Product Release

Aluminum-clad fuel (Mk 16 and Mk 22) is stored in the H-Canyon basin. The RINM inventory is relatively low (i.e., 13 assemblies in five fuel bundles) when compared to that currently in interim storage in the reactor basins.

No corrosion on fuel has been detected, but the lack of installed mechanisms for the control of water chemistry can, in time, initiate corrosion. If corrosion is initiated, it would be expected to penetrate the aluminum cladding with subsequent dissolution of the enriched uranium fuel releasing fission products contained in the fuel as has been observed in the reactor basins. Fuel inspections are made using remote cameras.

The storage basin is a concrete cell lined with stainless steel. Any leaks would go to the canyon and would not be released directly to the environment.

4.2.3 Radiation

There are no concerns with respect to radiation sources from the storage of RINM in the basin as the basin is located in the Hot Canyon which provides adequate shielding.

4.2.4 Institutional Controls

The SAR and other documentation constituting the authorization basis for H-Canyon did not contemplate the interim storage period of RINM in the canyon to be extended far in excess of that assumed in the design concept of the facility (9 to 12 months) since the initial startup of the processing of enriched uranium fuel in 1959.

4.3 F-Canyon Storage Basin

The storage of RINM was viewed by the Working Group Assessment Team via a video provided by the SRS Site Team.

4.3.1 Criticality

Comments in section 4.2.1 concerning the lack of a seismic authorization basis for the H-Canyon are also applicable to the F-Canyon. The seismic analysis currently being performed should support the basis for both the H- and F-Canyon. The analysis to establish the authorization basis for the F-Canyon equipment cannot be started until the structural evaluation is complete.

Target slugs are stored in buckets in the storage basin. If observed corrosion continues unmitigated, increased releases of fissile and radioactive materials are probable. The possibility for criticality will increase with increased release of these materials, however, the structure of the bucket storage rack should preserve required spacings to prevent criticality except possibly under severe seismic events.

4.3.2 Fission Product Release

The Working Group Assessment Team observations determined that the bucket storage support racks are not experiencing significant corrosion; consequently, there should be no resultant structural integrity concerns in the short term except during seismic events.

The basin is filled with stagnant potable water and the capability to filter, purify, or mix the water to maintain water chemistry was not provided. Sampling and analysis of the stagnant pool is performed every 6 months. Currently, the results show a pH of 7.78, a conductivity of 200 μmho/cm, chloride at 10.7 ppm, and total gamma of 4.56 x 10E4 dpm/ml (2.03 x 10^{-2} μc/ml).

This condition is more conducive to corrosion and subsequent fission product release than the water chemistry condition that exists in H-Canyon.

Any leaks would go to the canyon and would not be released directly to the environment.

4.3.3 Radiation

Similar to that of the RINM in storage in H-canyon the targets are remaining in a non-favorable environment for far longer than that envisioned or anticipated. Continued delay in processing for an indefinite period will result in gross penetration of the aluminum cladding and subsequent release of depleted uranium, plutonium, and fission products to the basin. The Site Team and the Working Group Assessment Team discussed that the corrosion of the slugs and resultant nuclear material release would not significantly impact ES&H while the fuel remains in the F-Canyon; however, retrievability and handling would be incumbered.

4.3.4 Institutional Controls

The SAR and other documentation constituting the authorization basis for F-Canyon did not contemplate the interim storage period of RINM in the canyon to be extended far in excess of that assumed in the design concept of the facility (12 to 18 months) since the initial startup of the processing of RINM in 1954.

4.4 L-Reactor Disassembly Basin

The reactor storage basin was toured by the Working Group Assessment Team.

4.4.1 Criticality

Delays and subsequent suspension of processing at SRS beginning in 1989 have resulted in fuel and target residence times in the reactor basin significantly greater than those originally anticipated. (Basins were originally intended only for interim storage, i.e., ~ 12-18 months). The facility has a long, and successful operating history without criticality related incidents demonstrating the basic adequacy of the existing procedures for handling and storing fuel/targets, and operational limits related to required spacings, numbers of elements in process, etc.

Storage geometries include individual assemblies hung vertically from hangers in the VTS area, 1- or 2-assembly bundles stored horizontally in slotted racks in the HTS area, and target slugs stored in stainless steel boxes. The physical structure of the hangers, bundles, and buckets, coupled with administrative controls based on fuel characteristics preclude unacceptable spacings and configurations. Limits are based on calculations with SRS validated methods. Slots in the floors restrict the range of travel of assemblies in transit to well defined pathways, except directly over pool areas.

The Mk-16 assemblies stored in the VTS at L-reactor have been retro-fitted with additional hangers/rods to restrict lateral motion in case of such failures (a vertical drop of ~1 foot would still be possible). Buckets containing target slugs are being transferred into additional stainless steel containers; the criticality safety of this operation was evaluated by SRS. Criticality analysis are also being conducte by the site to allow for more dense packing in the HTS, where the galvanic corrosion of aluminium fuel assemblies has been shown to be less. Continued corrosion will accelerate the transport of fissile materials into the coolant; subsequent deposition/concentration in sludge and structural and water treatment components (e.g., sand filters) will also increase concerns related to possible criticality. It is currently proposed to remove this sludge via vacuuming, and tests have been performed at P-reactor. Criticality related evaluations were performed in connection with this operation at L-reactor and are scheduled to be performed at the other basins prior to vacuuming.

Consequences of seismic events beyond the current capabilities of the facility raise similar concerns related to possible criticality, including changes in the geometry, compaction, and release of fissile and radioactive materials

To protect workers in the event of an accidental criticality, Nuclear Incident Monitors (NIMs) have been placed in areas where the greatest potential for criticality exists (e.g., the Machine Area where assemblies are handled/packaged, including cutting operations to reduce the volume of material to be stored). The NIM's are located so as to ensure detection and response characteristics necessary for personnel safety. However, these are not seismically qualified.

4.4.2 Fission Product Release

The L Reactor basin contains a number of MK 16B fuel assemblies and Li-Al control rods in vertical storage. Mk 16B fuel assemblies are stored horizontally in 6061 alloy racks. In addition, a very large number of Mk 31 target slugs are stored in stainless steel buckets in the basin.

The L-Reactor basin was designed for short-term storage of material hence, facilities for water chemistry control were not sized to accommodate high levels of impurities in the water resulting from cladding failures. The accumulation of sludge (i.e., iron, aluminum, and silicon) on the floor of the basin also contributes to the water chemistry control and corrosion problems. The fission product ^{137}Cs concentration is increasing in the basin water probably as a result of increased cladding failures and corrosion of fuel and target material and the limited capacity of the ion exchangers to remove impurity ions. Consequently, the basin activity is approaching the administrative limit of 500 dpm/ml compared with a control limit of 1000 dpm/ml. Actions have been initiated to increase the ion exchange capacity and remove the sludge by vacuuming.

Aluminum-clad Mk 16 fuel that is suspended vertically on stainless steel hangers is corroding severely at the aluminum-to-stainless steel interface region where a galvanic couple is formed. Relatively little corrosion (i.e., pitting or general) is occurring on cladding removed from the end region however, corrosion is occurring in localized regions where the aluminum-oxide protective coating has been damaged; cladding penetrations are assumed based on studies on representative non-irradiated alloys. Mk 16 fuel stored horizontally in 6061 alloy racks shows little evidence of corrosion. This corrosion behavior is in sharp contrast with the behavior of Mk 31 target slugs stored in stainless steel buckets. Extensive pitting corrosion has penetrated the cladding and corrosion of the uranium target material is releasing uranium, plutonium, and fission products to the basin coolant. The activity level in the L Reactor basin is increasing, indicating that the corrosion continues to accelerate, making it increasingly difficult to control activity levels within the administrative limit of 500 dpm/ml as compared to a control limit of 1000 dpm/ml.

The primary corrosion problem from the standpoint of the physical condition of the material resides with the Mk 31 target slugs that are stored in stainless steel boxes; (i.e., corrosion is causing the fuel to deteriorate and release contamination. There is evidence that the rate of activity release is increasing, indicating that the condition is becoming more severe. The most severe condition related to Mk 31 target slugs resides in the L-Reactor basin. The rate of activity release is also increasing in K-Reactor basin. This is attributed to pitting corrosion penetrating the cladding and corrosion of the fuel in the Mk 22 fuel assemblies.

4.4.3 Radiation

Continued release of fission products to the L-Reactor disassembly basin and the removal of these fission products using portable ion exchange columns and cleanup of the basin water using the sand filters will increase the radiation exposure to workers involved in the handling and operation of the ion exchange columns and the sand filters. On-going efforts to increase the ion change capabilities with outside vendors should reduce the exposure to personnel by reducing the frequency of ion exchanger regeneration.

4.4.4 Institutional Controls

The disassembly basin(s) are used to store RINM material and its failure in the SAR has been considered to be incredible. However these basins were not specifically designed for seismic and the SAR does not address the seismic adequacy of the basin(s). There are nevertheless potential vulnerabilities to Structures, Systems, and Components (SSCs) due to a DBE as noted below:

a) The basin structure above the base mat is effectively separated into two segments via an expansion joint from the mat above. There is also an abrupt change in base mat continuity at the same location. To prevent leakage through the expansion joint, water stops have been installed. Because of the differences in the mass and rigidity of the two sections, the water stops are potentially vulnerable to failure due to differential motion of the two segments during a seismic event.

b) Due to inadequate steel reinforcements, the vertical frames in the Vertical Tube Storage (VTS) area have been identified to be inadequate to withstand a DBE. Since the VTS frames support the monorails and hangers from which RINMs are kept suspended under water, failure of the frames will cause failure of the RINM storage system in the VTS area.

c) Since none of the SSCs (eg. fuel handling crane and supports) inside the basin have been seismically qualified, their failure during a DBE can result in dropping of such items on the horizontally stored fuel assemblies. Similarly the dislodging of the cask handling crane with or without a suspended cask over the transfer bay pit during a DBE can not only damage any RINM that may happen to be in the pit, but also potentially perforate the pit floor.

Westinghouse Savannah River Company (WSRC) developed shutdown/standby plans affecting facility hardware, employees, and programs. Hardware changes include blanking sources for makeup water for the disassembly basin and the suction line from the disassembly basin for the containment heat removal system (river water and cooling water headers). Control room operators staffing has been decreased and casualty response may rely on building personnel and operators from other facilities. The authorization basis for this condition, referred to as the Basis for Interim Operation (BIO), has not been completed at the time of the Working Group Assessment Team visit.

4.5 K-Reactor Disassembly Basin

The reactor storage basin was toured by the Working Group Assessment Team.

4.5.1 Criticality

Sludge characterization and related safety/criticality analysis have not been completed for the Sand Filters and basin floors in the "K" Basin Disassembly Areas as have been done in "L" Basin. Sludge and debris bearing fissile material have accumulated on the basin floors, horizontal surfaces of the hanger in the vertical tube section, machine basin, storage and transfer basins. The potential mobility of this material is such that significant quantities of material can be transferred to other locations within the basin during handling/transfer operations and through the sand filter system during operation. Because of the dynamic nature of the fuel corrosion process and the potential increase in the relative ratios of fissile to corrosion product material, a continuing characterization/safety assessment program maybe needed in conjunction with basin cleanup and chemistry controls.

Continued corrosion will acceler transport of fissile materials into the subsequent deposition/concentration in sluc structural and water treatment components (e.; filters) will also increase concerns related to j criticality. It is currently proposed to reloc sludge via vacuuming, and tests have been pe at P-reactor. The current ES&H risk associat the sludge material appears low. SRS has ini comprehensive characterization and cr assessment program to better evaluate and p the possibility of fissile material relocation, cr and worker exposure events.

Delays and subsequent suspensi processing at SRS beginning in 1989 have res fuel and target residence times in the reacto significantly greater than those originally antic (Basins were originally intended only for storage, i.e., ~ 12-18 months). The facility long, and successful operating history criticality related incidents demonstrating th adequacy of the existing procedures for handli storing fuel/targets, and operational limits rel required spacings, numbers of elements in p etc.

Storage geometries include ind assemblies hung vertically from hangers in th area, 1- or 2-assembly bundles stored horizont slotted racks in the HTS area, and target slugs physical structure of the hangers, bundles buckets, coupled with administrative controls on fuel assembly characteristics preclude unacce spacings and configurations. Limits are bas calculations with SRS validated methods. Slots floors restrict the range of travel of assembl transit to well defined pathways, except directly pool areas.

The assemblies stored in the VTS area not been retro-fitted with additional hangers/r restrict lateral motion in case of such failures been done at L-reactor.

Consequences of seismic events beyo current capabilities of the facility raise s concerns related to possible criticality, incl changes in the geometry, compaction, and rele fissile and radioactive materials

To protect workers in the event accidental criticality, Nuclear Incident Mo (NIMs) have been placed in areas where the gr potential for criticality exists (e.g., the Machine where assemblies are handled/ packaged, incl cutting operations to reduce the volume of mater be stored).

The failure of the VTS concrete fr monorail and hanger structures as well as droppi various non seismically qualified SSCs can result in nuclear criticality through rearrangement of the storage array, mispositioning of fissile assemblies and crushing of fuel.

4.5.2 Fission Product Release

Aluminum-clad Mk 22 fuel that is suspended vertically on stainless steel hangers is corroding severely in the aluminum-to-stainless steel interface region where a galvanic couple is formed. Relatively little corrosion (i.e., pitting or general) is occurring on cladding removed from the end region however, corrosion is occurring in localized regions on the cladding where the aluminum-oxide protective coating has been violated and cladding penetrations have been confirmed. Mk 22 fuel stored horizontally in 6061 alloy racks shows little evidence of corrosion. Although they were not readily visible because of a lack of lighting, it is likely that the Mk 31 target slugs stored in stainless steel buckets are corroding and releasing uranium, plutonium, and fission products to the basin coolant. Even though there are only a few Mk 31 target slugs in the K-Reactor basin, the activity level is increasing, indicating that the major source of the basin activity is from corrosion of the Mk 22 fuel. This situation makes it increasingly difficult to control activity levels within the administrative limit of 500 dpm/ml as compared to a control limit of 1000 dpm/ml.

Analysis of the basin water shows a pH 5.5 to 8.5, a conductivity of 120 μmho/ml, 6 ppmCl, and an activity of 450 dpm/ml. As in the L-Reactor basin, there is concern that if the activity level in the basin continues to increase as a result of an increasing number of fuel/target cladding failures, the current ion exchange capacity will not be able to maintain the activity level below the administrative limit of 500 dpm/ml. An average sludge thickness of 3 inches on the basin floor exacerbates the corrosion problem by providing a source of impurity ions in the water.

4.5.3 Radiation

Continued release of fission products to the K-Reactor disassembly basin and the removal of these fission products using portable ion exchange columns and cleanup of the basin water using the sand filters will increase the radiation exposure to workers involved in the handling and operation of the ion exchange columns and the sand filters.

4.5.4 Institutional Controls

Because of the similarity in the basin design, the vulnerability cited in section 4.4.4 affecting L-Reactor Basin SSC's due to a DBE are also applicable to K-Reactor Basin.

The current authorization documents do not recognize the disassembly basin as a long term storage location for irradiated reactor components. The fuel and targets have been in storage since 1989. However the Cobalt-60 targets in the K-reactor disassembly basin have been in storage since about 1970 and while no corrosion is evident by observation from above the basin extended prolonged storage may result in corrosion on a welded joint and could result in a release of cobalt-60 to the basin water.

Collection of low-level waste from the reactor basin sand filter sumps will continue and a review of the means to dispose of this low-level waste is underway and a plan as to future disposal should be available by January 1, 1994.

4.6 P-Reactor Disassembly Basin

The reactor storage basin was toured by the Working Group Assessment Team.

4.6.1 Criticality

With the current P-Basin configuration, and the proposed future lay-up plans identified for each of the Reactor Disassembly Basins, a more credible accident event analysis is necessary than those currently identified and evaluated in the existing facility SARs. The existing SARs identify accidents, consequences, limiting conditions for operations, and mitigation controls for that of an operating reactor facility. The current configuration and proposed operations at the L-Reactor Disassembly Basin reflect conditions and operational considerations not normally associated with a reactor facility. This vulnerability does not indicate a higher potential risk condition at SRS but addresses the lack of a more accurate bounding description and comprehensive safety envelope for the disassembly basins in their present and proposed future operations. Safety events associated with the present and future corrosion conditions, loss of pool water, equipment failure, load drops, fissile material movement, loss of shielding, etc., need to be more accurately analyzed to reflect these conditions. Other changes in the facility configurations, system isolation, and operational considerations relative to the corrective actions for corrosion of cladding and fissile material need to be addressed as part of the credible events and risk mitigation.

Delays and subsequent suspension of processing at SRS beginning in 1989 have resulted in fuel and target residence times in the reactor basin significantly greater than those originally anticipated. (Basins were originally intended only for interim storage, i.e., ~ 12-18 months). The facility has a long, and successful operating history without criticality related incidents demonstrating the basic adequacy of the existing procedures for handling and storing fuel/targets, and operational limits related to required spacings, numbers of elements in process, etc.

Storage geometries include individual fuel assemblies hung vertically from hangers in the VTS area, and 1- or 2-assembly bundles stored horizontally in slotted racks in the HTS area. The only material of concern at P-Area that is stored vertically are nine Mk-42 assemblies. These are packaged in individual canisters with internal water coolant, and provisions for off-gas. The physical structure of the hangers, and bundles, coupled with administrative controls based on assembly/target characteristics preclude unacceptable spacings and configurations. Limits are based on calculations with SRS validated methods. Slots in the floors restrict the range of travel of assemblies in transit to well defined pathways, except directly over pool areas.

To protect workers in the event of an accidental criticality, Nuclear Incident Monitors (NIMs) have been placed in areas where the greatest potential for criticality exists (e.g., the Machine Area where assemblies are handled/ packaged, including cutting operations to reduce the volume of material to be stored). The NIM's are located so as to ensure detection and response characteristics necessary for personnel safety. However, the NIMs are not seismically qualified.

4.6.2 Fission Product Release

The P-Reactor basin primarily contains Li-Al control rods in vertical storage and a significant number of Mk 16 and Mk 22 fuel tube assemblies and Mk 60B Li-Al alloy targets in horizontal storage. In addition, Mk 42 ^{242}Pu-producing assemblies contained in aluminum cans are hung in the vertical position on stainless hangers.

Although there is no evidence of corrosion on the surface of the fuel assemblies, the general corrosion of components, including galvanic corrosion at the aluminum-stainless steel interfaces of the Mk 42 containers, aluminum tools, and the horizontal storage racks is judged to be most severe in the P-Reactor basin. The corrosion is monitored with visual inspections once a month, video inspections of the bundles, corrosion coupons, and sampling for ^{137}Cs in the basin water.

Because there are no aluminum-clad fuel assemblies in vertical storage or Mk 31 target slugs stored in this facility, the ^{137}Cs concentration is relatively low at 160 dpm/ml.

Chemistry control is maintained with deionizers and a sand filter. Although the deionizers have not been operated since August 1992, the ^{137}Cs activity level has not increased during the last 8 months that samples have been taken, suggesting that corrosion and fuel failures are not increasing substantially. However, there is concern that continued storage of the fuel under the current water chemistry conditions may increase corrosion, the number of fuel failures, and increase the activity level in the basin. An average sludge thickness (~3 in.) on the basin floor contributes to the ionic impurities in the water.

4.6.3 Radiation

The stability of the ^{137}Cs activity levels in the P-Reactor disassembly basin reduces the radiation exposure concerns to workers involved in the handling and operation of the ion exchange columns and the sand filters as compared to that discussed in other Basins.

4.6.4 Institutional Controls

Because of the similarities in the basin design, the vulnerabilities in section 4.4.4 affecting L-Reactor Basin SSC's due to a DBE are also applicable to P-Reactor.

4.7 C-Reactor Disassembly Basin

This facility was not assessed by the Working Group Assessment Team because the reactor basin does not contain any RINM.

4.7.1 Criticality

No additional comments/observations were made for this facility.

4.7.2 Fission Product Release

There is no RINM currently stored in the C-Reactor basin, and the ES&H concerns related to fission product release is limited to the disposition of basin sludge which is discussed earlier in this report.

4.7.3 Radiation

No additional comments/observations were made for this facility.

4.7.4 Institutional Controls

No additional comments/observations were made for this facility.

4.8 Building 773A

Four sections of irradiated Mk 16B fuel material that were cut from full-length fuel assemblies are stored dry in one of the hot-cell cubicles. Each fuel section, which is less than 2 feet long, is contained in an aluminum can with a screw lid. The fuel, which contains a total of 826 gm of uranium (256.7gm ^{235}U), has been stored in the hot cell since mid-1987.

4.8.1 Criticality

The amounts of fissile RINM material located in Hot Cell #16 does not pose any concerns with respect to criticality.

4.8.2 Fission Product Release

Examination of one of the four Mk 16B fuel sections that are stored dry in aluminum cans shows it to be in good condition with no deterioration evident. Based on this assessment and the apparent suitability of the facility, no current ES&H vulnerabilities or any that may be associated with the continued storage of this material are evident.

4.8.3 Radiation

No conclusions required.

4.8.4 Institutional Controls

No conclusions required.

4.9 Building 331M

Unclad (bare) natural uranium fuel elements discharged from the 305-M test reactor pile (a graphite moderated critical test reactor that operated at a low, 30 watts, power rating). Material consists of approximately 4940 Mk. 25 fuel elements, cylindrical rods about 1.42 " in diameter by 8.25" long, and in total about 20,000 kg. of normal uranium.

4.9.1 Criticality

The natural uranium fuel stored in this location is from an old, low power (10-30 watts) graphite moderated critical assembly. The material is stored dry in plastic-lined wooden boxes in a building. There are no concerns with respect to criticality for this material.

Material is in dry storage.

4.9.2 Fission Product Release

The rods are wrapped in plastic and contained in wooden boxes with steel strapping and are stored in a warehouse (331M) with no heating or air conditioning. The warehouse is equipped with fire protection sprinklers.

Direct observation of the material was not possible because of the packaging but the material is reported to have some slight physical deterioration leading to natural uranium dust contained by the plastic containing the rods.

4.9.3 Radiation

Material is contained within a radiation controlled area, RCA, between and adjacent to other materials. Access appears to be properly controlled.

The building is not seismically qualified.

4.9.4 Institutional Controls

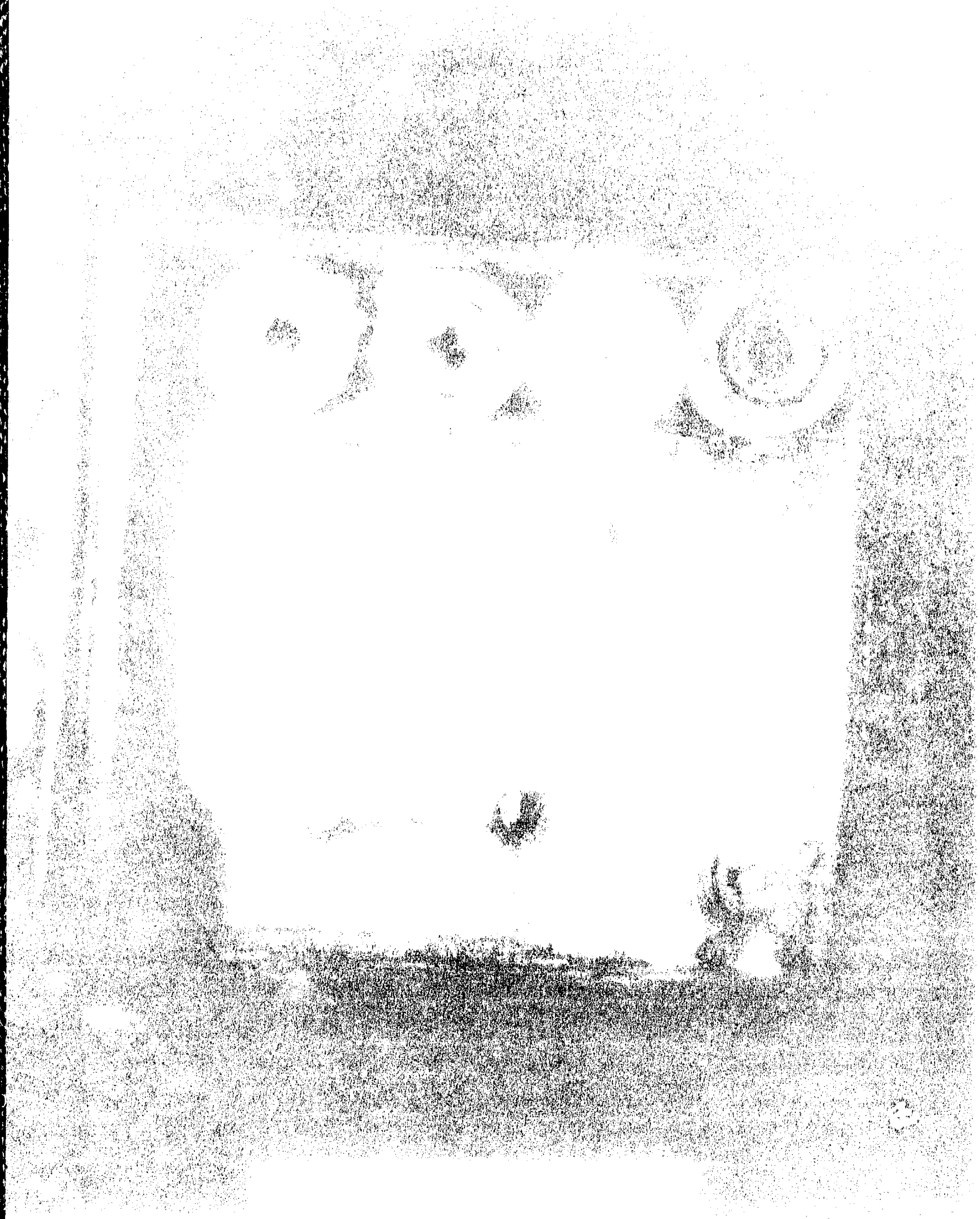
The warehouse is equipped with fire protection sprinklers.

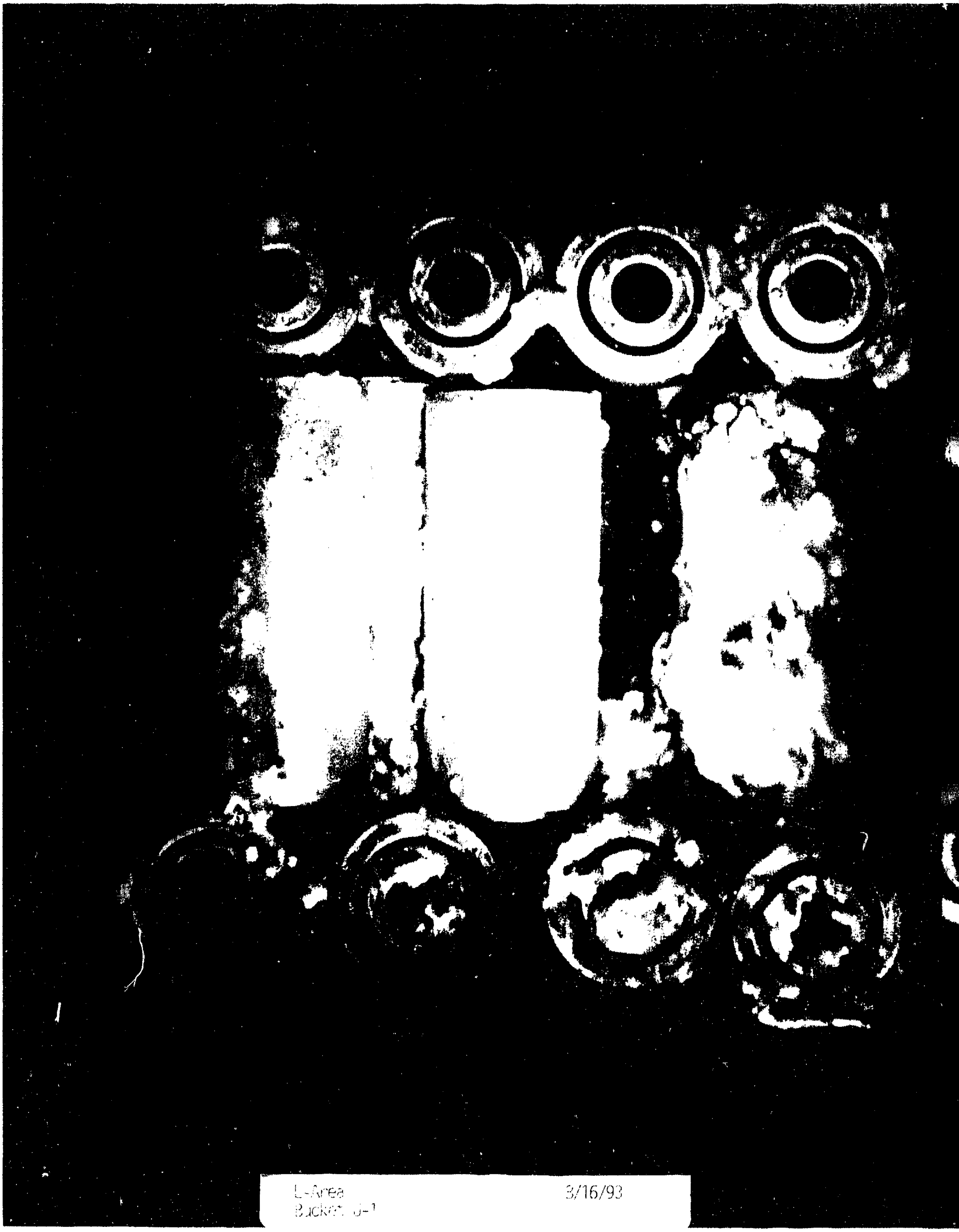
5.0 Summary

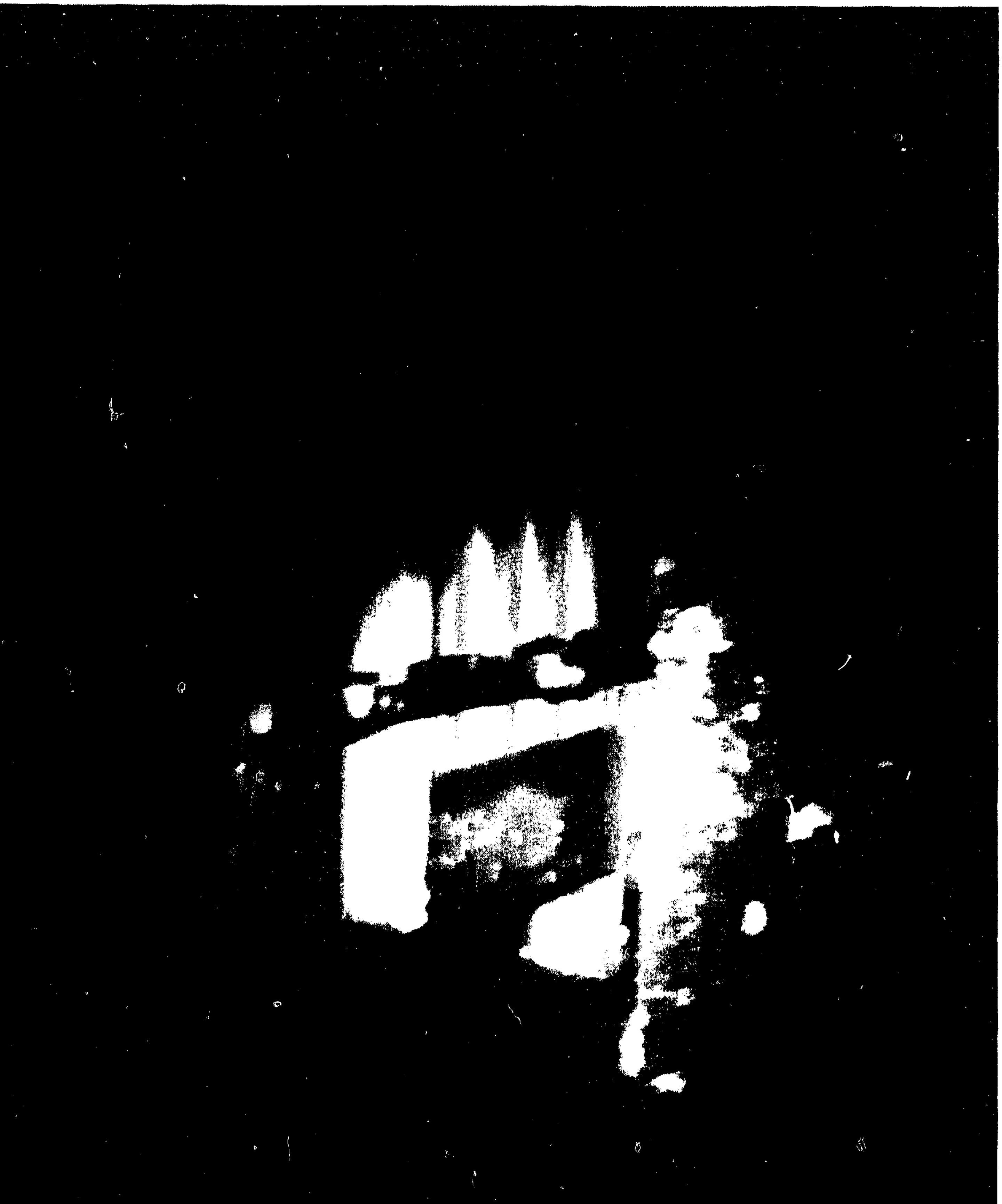
Corrosion of fuel and target materials in the water basins and its effects constitute the major ES&H vulnerability at the SRS pertaining to stored RINM. Corrosion is occurring in K- and L-Reactor basins and it is becoming increasingly difficult to maintain the Cs-137 activity within the administrative limit. Continued corrosion will eventually impact the physical integrity of stored materials. Such an eventuality would impact criticality, personnel radiation exposure, and fuel retrievability and disposal.

Attachment 1

Facility Photographs



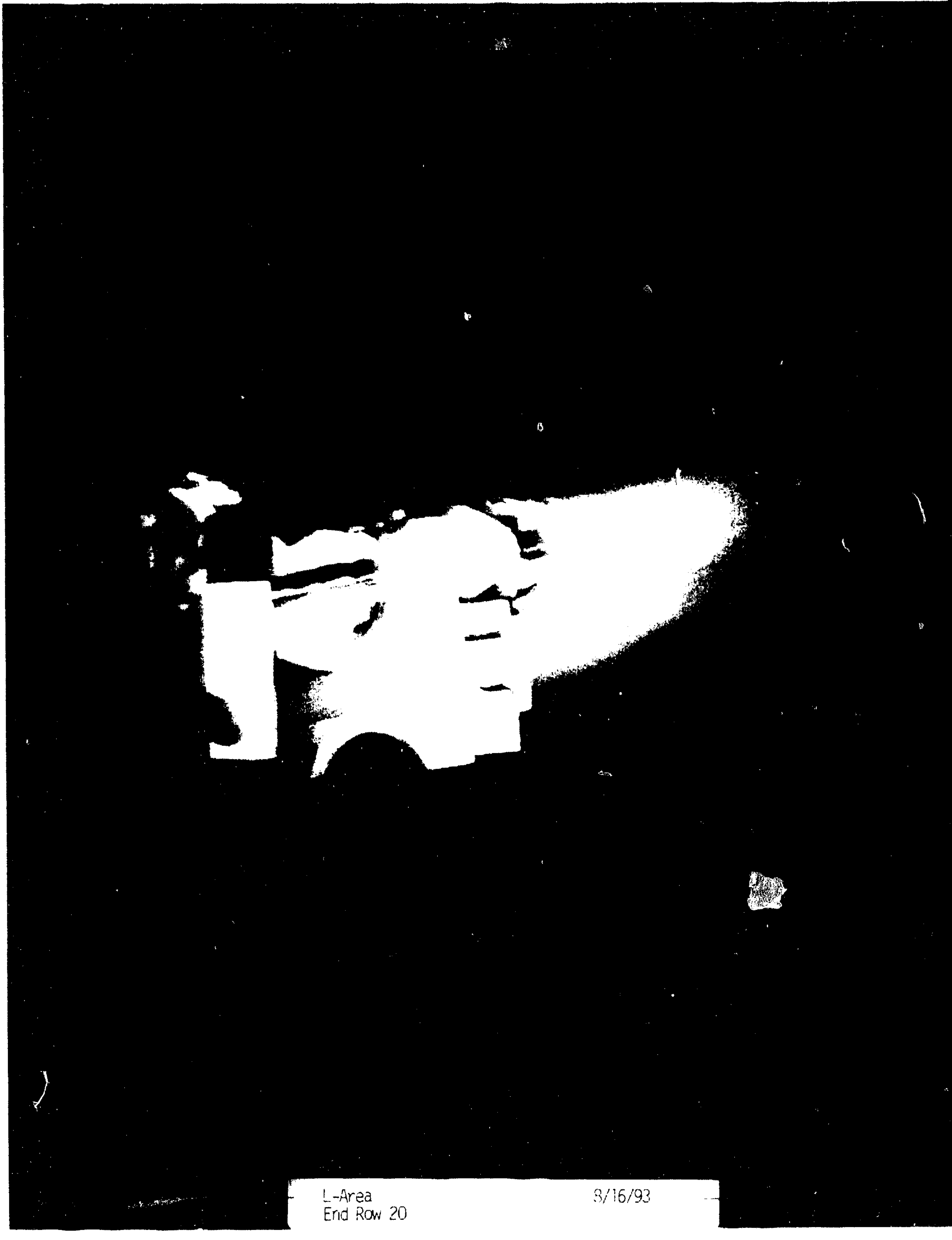

L-Area
Bucket J-1
3/16/93



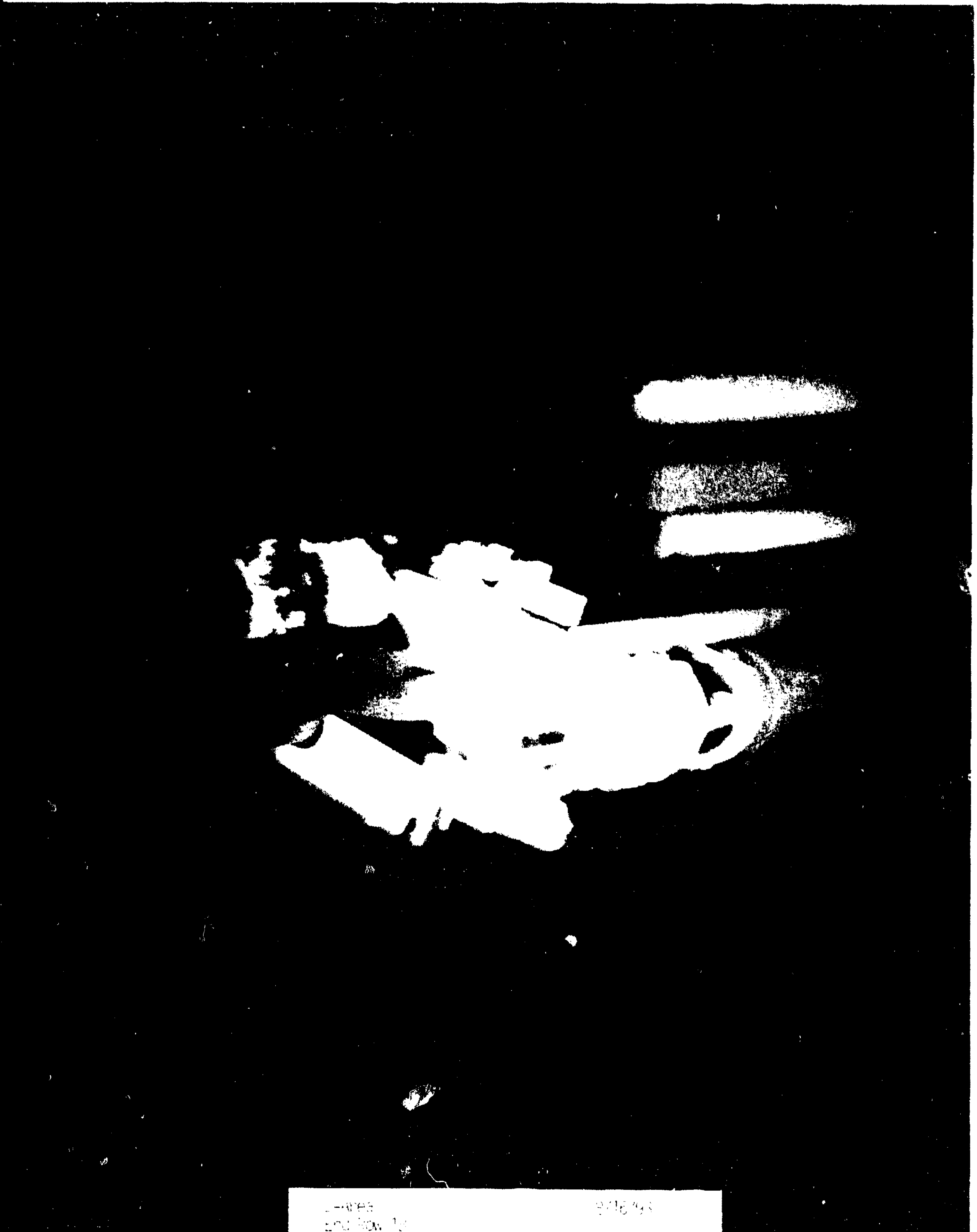
P-Area 8/16/93
Bundle Row 47 Left End


P-Area
16-93
Control Rod Bundle VTS

L-Area 3/16/93
Row 34 Dummy [illegible] Hanger



L-Area 8/16/93
End Row 20

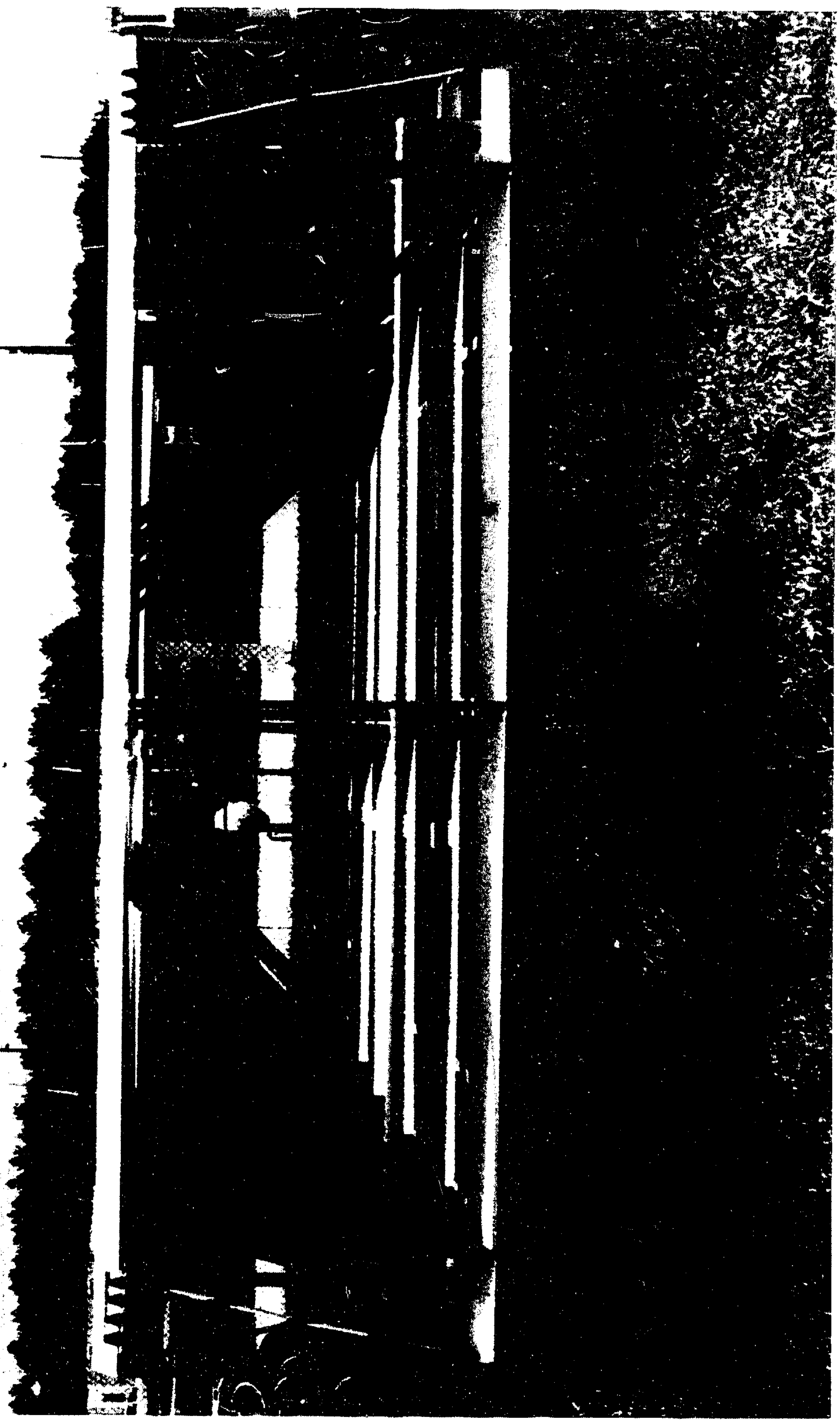


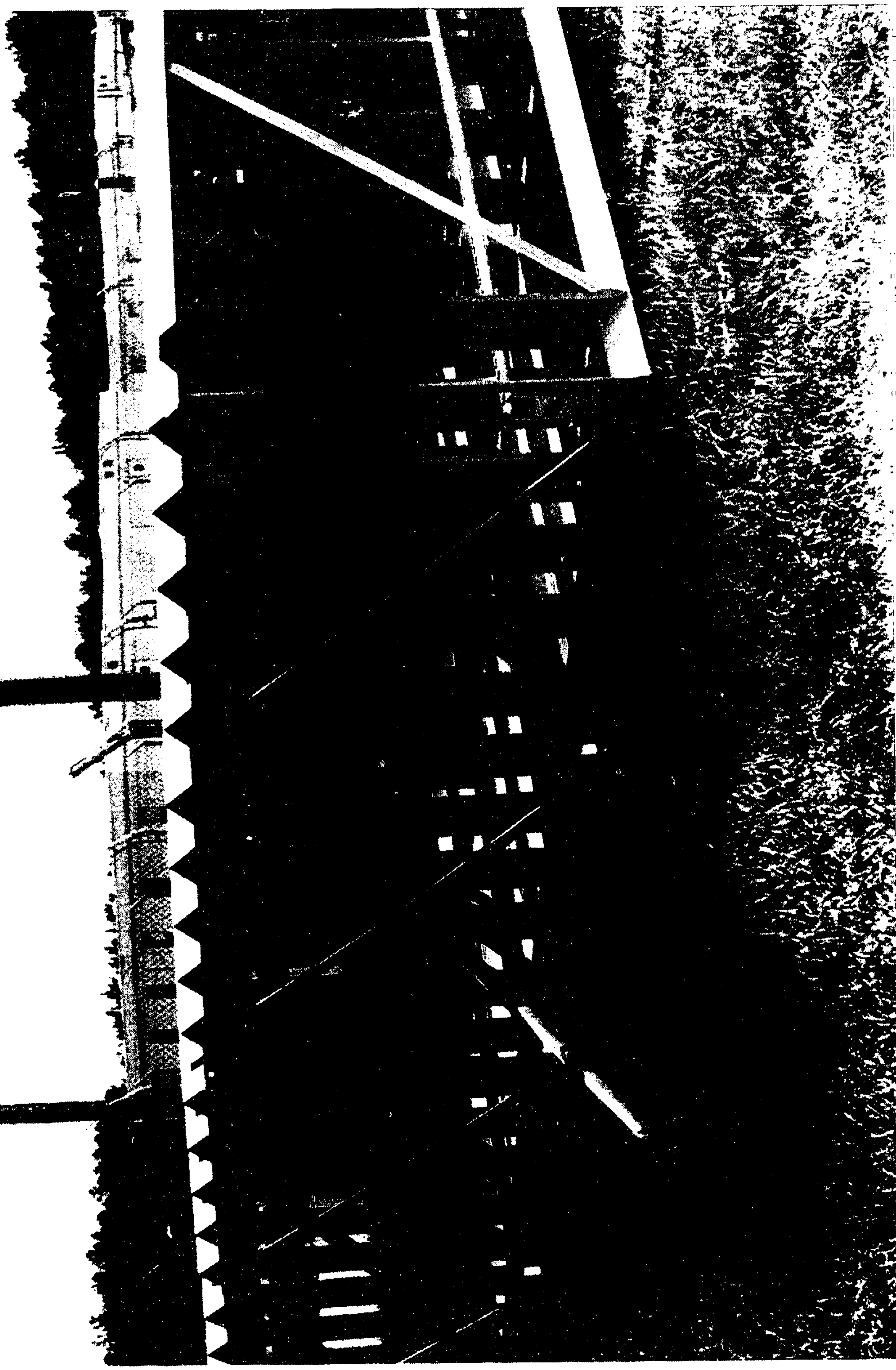
2 OF 7

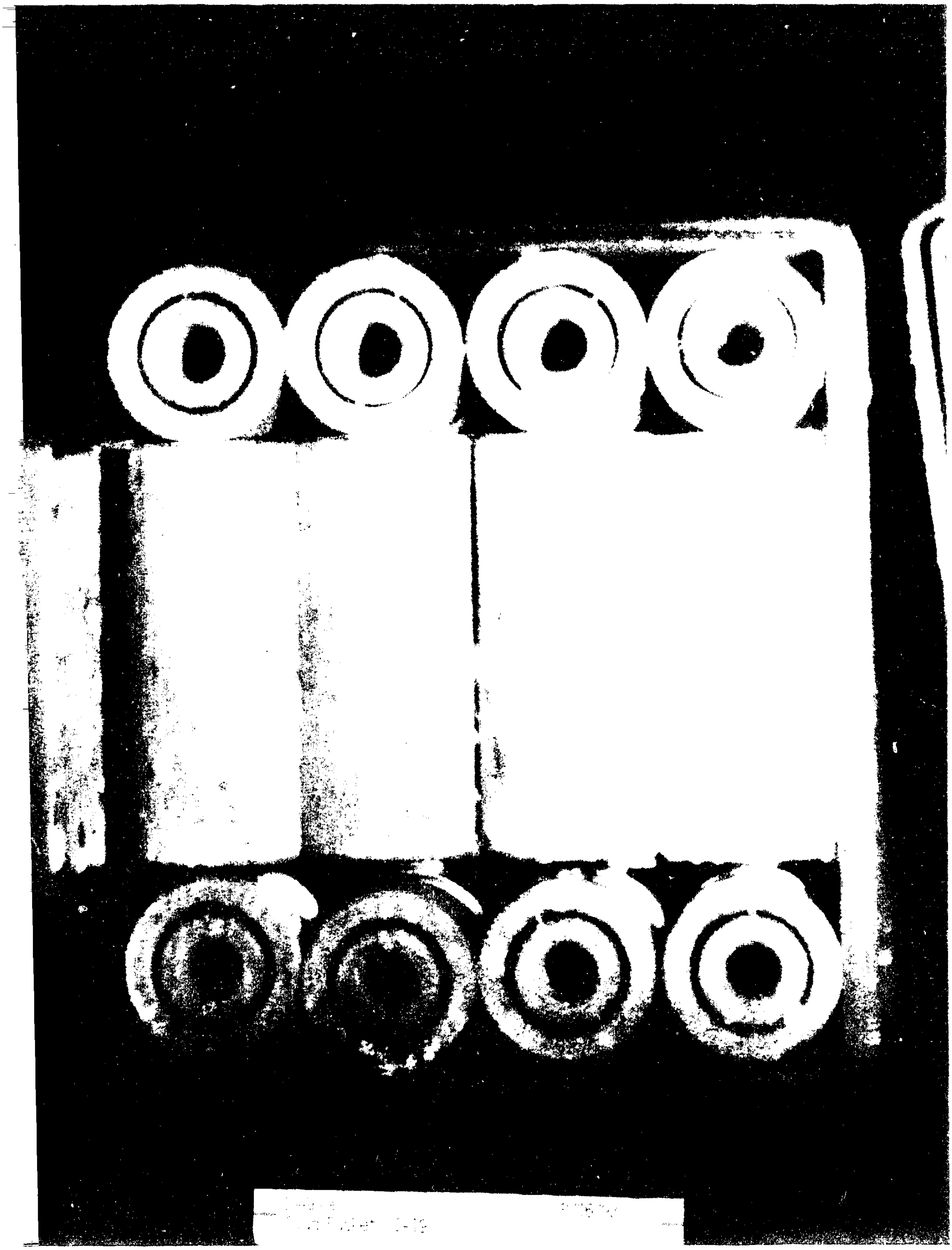
L-Area 8/16/93
Row 16 End

L-Area MK 16B 8/16/93
End Row 28

P-Area 8/16/93
HTS MK22 Fuel Bundle Right Side Row 44







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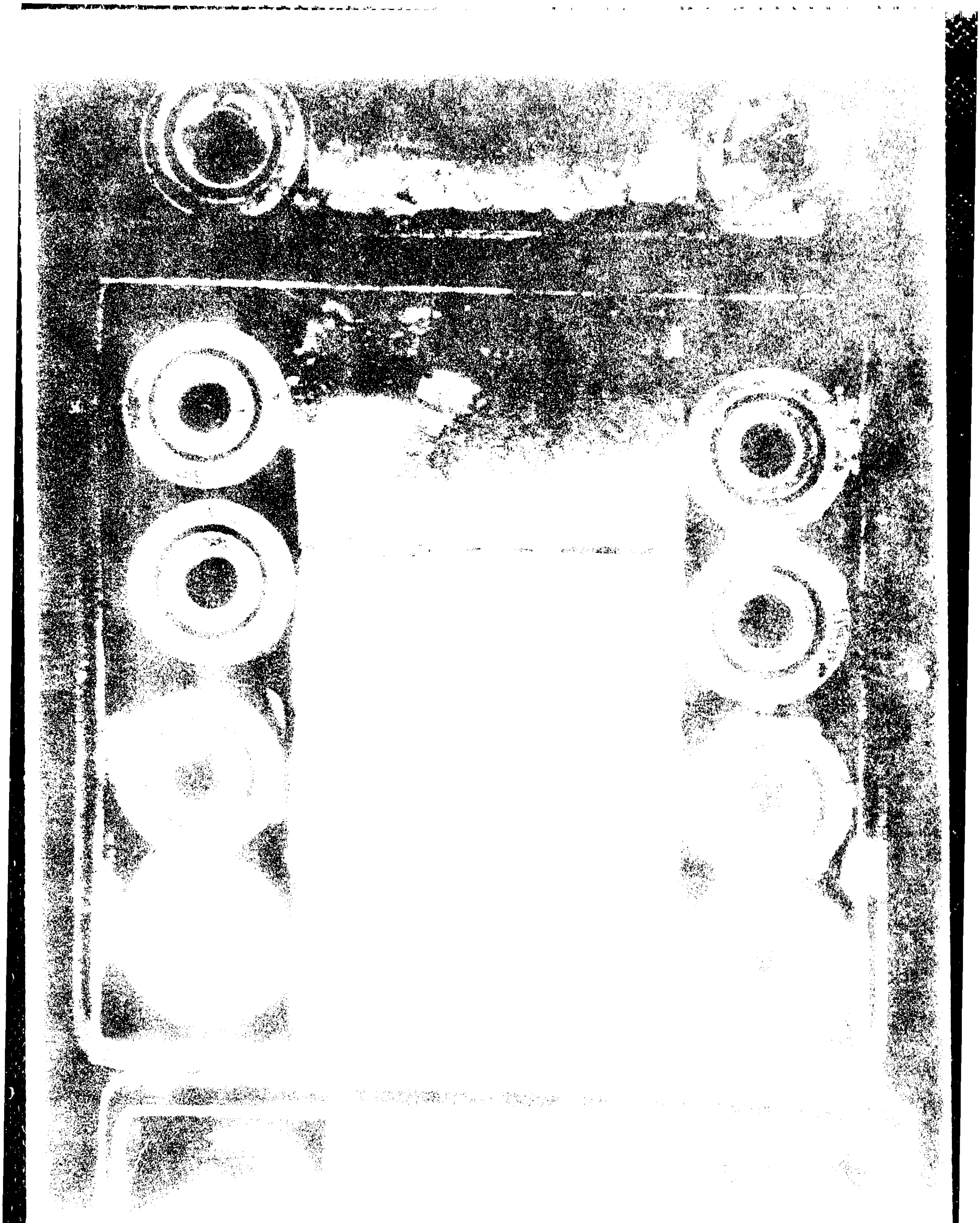
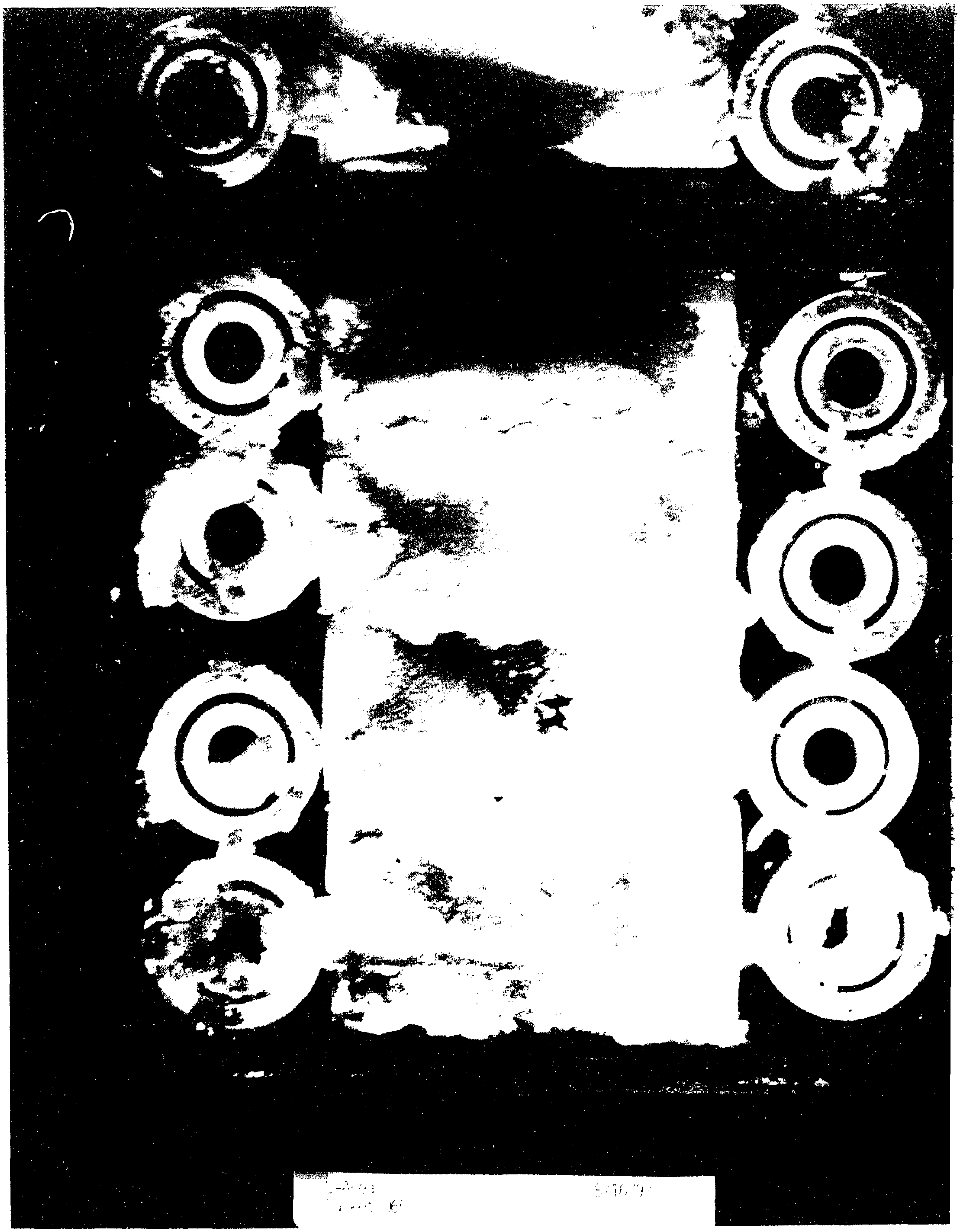
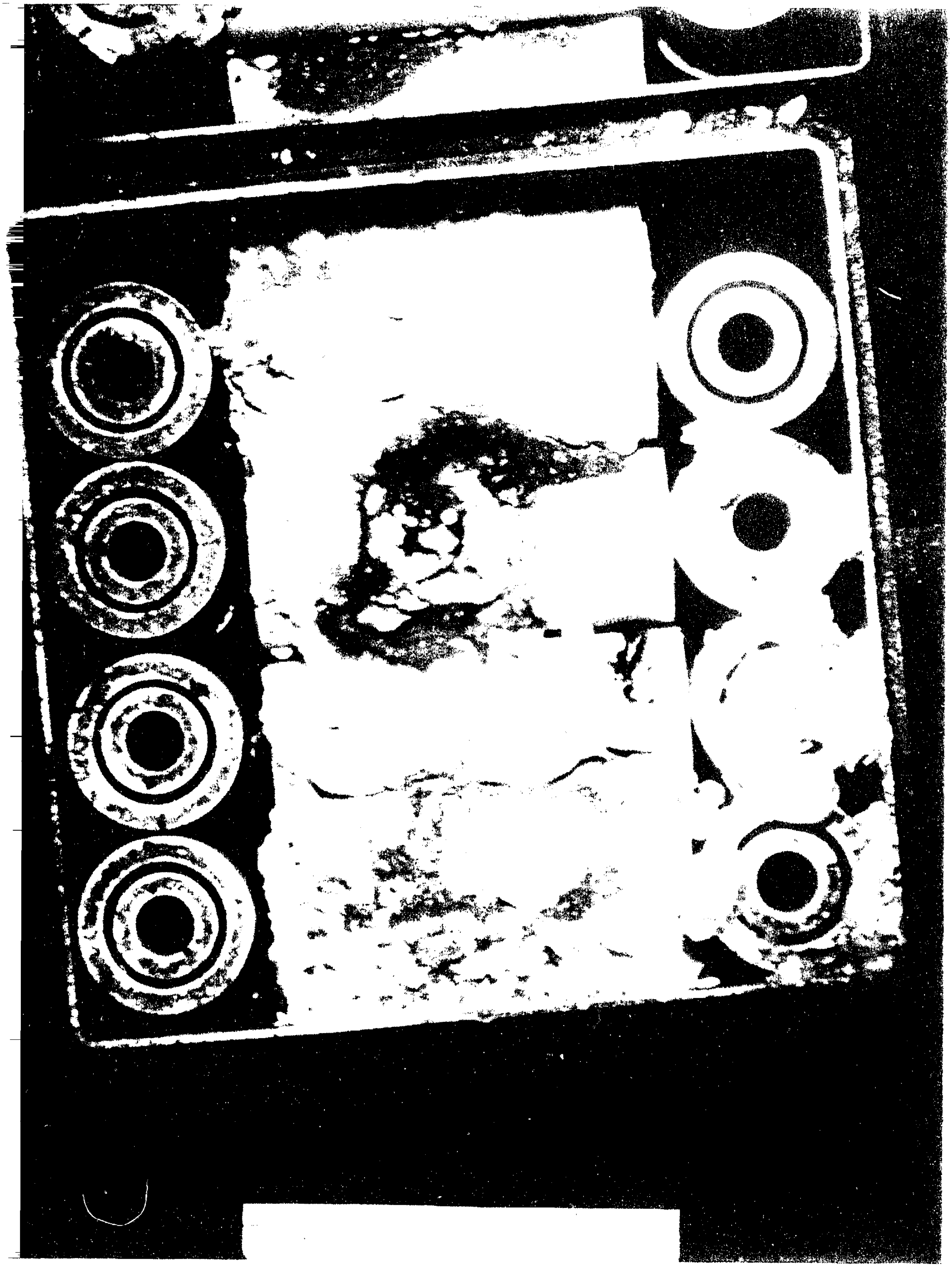
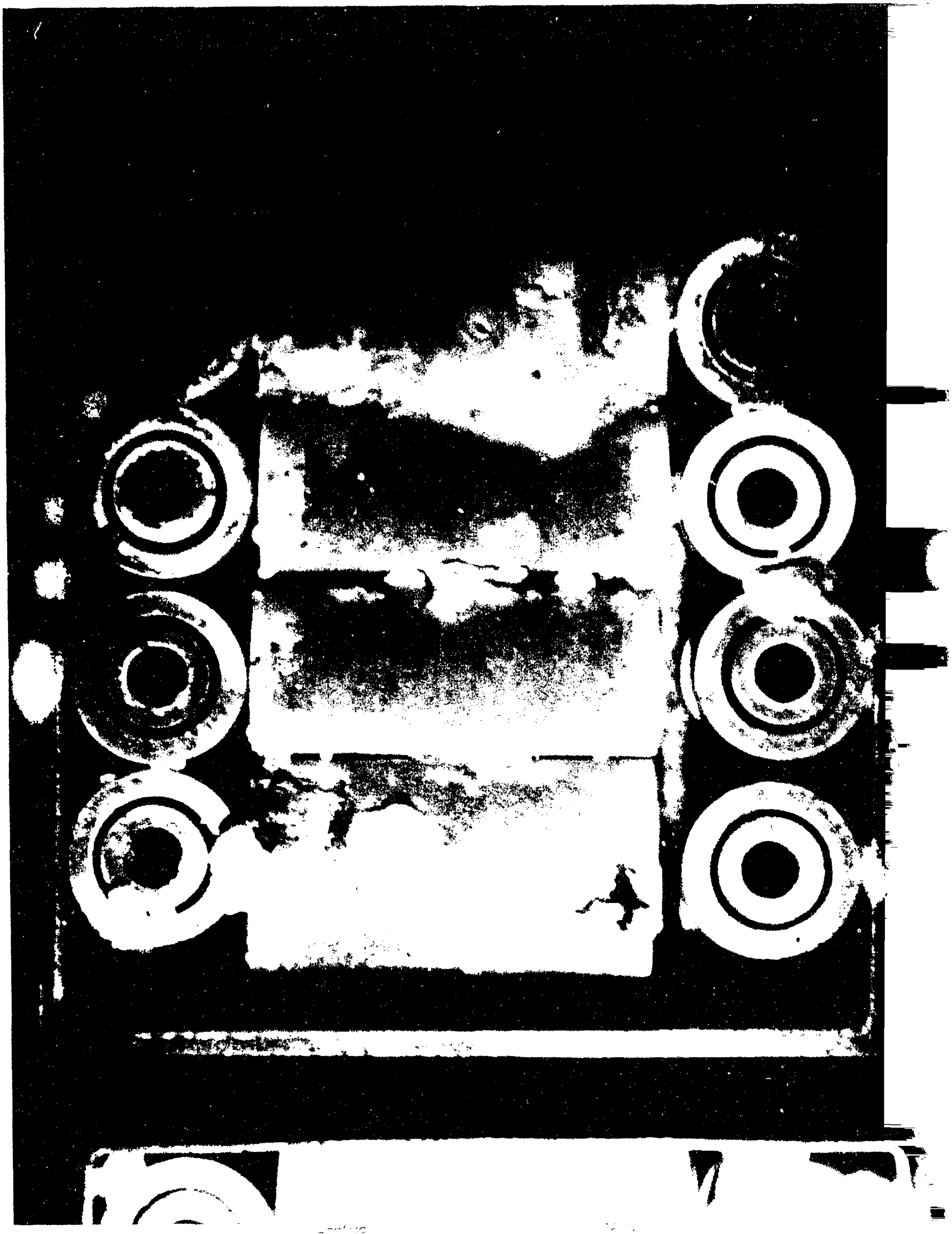
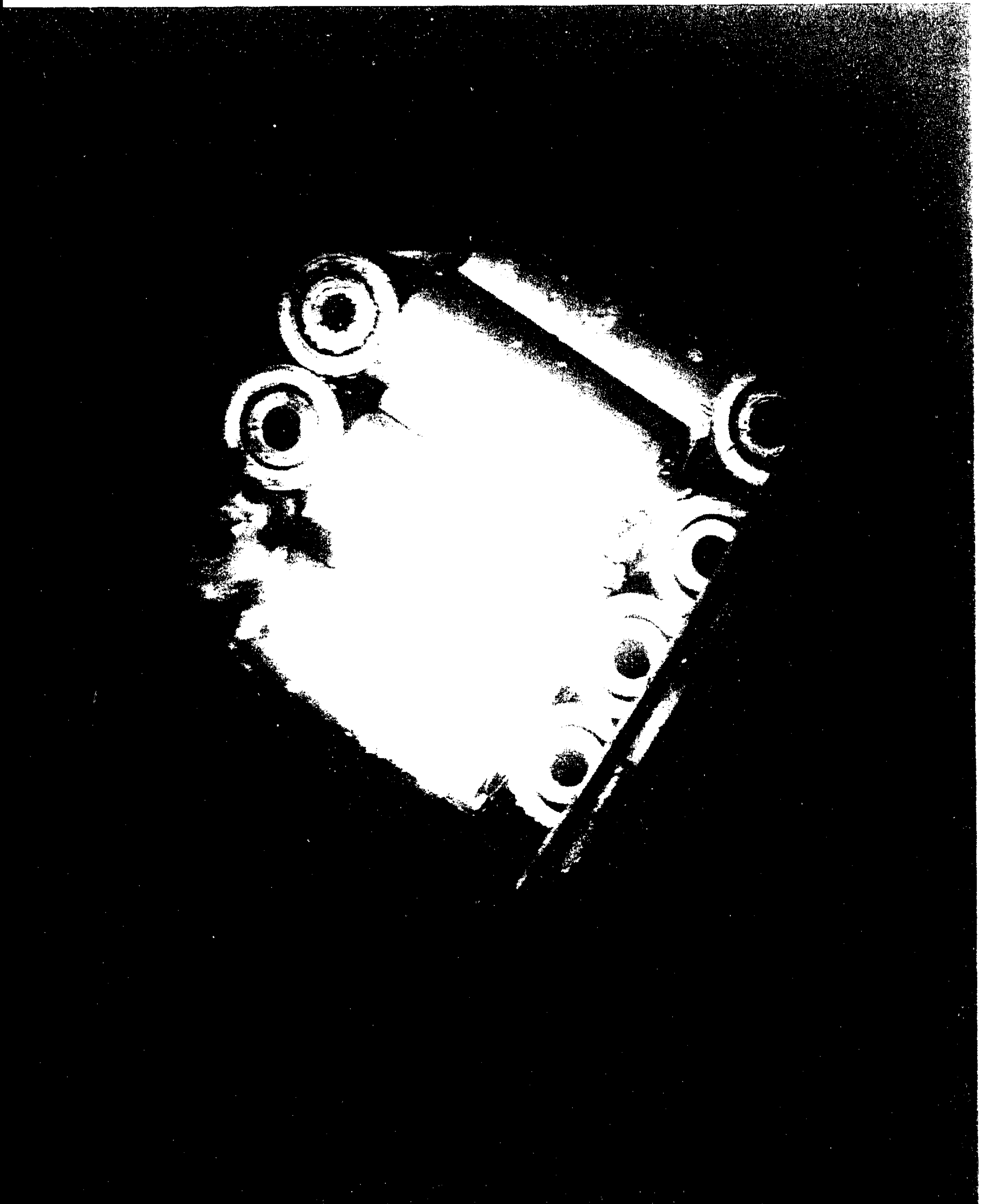


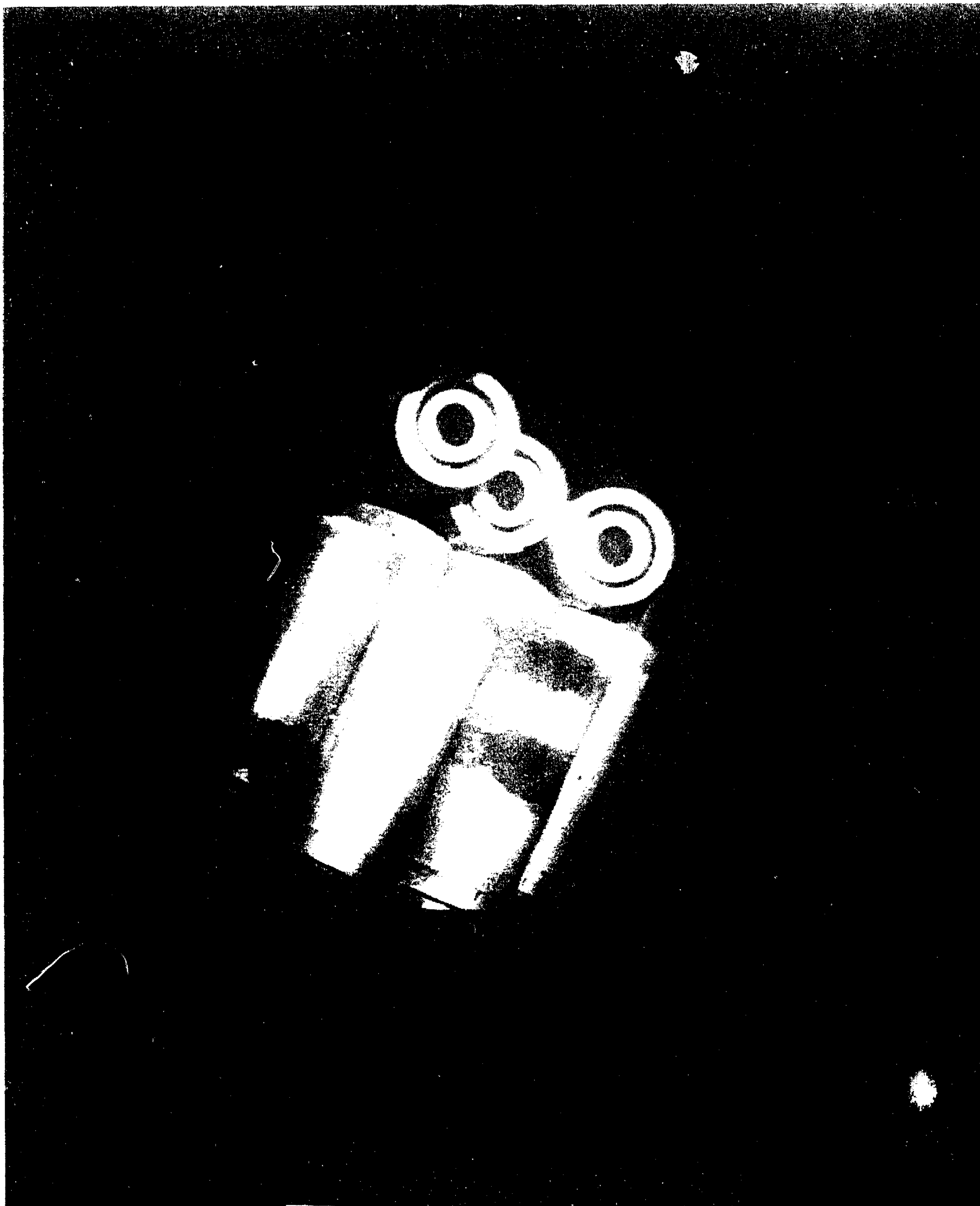




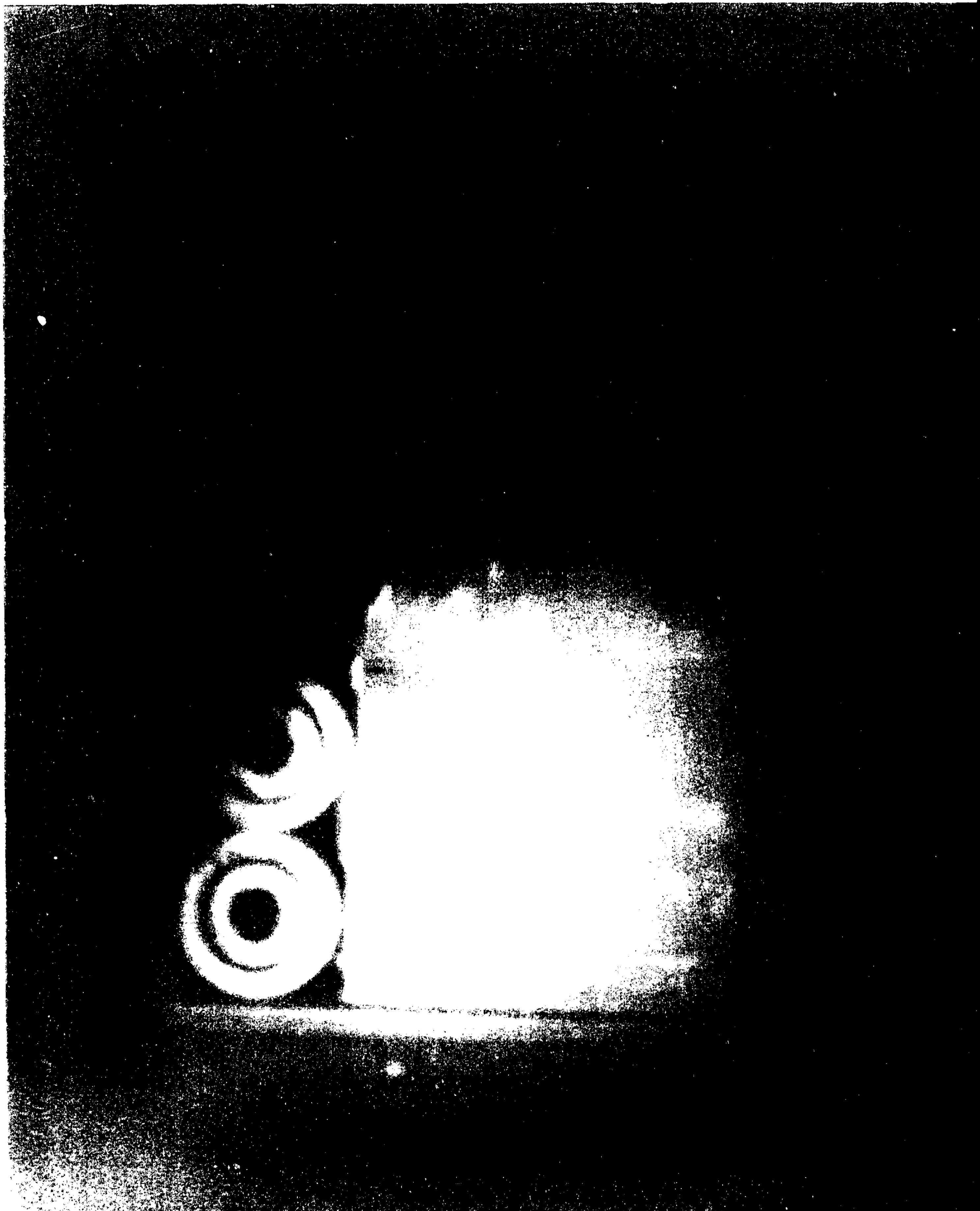




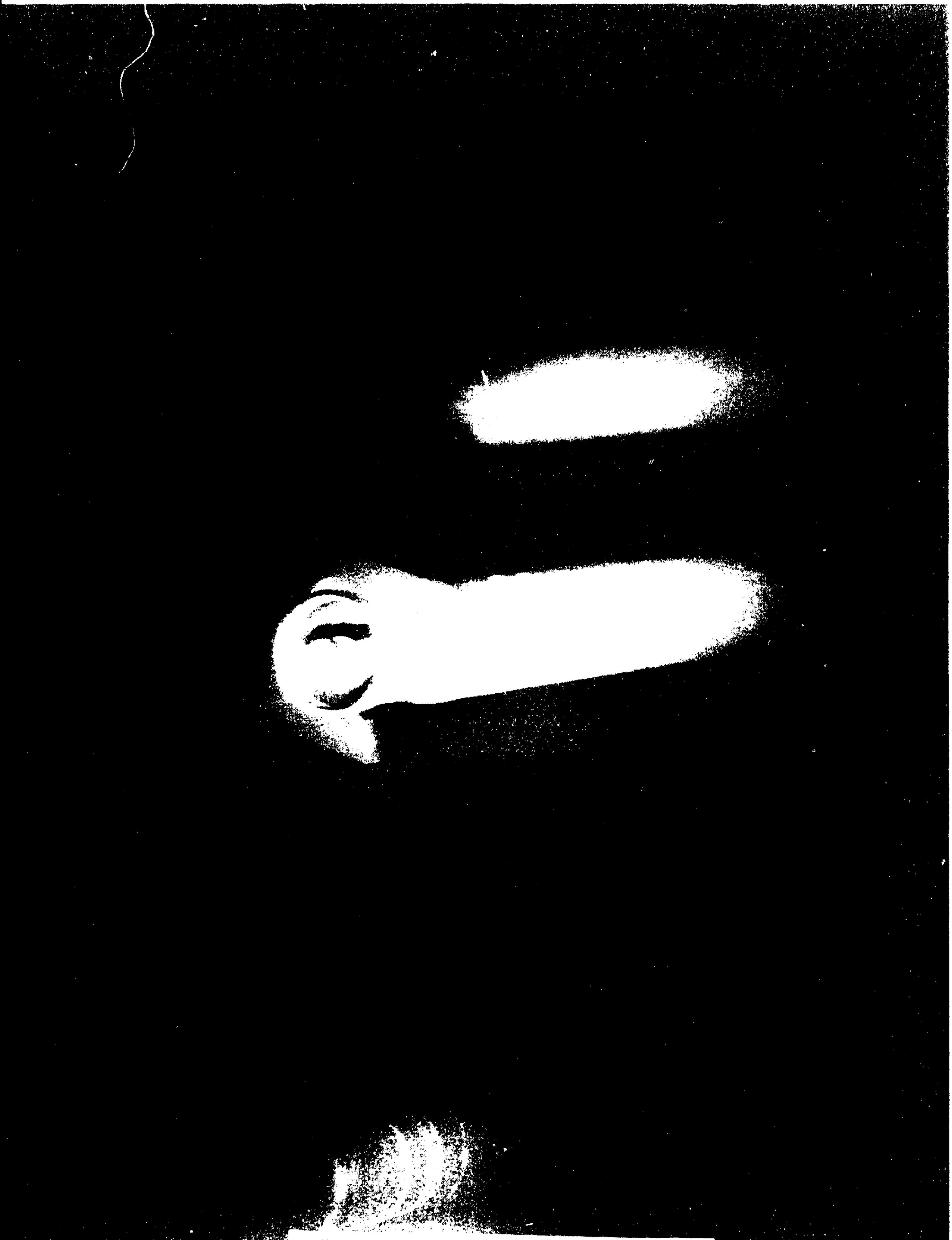
K-Area 8/16/93
Bucket 2 Emerg. Basin



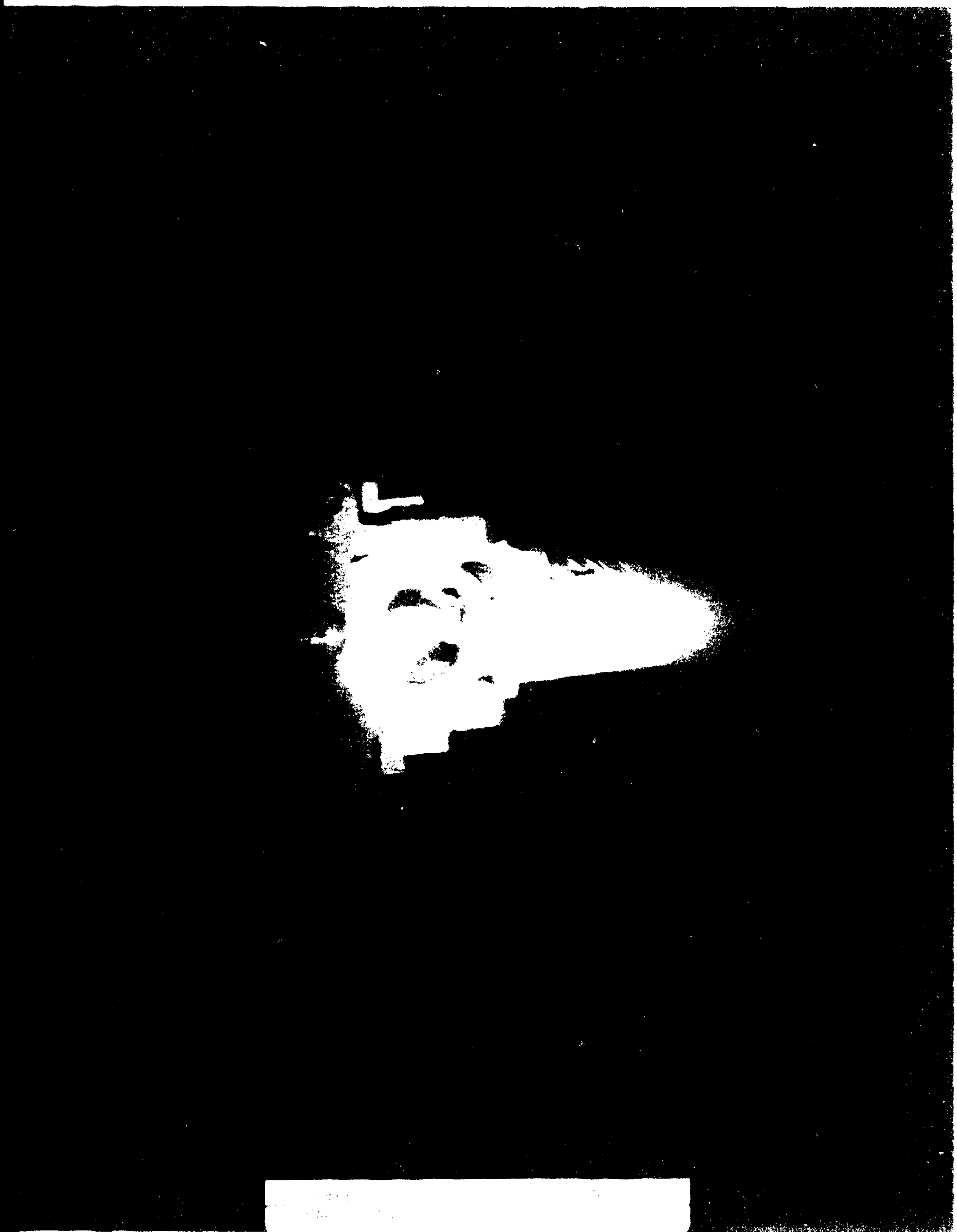
K-Area 9-16-93
Bucket Storage 10 Pieces



K-Area [illegible]
Bucket [illegible] 36 Pieces



K-Area 3/16/93
Row 6 End



Attachment 2

Vulnerability Development Forms

Table 1 Summary of Wet Basin Storage Characteristics

Facility	RBOF	K-Reactor	L-Reactor	P-Reactor	F-Canyon	H-Canyon
RINM Inventory	• Al, SS, Zry clad • metal/oxide fuel • housed Al cans/racks	• 896 MK 22 assys • 1 Mk 16B assy • 54 Mk 31A slugs • 36 Mk 31A slugs (all Al-clad)	• 514 Mk 16B • 6246 Mk 31A • 1 Th slug (all Al-clad)	• 9 Mk 42 • 449 Mk 16B • 60 Am (all Al-clad)	• Mk 31A slugs in 34 SS buckets (all Al-clad)	• 13 Mk 16B assys in tubes (vertical) (all Al-clad)
Gallons	0.5×10^6	3.4×10^6	3.4×10^6	4.8×10^6	0.003×10^6	0.013×10^6 *
Temperature	30°C	30°C	30°C	30°C	30°C	30°C
pH	7.4/7.5	6-8 (new range, 5.5-8.5)	6.7-7.9 (new range, 5.5-8.5)	6-8	7.8	8.5
Conductivity	1 μmhos/cm	120 (high of 180)	115 (high of 180)	145 μmho/cm	200 μmho/cm	171 μmho/cm
Cl^- ppm	(<10ppb)	6	20	9	11	6
Activity	$1 \times 10^{-4} \mu Ci/ml$	$2 \times 10^{-4} \mu Ci/ml$	$2 \times 10^{-4} \mu Ci/ml$	$7 \times 10^{-5} \mu Ci/ml$	$2 \times 10^{-2} \mu Ci/ml$	$8 \times 10^{-4} \mu Ci/ml$
Corrosion	• no visible corrosion on fuel, components, or coupons	• severe Al pitting at SS contacts • severe pitting on Al/U slugs in SS boxes • min. corr. Al-clad fuel stored horizontally	• severe Al pitting at SS contacts • severe pitting of Al/U slugs in SS boxes • min. corr. Al-clad fuel stored horizontally	• severe corrosion of Al cans at SS contacts • severe pitting of Al & CS fuel handling devices (no bucket storage)	• severe pitting of Al-clad slugs	• no recent inspection; no uranium in water analysis, but Al present
Sludge	thin dusting	3 in.(70% Fe,Al,Si)	1 inch	3 inches	unknown	unknown
Ion Exchange	permanent; 60 ft^3	portable; up to 120 ft^2; intermittent treatment	portable; up to 120 ft^2; intermittent treatment	portable; up to 120 ft^2; intermittent (pool water not treated over last year)	none - stagnant water	none - stagnant water
Filter	diat.earth (Porostone)	sand/anthracite	sand/anthracite	sand/anthracite	none	none
Storage Time as of 10/93	~30y for SS & zry. & 11y for Al	up to 5y	up to 5y	up to 5y	• disch. L-R 3/88 • In F ~2.5y	• disch. P-R 4/87 • In H 5/91&7/92
Corrosion Surveillance	• visual/photo • water analysis • coupons	• visual/photo • water analysis • coupons	• visual/photo • water analysis • coupons	• visual/photo • water analysis • coupons	• visual/video • water analysis • insp. 3/91&12/92	• no inspections through 10/93 • water analysis

* (Drained Dec. 1992; 2 bundles dry for 1.5d)

on the inventory was accomplished by asking about a random container being found on the master list. This container and its contents were quickly identified and verified. Sandia is currently implementing a bar code system to improve the current inventory system. The HP practices were carried out in a professional manner. There are no permanent radiation measuring devices (radiation air monitors [RAMs] or continuous air monitors [CAMs]) at the vault with detection of any release being relegated to direct HP monitoring prior to every entry for periodic inventorying and additions or removal of material. Inspections are performed on a periodic basis. Ventilation at the vault is only by natural circulation out the front of the vault. No criticality limits were posted at the facility; however, discussion with the site team showed that very detailed inventory control procedures are used. These procedures control the several steps used in the transfer and storage of RINM. The location and spacing requirements specified in these procedures will prevent any criticality concerns.

Conclusions

The walkdown validated the Site Team report concerning the amount, positioning, general condition of the facility and controls to protect the spent fuel and RINMs.

4.2 Annular Core Research Reactor Facility

The WGAT performed a walkdown of ACRR which is a typical research reactor in configuration and operation. The team located the storage locations near the reactor.

The walkdown included observation of the following parameters: potential of water ingress, the health physics practices and air monitoring, the ventilation system, the apparent age and condition of the facility, any corrosion of containers, criticality safety, and general maintenance. The possibility of water ingress into the storage holes was judged to be low based on the location and design of the storage pits. The facility is ventilated using a typical negative pressure approach which forces any releases through a filter system. Any actual release of activity during opening of the pits would be expected to be detected immediately by both local HP instrumentation and permanent radiation detectors near the storage locations. The facility appeared to be maintained in excellent condition and no corrosion of the storage containers would be expected based on the materials of construction and the design. Criticality limits were posted to control any changes to the existing configuration.

Conclusions

The walkdown validated the Site team report concerning the condition, location, controls, and structural integrity of the storage locations at the ACRR.

4.3 Sandia Pulse Reactor Facility

The team conducted a walkdown of the spent fuel storage locations under the control of the Sandia Pulse Reactor facility. These locations were both inside and outside the facility building. Inside the building was a storage vault containing fuel stored in a movable cart. Outside the facility is a series of tubular storage pits (the Yard) placed underground containing a large variety of materials.

The walkdown included observation of the following parameters: potential of water ingress, the validity, the health physics practices and air monitoring, the ventilation system, the apparent age and condition of the facility, any corrosion of containers, criticality safety, and general maintenance.

The SPR appeared to be in good general condition with the storage vault clean without any signs of water ingress. Criticality limits were posted. Monitoring for any degradation of the fuel appeared to be adequate with typical radiation monitors present both locally and on the ventilation system. No corrosion was visible on the outside of the fuel canisters in the vault. The storage pits outside the facility were located and were visually observed from a distance. These tubes have a cap but are susceptible to water ingress if sheet water from a large rainfall in a short period of time. Also, some dust ingress into the pits is possible.

Conclusions

The walkdown validated the Site team report concerning the condition, location, controls, and structural integrity of the storage locations at the SPR facility.

4.4 Hot Cell Facility

The assessment team conducted a walkdown of the storage locations associated with the Hot Cell Facility located near the ACRR. These locations include the storage vault in the hot cell and a storage pit located outside the hot cell located under the crane. This outside storage pit contains a fuel sample from the Savannah River site production reactors.

The walkdown included observation of the following parameters: potential of water ingress, the health physics practices and air monitoring, the ventilation system, the apparent age and condition of the facility, any corrosion of containers, criticality safety, and general maintenance.

The inside storage vault was in excellent clean condition with no signs of water ingress. There were no fire sprinklers and little flammable material inside the vault. The inventory of containers appeared consistent with the site report. Criticality limits were posted and normal radiation monitoring equipment was present. A negative differential pressure ventilation system was in use. No corrosion of containers was noted.

Conclusions

The walkdown validated the Site team report concerning the condition, location, controls, and structural integrity of the storage locations at the Hot Cell facility.

4.5 SNM Storage Facility

Two irradiated fuel "disks" from one of the SPR reactors as well as fifteen unirradiated fuel disks are currently in storage at this location. Because of the access difficulties of conducting a walkdown, no walkdown was performed. However, the WGAT was provided with ample information including a viewing of a number of photographs taken of the fuel while in the facility. It was noted that the disks are individually suspended in "cages" with required separations of over three feet to preclude criticality.

5.0 Summary Conclusions

Two Potential Vulnerabilities were initially identified by the WGAT. However, during the Factual Accuracy review conducted at the end of the WGAT''s visit, the WGAT was informed of sufficient additional information relative to one of the vulnerabilities, so that it was dispensed with.

The remaining vulnerability, SNL-1, described below, was thoroughly reviewed by the site representatives and received their concurrence.

Potential Vulnerability SNL-1:

"The current approved safety analyses do not adequately address the storage of spent fuel and RINM for Manzano Storage Structures, Sandia Pulse Reactor (SPR), Hot Cell Facilities (HCF), and one SNM storage location. The need for upgrading Sandia National Laboratories (SNL) nuclear facility Safety Analysis Reports (SARs) to meet DOE 5480.23 has been recognized, and an implementation plan has been sent to DOE. This plan, in conjunction with the old SARs, is considered the authorization basis for the facilities. The updated SARs will specifically provide safety analysis for spent fuel and RINM storage locations when implemented."

SPENT FUEL INITIATIVE

General Atomics, San Diego

WORKING GROUP ASSESSMENT TEAM REPORTS

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

GENERAL ATOMICS

Preface

The Secretary of Energy's memorandum of August 19, 1993, established a requirement that the Department determine the vulnerabilities of stored spent fuel and other reactor irradiated nuclear materials. A Project Plan to accomplish this study was issued on September 20, 1993 by EH-1 which established responsibilities for laboratories and personnel essential to the study. The DOE Spent Fuel Working Group, which was formed for this purpose and which produced the Project Plan, will manage the assessment and produce a report for the Secretary by November 20, 1993.

The following report prepared by one of several Working Group Assessment Team contains the results of the study of potential vulnerabilities at General Atomics where DOE fuel is being stored at two locations. Results contained in this report will be reviewed along with similar reports from all other selected DOE storage sites, by a select committee which will finally assemble the Working Group report to the Secretary on spent fuel storage inventory and vulnerability.

Executive Summary

The Working Group Assessment team visited General Atomics October 8, 1993, where it conducted an evaluation and validation of that site's responses to the Working Group's request for information. One storage facility, the hot cell facility, and a future designated storage facility next to the Linear accelerator, were represented in the review. Assessment walkdowns of both facilities were conducted.

As a result of the study by the Working Group Assessment Team, no potential vulnerability was identified for this site. However DOE should take immediate steps to reclaim this material to take it out of the hands of a disinterested landlord. There appears to be no reason to delay transfer of the fuel to a DOE facility.

1.0 Objectives

The primary objective of the visit by the Working Group Assessment Team (WGAT) to General Atomics was to receive, evaluate and validate information assembled by representatives of two storage facilities with respect to storage of reactor irradiated nuclear materials (RINMs), and to discern the existence of potential vulnerabilities for the Department resulting from such storage. The WGAT also had the objective of conducting this assessment according to the direction of the Spent Fuel Working Group described in both the Project Plan and in the Assessment Plan so that the conclusions and identified vulnerabilities would be comparably detailed, defined and described to those of other teams at other sites. Still another objective of the WGAT visit is to ensure that site representatives play key roles in the process and are therefore fully cognizant, if not in full accord, with conclusions reached by the WGAT.

2.0 Facilities and Inventories

This section of the report lists each storage facility, along with brief descriptions of salient features of the facility, purpose, nature and frequency of operations, typical RINMs stored (not detailed), normal and maximum (if applicable) inventories of heavy metal (MT). Attachment 1 of this report contains detailed inventory information provided by the site in response to the EH-1 request.

2.1 - Hot Cell Facility

Description:

The Hot Cell facility consists of office space, three hot cells (the high-level cell, low-level cell, and metallography cell), and operating gallery, and hot and cold auxiliary areas.

The high-level cell, which is the largest of the cells and which has the most shielding, is 8 ft wide, 18 ft long, and 15 ft high. The cell walls range from 42 in. thick high-density concrete on the front to 60 in. thick conventional concrete on the rear. A two section steel door separates this cell from the adjacent low-level cell; the lower section is 21 in. thick and 11 ft high, and the upper section is 12 in. thick and 3 1/2 ft high. There are three operating stations, two on the front wall and one on the end wall, each with a viewing window and two master-slave manipulators.

The low-level cell is 10 ft long, 8 1/2 ft wide, and 15 ft high. The wall of this cell are formed by the high-level cell door, a 17-in-thick solid steel door to the specimen area, a 36 in. front wall and 32 in. back wall of high-density concrete. The front wall has a viewing window with manipulators and various shielded access holes. There are also shielded transfer tubes connecting the low-level cell to the other two cells.

The metallography cell measures 9 ft long, 5 ft wide, and 11 1/2 high. The walls are made of high-density concrete and range in thickness from 34 to 36 inches. Personnel access to the cell is through a 15 in thick solid-steel sliding door to the service area. The front wall of the cell has one operating station equipped with a viewing window, manipulators, and access holes. On the corner of the cell is an operating station equipped with a stereo-microscope and a remote-operated specimens stage for viewing small specimen. The side wall of the cell contains a metallograph mounted in such a manner that the stage can be retracted into the cell wall, and a lead-filled shielding door located inside the cell is closed to protect the optical and electronic components.

The hot cell facility is also equipped with a number of dry wells, which provide shielded storage for samples. There are dry wells in the low-level cell that are used for sample storage, except during the handling of certain casks. A 24 inch dry well and three 13 inch dry wells are located in the high-level cell. A fourth 13-inch dry well is located in the low-level cell. Eight more 13-inch wells are located in the service gallery. The latter are 15 ft deep and are serviced by a remotely operated shielding cask equipped with a small winch for transferring samples to and from the low-level cell.

Purpose:

The hot cells have been used to perform post-irradiation examinations on fuels, structural materials, and instrumentation and for dosimetry. The warm metallography hood has been used fairly extensively for examining irradiated fuels for the HTGR fuel development projects. The hot cell yard and the service gallery have been used for cask handling and cask maintenance activities. These latter areas have been used extensively for waste consolidation, packaging, and characterization.

Operations:

The Hot Cell Facility has been operated fully for over 30 years. This facility has been used to perform numerous pos-irradiative examinations on DOE fuels, structural materials, and project instrumentation. Reduced demand and continuing private industrial development around the site has resulted in the requirement to decontaminate and decommission (D&D) the Hot Cell facility. Proposal to D&D the Hot Cell Facility has been submitted to DOE San Francisco Field Office for review and approval.

Inventory:

There are reduced enrichment research & test reactor (RERTR) program material and high temperature gas reactor (HTGR) program material stored in the storage wells in the Hot Cell facility. These materials are owned by various DOE organizations at different times, including NE-42 and EM-40. The RERTR materials were irradiated in the Oak Ridge Reactor during the period December 79 to August 84. The HTGR material was irradiated at various reactor facilities over various periods of time.

The total EOL RINM quantity of the RERTR material is 3037.00 gm of U, 352.00 gm of U235. The total EOL RINM quantity of the HTGR material is 178.45 gm of U, 119.85 gm of U235.

3.0 Conclusions from Review of Site Team Draft Report

Because General Atomics (GA) is not a DOE facility, no Site Team was organized by GA and no Site Team Report was developed. GA did, however, provide a response to the Working Group's questionnaire on the facility and the stored fuel. This response is provided as Attachment #2. The WGAT prepared a response to the "Eight Questions" normally answered by a Site Team. These responses were reviewed by the Manager of Licensing for GA and generally approved as accurate. They are provided here as Attachment #1.

Descriptions of stored fuels, inventories, material conditions, environmental controls, the conditions of the two facilities of interest (the hot cell and the intended new location, the LINAC facility), open items from previous assessments by the NRC, authorization bases, and administrative controls were discussed with managers and staff.

The assessment team identified one potential vulnerability which was subsequently discarded during factual accuracy review with GA. The potential vulnerability asserted that with GA's current reduction of efforts in the nuclear energy business, and their ongoing effort to divest themselves of facilities that represent liability to the corporation, that there was a vulnerability of reduced rigor in nuclear safety and safeguards in the extended future. It was pointed out by GA, however, that GA has no intention now or in the long term future to lose its NRC license which is necessary for its continued supply of TRIGA fuel, and that it is absolutely inconsistent with license requirements that they would relax on criticality and other safeguards. The WGAT was thoroughly convinced as a result of this factual accuracy, that there is indeed no potential vulnerability of this nature. Therefore, the visit to GA resulted in finding of NO potential vulnerabilities. Nevertheless, the Team feels it would be prudent for DOE to reclaim its fuel from GA at the earliest possible time, and place it under its own control at a DOE facility.

4.0 Conclusions from the Walkdown

The assessment team conducted a walkdown of the storage location of the small amount of spent fuel and RINM at the Hot Cell located at the Gulf Atomic site.

The walkdown included observation of the following parameters: potential of water ingress, the health physics practices and air monitoring, the ventilation system, the apparent age and condition of the facility, any corrosion of containers, criticality safety, and general maintenance.

The storage of the RERTR fuel samples and the HTGR fuel samples is provided inside the hot cell and visual observation of the actual locations was completed through the hot cell glass window for the RERTR fuel and through a video system for the HTGR fuel samples. No water ingress was apparent at either locations and no firewater through any addition systems is possible. The facility is preparing to undergo a D&D operation for the entire facility but still appeared to be in excellent well maintained condition. Criticality information was posted. Health Physics radiation detection equipment was in operation as well as the negative delta p ventilation system. No apparent corrosion problems were identified.

Conclusions:

The walkdown validated the information provided by General Atomics concerning the condition, location, controls, and structural integrity of the storage locations at the Hot Cell facility.

5.0 Summary Conclusions

No potential vulnerabilities were identified by the WGAT due largely to the small amount of material (under any criticality concern) and the stable condition of the facility and very little operations being considered other than the D&D of the facility. The Team would recommend that consideration be given to expediting the transfer of this material to a DOE controlled location and to eliminate the costs of transfering of the material to a new location once D&D starts.

SPENT FUEL INITIATIVE

Babcock & Wilcox, Lynchburg Technical Center

WORKING GROUP ASSESSMENT TEAM REPORTS

BABCOCK AND WILCOX LYNCHBURG TECHNOLOGY CENTER

Preface

A Secretary of Energy memorandum dated August 19, 1993, "Vulnerability Review of Irradiated Nuclear Materials Currently in Storage," established a requirement that the Department of Energy determine the environment, safety, and health (ES&H) "vulnerabilities" of stored spent fuel and other reactor irradiated nuclear materials. On September 20, 1993, the EH Office of Nuclear Safety issued a project plan to accomplish this study. The plan created a DOE Spent Fuel Working Group to manage the study and produce a report to the Secretary by November 20, 1993. A Working Group Assessment Team prepared the following report that contains the results of its study of the Babcock and Wilcox Lynchburg Technology Center site in Lynchburg, VA. A select committee will review the results of this report, along with similar reports from all other selected sites, and will assemble the full report on spent fuel storage vulnerabilities and concerns.

Executive Summary

The Working Group Assessment Team visited the Babcock and Wilcox Lynchburg Technology Center on October 12, 1993. DOE has contracted with them to store some DOE-owned spent fuel. Three storage facilities at the site contain intact or sectioned irradiated commercial nuclear power plant fuel owned by DOE. These facilities are a storage pool and two dry storage areas: one inside the hot cell complex and one outside. The Lynchburg Technology Center is licensed by the Nuclear Regulatory Commission to possess, handle, and store a wide variety of radionuclides.

The Assessment Team identified no environmental, safety or health vulnerabilities at the Lynchburg Technology Center for further review by the Select Committee of the Spent Fuel Working Group. However, for commercial reasons, Babcock and Wilcox does not wish to continue storing the DOE spent fuel and plans to terminate their DOE contract in September 1994. Thus, in the near future, DOE will have to make alternative arrangements for storing this fuel.

1.0 Objectives

The objective of this visit by the Assessment Team to the Lynchburg Technology Center was to evaluate and validate information assembled by representatives of the site with respect to storage of DOE-owned reactor irradiated nuclear materials at the storage facilities, and to discern the existence of ES&H vulnerabilities for the Department resulting from such storage. In doing so, the Assessment Team also had the objective of conducting this assessment according to the direction of the Spent Fuel Working Group as described in its Project Plan and in its Assessment Plan so that the summary conclusions and identified vulnerabilities would be consistently detailed, defined and described. Still another objective was to ensure that site representatives played key roles in the process so that they were fully cognizant, if not in full accord, with all conclusions.

2.0 Facilities and Inventories

The Lynchburg Technology Center currently stores 3 intact irradiated fuel rods and 17 sectioned irradiated fuel rods owned by DOE. All of this fuel is low enriched uranium oxide clad in zircaloy and was irradiated at either the Oconee or Arkansas Nuclear One commercial nuclear power plants. The Lynchburg Technology Center received this fuel between 1980 and 1987 as part of a "high-burnup" research program sponsored by the DOE Office of Nuclear Energy. The experiments were completed in 1989 and the program was officially terminated in 1992. Since that time, the Lynchburg Technology Center has stored this fuel under contract to DOE. The contract provides that both parties must agree if storage is to extend beyond September 1994. As explained in Section 4 of this report, for commercial reasons, Babcock and Wilcox does not plan to agree to continued storage beyond that date.

The irradiated fuel currently owned by DOE is essentially indistinguishable from other whole or sectioned irradiated fuel rods stored at the site. Like commercial irradiated fuel stored at power stations, the balance of irradiated fuel stored at the Lynchburg Technology Center is subject to the provisions of the Nuclear Waste Policy Act. Therefore, by 1998, DOE may own all of the irradiated fuel stored at this site.

The following sections briefly describe the irradiated fuel storage facilities at the Lynchburg

Technology Center. Attachment I provides schematic drawings of the facilities. Attachment II provides a detailed inventory of stored irradiated fuel. Attachment III is the Site Team Report.

2.1 Facility: Storage Pool and Transfer Canal

Description:

The Cask Handling Area contains a 24-foot deep storage pool with an integral transfer canal to Hot Cell 1. The pool is equipped with a coolant cleanup system. The Cask Handling Area is maintained at a negative pressure relative to the outside environment, and its ventilation system exhausts through High Efficiency Particulate Air filters to a monitored stack. A separate High Efficiency Particulate Air filtered ventilation system serves the hot cells.

Purpose:

The pool is used to store intact irradiated fuel rods, reactor vessel surveillance specimens, and activated components and tools.

Operations:

Coolant activity is routinely monitored and has been maintained within specifications. There is no indication that any of the stored fuel rods has experienced cladding breach.

Inventory:

Nine irradiated fuel rods are stored in the pool. Three of these are owned by DOE. They have not been sectioned. Babcock and Wilcox does not currently plan to section this fuel and transfer it to dry storage. However, they have the discretion to do so if they decide this would be a preferable storage mode. They have no contractual obligation to inform DOE if they decide to section this fuel.

2.2 Facility: Inside Special Nuclear Material Storage Tubes

Description:

Thirteen carbon steel pipes are set in the concrete floor of the Cask Handling Area adjacent to the hot cells and storage pool. The pipes are 5 inches in diameter and approximately 9' feet deep. They extend 6 inches above the floor and are surrounded by a concrete platform. Each tube has a seal plug. All of the sectioned fuel is stored in inner containers which are then placed in watertight aluminum storage canisters. These canisters are stored in the storage tubes.

Purpose:

The facility provides interim dry storage of sectioned fuel rods.

Operations:

The facility was designed for maintenance-free storage. The aluminum storage canisters are intended to remain in the storage tubes until they are ready for transport off site or for further evaluation or handling in the hot cells. If fuel sections are needed, the storage canisters are loaded directly into a shielded cask that is then transported to the adjacent storage pool. These canisters are transported through the pool transfer canal into Hot Cell 1, where the aluminum storage canister is opened and the inner container and sectioned fuel is removed.

There is no periodic surveillance on the storage canisters. However, for various programmatic reasons in the past six months, the Lynchburg Technology Center removed some storage canisters from the storage tubes and repackaged some fuel segments in Hot Cell 1. Facility personnel did not observe any degradation of the storage canisters, inner containers, or sectioned fuel at that time.

Inventory:

Sectioned fuel rods owned by DOE are stored in two of the storage tubes.

2.3 Facility: Outside Special Nuclear Material Storage Tubes

Description:

Twenty-six carbon steel pipes are set in an underground concrete monolith. The pipes are 6 inches in diameter and approximately 9' feet deep. The seal plugs extend a few inches above the concrete, which extends out of the ground 6 inches. A locked aluminum cover protects the seal plugs from the weather and other physical hazards. Ground water monitoring wells surround the facility. Each storage tube can hold two of the sealed watertight aluminum storage canisters.

Purpose:

The facility provides interim dry storage of sectioned fuel rods.

Operations:

The facility was designed for maintenance free storage. The storage canisters are intended to remain in the storage tubes until they are ready for transport off site. There is no periodic surveillance of the storage canisters.

Inventory:

Sectioned fuel rods owned by DOE are stored in nine of the storage tubes. This fuel is packaged in inner containers which are then packaged in the aluminum storage canisters.

3.0 Conclusions from the Review of Site Team Report and Facility Walkdowns

3.1 Spent Fuel Storage Pool

The DOE-owned spent fuel rods that are stored in this facility are intact and in good condition. Water quality is also good and is maintained by passing it through particulate filters and resin beds. No chemistry controls have been needed. In addition, sludge is not present in the pool and biological contamination has not been observed.

3.2 Inside Dry Storage Facility

There are no routine inspections of the condition of spent fuel rods that have been sectioned and placed in dry storage. However, some of the fuel stored in this facility was recently repackaged and moved; this fuel and its containers are known to be in good condition. Other evidence that the integrity of spent fuel storage containers has been maintained in good condition is routine monitoring of ground water, direct-radiation, and smearable-contamination, all of which indicate that leakage of radionuclides is not occurring.

3.3 Outside Dry Storage Facility

The Assessment Team discussed the design and inspected the dry storage system being employed at this facility. Ground water and other radionuclide monitoring have not indicated any radionuclide releases from this facility. There is currently no reason to suspect that spent fuel storage containers will degrade in the near term in a manner that would result in a release of fission products. This facility is routinely inspected by the Nuclear Regulatory Commission and relicensed by them every 5 years. Hence, any developing storage problems would most likely be dealt with and corrected under the direction of the Nuclear Regulatory Commission.

4.0 Summary of Vulnerabilities and Conclusions

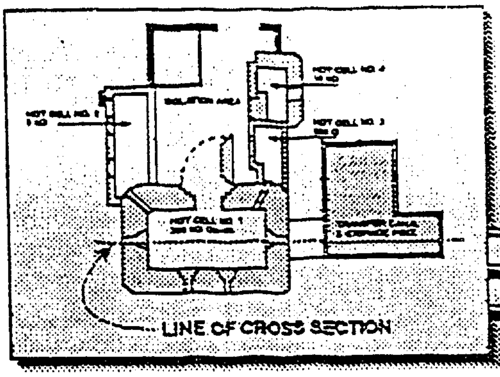
The Assessment Team identified no environmental, safety, or health vulnerabilities at the Lynchburg Technology Center for further review by the Select Committee of the Spent Fuel Working Group. However, the Assessment Team is concerned that DOE will have to arrange for alternative storage of this spent fuel in the near future. The contract for storing this spent fuel allows either of the parties to discontinue the contract in September 1994. The contractor, Babcock and Wilcox Nuclear Environmental Services, Inc., views storing the DOE spent fuel as a reduction in its operational capacity allowed under its Nuclear Regulatory Commission license for the site. Increasing the limit would require Babcock and Wilcox to incur many added costs to meet accountability and security requirements set by the Nuclear Regulatory Commission. Therefore, the contractor currently plans to exercise the option to discontinue the storage contract when the option comes up in September 1994.

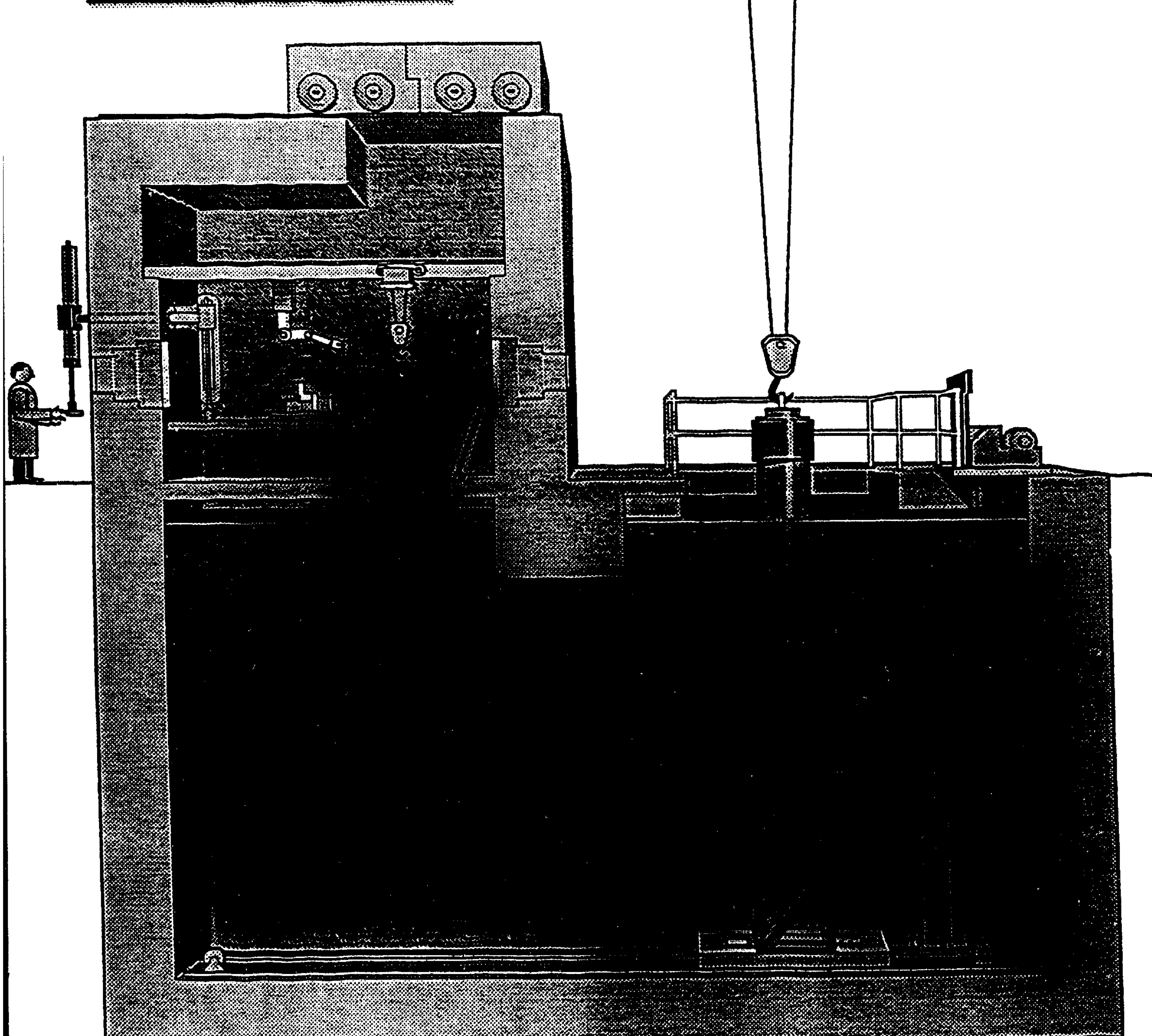
ATTACHMENT
I

FACILITY SCHEMATICS

Lynchburg Research Center
Hot Cell Facility

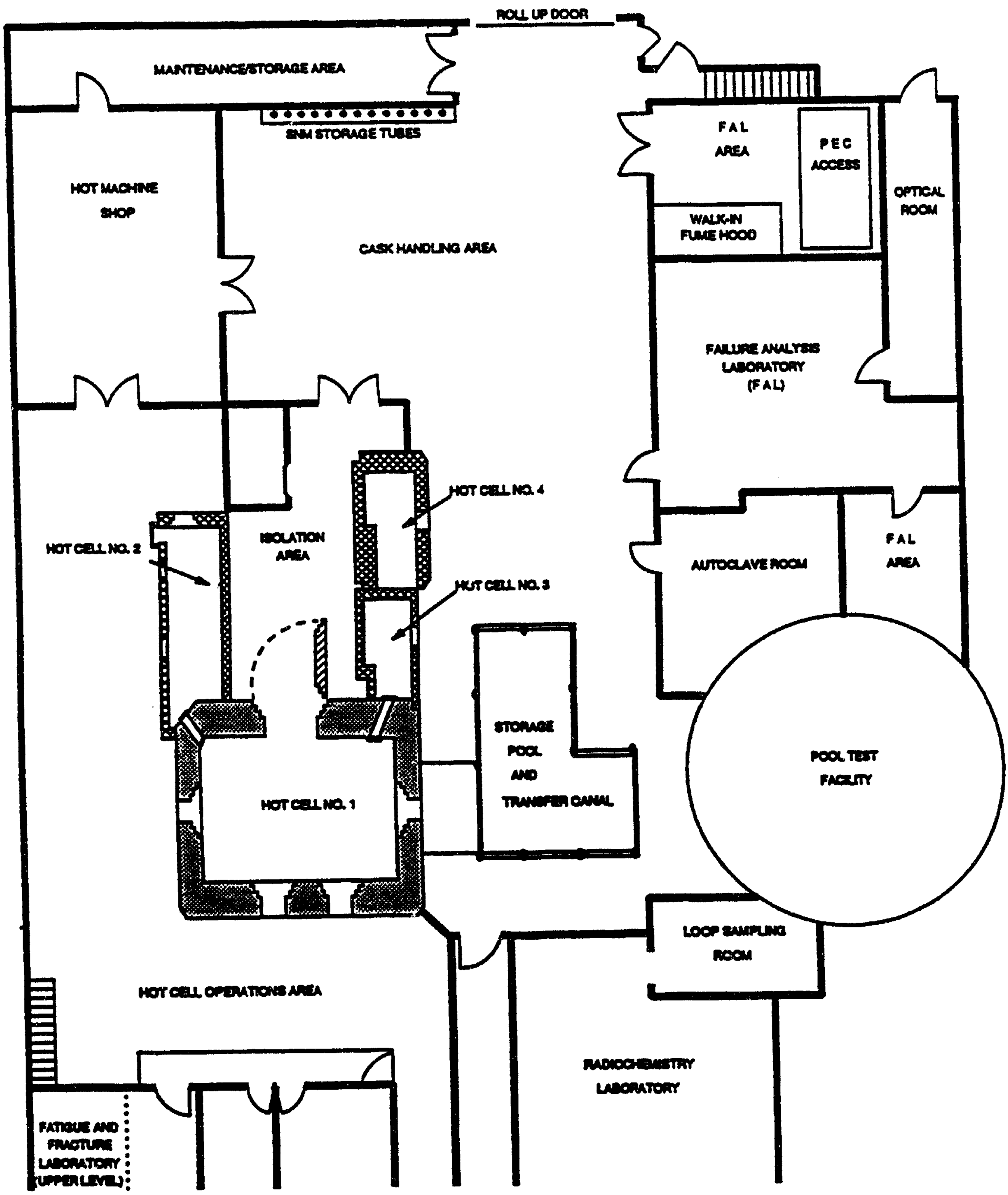
Babcock & Wilcox

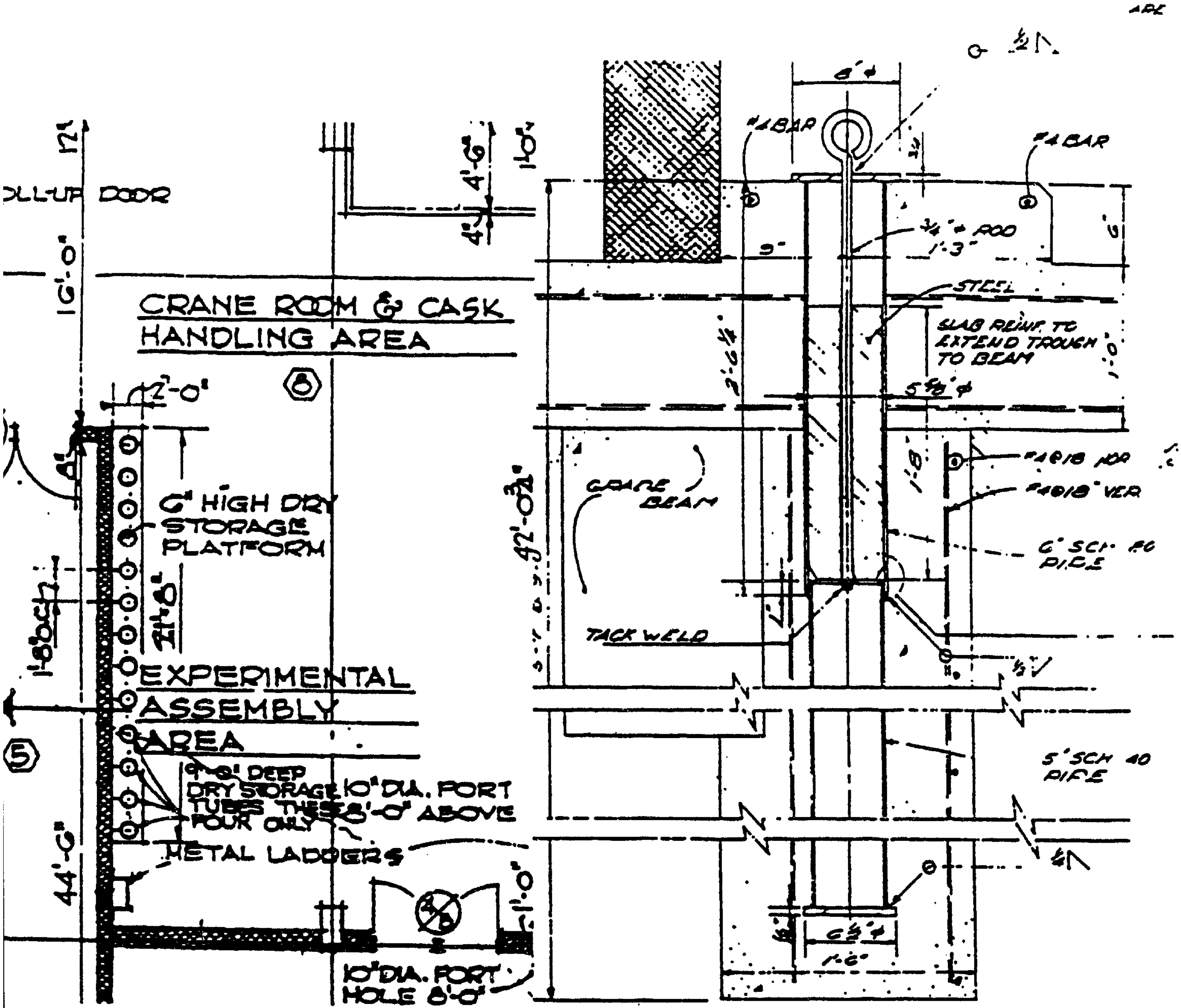




B & W, Nuclear Enviromental Services

HOT CELL PLAN VIEW





DETAIL OF DRY STORAGE PIPES

ATTACHMENT
II

INVENTORY

B&W Nuclear Environmental Services, Inc.
a McDermott company

P.O. Box 10548
Lynchburg, VA 24506-0548
(804) 948-4600
FAX (804) 948-4846

October 5, 1993
Letter No: KW93-326
DOE Contr: DE-AC02-92NE34269

Mr Christopher Swierczek
Contracts Division
U.S. Department of Energy
Field Office Chicago
9800 South Cass Avenue
Argonne, IL 60439

Dear Mr. Swierczek

Subject: Semi-Annual Reporting Requirements for DOE-Owned Radioactive Waste Stored at B&W NESI's Lynchburg Technologies Center (LTC)

Attached, please find form number DOE F 1332.3 entitled "Milestone Schedule Status Report" which is being provided in accordance with DOE Contract DE-AC02-92NE34269, Part III, Section "J", Item 2 entitled "DOE F 1332.1 - Reporting Requirements Checklist". Notice that all DOE-Owned radioactive waste is still in storage, as it was reported six (6) months ago (Letter KW93-088, dated April 5, 1993), and as it was at the beginning of the contract term (October 1, 1992).

If you have any questions concerning this information, please call me at 804-948-4737.

Sincerely,
B&W Nuclear Environmental Services, Inc

Kenneth W. Willis

Kenneth W Willis,
Contract Administration,
Business Analysis Section

cc: RN Gurley
GE Vaughan
GO Hayner
KD Long

DOE F1332.3
(11-84)

U.S. DEPARTMENT OF ENERGY

MILESTONE SCHEDULE ☐ PLAN ☒ STATUS REPORT

FORM APPROVED
OMB NO 1901-1400

1. TITLE	2. REPORTING PERIOD	3. IDENTIFICATION NUMBER
Storage of DOE-Owned Radioactive Waste	4/1/93 - 9/30/93	DE-AC02-92NE34269

4. PARTICIPANT NAME AND ADDRESS

B&W Nuclear Environmental Services, Inc.
P.O. Box 10548
Lynchburg, VA 24506-0548

5. START DATE: 10/1/92

6. COMPLETION DATE: 9/30/94

7. ELEMENT CODE	8. REPORTING ELEMENT	9. DURATION	FY	FY	10. PER CENT COMPLETE a. Plan	b. Actual
		The DOE-Owned radioactive waste being maintained in storage at B&W NESI's Lynchburg Technologies Center (LTC), continues to be in storage, as it was placed initially. There have been NO changes in the storage. See the attached table entitled, "DOE-Owned Radioactive Waste," for detailed information of the radioactive waste in storage.				

11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE

File No: KW93-326.XLS
Date: 10/5/93

DOE-Owned Radioactive Waste
Contract No: DE-AC02-92NE34269

Amie B&W

	Fuel Assembly Number	Power Station	Unit/ Cycle Number	Utility	No. of Rods Full-Length	No. of Rods Sectioned	Uranium % Enrichment or Depletion	Depleted U Grams Element	Enriched U Grams Element	Enriched U Grams Isotope U-235	Pu Element (Grams)	Pu Isotope (Grams)	Percent Pu-240
5/31/80	1D54	Oconee	1/3	Duke	0	2	0.9600	-	4275	41	37	27	23.01%
12/5/80	1D13	Oconee	1/4	Duke	0	4	0.5200	11000	-	-	101	70	24.50%
2/4/84	1D45	Oconee	1/6	Duke	0	4	0.3530	8517	-	-	94	60	27.84%
7/13/85	NJ037P	Oconee	1/1	Duke	0	4	1.3000 (AV)	-	7911	103	48	38	14.74% (AV)
7/19/87	NJ023Q	ANO	1/3	AP&L	3	3	0.3923	11762	-	-	133	91	23.89%

HIGH LEVEL WASTE FOR DISPOSAL BY DOE
(IRRADIATED FUEL)

REVISED 08-20-93 (PHYSICAL INVENTORY)

741 Transfer No.	Date Recieved	Assembly No.	Power Station	Unit No./ Cycle No.	MWDt Burnup (a)	No. of Rods On site (Full Length)	No. of Rods On site (Sectioned)	Uranium % Enrichment or Depleted	Depleted Uranium Grams Element	Enriched Uranium Grams Element	Enriched Uranium Grams Isotope (U-235)	Pu Element (Grams)	Pu Isotope (Grams)	% Pu-240	Owner	Transfer No. From YCE to CCS	Date	Unit
VARIOUS FUEL SCRAP SAMPLES(b)				-	-	-	-	30.46%/82%	-	117	56	0	0	-	Private			TUBE 4
YNR-YCE-2	06/23/76	1C50	OCONEE	1/2	16,000	0	1/3	0.80	-	0	0	0	0	24.55	Private			TUBE 4
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	0	0	0	0	23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	TUBE 4
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	35%/35.5%	-	313	111	0	0	-	Private			TUBE 6
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	32%/33%	-	344	112	0	0	-	Private			TUBE 6
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	30.8%/30%	-	301	91	0	0	-	Private			TUBE 7
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	7.8%/32%	-	887	113	0	0	-	Private			TUBE 8
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	29%/30.4%	-	376	113	0	0	-	Private			TUBE 9
VARIOUS FUEL SCRAP SAMPLES(b)			-	-	-	-	-	29%/29.86%	-	377	105	0	0	-	Private			TUBE 10
YNR-YCE-2	06/23/76	1C50	OCONEE	1/2	16,000	0	1/3	0.80	-	481	4	3	3	24.65	Private			TUBE 10
VARIOUS FUEL SCRAP SAMPLES(b)				-	-	-	-	29%	-	183	56	0	0	-	Private			TUBE 12
XEL-YCE-1	09/10/86	LJ3700	CECO	3/7	20,531	0	2	.4486	8437	-0-	-0-	43	27	20.78	Private			TUBE 19
XEL-YCE-1	09/10/86	LJ3704	CECO	3/7	20,523	0	2	.0721	8422	-0-	-0-	45	28	20.78	Private			TUBE 19
YZW-CCS-1	07/10/87	NJ023O(d)	ARKANSAS	1/3	47,000	3	3	.3023	8417	-0-	-0-	82	41	23.89	D.O.E			TUBE 19
YNR-YCE-9	07/13/85	NJ037P(c)	OCONEE	1/1	16,000	0	4	1.318(AVG.)	-	7436	86	44	37	14.74(AVG.)	D.O.E	YCE-CCS-4	01/10/86	TUBE 20
JSO-CCS-1	10/27/83	TMI-2 FUEL DEBRIS(e)		-	-	-	-	2.36	-	16				8.00	D.O.E			TUBE 21
YNR-YCE-9	07/13/85	NJ037F(c)	OCONEE	1/1	16,000	0	4	1.318(AVG.)	-	451	0	3	2	14.74(AVG.)	D.O.E	YCE-CCS-4	01/10/86	TUBE 21
YZW-CCS-1	07/10/87	NJ023O(d)	ARKANSAS	1/3	47,000	3	3	.3023	59	-0-	-0-	1	0	23.89	D.O.E			TUBE 21
YNR-YCE-8	02/04/84	1D48(e)	OCONEE	1/6	60,000	0	4	.3630	1250	-0-	0	14	9	27.84	D.O.E	YCE-CC2-7	04/30/86	TUBE 21
YNR-YCE-8	02/04/84	1D48(e)	OCONEE	1/6	60,000	0	4	.3630	4000	-0-	-0-	45	28	27.84	D.O.E	YCE-CC2-7	04/30/86	TUBE 22
YNR-YCE-8	02/04/84	1D48(e)	OCONEE	1/6	60,000	0	4	.3630	3000	-0-	0	34	21	27.84	D.O.E	YCE-CC2-7	04/30/86	TUBE 23
YNR-YCE-7	12/05/80	1D13(c)	OCONEE	1/4	30,100	0	4	.82	0	-0-	-0-	0	0	24.60	D.O.E	YCE-CCS-2#3#5	05/19/82,-,10/12/83	TUBE 23
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	822	1	6	4	23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	TUBE 24
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	81	1	2	1	21.04	Private			TUBE 24
YNR-YCE-7	12/05/80	1D13(c)	OCONEE	1/4	30,100	0	4	.82	7000	-0-	0-	30	27	24.60	D.O.E	YCE-CCS-2#3#5	05/19/82,-,10/12/83	TUBE 24
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	1		6	5	23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	TUBE 25
YNR-YCE-7	12/05/80	1D13(c)	OCONEE	1/4	30,100	0	4	.82	4000	-0-	-0-	22	18	24.60	D.O.E	YCE-CCS-2#3#5	05/19/82,-,10/12/83	TUBE 25
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	3		0	0	23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	TUBE 26
YNR-YCE-7	12/05/80	1D13(c)	OCONEE	1/4	30,100	0	4	.82	0	-0-	-0-	40	28	24.60	D.O.E	YCE-CCS-2#3#5	05/19/82,-,10/12/83	TUBE 26
XEK-YCE-2	12/10/86	NJ01JE	OCONEE	3/2	31,000	0	3	.8881	-	226	2	2	1	25.60	Private			CHA 2
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,800	0	5	.90	-	1610	16	15	10	21.04	Private			CHA 2
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	1				23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	CHA 2
XEK-YCE-2	12/10/86	NJ01JP	OCONEE	2/3	36,000	0	1	.7048	333	-0-	0	2	2	20.32	Private			CHA 2
YNR-YCE-10	10/01/89	NJ037K(g)	OCONEE	1/4	60,300	5	3	.3230(AVG.)	892	-0	0	7	5	25.375	Private			CHA 2
YZW-CCS-1	07/10/87	NJ023O(d)	ARKANSAS	1/3	47,000	3	3	.3023	313	0	0-	4	2	23.89	D.O.E			CHA 2
YNR-YCE-6	05/31/80	1D54(c)	OCONEE	1/3	31,100	0	2	.96	-	3048	35	32	23	23.01	D.O.E.	YCE-CCS-2#5	05/19/82,10/12/83	CHA 3
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	180	2	2	1	21.04	Private			CHA 4
YNR-YCE-4	03/15/78	1C90	OCONEE	1/3	26,400	0	3	.61	1000	0-	0	9	6	25.26	Private			CHA 4
YNR-YCE-2	06/23/76	1C50	OCONEE	1/2	16,000	0	1/3	0.80	-	60	0	8	6	24.65	Private			CHA 5
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	1006	10	9	7	21.04	Private			CHA 6
YNR-YCE-4	03/16/78	1C90	OCONEE	1/3	26,400	0	3	.61	230	-0	0	2	1	25.26	Private			CHA 6
BAW(TR (TR-4) REACTOR IRRADIATED SCRAP				-	-	-	-	34.83	-	16	5			-	Private			CHA 6
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	1640	16	13	11	21.04	Private			CHA 7
YNR-YCE-4	03/15/78	1C90	OCONEE	1/3	26,400	0	3	.61	1870	-0	-0	16	11	25.26	Private			CHA 7
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	3061	30	27	20	21.04	Private			CHA 8
XEK-YCE-1	01/10/78	2B40	OCONEE	3/2	27,500	0	5	.90	-	3090	30	27	20	21.04	Private			CHA 9
XEK-YCE-2	12/10/86	NJ01JE	OCONEE	3/2	31,000	0	3	.8881	-	6110	54	63	37	26.00	Private			CHA 10
XEK-YCE-2	12/10/86	NJ01JP	OCONEE	2/3	36,000	0	1	.7048	1511	-0-	-0-	11	10	20.32	Private			CHA 10
YNR-YCE-10	10/01/89	NJ037K(g)	OCONEE	1/4	60,300	5	3	.3232(AVG.)	3425	-0-	-0-	41	27	25.375	Private			CHA 10
XEK-YCE-2	12/10/86	NJ01JE	OCONEE	3/2	31,000	0	3	.8881	-	66	1	7	6	26.00	Private			CHA 11
JSO-YCE-1	03/13/87	TMI-2 FUEL DEBRIS		-	-	-	-	2.96	-	32	1	0	0	8.00	Private			CHA 11
FUEL PELLETS	-	YNJ530	BWFC	-	-	-	-	2.96	-	74	2	0	0	-	Private			CHA 11
FUEL PELLETS	-	YNJ533	BWFC	-	-	-	-	2.2	-	60	1	0	0	-	Private			CHA 11
XEK-YCE-2	12/10/86	NJ01JP	OCONEE	2/3	36,000	0	1	.7048	166	-0-	-0-	1	1	20.32	Private			CHA 11
YNR-YCE-10	10/01/89	NJ037K(g)	OCONEE	1/4	60,300	5	3	.3232(AVG.)	1620	-0-	-0-	19	12	25.375	Private			CHA 11
YNR-YCE-4	03/15/78	1C90	OCONEE	1/3	26,400	0	3	.61	3364	-0-	-0-	29	20	25.26	Private			CHA 12
YNR-YCE-3	01/25/78	1D40	OCONEE	1/2	24,000	0	1	1.30	-	2150	26	17	13	17.86	Private			CHA 12
YZW-CCS-1	07/15/87	NJ023O(d)	ARKANSAS	1/3	47,000	3	3	.3023	6461	-0-	-0-	66	46	23.89	D.O.E			POOL
YNR-YCE-8	02/04/84	1D45(f)	OCONEE	1/6	60,000	1	0	.3630	2083	0-	0	23	14	27.84	Private	CCS-YCE-5	08/10/91	POOL
YNR-YCE-10	10/01/89	NJ037K(g)	OCONEE	1/4	60,300	5	3	.3232(AVG.)	9009	-0-	-0-	106	68	25.375	Private			POOL

CA-1

CA-1

Inventory Date: October 6, 1993
Control Area 1, Cask Handling Area

Storage Tube 1:
Empty can, Stuck in hole.

Storage Tube 2:
Storage can #8/93-2
Fuel Assembly No. 1D54; Oconee 1, Cycle 3
Eu Element: 0.61 Eu Isotope: 0.01
Pu Element: 0.01 Pu Isotope: 0.01
U-enrichment: .96
Formula Quantity Amount: .025

YNR-YCE-6 (May 31, 1980)
YCE-CCS-2 (May 19, 1982)
YCE-CCS-5 (October 12, 1983)
Government owned

Storage can #8/93-2
Fuel Assembly No. NJ01JE; Oconee 2, Cycle 2
Eu Element: 25.24 Eu Isotope: 0.22
Pu Element: 0.22 Pu Isotope: 0.15
U-enrichment: .8891
Formula Quantity Amount: .55

XEK-YCE-2 (Dec 10, 1988)
Privately owned

Storage can #8/93-2
Fuel Assembly No. NJ01JP; Oconee 2, Cycle 3
Eu Element: 165.48 Eu Isotope: 1.17
Pu Element: 1.24 Pu Isotope: 1.08
U-enrichment: .7046
Formula Quantity Amount: 3.10

XEK-YCE-2 (Dec 10, 1988)
Privately owned

Storage can #8/93-2
Fuel Assembly No. NJ037K; Oconee 1, Cycle 4
Eu Element: 316.88 Eu Isotope: 0.86
Pu Element: 3.81 Pu Isotope: 2.45
U-enrichment: .2895(AVG.)
Formula Quantity Amount: 9.525

YNR-YCE-10 (Oct 01, 1989)
Privately owned

Storage Can #9/93-3
Fuel Assembly No. 2B40; Oconee 2, Cycle 2
Eu Element: 1609.80 Eu Isotope: 15.89
Pu Element: 14.52 Pu Isotope: 10.17
Formula Quantity Amount: 36.30 Grams

XEK-YCE-1 (January 18, 1978)
Privately owned

Storage can #9/93-3
Fuel Assembly No. NJ01JE; Oconee 2, Cycle 2
Eu Element: 201.00 Eu Isotope: 1.79
Pu Element: 1.75 Pu Isotope: 1.23
U-enrichment: .8891
Formula Quantity Amount: 4.375

XEK-YCE-2 (Dec 10, 1988)
Privately owned

Storage Tube 2:

Storage can #9/93-3
Fuel Assembly No. NJ023Q; Arkansas 1, Cycle 3
Eu Element: 313.38 Eu Isotope: 1.21
Pu Element: 3.61 Pu Isotope: 2.40
U-enrichment: .39(AVG.)
Formula Quantity Amount: 9.025

YZW-CCS-1 (Jun 19, 1987)
Government owned

Storage can #9/93-3
Fuel Assembly No. NJ037K; Oconee 1, Cycle 4
Eu Element: 274.90 Eu Isotope: 0.98
Pu Element: 3.45 Pu Isotope: 2.23
U-enrichment: .2895(AVG.)
Formula Quantity Amount: 8.625

YNR-YCE-10 (Oct 01, 1989)
Privately owned

Storage can #9/93-3
Fuel Assembly No. NJ01JP; Oconee 2, Cycle 3
Eu Element: 167.73 Eu Isotope: 1.18
Pu Element: 1.26 Pu Isotope: 1.09
U-enrichment: .7046
Formula Quantity Amount: 3.15

XEK-YCE-2 (Dec 10, 1988)
Privately owned

Storage Tube 3:

Storage can #1D-54; Waste
Fuel Assembly No. 1D54; Oconee 1, Cycle 3
Eu Element: 3,648.30 Eu Isotope: 34.99
Pu Element: 32.43 Pu Isotope: 23.31
U-enrichment: 0.96
Formula Quantity Amount: 81.075 Grams

YNR-YCE-6 (May 31, 1980)
YCE-CCS-2 (May 19, 1982)
YCE-CCS-5 (October 12, 1983)
Government owned

Storage Tube 4:

Storage can #HC-80-2
Fuel Assembly No. 1C66; Oconee 1, Cycle 3
Eu Element: 1,009.10 Eu Isotope: 5.15
Pu Element: 8.60 Pu Isotope: 5.88
U-enrichment: 0.51
Formula Quantity Amount: 21.50 Grams

YNR-YCE-2 (August 23, 1976)
Privately owned

Storage can #HC-80-2
Fuel Assembly No. 2B40 (PWR); Oconee 2, Cycle 2
Eu Element: 179.84 Eu Isotope: 1.74
Pu Element: 1.54 Pu Isotope: 1.15
U-enrichment: 0.98
Formula Quantity Amount: 3.85 Grams

XEK-YCE-1 (January 18, 1978)
Privately owned

Storage Tube 5:
Storage can # HC-80-1
Fuel Assembly No. 2B40 (PWR); Oconee 2, Cycle 2 — XEK-YCE-1 (January 18, 1978)
Eu Element: 1,066.40 Eu Isotope: 10.34 — Privately owned
Pu Element: 9.14 Pu Isotope: 6.79
U-enrichment: 0.98
Formula Quantity Amount: 22.85 Grams

Storage can #HC-80-1
Fuel Assembly No. 1C66; Oconee 1, Cycle 3 — YNR-YCE-4 (March 15, 1978)
Eu Element: 239.40 Eu Isotope: 1.22 — Privately owned
Pu Element: 2.04 Pu Isotope: 1.39
U-enrichment: 0.51
Formula Quantity Amount: 5.10 Grams

Storage can # HC-80-1
Fuel Assembly No. 1C56; Oconee 1, Cycle 2 — YNR-YCE-2 (August 23, 1976)
Eu Element: 50.40 Eu Isotope: 0.41 — Privately owned
Pu Element: 0.37 Pu Isotope: 0.28
U-enrichment: 0.80
Formula Quantity Amount: 0.925 Grams

Storage Tube 6:
Storage Can #HC-27;
Fuel Assembly No. BAWTR; High Burn-Up Fuel — Privately owned
Eu Element: 14.96 Eu Isotope: 5.18
Pu Element: * Pu Isotope: *
U-enrichment: 34.63
Formula Quantity Amount: 5.18 Grams

Storage Tube 7:
Storage can #HC-100
Fuel Assembly No. 2B40 (PWR); Oconee 2, Cycle 2 — XEK-YCE-1 (January 18, 1978)
Eu Element: 1,614.00 EU Isotope: 15.85 — Privately owned
Pu Element: 13.13 Pu Isotope: 10.48
U-enrichment: 0.98
Formula Quantity Amount: 32.825 Grams

Storage can #HC-100
Fuel Assembly No. 1C66; Oconee 1, Cycle 3 — YNR-YCE-4 (March 15, 1978)
Eu Element: 1,877.80 Eu Isotope: 9.58 — Privately owned
Pu Element: 16.30 Pu Isotope: 10.98
U-enrichment: 0.51
Formula Quantity Amount: 40.75 Grams

Storage Tube 8:
Storage Can #PWR-HC-3
Fuel Assembly No. 2B40 (PWR); Oconee 2, Cycle 2 — XEK-YCE-1 (January 18, 1978)
Eu Element: 3,060.60 Eu Isotope: 30.08 — Privately owned
Pu Element: 26.78 Pu Isotope: 19.94
U-enrichment: 0.98
Formula Quantity Amount: 66.95 Grams

Storage Tube 9:
Storage Can #PWR-HC-2
Fuel Assembly No. 2B40 (PWR); Oconee 2, Cycle 2 — XEK-YCE-1 (January 18, 1978)
Eu Element: 3,098.70 Eu Isotope: 30.43 — Privately owned
Pu Element: 27.10 Pu Isotope: 20.20
U-enrichment: 0.98
Formula Quantity Amount: 67.75 Grams

Storage Tube 10:
Storage can #7/93-1
Fuel Assembly No. NJ01JE; Oconee 2, Cycle 2 — XEK-YCE-2 (Dec 10, 1988)
Eu Element: 6119.19 Eu Isotope: 54.41 — Privately owned
Pu Element: 53.45 Pu Isotope: 37.22
U-enrichment: .8891
Formula Quantity Amount: 133.625

Storage can #7/93-1
Fuel Assembly No. NJ01JP; Oconee 2, Cycle 3 — XEK-YCE-2 (Dec 10, 1988)
Eu Element: 1522.42 Eu Isotope: 10.65 — Privately owned
Pu Element: 11.34 Pu Isotope: 9.82
U-enrichment: .7046
Formula Quantity Amount: 13.84

Storage can #7/93-1
Fuel Assembly No. NJ037K; Oconee 1, Cycle 4 — YNR-YCE-10 (Oct 01, 1989)
Eu Element: 3424.84 Eu Isotope: 9.81 — Privately owned
Pu Element: 41.46 Pu Isotope: 26.61
U-enrichment: .2895(AVG.)
Formula Quantity Amount: 103.65

Storage Tube 11:
Storage can #9/93-4
Fuel Assembly No. NJ01JE; Oconee 2, Cycle 2 — XEK-YCE-2 (Dec 10, 1988)
Eu Element: 65.65 Eu Isotope: 0.58 — Privately owned
Pu Element: 0.57 Pu Isotope: 0.40
U-enrichment: .8891
Formula Quantity Amount: 1.425

Storage can #9/93-4
Fuel Assembly No. NJ01JP; Oconee 2, Cycle 3 — *XEK-YCE-2 (Dec 10, 1988)*
Privately owned
Eu Element: 155.36 Eu Isotope: 1.09
Pu Element: 1.17 Pu Isotope: 1.01
U-enrichment: .7046
Formula Quantity Amount: 2.925

Storage can #9/93-4
Fuel Assembly No. NJ037K; Oconee 1, Cycle 4 — *YNR-YCE-10 (Oct 01, 1989)*
Privately owned
Eu Element: 1519.96 Eu Isotope: 4.69
Pu Element: 18.63 Pu Isotope: 11.98
U-enrichment: .2895(AVG.)
Formula Quantity Amount: 46.575

Storage Tube 12:
Storage can #HC-101
Fuel Assembly No. 1C66; Oconee I, Cycle 3 — *YNR-YCE-4 (March 15, 1978)*
Privately owned
Eu Element: 3,356.40 Eu Isotope: 17.12
Pu Element: 28.60 Pu Isotope: 19.68
U-enrichment: 0.51
Formula Quantity Amount: 71.50 Grams

Storage Tube 13:
Storage Can #HC-13
Fuel Assembly No. 1D40; Oconee 1, Cycle 2 — *YNR-YCE-3 (January 25, 1978)*
Privately owned
Bent Fuel Rod #13917B
Eu Element: 2,159.00 Eu Isotope: 28.00
Pu Element: 17.00 Pu Isotope: 13
U-enrichment: 1.30
Formula Quantity Amount: 42.50 Grams

SPENT FUEL INITIATIVE

Argonne National Laboratory - East

WORKING GROUP ASSESSMENT TEAM REPORTS

ARGONNE NATIONAL LABORATORY EAST

Preface

A Secretary of Energy memorandum dated August 19, 1993, "Vulnerability Review of Irradiated Nuclear Materials Currently in Storage," established a requirement that the Department of Energy determine the environment, safety, and health (ES&H) "vulnerabilities" of stored spent fuel and other reactor irradiated nuclear materials. On September 20, 1993, the EH Office of Nuclear Safety issued a project plan to accomplish this study. The plan created a DOE Spent Fuel Working Group to manage the study and produce a report to the Secretary by November 20, 1993. A Working Group Assessment Team prepared the following report that contains the results of its study of the Argonne National Laboratory East site in Argonne, IL, southwest of Chicago. A select committee will review this report, along with similar reports from all other selected DOE sites, and will assemble the full report on spent fuel storage vulnerabilities and concerns.

Executive Summary

The Working Group Assessment Team visited the Argonne National Laboratory East site on October 14, 1993. Spent nuclear fuel is stored at three facilities at this site, the Alpha-Gamma Hot Cell facility, the Chicago Pile - 5 reactor facility, and a few analytical laboratories in Building 205.

The Assessment Team identified no environmental, safety, or health vulnerabilities at Argonne East for further review by the Select Committee of the Spent Fuel Working Group. However, the assessment Team is concerned about the absence of a formal integrated long term plan for either safely storing the spent fuel on site for an extended period of time or alternatively for shipping the spent fuel off site to a suitable "long term interim storage facility". This concern is exemplified in two principal ways. First, the Alpha-Gamma Hot Cells have no direct funding of facility infrastructure requirements; thus safe long term storage is not assured. Second, spent fuel currently stored in the Chicago Pile 5 facility is obstructing the decontamination and decommissioning of that facility; there is no other suitable storage at Argonne East.

1.0 Objectives

The objective of this visit by the Assessment Team to Argonne East was to evaluate, and validate information assembled by representatives of the site with respect to storage of spent nuclear fuel at the storage facilities, and to discern the existence of ES&H vulnerabilities for the Department of Energy resulting from such storage. In doing so, the Assessment Team had the objective of conducting this assessment according to the direction of the Spent Fuel Working Group as described in its Project Plan and in its Assessment Plan so that the summary conclusions and identified vulnerabilities would be consistently detailed, defined and described. Still another objective was to ensure that site representatives played key roles in the process so that they were fully cognizant, if not in full accord, with all conclusions.

2.0 Facilities and Inventories

Argonne East is operated by the University of Chicago. The DOE Cognizant Secretarial Office is the Office of Energy Research, and the cognizant site office is the Chicago Operations Office, Argonne Area Office, located at the site. Attachment I is a facility schematic of the Alpha-Gamma Hot Cell. Attachment II is the Site Team Report for the Alpha-Gamma Hot Cell.

2.1 Alpha-Gamma Hot Cell - Building 212, Wing F

Description:

The Alpha-Gamma Hot Cell was designed to handle uranium and plutonium bearing fuels in complete containment (sealed hot cells) and in an inert environment (nitrogen). Oxygen levels in the hot cells are limited to approximately 100 ppm and 0.3 wt.%, which is sufficiently low to preclude combustion of Class A materials. Humidity levels are limited to 200 ppm. The facility is designed to safely handle pyrophoric and reactive materials including sodium and sodium potassium compounds. The nitrogen atmosphere is supplied from the boil-off of a liquid nitrogen supply tank in a once-through pass through the hot cell, and then passed through High Efficiency Particulate Air filters before it is exhausted through the facility stack. The hot cell is maintained at a negative pressure of 0.25-inch water relative to its surroundings. The hot cell walls, floor, and ceiling are constructed of high density concrete and are completely lined with welded steel plate. The shield windows are three feet thick and are filled with zinc bromide solution.

Purpose:

The Alpha-Gamma Hot Cell is a multi-program facility for examining, characterizing, and testing of irradiated nuclear materials and components. "Its principal mission is to perform research on the behavior of materials, fuel, and structures used in nuclear reactors."

Operations:

Facility personnel perform both destructive and nondestructive examination of irradiated nuclear fuel and other fuel related components or structural materials. Fission product gases are also collected and analyzed. Operational Safety Requirements control the quantity and configuration of fissile material and the operability of several systems considered important to the safety of either workers or the public. These systems include the criticality detectors and alarms, the stack monitors and alarms, the fire detectors and alarms, the emergency power generator, the nitrogen inerting system, and the High Efficiency Particulate Air filters. All of these systems are subject to a preventative maintenance program.

Inventory:

In addition to materials in process, the facility currently stores the remains of experimental fuel rods and some DOE-owned commercial nuclear power fuel covering some 30 years of facility activities. The stored spent fuel consists of mixed-oxide, carbide, and metallic fuels in stainless steel or refractory alloy cladding; oxide, aluminide, and silicide fuels in an aluminum matrix and clad with aluminum; and uranium-oxide fuel in Zircaloy cladding. The stored material is contained in aluminum, copper, or steel pipe nipples as a primary container. One or more primary containers are stored in closed but not hermetically sealed tin plated steel cans. The cans are stored on shelves in 8 foot deep storage tubes. These tubes are either 4 or 6 inches in diameter (i.e., slightly larger in diameter than the cans) and are set in the concrete floor of the hot cell near the back wall of area I. The storage tubes have a nitrogen atmosphere comparable to that of the hot cell proper. The fuel contains approximately 0.075 metric tons of uranium, and 0.006 metric tons of Plutonium.

2.2 Chicago Pile 5

Description:

The Chicago Pile 5 facility was a 1 MWt (later upgraded to 5 MWt) high enriched uranium (93% enriched) fueled and heavy water moderated reactor. The reactor vessel is a right circular cylinder and is surrounded by an air gap and then graphite. The facility contains several vertical "flux tubes". To irradiate experimental material with a fast neutron flux, a target element (called a converter) was installed in a flux tube. The experimental material would then be lowered inside the converter. Thermal neutrons from the reactor would strike the converter producing a fast neutron spectrum for the experiment. A cask handling area, storage pool, and hot cell are located at the facility. The spent nuclear fuel and other irradiated materials were either stored in the pool for in dry storage tubes built into the floor of the rod storage area.

Purpose:

The reactor was used to irradiate test and research materials in either a thermal or fast neutron flux.

Operations:

The facility is now being decontaminated and decommissioned. All of the irradiated reactor fuel has been shipped off site.

Inventory:

Two converters are presently stored in this facility. The converters are 93% enriched uranium-zirconium alloy clad in Zircaloy. They are hollow tubes approximately two feet in length. One of the converters has a smaller diameter and can fit inside the other. Each converter contains approximately 0.5 kg of special nuclear material. The two converters contain approximately 0.0011 metric tons of uranium-235.

2.3 Building 205

Description:

Building 205 contains several multi-purpose analytical laboratories including metallographic examination laboratories.

Inventory:

The facility contains only gram quantities of special nuclear material in one or more of the metallographic examination laboratories. The material is considered "in process" and is tracked on the Argonne East accountability records.

3.0 Conclusions From Review of Site Team Report and Facility Walkdowns

3.1 Alpha-Gamma Hot Cell - Building 212, Wing F

In July and August 1993, respectively, the DOE Office of Energy Research and the DOE Chicago Operations Office approved a Basis for Interim Operation of the Alpha-Gamma Hot Cell. The Basis for Interim Operation consists of the following documents:

- Alpha-Gamma Hot Cell Facility, Safety Analysis Report, November 1982
- Addendum, AGHCF SAR, May 1984
- Operational Safety Requirements, July 1982 and onward
- Criticality Hazards Control Statement, Rev. 9, March 1990
- Alpha-Gamma Hot Cell Facility Operations Manual, Volumes. I and II, June 1989, en toto, but specifically:
- Preface referencing conformance to DOE Order 5480.19, Conduct of Operations, October 1991
- Section 4, General Operating Procedures and Guidelines, June 1989 and additions
- Section 6, Emergency Procedures, June 1989 and additions
- Section 8, Administrative Controls, August 1992.

The Assessment Team reviewed these documents prior to arriving on site. These documents along with the Site Team Report formed the basis for extensive discussions with the Alpha-Gamma Hot Cell Site Team. The Assessment Team particularly appreciates the candid and insightful comments and tour provided by Mr. Larry Neimark and Adam Cohen.

Facility personnel are engaged in a significant effort to upgrade their Safety Analysis Report, Technical Safety Requirements, and criticality analysis to meet new DOE order requirements. They expect to complete these new safety documents in the latter half of 1994. We discussed those portions of these documents that have already been completed.

Facility personnel are approaching completion of a 100% physical inventory of all special nuclear material contained in the facility. They initiated this inventory in response to an accountability deficiency discovered and reported in June 1992. (Routine surveillance of the stored fuel is limited to examination of the condition of some secondary containers during annual audits of SNM holdings.) They have completed the inventory in all areas of the facility except the spent fuel storage tubes. To date, they have examined the physical condition of irradiated fuel segments stored in 5 of the 34 storage tubes that contain fuel (there are a total of 46 storage tubes).

Facility personnel have not observed any physical degradation of either the outer or primary containers in the five storage tubes examined to date. The Assessment Team observed the physical condition of the outer containers stored in one tube and likewise noticed no degradation that could hinder safe handling of the outer container. The Assessment Team also observed that criticality limits were clearly posted and questioned facility personnel on the use of these postings.

Several fuel segments are showing significant deterioration. Facility personnel are keeping a detailed log book on the observable physical condition of each fuel segment. Unclad uranium-plutonium carbide fuels are losing integrity and turning to powder. The stainless steel cladding on uranium-plutonium oxide fuel is degrading by intergranular corrosion and is subject to brittle fracture. Metallic fuels are physically deteriorating through oxidization. These phenomena are not unexpected for extended storage of these fuel types. They have been previously analyzed and documented (e.g., 1983 Los Alamos National Laboratory report to Robert Neuhold, DOE Office of Nuclear Energy). Nonetheless, they do present concern for long term storage of these fuel types pending their ultimate disposal. The Assessment Team believes that EM-37 should address this issue.

The Assessment Team examined both the operating and maintenance galleries of the facility. Facility housekeeping is good. Conduct of Operations improvements are clearly visible. For example, controlled operator aids have been added to the Magnehelic gauges to indicate normal, abnormal, and unacceptable operating regions.

Two long planned facility upgrades are scheduled for completion in 1994. Replacement zinc bromide shield windows will be installed and a diesel powered emergency power generator will replace an existing steam driven one.

3.2 Chicago Pile 5

The Site Team Report does not address the spent fuel stored in this facility. However, Argonne East personnel were prepared to discuss storage of this fuel and the Assessment Team visited the facility and observed the storage conditions. Ken Poupa and Ralph Ditch, both of Argonne East, were very helpful in arranging a tour and answering our questions.

One converter is stored inside a site shipping cask. Last month this cask was transported from a vault in Building 315 to the cask handling area of Chicago Pile 5. This area is adjacent to the facility's hot cell and storage pool. The cask was transported to the facility in preparation for shipping the material off site. Argonne East is converting the vault where the converter was previously stored to a low level waste handling and storage area. Consequently, the converter can not be returned there for storage.

The second converter is stored in a dry storage tube in the Chicago Pile 5 rod storage area. The storage tubes are pipes set in the concrete floor adjacent to the reactor confinement area. The tubes are capped with a lead shield plug. The remaining tubes are either empty or contain a variety of activated components. Argonne East has hired a subcontractor to remove the activated material and ship it to a low level waste disposal facility at Hanford. This operation cannot commence until the converter is removed from the rod storage area.

Existing administrative controls do not permit more than one converter outside of the storage tubes at the same time. Because the converter stored in the cask is already outside of the storage tubes, the second converter cannot be removed from the storage tube. Facility personnel plan to revise the facility criticality analysis and other relevant safety documentation to permit placing one converter inside the other and then placing both converters in a stainless steel container. This operation would take place in the facility hot cell. In-facility casks are available for transporting the converters to the hot cell. Facility personnel have already fabricated the stainless steel container and leak tested it for gas containment capability. They have not performed drop tests on the container.

The current plan is to transport the converters to the Fuel Cycle Facility at Argonne National Laboratory West in Idaho by January 1994. The converters are considered an appropriate test simulant for Integral Fast Reactor fuel reprocessing at the Fuel Cycle Facility.

The presence of the converters at Chicago Pile 5 is an obstacle to the expeditious decontamination and decommissioning of the facility if shipment to Argonne West is not possible. Interim storage at the Alpha-Gamma Hot Cells is possible but this would limit the operational flexibility of that facility. Adding the converters' 1.1 kg of special nuclear material to the existing inventory of special nuclear material at the Alpha-Gamma Hot Cells would severely limit that facility's ability to accept additional experimental material without having to implement extensive and costly safeguards and security controls.

3.3 Building 205

The Site Team Report does not address reactor irradiated nuclear material located in this facility. Discussions with the Site Team revealed that the facility contains only gram quantities of commercial nuclear fuel (Zircaloy clad low enriched uranium oxide from Big Rock Point Nuclear Station) that are used for metallographic examination. The Site Team considers this material as "in-process". The Assessment Team agreed that this material was beyond the scope of this initiative and decided against visiting the facility.

The existence of the material is noted here simply as information for EM- 37. DOE Chicago Operations Office policy is that there is no lower limit of accountability on special nuclear material. Therefore, Argonne East believes that all special nuclear material is presently accounted for in the three facilities discussed in this report.

4.0 Summary of Vulnerabilities and Conclusions

The Assessment Team identified no environmental, safety, or health vulnerabilities at Argonne East for further review by the Select Committee of the Spent Fuel Working Group. However, two Assessment Team concerns are discussed below.

4.1 Alpha-Gamma Hot Cell - Building 212, Wing F

The Site Team believes and the Assessment Team concurs that irradiated fuel segment storage and the observed fuel segment degradation does not constitute an ES&H vulnerability at the Alpha-Gamma Hot Cell provided that the facility safety systems remain operable. However, the Assessment Team is concerned that the Alpha-Gamma Hot Cell is a de-facto interim storage facility but is receiving no funding for facility surveillance and maintenance from the DOE Office of Environmental Restoration and Waste Management. The Assessment Team is also concerned about the absence of a long term plan to dispose of the irradiated fuel stored at the facility.

All of the Alpha-Gamma Hot Cell infrastructure requirements (e.g., safety documentation, surveillance and testing, preventative and corrective maintenance, safety systems upgrades or replacement, etc.) are funded by programmatic accounts. Programmatic funds must be stretched to cover these infrastructure requirements as well as the experimental program activity. If the programs currently funding the facility were to be terminated, there is no infrastructure account to ensure continued safe storage of the irradiated nuclear fuel.[1]

The Alpha-Gamma Hot Cell presently stores "orphan" fuel segments. Facility personnel consider this fuel orphan because the programs under which the fuel was acquired and analyzed have been terminated. Much of this fuel has been stored in the facility for 20 to 30 years. Even if there were a suitable recipient for this fuel, there is no active program to fund packaging and shipment.

The Assessment Team believes that EM-37 is accountable for this orphan fuel and should implement a program to ensure continued safe storage at the Alpha-Gamma Hot Cell until such time as it can be safely shipped to an authorized "interim long-term storage facility". Moreover, the Assessment Team recommends that DOE consider formally setting aside a portion of current programmatic funds for the Alpha-Gamma Hot Cell to ensure continued safe storage and shipment of irradiated fuel after program termination.

4.2 Chicago Pile 5

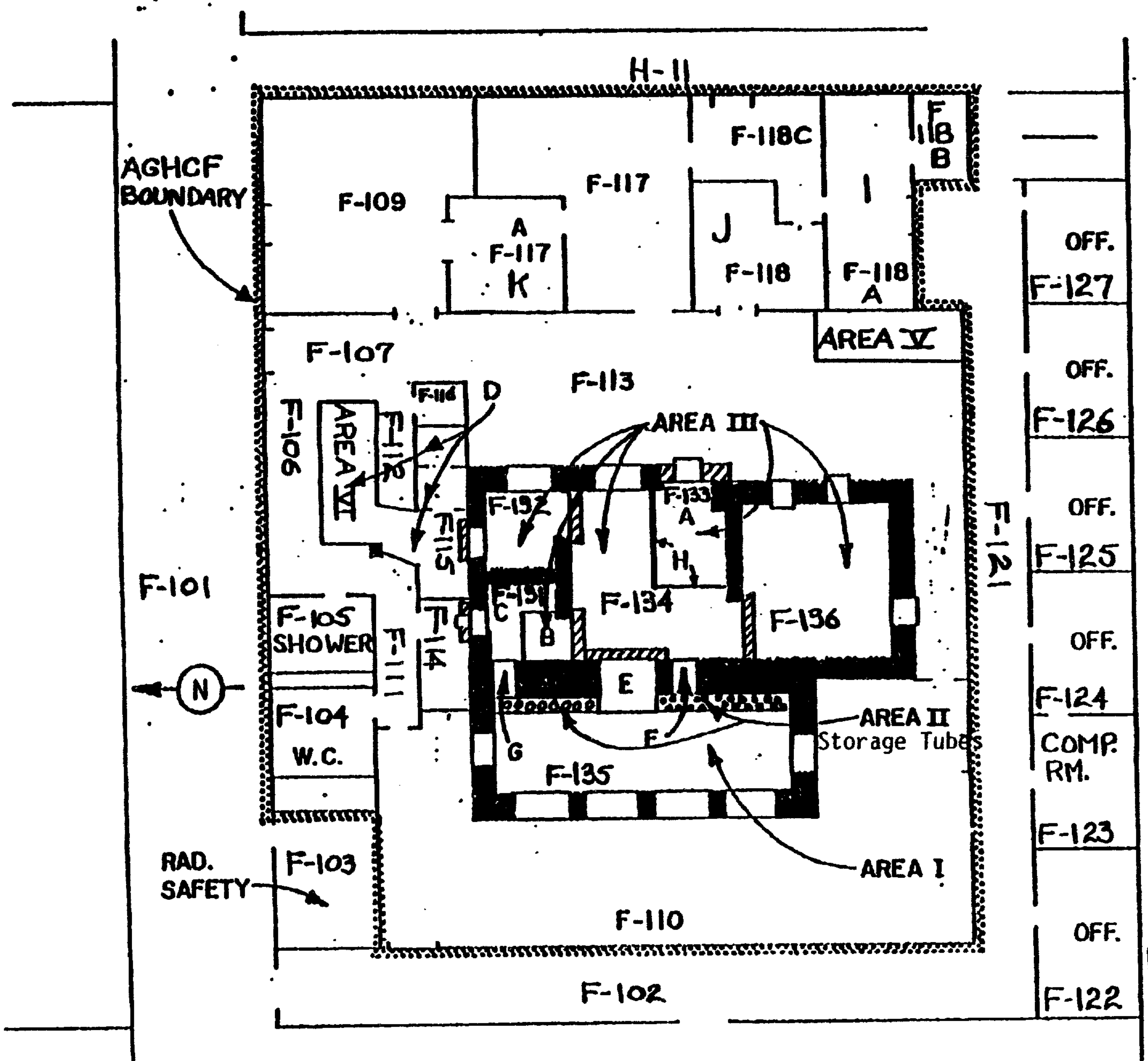
The Assessment Team did not find any ES&H vulnerabilities at this facility. However, the team believes that the potential inability to remove the converters from Chicago Pile 5 and ship them off site is a concern that warrants attention from EM-3.

[1]. A significant portion of Alpha-Gamma Hot Cell funding comes from the Integral Fast Reactor program. The US House of Representatives has voted to terminate this program. DOE has in the past experienced the complete deterioration of a hot cell facility at the Savannah River Site due to lack of infrastructure funding and program termination. (See Report of an Investigation into Deterioration of the Plutonium Fuel Form Fabrication Facility (PuFF) at the DOE Savannah River Site, US Department of Energy, Office of Nuclear Safety, DOE/NS-0002P, October 1991.)

ATTACHMENT
I

FACILITY SCHEMATICS

N8013-44830



LEGEND-HOT CELL

A. CLEAN TRANSFER AREA
B. GLOVED REPAIR
C. ACCESS TO GLOVES
D. DECONTAMINATION-REPAIR AREA
E. LARGE GAS LOCK
F. SMALL GAS LOCK
G. GLOVED REPAIR
H. TRANSFER WALLS
I. AUGER ELECTRON MICROPROBE
J. ELECTRON MICROPROBE
K. SCANNING ELECTRON MICROSCOPE

Note: All spaces within the Boundary and unmark as to Area are Area:

ALPH-GAMMA HOT CELL FACILITY-SPECIAL FACILITY FF1

Fig. 1

SPENT FUEL INITIATIVE

VOLUME II

SECTION 2

VULNERABILITY DEVELOPMENT FORMS

DEPARTMENT OF ENERGY • UNITED STATES OF AMERICA

Spent Nuclear Fuel Initiative
Identified Vulnerabilities

Site/Facility: Brookhaven/HFBR
Vulnerability #: BNL-1
Title: Unevaluated seismic resistance of spent fuel and racks.

Site/Facility: Hanford/K-East Basin
Vulnerability #: HAN-1-1
Title: Corrosion of Fuel in Unsealed Canisters, and Its Release, with Fission Products into KE-Basin Environment.

Vulnerability #: HAN-1-2
Title: Worker Exposures and Releases to the Environment During Re-Encapsulation of Corroding Fuel in KE-Basin.

4 **Site/Facility: Hanford/KE & KW Basins**
Vulnerability #: HAN-1-3
Title: Basin Leakage Due to Deterioration and Seismic Inadequacy of KE and KW Basin Discharge Chute Construction Joint.

Site/Facility: Hanford/KE/KW Basins
Vulnerability #: HAN-1-4
Title: The Institutional Control of Stored RINM is a Concern at K-Basins.

Site/Facility: Hanford 100 Area/105 K-Ea
Vulnerability #: HAN-1-5
Title: Plutonium-239 Accumulation in the Sand Filter Backwash Pit of 105 K-East Basin Resulted in a USQ.

Site/Facility: Hanford/KE-Basin
Vulnerability #: HAN-1-6
Title: Creation of TRU Waste Associated with the KE-Basin Operations.

Vulnerability #: HAN-1-7
Title: Tritium is Evident in Monitoring Wells Near the K-Basins.

Site/Facility: Hanford/KW and KE Basins
Vulnerability #: HAN-1-8
Title: Uncharacterized Fuel Stored in Sealed and Unsealed Canisters in KW and KE-Basins.

Site/Facility: Hanford/PNL 327
Vulnerability #: HAN-2-1
Title: Uncharacterized Mixed Fission Product Accumulation in the Hot Cell Ducts in the PNL 327 Building (Hot Cells D, F, SERF).

Vulnerability #: HAN-2-2
Title: Isolation of Radioactive Liquid Waste (RLW) System in Building PNL-327 Due to Inability to Send RLW to the 300 Area RLW Collection Building (Bldg. 340).

Site/Facility: Hanford/PNL 324
Vulnerability #: HAN-2-3
Title: Significant Quantities of Hazardous Materials (HAZMAT)/Special Case Wastes Temporarily Stored (Co-Located with RINM) in Hot Cells in Building PNL-324.

Vulnerability #: HAN-2-4
Title: Unresolved USQ from 1986 Radioactive Spill which Occurred in Building PNL-324, B Cell.

Site/Facility: Hanford/PNL 324/325/327
Vulnerability #: HAN-2-5
Title: Lack of Approved Disposal Pathway for RINM Causing a Backlog of RINM at all 3 Hot Cell Facilities at PNL (Building 324/325/327).

Site/Facility: Hanford/PNL 324
Vulnerability #: HAN-2-6
Title: Lack of an Approved Integrated Facility SAR for Building 324 Radiochemical Engineering Cells (REC) and Shielded Material Facilities (SMF).

Site/Facility: Hanford/PNL Building 325
Vulnerability #: HAN-2-7
Title: Lack of an Approved Integrated Facility SAR for Building 325 High-Level Radiochemistry Facility (HLRF) and Shielded Analytical Laboratory (SAL).

Site/Facility: Hanford/Building 327
Vulnerability #: HAN-2-8
Title: Lack of an Updated Integrated Facility SAR for the PNL Building 327 Postirradiation Testing Laboratory.

Vulnerability #: HAN-2-9
Title: Lack of a Current Building 327 Seismic Analysis.

Site/Facility: Hanford/FFTF
Vulnerability #: HAN-3-1
Title: Potential for Inadequate Funding for Removal and Interim Storage of FFTF Spent Fuel.

Site/Facility: Hanford/308 Bldg Annex
Vulnerability #: HAN-3-2
Title: Inadequate Technical Safety Requirements for Storage of TRIGA Fuel in the 308 Building Annex.

Vulnerability #: HAN-3-3
Title: Transport/Storage Casks for Removing the Irradiated Fuel from the NRF TRIGA Storage Basin in the 308 Building Annex Have Not Been Designed or Procured.

Site/Facility: Hanford/Burial Grounds
Vulnerability #: HAN-4-01
Title: EBR-II Waste Containers May Exceed Expected 25 Year Life Analyzed in the SAR of the 200 W Burial Ground.

Vulnerability #: HAN-4-02
Title: Containers, Other Than EBR-II Casks, Are Not Analyzed in the SARs for Fuel Storage Containers in the 200W Burial Grounds.

Vulnerability #: HAN-4-03
Title: The Inventory of RINM Cannot Be Determined or Verified at the Hanford Burial Grounds or in Basins at F- and H-Reactors.

Vulnerability #: HAN-4-04
Title: Fuel Stored on Interim Basis in Burial Ground May Exceed Expected Storage Period in the 200 Area Burial Grounds.

Site/Facility: Hanford/T-Plant
Vulnerability #: HAN-4-05
Title: Susceptibility of the T-Plant Fuel Pool to Seismic Damage.

Vulnerability #: HAN-4-06
Title: Lack of Forward Path for Removal and Ultimate Disposition of the Fuel Currently Stored in the T-Plant Spent Fuel Pool.

Vulnerability #: HAN-4-07
Title: Poor Housekeeping in the T-Plant Canyon.

Site/Facility: Hanford/T-Plant Canyon
Vulnerability #: HAN-4-08
Title: T-Plant Fuel Pool Cooling System Pump not Qualified for Current Environmental Service Conditions.

Site/Facility: Hanford/PUREX
Vulnerability #: HAN-4-09
Title: Frequency of Fuel Pool Level Monitoring at PUREX.

Vulnerability #: HAN-4-10
Title: Inaccessibility of Fuel for Inspection at PUREX.

Vulnerability #: HAN-4-11
Title: The Four Fuel Baskets are Only Supported from One Rail at the PUREX Fuel Pool.

Vulnerability #: HAN-4-12
Title: Fuel, Fuel Baskets, and Yoke Assemblies are Corroded at PUREX Fuel Pool.

Vulnerability #: HAN-4-13
Title: N and K-Reactor Fuel Elements, Both Intact and Broken, Located on Dissolver Cell Floors at PUREX.

Vulnerability #: HAN-4-14
Title: No Path Forward for Ultimate Disposal of Fuel Stored at PUREX.

Site/Facility: Hanford/Site-wide
Vulnerability #: HAN-S-1
Title: Sitewide Classification of DOE Spent Nuclear Fuel (SNF) and Spent Nuclear Material (SNM) Materials as Hazardous Waste.

Site/Facility: Hanford/Burial Grounds
Vulnerability #: HAN-S-2
Title: Classification of Fuel Materials is Undetermined in the 200 Area Burial Grounds.

Site/Facility: INEL/Hot Fuels Exam. Fac.
Vulnerability #: ID.A.1.1
Title: Lack of an approved SAR for Hot Fuels Examination Facility (HFEF)

Site/Facility: INEL/RSWF
Vulnerability #: ID.A.2.1
Title: Corrosion of inground carbon steel fuel storage containers at RSWF - ANL West.

Site/Facility: INEL/Zero Pwr Physics Rx
Vulnerability #: ID.A.5.1
Title: Potential radioactive releases from cladding separation from fuels stored in ZPPR storage vault.

Vulnerability #: ID.A.5.2
Title: Lack of approved path forward for ultimate disposal of ZPPR fuel stored in ZPPR storage vault.

Site/Facility: INEL/TAN
Vulnerability #: ID.E.1.1
Title: Corrosion monitoring inadequate at TAN.

Site/Facility: INEL/TAN Pool
Vulnerability #: ID.E.1.2
Title: Lack of Leak Detection and Leak Trending of Test Area North (TAN) Storage Pool Water Inventory.

Vulnerability #: ID.E.1.3
Title: Long Term Ownership of TAN Pool and Disposition of Residual RINM Inventory.

Spent Nuclear Fuel Initiative
Identified Vulnerabilities

Site/Facility: **INEL/TAN/TAN 607**
Vulnerability #: ID.E.1.4
Title: Potential Deficiency in Seismic Design of TAN 607 Basin.

Site/Facility: **INEL/MTR**
Vulnerability #: ID.E.3.1
Title: Corrosion monitoring inadequate at MTR (EG&G).

Site/Facility: **INEL/MTR Canal**
Vulnerability #: ID.E.3.2
Title: Lack of Leak Detection and Leak Trending of Material Test Reactor (MTR) Canal Water Inventory.

Vulnerability #: ID.E.3.3
Title: The MTR Canal has no clear DOE ownership: it is on orphan facility.

Site/Facility: **INEL/ARM**
Vulnerability #: ID.E.4.1
Title: Corrosion monitoring inadequate at ARM (EG&G).

Site/Facility: **INEL/ARMF/CFRMF Canal**
Vulnerability #: ID.E.4.2
Title: The ARMF/CFRMF Facility has no programmatic ownership: it is on orphan facility.

Site/Facility: **INEL/PBF**
Vulnerability #: ID.E.5.1
Title: Corrosion monitoring inadequate at PBF.

Site/Facility: **INEL/CPP-603 Basins**
Vulnerability #: ID.W.1.01
Title: Corrosion of aluminum associated with fuel and release of fissile material and radionuclides into the CPP-603 basin environment.

Vulnerability #: ID.W.1.02
Title: Uncharacterized water content of fuel now stored or to be encapsulated in containers at CPP-603 Basins.

Site/Facility: **INEL/CPP-603 Basin**
Vulnerability #: ID.W.1.03
Title: Institutional criticality control of stored RINM is a concern.

Site/Facility: **INEL/CPP-603**
Vulnerability #: ID.W.1.04
Title: A repacking capability, required to help minimize the effects of corrosion on the fuel assemblies and ensure safe storage of the fuel, does not exist at CPP-603.

Vulnerability #: ID.W.1.05
Title: There is no path for the ultimate disposal of fuel stored in the CPP- 603 basins.

Vulnerability #: ID.W.1.06
Title: Excessive corrosion of fuel handling units at ICPP-603

Site/Facility: INEL/CPP-603 Basin
Vulnerability #: ID.W.1.07
Title: Lack of leak detection and leak trending of release of Fission Products into the environment from the spent fuel storage basins at CPP-603.

Site/Facility: INEL/CPP-603 Basins
Vulnerability #: ID.W.1.10
Title: Worker exposures and releases to the environment during encapsulation of fuel in CPP-603 basins.

Site/Facility: INEL/CPP-603 Basin
Vulnerability #: ID.W.1.11
Title: Basin Wall Failure and Superstructure Collapse due to a Large Seismic Event.

Site/Facility: INEL/CPP-603
Vulnerability #: ID.W.1.12
Title: Carbon steel yokes not rigged associated with fuel at CPP-603 basin and potential for criticality.

Site/Facility: INEL/CPP-666 Basins
Vulnerability #: ID.W.2.1
Title: Corrosion of aluminum clad fuel and release of fissile material and radionuclides into the CPP-666 basin environment.

Vulnerability #: ID.W.2.2
Title: Susceptability and downgrading or engineered safety features at CPP.666 basins.

Site/Facility: INEL/CPP-666
Vulnerability #: ID.W.2.3
Title: There is no path for the ultimate disposal of fuel stored in the CPP- 666 Fuel Storage Facility.

Site/Facility: INEL-CPP/IFSF
Vulnerability #: ID.W.3.2
Title: Ignition of Brittle Cardboard Fuel Containers at IFSF

Site/Facility: INEL/CPP-603 IFSF
Vulnerability #: ID.W.3.3
Title: Roof Collapse and Control Room Equipment Failure due to a Large Seismic Event.

Site/Facility: INEL/CPP-603 (FECF)
Vulnerability #: ID.W.4.1
Title: There is no path for the ultimate disposal of fuel stored in the CPP- 603 Fuel Cutting Facility.

Vulnerability #: ID.W.4.2
Title: Possible degraded Peach Bottom Fuel

Site/Facility: INEL/CPP-749 drywell and
Vulnerability #: ID.W.5.1
Title: There is no path for the ultimate disposal of fuel stored in the CPP- 749 drywell storage area or the CPP-603 Irradiated Fuel Storage Facility.

Site/Facility: INEL/ICPP-749
Vulnerability #: ID.W.5.2
Title: Potentially degrading aluminum fuel cans and baskets at ICPP-749 (WINCO).

Site/Facility: Los Alamos/Omega West Rx
Vulnerability #: LA-1
Title: Spent Fuel And Pool Vulnerability To Damage From Falling Boulders At The Omega West Reactor Facility.

Vulnerability #· LA-2
Title: Potential Damage to Spent Fuel and Pool from Dislodging of the Overhead Crane during a Seismic Event at the Omega West Reactor.

Vulnerability #: LA-3
Title: Lack of Long Term Safety Analysis for Fuel Storage at Omega West Reactor (OWR).

Vulnerability #: LA-4
Title: Vulnerability of Criticality Unsafe Storage Configuration at Omega West Reactor.

Site/Facility: ORNL/MSRE
Vulnerability #: ORNL-1
Title: Radioactive Material Migration from the Molten Salt Reactor Storage Tanks.

Site/Facility: ORNL/TSR-II
Vulnerability #: ORNL-2
Title: Possible collapse of steel truss tower structure of TSR-II facility due to earthquake loads.

Site/Facility: ORNL/TSF/Bldg 7708
Vulnerability #: ORNL-3
Title: Potential for fire and activity release from stored reactor fuel.

Site/Facility: **ORNL/7823A/7827/7829 Well**
Vulnerability #: ORNL-4
Title: Release of radioactive material to the environment as the result of corrosion failure of stainless steel wells 7823A, 7827, and 7829.

Site/Facility: **ORNL/HRE Wells**
Vulnerability #: ORNL-5
Title: Irradiated fuel and associated fission products released to the environment from HRE storage wells.

Site/Facility: **ORNL/Class. Burial Grnd**
Vulnerability #: ORNL-6
Title: Uranium of unknown quantity was placed in unknown locations within the Classified Burial Ground in the 1970's.

Site/Facility: **SNL**
Vulnerability #: SNL-1
Title: Lack of Current Approved Safety Analysis for Spent Fuel and RINM Located in Storage Facilities Associated with the Sandia National Laboratory.

Site/Facility: **SRS/L Rx Basin**
Vulnerability #: SRS-01
Title: Potential unmonitored build-up of radionuclide and/or fissile materials in sand filters.

Site/Facility: **SRS/General**
Vulnerability #: SRS-02
Title: Incomplete Inventory of RINM.

Site/Facility: **SRS/L - Rx Basin**
Vulnerability #: SRS-03
Title: Different load bearing bolts installed in I beam RINM and target hanger trolleys.

Site/Facility: **SRS/"L" Disassembly Basin**
Vulnerability #: SRS-04
Title: Lack of authorization basis in operating the sand filter cleanup system for "L" Area Disassembly Basin.

Site/Facility: **SRS/"L" Basin**
Vulnerability #: SRS-06
Title: 137Cs activity level in "L" Basin.

Site/Facility: **SRS/L Rx Basin**
Vulnerability #: SRS-07
Title: Determine whether gas bubbles release is a potential hazard above the bucket storage area at L- Reactor.

Site/Facility: SRS/Reactors
Vulnerability #: SRS-08
Title: Lack of Reactor Authorization Basis.

Site/Facility: SRS/K,L Disassem. Basins
Vulnerability #: SRS-09
Title: Corrosion of Mark 31 A and B target slugs in K and L disassembly basins.

Site/Facility: SRS/P-Reactor Basin
Vulnerability #: SRS-10
Title: Hoist Rod Corrosion.

Site/Facility: SRS/Rx Disassembly Basins
Vulnerability #: SRS-11
Title: Reactor Disassembly Basin Safety Analysis Envelope.

Site/Facility: SRS/L-Rx Disassem. Basin
Vulnerability #: SRS-12
Title: Inadvertent flooding of L-Reactor Disassembly Basin.

Site/Facility: SRS/K-Rx Disassem.Basin
Vulnerability #: SRS-13
Title: Inadvertent flooding of K-Reactor Disassembly Basin.

Site/Facility: SRS/P-Rx Disassem.Basin
Vulnerability #: SRS-14
Title: Inadvertent flooding of P-Reactor Disassembly Basin.

Site/Facility: SRS/RBOF; P,K,L,C,R Rx's
Vulnerability #: SRS-15
Title: Conduct of Operations at reactor facilities.

Site/Facility: SRS/RBOF
Vulnerability #: SRS-16
Title: Inadequate Tornado Protection at RBOF

Vulnerability #: SRS-17
Title: Seismic Vulnerability of RBOF

Site/Facility: SRS/H-Canyon
Vulnerability #: SRS-18
Title: Seismic Vulnerability of H-Canyon.

Site/Facility: SRS/F-Canyon
Vulnerability #: SRS-19
Title: Seismic Vulnerability of F-Canyon.

Site/Facility: SRS/LKP Rx Basins & RBOF
Vulnerability #: SRS-20
Title: Inadequate leak detection system in the underground water filled RINM storage basin.

Site/Facility: SRS/LKP Rx Disassem Basin
Vulnerability #: SRS-21
Title: Inadequate Seismic evaluation and potential inadequacies of structures, systems and components to withstand a DBE.

Site/Facility: West Valley/FRS
Vulnerability #: WV-01
Title: Lack of Systems for Leak Detection and Mitigation.

Vulnerability #: WV-02
Title: Inadequate water chemistry monitoring program for the spent fuel pool.

Vulnerability #: WV-03
Title: Unknown Condition of Fuel Cladding.

Vulnerability #: WV-04
Title: Seismic vulnerability of building and fuel storage racks.

SPENT FUEL INITIATIVE

Hanford Site

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-S-1	Site: Hanford
Date: October 14, 1993	Facility: Site-wide

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Sitewide Classification of DOE Spent Nuclear Fuel (SNF) and Spent Nuclear Material (SNM) Materials as Hazardous Waste.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

Over 80% of DOE's spent nuclear fuel is stored in various facilities on the Hanford site. If this material is not officially declared as spent nuclear fuel to be held for future reprocessing and use, the public and its intervenors may request its classification as waste and require that its treatment follow the environmental regulations of EPA, RCRA, and CERCLA.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The largest amount (>80%) of DOE's total SNF inventory is stored at various locations on the Hanford, Washington site. This inventory includes not only spent and unreprocessed fuel, but also small pieces and samples used during experiments that have not yet been classified as transuranic (TRU) waste. DOE decided in 1992 not to reprocess SNF solely for the recovery of highly enriched uranium or ^{239}Pu. Instead, SNF will be stored pending geologic disposal or other future actions, such as reprocessing at a future date. The SNF in interim storage is deteriorating because of its age and the conditions under which it is stored. This deterioration is producing fuel oxides that settle into sludge that settles on the bottom of the storage containers or storage basins. These materials (SNF, fuel oxides, sludge, etc.) have not been characterized for hazardous components per RCRA. Should hazardous components be present, the materials would be classified as mixed TRU/hazardous waste. It would be impractical to meet all of the requirements of the EPA, RCRA, and CERCLA regulations.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

No repository for mixed waste presently exists at the Hanford site. Thus, it is impossible to safely dispose of the SNF inventory stored at the Hanford site according to the environmental regulatory requirements should the SNF and its byproducts be classified as mixed waste and fall under environmental regulatory requirements. This vulnerability represents an institutional failure.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-S-1	Site: Hanford
Date: October 14, 1993	Facility: Site-wide

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This vulnerability affects the environment, public health and safety, and worker health and safety. Should this material be classified as waste there would not be sufficient time nor manpower to dispose of it as required by the environmental regulations, nor would sufficient facilities be available to permanently store this hazardous material in a safe manner.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Since DOE has not issued a formal statement of the classification of the SNF and its byproducts as fuel the public and its intervenors may consider its classification as waste and require that it be treated under the environmental regulations of EPA, RCRA, and CERCLA. Consequently, the urgency of this vulnerability is <1 year.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Signature, Team Member

10/15/93
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-S-2	Site: Hanford
Date: October 14, 1993	Facility: Burial Grounds

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Classification of Fuel Materials is Undetermined in the 200 Area Burial Grounds.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The classification and planned ultimate disposition of the fuel and test specimen materials temporarily stored in shallow land disposal at the 200 West Area Burial Grounds is based on an unapproved interpretation of DOE Order 5820.2A, and the assumption that WIPP is a viable and proper repository for such materials.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

It has been assumed by DOE-RL and WHC that the materials temporarily stored at the 200 West Area Burial Ground facility in active interim storage are classified as remote-handled transuranic waste that will be retrieved and shipped ultimately to WIPP for final disposition.

The interpretation that spent fuel and reactor irradiated nuclear materials stored at the 200 West Area Burial Ground can be classified as remote-handled transuranic waste rather than spent fuel may not be valid. The pathway for storage, retrieval and ultimate disposition of this material is a strong function of whether it is called remote-handled, transuranic waste or spent fuel. Although DOE-RL documented its interpretation of DOE Order 5820.2A in correspondence to DOE-HQ in 1991, DOE-HQ has not responded.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

This is an institutional failure in that a definitive determination of the classification of the materials stored in the Burial Grounds. This could result in application or failure to apply correct requirements on the materials. This could result in the inability to transfer the materials to a permanent storage location.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # HAN-S-2	Site: Hanford
Date: October 14, 1993	Facility: Burial Grounds

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

The materials stored at 200 West Area Burial Ground were intended for temporary, interim storage. There is a real possibility that due to a lack of clear DOE policy, they will remain in place indefinitely. This is an environmental vulnerability in that the storage containers used for shallow land storage are not designed for long term service, and will eventually begin to degrade. Fuel and test specimen materials could eventually find pathways to the site environment.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

The DOE needs to clearly establish a spent fuel policy within the next 1-5 years that includes the final disposition of spent fuel and reactor irradiated nuclear materials.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

If the DOE fails to establish a clear policy for the final disposition of spent fuel and reactor irradiated nuclear materials, the quantity of materials at the Burial Grounds will continue to increase and remain in a condition that is not designed for long term storage.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Establish a clear policy for the final disposition of spent fuel and reactor irradiated nuclear materials. Clarify definitions of transuranic waste and spent fuel.

Mark W Parrish	[illegible] 10/15/93
Signature, Team Member	Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-1-1	Site: Hanford
Date: October 13, 1993	Facility: K-East Basin

<u>Block #1:</u> <u>Title of Vulnerability</u> *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Corrosion of Fuel in Unsealed Canisters, and Its Release, with Fission Products into KE-Basin Environment.

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u> *(Approximately 50 words)*

Continuing corrosion of fuel in unsealed canisters in water-filled storage basin causes increasing amounts of uranium, TRU, and fission products in pool and pool sludge and attendant increased risks of exposure to workers, risk of increased accidental criticality, and increased release of radionuclides to the environment.

<u>Block #3:</u> *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Fuel in unsealed canisters in K-East Basin shows significant corrosion and breaches in cladding, exposing metallic uranium alloys to basin environment. Corrosion of the uranium alloy adds significant amounts of tritium, fission products, and uranium and plutonium oxides to the basin coolant, much of it as fines or sludge. Up to 50% of fuel elements have been breached, and the process is continuing.

<u>Block #4:</u> *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Release of tritium, fission products, and uranium and plutonium isotopes in the basin increases exposure to workers. Increased amounts of uranium and plutonium in the basin sludge increases risks of accidental criticality. Increase of fission product and tritium activity in the basin increases intrusion into the environment as a result of basin leakage.

<u>Block #5:</u> *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety are affected by increased activity and sludge buildup in the basin and canisters. Since the facility has a history of leakage, the environment will be increasingly contaminated.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-1-1	Site: Hanford
Date: October 13, 1993	Facility: K-East Basin

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

1-5 years. Plans to encapsulate damaged fuel into sealed canisters are underway. Continuing degradation makes this urgent. The process will require approximately two years, starting in mid-FY-1994 at the earliest. Another two years will be required to encapsulate the sludge material.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Disintegration into sludge of approximately 50% of the stored fuel may occur. Increased release to environment and exposure to workers may develop during normal operation. Since corrosion product sludge is building up in the open canisters, continuing corrosion will result in increasing exposure to the workers during the encapsulation process, when this material is likely to be stirred up in the basin water (see VDF# HAN-1-2).

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Encapsulation of the exposed fuel should be expedited.

Signature, Team Member

Signature, Team Leader 10/15/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-1-2	Site: Hanford
Date: October 14, 1993	Facility: K-East Basin

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Worker Exposures and Releases to the Environment During Re-Encapsulation of Corroding Fuel in KE-Basin.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The potential for significantly increased exposures to workers and releases to the environment exists during encapsulation of the corroded fuel presently stored in open canisters. Release of corroded material to basin water will increase burdens on filters and demineralizers. Alternative plans to minimize spread of these contaminants need to be developed with an objective of reducing personnel exposure to ALARA.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Encapsulation plans have no design/equipment to limit or control releases of radioactive nuclides or uranium and plutonium-containing sludge to the basin coolant during encapsulation. The resultant worker exposure increases can cause delays in the needed encapsulation program. Increased releases of nuclides and uranium and plutonium oxides to the basin places increased burden on filters and demineralizers and on resulting worker exposures during replacement, storage, and disposal.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Encapsulation plans call for inverting open fuel canisters to empty their contents into a tray, load the material (fuel) from the tray into new (sealed) canisters with manipulators. Since much corrosion of fuel has occurred during storage in open canisters (see VDF# HAN-1-1) considerable sludge has developed which may be released to basin as fines during unloading of the open canisters. Also, corrosion of fuel, of the order of 50% of the fuel rods, results in increased volume and increased difficulty in removing fuel into the tray. Activities to free stuck elements are expected to increase loading of fission products and uranium and plutonium oxides dispersed in the pool water, and increased radiation exposures to workers. All of these conditions will increase loads on filters and demineralizers and increase worker exposures during their replacement, storage, and disposition.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-1-2	Site: Hanford
Date: October 14, 1993	Facility: K-East Basin

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety are potentially affected by the increased exposures. Also, since the basin has a history of leakage, the surrounding environment is potentially affected.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

The possibility of placing the unsealed canisters and their contents into sealed outer containers, without removing the damaged fuel, should be reviewed prior to initiation of the re-encapsulation procedures (<1 year). This may require replacement of fuel storage racks, or design of a stand alone container to replace the racks.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

M&O contractor believes dosages to workers will not become unacceptably high during the encapsulation operation, based on experiences during the segregation and encapsulation operations performed approximately 10 years ago.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

In view of continuing corrosion of stored fuel and increase in the number of corroded fuel rods from approximately 10% to approximately 50%, increased worker exposure is a vulnerability during this operation and the engineering to reduce these exposures needs to be performed.

Increases in worker exposures may be followed by delays in expediting the encapsulation program.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

The canisters containing the corroded fuel should be placed in sealed outer containers, or improved methods of collecting the debris from the open canisters should be developed. Improved methods of replacing, storing, and disposal of used filters and demineralizers should be developed.

[signature]	[signature]
Signature, Team Member	Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-1-3	Site: Hanford
Date: October 13, 1993	Facility: KE & KW Basins

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Basin Leakage Due to Deterioration and Seismic Inadequacy of KE and KW Basin Discharge Chute Construction Joint.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The reactor fuel discharge chute is located above a construction joint between the foundation slabs of the fuel storage basin and the reactor foundation. Leaks have been detected in the KE-Basin between 1975 and 1980 and in 1993. Reasons for these leaks have not been identified, and a seismic analysis of the structure fails to qualify this construction joint. Failure of this joint presents a vulnerability to the environment in the release of fissionable materials.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The KE and KW fuel storage basin foundations are connected to their respective reactor structures by means of an unreinforced construction joint underneath the fuel discharge chute. A rubberized water stop was embedded in this joint when the facilities were constructed 40 or so years ago; however, leaks have occurred in this region in the KE-Basin between 1975 and 1980. A leak also occurred in 1993. The cause for the most recent leak has not been identified; this leak was stopped by increasing the basin temperature. (Guesses as to the cause range from unequal thermal expansion between the two foundations to unequal or differential settlements between the two foundations). It is likely that another larger leak may develop in the future.

As part of the safety analysis investigations a detailed dynamic seismic analysis of the entire reactor structure and fuel storage basin was performed. This analysis showed some structural deficiencies in the basin walls and roof superstructure that could be remedied through structural upgrades; however, the analysis could not ascertain the structural adequacy of the unreinforced construction joint. The dynamic seismic analysis predicts a maximum relative displacement between the basin and the reactor foundation slabs of 0.2 in.; this may also provide a pathway for the basin's cooling water to enter the environment.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-1-3	Site: Hanford
Date: October 13, 1993	Facility: KE & KW Basins

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The activity in the KE-Basin varies significantly in the range of 1 to 10 µCi/ℓ ^{90}Sr, 1 to 25 µCi/ℓ ^{137}Co, 3,000 µCi/ℓ ^{3}H, and 0.002 to 0.25 µCi/ℓ ^{239}Pu, and since these activities are likely to increase during the encapsulation process a reoccurrence of a leak, especially if caused by the design basis earthquake, would result in significant releases of fission products (especially tritium) to the environment.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This vulnerability affects the environment. Tritium releases to the soil underneath the KE or KW-Basin may enter the Columbia River, which is only a short distance removed. Also, Tritium releases are generally accompanied by Strontium and Cesium fission products, which contaminate the soil column.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Since the origin of the leaks between 1975 and 1980 and in 1993 in the KE-Basin was never specifically identified and small leaks are difficult to detect (the threshold of detectability is 25 gal/hr), another significant leak could occur anytime. Thus, the urgency of this vulnerability is classified as 1-5 years.

The leak due to the seismic failure of the construction joint depends on the probability of exceedance of the design basis earthquake which is estimated at 10^{-5}/yr. Because of this large time period the urgency of that vulnerability is classified as >5 years.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # HAN-1-3	Site: Hanford
Date: October 13, 1993	Facility: KE & KW Basins

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Urgently determine source of leakage by such means as sampling the water in the existing construction joint monitoring wells, drilling horizontal monitoring wells and collecting soil and water samples under the construction joint. Place a rubber liner over the discharge chute floor prior to setting equipment for the encapsulation program. This should be viewed as the permanent compensatory measure pending removal of fuel material before 2004.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-1-4	Site: Hanford
Date: October 11, 1993	Facility: KE/KW Basins

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

The Institutional Control of Stored RINM is a Concern at K-Basins.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The KE/KW Basin facilities are an EM responsibility and the irradiated fuel has also recently become an EM responsibility. A lack of clear planning and priorities for final disposition of the fuel material is evident. To compound this problem, organization and personnel changes are frequent. A project organization has not been formed to be accountable for the eventual resolution of ES&H concerns with the facility and its fuel material.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

There is no plan which describes the organizational responsibility, technical workscope, cost and schedule for the continued operation of the K-Basins and disposition of the fuel currently stored in the two facilities. The material stored within the KE-Basin is significantly degraded and plans for encapsulation are proceeding slowly and will take up to four years to perform. The potential for release of radionuclides to the environment and significant exposure to workers exist as a result of the current conditions.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Lack of a clear plan for K-Basin fuel is indication of institutional failure. The line item funding for critical facility upgrades has been slipped for three consecutive years, the fuel has not been characterized so that long term disposition can be evaluated, and encapsulation has been delayed at KE due to a regulatory focus on permits. Management changes in the M&O have been made to correct deficiencies in conduct of operations to begin the encapsulation. A May 1993 Program Summary is already outdated if a draft Federal Facility Agreement and Consent Order Change Control Form is agreed upon. The schedule in the draft, dated September 7, 1993 appears quite unrealistic, based upon past performance of DOE, its contractors and its regulators in supporting urgent schedule actions.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-1-4	Site: Hanford
Date: October 11, 1993	Facility: KE/KW Basins

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This particular vulnerability affects the environment through release of tritium and fission product radionuclides from the KE-Basin, can potentially result in tritium releases at near Drinking Water Standards to the Columbia River, and affects the exposure of workers who are regularly in the plant; it also affects the credibility of the DOE and M&O commitwents to remediate the situation.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Developing a solid and realistic plan of action and assuring funding to support this plan is urgently required (in less than a year). Until such a plan is developed, activities will be fragmented, delays will be the norm rather than an exception, and the affects identified in Block 5 will continue to be realized.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Delays in cleaning up an urgent problem such as exists at the KE-Basin will result in the problem becoming even more difficult. This is not an issue of technology, it is an issue of institutional inaction.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Get a plan, form a partnership between the DOE, its contractors, and its regulators and get everyone performing to the plan.

Signature, Team Member

10/13/93

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-1-5	Site: Hanford 100 Area
Date: October 13, 1993	Facility: 105 K-East Basin

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Plutonium-239 Accumulation in the Sand Filter Backwash Pit of 105 K-East Basin Resulted in a USQ.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

Pu^{239} in the sand filter backwash pit has been estimated to be in the range from 647 g to 1,730 g. This is well in excess of the OSR limit of 225 g, and poses a concern due to the likelihood of a criticality event. Such an event could result in the release of radionuclides in the environment and would indicate a significant failure in operational control.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

A USQ was developed on 5-10-93 as a result of backwashing a sand filter. The estimated accumulation of 647 g of plutonium exceeded the OSR limit of 225 g in that location. Subsequent analysis of another backwash pit sample yielded a plutonium content of 1,730 g.

The Encapsulation Program may result in increased need to use the sand filter and resolution of the OSR limit is not scheduled until April 1994. The actual Pu^{239} concentration in the sand filter backwash sludge is being evaluated, but is not scheduled for completion until April 1994.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

A criticality could occur if dissolved/suspended Pu^{239} were to preferentially occur on filters or in ion exchangers. Backwashing to pits can result in accumulation of this material.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-1-5	Site: Hanford 100 Area
Date: October 13, 1993	Facility: 105 K-East Basin

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

If a criticality were to occur, it would indicate a significant operational control problem. A criticality occurrence would endanger the health and safety of the workers and would lead to release of fission products to the environment.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Because of the uncertainties in the amount of fissionable material and the fact that the Pu^{239} content in the sand filter backwash pit exceeded the OSR 225 g limit, corrective action is urgently required. Corrective action should be taken in the immediate future, i.e., within a period of less than one month.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The criticality issue was discussed, during a meeting on October 13, 1993 with the Westinghouse Hanford Company technical staff. It was agreed that the encapsulation program cannot be initiated until and unless the problems leading to Plutonium accumulation in the sand filters are resolved.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

As stated in Item #4, a criticality event could occur which would result in the release of fission products, would be a significant failure in operational control and would adversely affect the environment.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Increase frequency and improve the procedure for monitoring quantities of plutonium in the sand filter backwash pit.

Signature, Team Member

Signature, Team Leader 10/13/93

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-1-6	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Creation of TRU Waste Associated with the KE-Basin Operations.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The high concentration of Plutonium in KE-Basin results in the creation of TRU waste packages. No disposition method currently exists for these packages and storage of such waste can present hazards such as explosive or flammable concentrations of hydrogen. Hydrogen is generated through degradation of organic resins and hydrolysis of water contained in the TRU packages. Filter cartridges also contain TRU waste and their handling results in significant personnel exposure.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Significant fission product releases to the KE-Basin water require cleanup by ion exchange media. A mixed bed synthetic resin (nuclear grade duolite) is used to capture cesium-137 and strontium-90. These ion exchange media also capture a significant quantity of plutonium. Depending upon the container for the ion exchange media and the loading of fission products, a number of the spent fuel cartridges are categorized as TRU waste. There is currently no site which can receive and disposition these waste containers.

Heavily loaded organic ion exchange resins can experience severe degradation in a radiation field. This can result in combustible quantities of hydrogen and hydrocarbon gases as a result of resin degradation and radiolysis of water remaining in the resin. Hydrolysis of water by radiation can also result in hydrogen rich atmospheres when a material which reacts with the oxygen from the hydrolysis is present (such as metals or the degraded resin).

Exposures to personnel handling spent filter cartridges in preparing them as a waste burial package are significant due to the radiation levels (>1 R/hr) and air handling practices.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-1-6	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The creation of waste which cannot be dispositioned, in conjunction with fuel storage operations, results in the potential for additional accidents involving release of radionuclides. This can subsequently result in exposure of personnel, particularly workers providing accident recovery support, and a loss of credibility for DOE and its contractors.

The current practice of handling filter cartridges in air results in a direct exposure to personnel and is not ALARA.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Release of fission products from waste packages due to explosion accidents could affect the environment and worker health and safety. It is unlikely, due to the remote site of temporary storage of these ion exchange media, that public health and safety could be affected.

Current filter cartridges handling practice results in significant worker exposure.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

A viable plan for disposition of these ion exchange media should be determined and the waste shipped to that location as soon as it can be prepared for shipment from the KE-Basin. A new filter cartridge module should be designed and placed into service to eliminate a source of TRU waste and minimize worker exposure. These should be done in less than one year.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

VULNERABILITY DEVELOPMENT FORM	**(Page 3)**
Vulnerability # HAN-1-6	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #8 (Optional): ***To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.***

Experience following the TMI-2 accident demonstrated that organic resins can be severely degraded by heavy loadings of radionuclides. This degradation resulted in hydrogen rich atmospheres within the containers with the potential for fire or explosion accidents. The buildup of these gases due to long term storage requires compensatory measures prior to shipment which is difficult to achieve, exposes workers to direct radiation, and causes a loss of credibility of the waste generator due to delays in material disposition.

Block #9 Optional: ***To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.***

A cartridge filter/burial container much like the IXM should be developed to minimize the potential for the filter materials being classified as TRU waste. A site for permanent disposition of those materials already classified as TRU waste should be identified and the material buried as soon after removal from the process as possible. Preparations for burial should be determined which would minimize potential for release of fission products and plutonium from the containers.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-1-7	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Tritium is Evident in Monitoring Wells Near the K-Basins.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

Elevated tritium concentrations in wells adjacent to the K-East Basin appear to be the result of leakage from the basin. Tritium concentrations in wells near the Columbia Rive shoreline are approaching the Drinking Water Standard of 20,000 pCi/l. Currently a model does not exist to track leakage from the basin and low volume leakage (<25 gallons/hr) is not detectable by measurement of basin water level. Other fission products which accompany the leakage are not detectable as they are absorbed by soil prior to reaching the monitoring wells.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Monitoring wells surrounding the KE-Basin are exhibiting increasing levels of tritium. The Washington Department of Ecology has expressed concerns and suspects the KE-Basin as being the source of contamination. While the source has not been absolutely verified to be the KE-Basin, prior leaks in the facility in the mid 70's, increasing tritium in monitoring wells since the mid 1980's and a significant increase following a recent leak make this basin a reasonable suspect. During late 1976 a leak of up to 800 gallons/hr was experienced. It was reduced to 500 gallons/hr by mid 1977 but was not controlled until mid 1979. Another significant leak occurred in March 1993 with rates up to 60 gallons/hr.

The K-Area is an operable unit in the Federal Facility Agreement and Consent Order for early remediation.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Until more wells are installed and the source verified, the source of tritium and fission products released to the environment in the K-Area must be presumed to be the KE-Basin. This release of fission products is difficult to prevent due to the fuel condition and indicated basin leakage.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-1-7	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

The suspected release of tritium and fission products from the KE-Basin to the environment has been evaluated and public health is not a concern. Tritium concentrations in wells downgradient of the KE-Basin near the river shoreline approach the Drinking Water Standard of 20,000 pCi/l. While river concentrations and downstream concentrations are well below the Drinking Water Standard, perception is that such releases are hazardous and public concern will result in loss of credibility of DOE and its contractors.

Fission products, notably cesium-137 and strontium-90, which accompany leaching coolant from KE-Basin, are absorbed in the soil column near the source of leakage and represent environmental vulnerabilities which will require future remediation.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Relating monitoring well activity to KE-Basin activity can be done at present. Monitoring fission products and tritium in the construction joint drainhole inspection wells and increasing the number of monitoring wells to verify the source of tritium should be done within the next year. This will demonstrate DOE's concern over such releases and verify the source as well as increase credibility of monitoring basin leakage (since small quantity leakage on the order of <25 gallons/hr is difficult to verify).

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

The most significant vulnerability is increased loss of credibility with regulators and the public, however it is likely that seepage in the near future along the shoreline of the Columbia river will be at levels near the drinking water standard. Contamination of the soil column will continue if the source of leakage cannot be identified and stopped or isolated.

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # HAN-1-7	Site: Hanford
Date: October 13, 1993	Facility: KE-Basin

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Several monitoring wells should be located near suspected sources and a well planned program developed to model and track the source of tritium near the KE-Basin. One of the easiest activities to perform would be to monitor fission products and tritium in the inspection wells for the formed drainhole, which are now only monitored for water level. Another action, which would mitigate the potential for increased leakage, would be to place a rubber liner over the basin discharge area construction joint (see VDF# HAN-1-3).

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-1-8	Site: Hanford
Date: October 14, 1993	Facility: KW and KE Basins

__Block #1:__ __Title of Vulnerability__ *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Uncharacterized Fuel Stored in Sealed and Unsealed Canisters in KW and KE-Basins.

__Block #2:__ __Executive Summary of Vulnerability__ *(Approximately 50 words)*

The condition of the fuel stored in water-filled canisters, both sealed (K-West) and unsealed (K-East), is not known. Fuel is believed to have been damaged during discharge from reactors. Characterization of its condition is needed to minimize worker exposure and environmental damage during final disposal.

__Block #3:__ *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Fuel is stored in both sealed and unsealed, water-filled canisters in these basins. In some instances locking bars on the sealed canisters have cracked. There is reason to believe that degradation of the stored fuel has occurred in the sealed canisters in K-West similar to that observed in the open canisters in the K-East Basin. The present condition of the stored fuel is not characterized; degradation of fuel in these canisters could give rise to increased environmental damage and worker exposure during final disposition. The character of the fuel (chemical and physical condition) will define the needed steps to ultimate disposal.

__Block #4:__ *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Release of fission products from degraded fuel and hydrogen from corrosion processes occurring both in unsealed and inside sealed, water-filled containers could occur during final disposal or storage of this fuel.

__Block #5:__ *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety and the environment could be affected because of unexpected release, possibly accelerated by chemical reactions, which causes spread of fission products, uranium, and plutonium from degraded fuel.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # HAN-1-8	Site: Hanford
Date: October 14, 1993	Facility: KW and KE Basins

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Corrective actions should be made and the stored fuel characterized prior to decisions regarding methods for its ultimate disposal (1-5 years).

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Disposal of the stored fuel would be delayed, and result in increased worker exposures and environmental damage.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Plans for fuel characterization studies should be formalized and initiated.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-1	Site: Hanford
Date: October 11, 1993	Facility: PNL 327

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Uncharacterized Mixed Fission Product Accumulation in the Hot Cell Ducts in the PNL 327 Building (Hot Cells D, F, SERF).

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Accumulation of mixed fission product activity and radioactive contamination in ductwork as a result of handling and machining operations in D, F, and SERF Hot Cells have resulted in excessive radiation levels in accessible areas. Additionally, no criticality assessments have been completed on this accumulation.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Accessible areas in the basement of Building 327 have historically had general area radiation levels as high as 45 R/hr. Maximum general area radiation levels have decayed to 10 R/hr with other accessible areas ranging form 30-40 mR/hr to 4-5 R/hr. In addition, and because the accumulation of mixed fission products in the ducts has not been characterized, it represents a potential criticality concern. This buildup is further escalated by the inability to decontaminate Hot Cells due to isolated RLW drains (see VDF# HAN-2-2).

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Direct exposure from excessive radiation levels.

Inadvertent criticality in the exhaust ducts.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety from direct exposure and inadvertent criticality.

Public health and safety from inadvertent criticality.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-2-1	Site: Hanford
Date: October 11, 1993	Facility: PNL 327

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 year. Characterization of mixed fission product buildup is funded and scheduled to commence in FY 94. However, until the characterization is completed and the ducts are decontaminated, the vulnerability will continue to exist.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Characterization of mixed fission product buildup is funded and scheduled to commence in FY 94. However, until the characterization is completed and the ducts are decontaminated (currently unfunded), the vulnerability will continue to exist.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Additional unnecessary personnel exposure.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Proceed with the site plans to characterize the buildup of mixed fission product activity in the ducts. Then ensure funding is scheduled for the decontamination of the ductwork. In the interim, recommend locking access to basement of Building 327 to restrict access and prevent inadvertent entry into High Radiation Areas.

[signature] 10/15/93 — Signature, Team Member

[signature] 10/15/93 — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-2	Site: Hanford
Date: October 11, 1993	Facility: PNL 327

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Isolation of Radioactive Liquid Waste (RLW) System in Building PNL-327 Due to Inability to Send RLW to the 300 Area RLW Collection Building (Bldg. 340).

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Due to current prohibitions on RLW drains being sent to Building 340, all RLW drains including sink drains and floor drains have been isolated. This has resulted in a reduction in decontamination efforts and a potential threat to the environment from the runoff of potentially contaminated water to the environment.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Building 327 has no RLW hold-up tank capability. This has resulted in a reduction in the decontamination efforts within Building 327 since the only current path for removing RLW water from the facility is to: collect it in small quantities (5-10 gallons); complete permit analysis required for transfer to Building 340 (at an approximate cost of $6,000 per sample); then transfer to Building 340. The failure to decontaminate the hot cells adequately may also be contributing to the build up of mixed fission product activity in the ductwork (see VDF# HAN-2-1).

In addition, with the isolation of floor drains, if the fire fighting sprinkler system were actuated, or other flooding occurred (overflow of storage pool, service water rupture, etc.) water would fail to drain through the isolated floor drains and result in a release of potentially contaminated water to the environment by flowing out of the canyon doors (non-air-locked) and onto the ground outside Building 327. The source of contamination is loose surface contamination which could be washed out from underneath each hot cell.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Environmental release.

Direct exposure and criticality (contributing to VDF# HAN-2-1).

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-2-2	Site: Hanford
Date: October 11, 1993	Facility: PNL 327

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Environmental impact due to potentially contaminated water being released due to isolated floor drains. Although uncharacterized, it is believed that a significant quantity of loose surface contamination exists underneath each hot cell and would be washed out in the event of building flooding.

Worker and public safety (contributing to VDF# HAN-2-1).

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 year. Interim corrective actions should be taken immediately to minimize the risk of the environmental release. Interim measures might include installation of a temporary shielded drain tank and placing temporary door dams around each canyon exterior door to significantly reduce the vulnerability of a potential release to the environment.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Consider installation of RLW tank for long-term use.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Continued unnecessary personnel exposure and facility contamination. Potential increase of material accumulation in ductwork.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

With current discussions ongoing for the future mission of Building 327, rather than proceeding with a large project for RLW tank installation, the contractor should consider interim corrective actions to minimize potential releases by placing temporary floor dams around each exterior door. This would represent a significant reduction in the risk of environmental release.

10/15/93 — Signature, Team Member

10/15/93 — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-3	Site: Hanford
Date: October 11, 1993	Facility: PNL 324

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Significant Quantities of Hazardous Materials (HAZMAT)/Special Case Wastes Temporarily Stored (Co-Located with RINM) in Hot Cells in Building PNL-324.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Significant quantities of dispersible radioactive hazardous materials and special case wastes are co-located with the RINM stored in hot cells in Building 324. Quantities and locations are as follows:

B Cell: 1.5 M Ci of Cesium (Cs) & Strontium (Sr) in dispersible form, 20 ft^3 of Pb (radioactive mixed waste [RMW]), 100 ft^3 filter media MW.

South Cell: 300,000 Ci of Cs Powder in containers, 10,000 Ci Cs in dispersible form. The dispersible materials are temporarily stored in a ventilated Hot Cell and represent a potential release hazard until placed in appropriate containers.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Quantity of dispersible, high Ci content HAZMAT temporarily stored in hot cells could result in large radioactive releases to the environment. While temporary storage of this material in a Hot Cell appears acceptable from an ES&H concern, the lack of a pathway to dispose of these materials could represent a significant legal liability for the department, if a release occurred.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Release of dispersible, radioactive materials.

Institutional liability for the Department.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-3	Site: Hanford
Date: October 11, 1993	Facility: PNL 324

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Environmental impact of release, impact to worker and public as a result of possible release of over 1.5 M Ci of Cs and Sr. While temporary storage of the materials in a hot cell maybe adequate, no permanent disposal pathway has yet been identified. The potential exists for release from a ventilated facility unless the dispersible materials are collected and placed in appropriate containers or otherwise stabilized.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

1-5 years. While temporary storage of the dispersible radioactive hazardous materials in a hot cell represents an adequate temporary solution, no permanent pathway for disposal has yet been identified. And while uncontainerized dispersible radioactive materials are continued to be stored in a ventilated facility, albeit HEPA filtered, significant liabilities exist while this material awaits a path for ultimate disposition.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Develop and execute an integrated plan for consolidation and permanent disposal of mixed waste and radioactive hazardous materials currently being temporarily stored in hot cells in Building 324.

10/15/93
Signature, Team Member

10/15/93
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-4	Site: Hanford
Date: October 11, 1993	Facility: PNL 324

Block #1: **Title of Vulnerability** ***Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.***

Unresolved USQ from 1986 Radioactive Spill which Occurred in Building PNL-324, B Cell.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The lack of a clearly defined and up-to-date authorization basis led to a seven year delay in the declaration of a USQ regarding a spill which occurred in the B-Cell of Building 324 in 1986. The lack of institutional controls resulted in operations continuing in B-Cell throughout this period. The most recent accident analysis concluded that doses to workers and the public were respectively 1.5 and 3 times PNL accident guidelines for a postulated seismic event as a result of the spill in 1986. In addition a potential political vulnerability exists in that clean-up work is ongoing in the cell with an unresolved USQ without CSO approval.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

A 1.3 M Ci liquid spill in B-Cell in 1986 did not proceed as predicted according to an accident identified in a 1984 SAR supplement. Liquid became held-up by debris and dust in the cell rather than draining to the sump as expected. No USQ was declared in 1986 since the hold-up Ci content had not exceeded the existing OSR limit for B-Cell and the change in waste form from liquid to dispersible was not recognized. In 1991, PNL again reviewed the incident in B-Cell and concluded that there was not a USQ. In June 1993, following a third review and discussions about the lack of a formal authorization basis, a decision was made to incorporate two existing documents (the 1984 SAR Supplement and the 1985 SAR) as the authorization basis, which resulted in a USQ being declared.

Block #4: ***Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.***

The failure of institutional controls and the lack of a formal authorized safety basis left the facility with an unresolved USQ and a condition in which for 7 years the workers and public were at risk from direct exposure. The subsequent accident analysis has shown that a fission product release as a result of a postulated seismic event would have exceeded accident guideline exposure levels for workers and the public.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-4	Site: Hanford
Date: October 11, 1993	Facility: PNL 324

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker and public health and safety, and environmental impacts were at risk for 7 years (in which the failure of institutional controls resulted in the lack of characterization during this time). As a result of the B-Cell spill, maximum doses to workers on site (7.7 rem) and public offsite (1.5 rem) would exceed PNL accident guidelines by 1.5 and 3 times, respectively, during a postulated seismic event.

For a further discussion of the vulnerabilities associated with the lack of authorized safety basis (see VDF# HAN-2-6, 2-7, 2-8).

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Immediate attention should be directed to completing the resolution of the USQ and gaining CSO approval for work activities to continue in B-Cell despite the outstanding USQ.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

PNL is currently drafting the B-Cell USQ resolution package. The estimated date for submittal to DOE-RL is October 1993.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

In addition to those recommendations regarding the lack of authorization basis for the PNL facilities in VDF# HAN-2-6, 2-7, 2-8, work is continuing in the B-Cell since clean-up activities will help to mitigate consequences of a fission product release as a result of a seismic event. However, this work is proceeding without appropriate CSO approval and represents a potential political vulnerability.

10/15/93 10/15/93

Signature, Team Member Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-5	Site: Hanford
Date: October 11, 1993	Facility: PNL 324/325/327

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of Approved Disposal Pathway for RINM Causing a Backlog of RINM at all 3 Hot Cell Facilities at PNL (Building 324/325/327).

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Due to a lack of approved pathway for transfer to long-term retrievable storage of RINM, a backlog of RINM awaiting shipment to the 200 W Burial Ground is accumulating. Although the facilities are operating with sufficient margin to their source term limits (current inventories are 80-90% below source term limits) in the hot cells, poor institutional controls has led to overcrowded storage conditions in the hot cells (D-Cell in 324, shielded analytical lab cells [left side] in 325 and F-Cell in 327). Additionally, a transport cask loaded since 1990 has been temporarily stored in 327 awaiting shipment to the 200 W Burial Ground resulting in unnecessary increases to background radiation levels in manned spaces (327 canyon).

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Due to poor institutional controls over general housekeeping conditions within several hot cells, RINM are haphazardly stored atop piles of debris in D-Cell in 324, and stacked in 1-gallon "paint cans" stored in the shielded analytical lab cells in 325. Also materials are haphazardly stored in F-Cell in 327.

Lack of institutional controls and cooperation among the two prime contractors has led to storage of a transport cask at the 327 canyon. The cask is awaiting transfer to 200 W Burial Ground, but is being upheld due to a failure to reach agreement between WHC and PNL.

Although it is concluded that the quantities of material stored in 324 D-Cell are well within allowable material limits, it is not clear that material conditions and location do not compromise some aspect of the authorization basis such as blocked floor drains, blocked ventilation ducts, etc.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-5	Site: Hanford
Date: October 11, 1993	Facility: PNL 324/325/327

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

While storage of RINM in a hot cell is an adequate temporary storage location, there is no permanent pathway for final transfer to long-term retrievable storage in the 200 W Burial Ground. The accumulation along with a lack of institutional controls in hot cell management has resulted in conditions which could lead to a loss of control (or in the case of D-Cell, just a loss) of the RINM. Also due to a current moratorium on the EBR-II casks, 1 transport cask in 327 building has been awaiting final transfer to the Burial Grounds for over 2 years resulting in unnecessary increases to background radiation levels.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Current potential impact to worker safety is small, but ultimately if DOE does not establish a consolidated plan for long term storage of RINM, the environment, worker and public will come to risk from potential releases to the environment as a result of continued facility loading and degradation. Also, poor Hot Cell management and housekeeping can lead to potential future impacts to worker and public safety by compromising some aspect of the authorization basis (i.e., blocked drains, obstructed ventilation, etc.).

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

1-5 years to develop, implement and plan for the consolidation of RINM on the Hanford site at the 200 W Burial Ground to alleviate current conditions in the Hot Cells.

<1 years to improve Hot Cell housekeeping practices, consolidated waste and debris, and institute better controls over Hot Cell management.

VULNERABILITY DEVELOPMENT FORM	(Page 3)
Vulnerability # HAN-2-5	Site: Hanford
Date: October 11, 1993	Facility: PNL 324/325/327

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

PNL has developed a compactor and storage system process by which RINM can be compacted, placed in storage containers and shipped to the 200 W Burial Ground for interim storage of RINM until ultimate disposition in WIPP. The system meets the WIPP Waste Acceptance Criteria (WAC) and was designed so that the same container could then be moved from the 200 W Burial Ground directly to WIPP without the need for repackaging. However, this design does not meet the 200 W Burial Ground criteria, and cannot be shipped to the Burial Ground.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Resolve the disparity of the WIPP WAC with the 200 W WAC so that materials planned for WIPP can be shipped for interim storage to the 200 W Burial Ground to wait final transfer and disposition in WIPP. Also resolve institutional issues with the moratorium on the EBR-II cask shipments.

10/15/93 10/15/93

Signature, Team Member Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-6	Site: Hanford
Date: October 13, 1993	Facility: PNL 324

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of an Approved Integrated Facility SAR for Building 324 Radiochemical Engineering Cells (REC) and Shielded Material Facilities (SMF).

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Although a revised draft of the building SAR and supporting OSRs were submitted to DOE-RL in January 1992, the current authorization basis for the 324 facility appears to be a DOE-RL letter dated April 24, 1990 which in turn is based on a Building 324 OSR check list derived from 1) the 1985 SAR for the Shielded Material Facility (Reference HEDL-TC-1008), and 2) applicable OSRs from the 324 Building Pilot-Scale Radioactive LFCM dated 1984 (Reference PNL-3-387, Rev. 1). In absence of a positive response and action from DOE-RL on the revised draft of the SAR, PNL has unilaterally implemented the new draft OSRs as requirements for Building 324 operations.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Subsequent to the submittal of the revised draft SAR and OSRs, PNL was directed to resubmit the SAR in revised format as contained in DOE Order 5480.23. Thus while the revised OSRs have been implemented as requirements by PNL, and PNL is committed to provide draft TSRs and a revised draft of the SAR by November 1993 and July 1994 respectively, none the less, the bases for these new requirements have not been reviewed and approved as the current authorization bases by DOE.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

While the revised OSRs are most likely conservative, none the less these requirements have not been reviewed and approved by DOE as the authorization basis for current facility operations.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-6	Site: Hanford
Date: October 13, 1993	Facility: PNL 324

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Without formal, independent review and approval of the proposed SAR analysis and corresponding OSRs all ES&H elements are potentially affected.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1Year. In addition to safety concerns the current status may involve legal considerations thus placing additional emphasis on a timely resolution of the described situation.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

A plan for achieving compliance with DOE Orders 5480.22 and 5480.23 was transmitted to DOE-RL on August 6, 1993 by PNL.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Potential for OSR/TSR violations and USQ's due to differences in the approved and implemented authorization basis.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Immediate interactions between DOE-RL and PNL to develop a strategy for resolution based on consideration of interim approval of revised SAR, OSRs and TSRs and subsequent follow-on revisions as directed for compliance with DOE 5480.23.

10/15/93
Signature, Team Member

10/15/93
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-2-7	Site: Hanford
Date: October 13, 1993	Facility: PNL Building 325

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of an Approved Integrated Facility SAR for Building 325 High-Level Radiochemistry Facility (HLRF) and Shielded Analytical Laboratory (SAL).

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Although revised drafts of the Building 325 SAR were submitted to DOE-RL in 1991 and again in January of 1992, the current authorization basis for the 325 facility consists of 1) Safety Analysis Report for the 325 Radio Chemistry Building, TC-299, Rev. 2 1977, Westinghouse Hanford Company, Richland, Washington, and 2) Operational Safety Requirements Check list for Building 325, 1991. In absence of a positive response and action from DOE-RL on the 1992 draft of the SAR, PNL has unilaterally implemented the new draft OSRs as requirements for Building 325 operations.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Subsequent to the submittal of the revised January 1992 draft SAR, PNL was directed to resubmit the SAR in revised format as contained in DOE Order 5480.23. Thus while the revised OSRs have been implemented as requirements by PNL, and PNL is committed to provide draft TSRs by February 1994 and a subsequent revision of the SAR by a yet to be established date, the bases for these new requirements have not been reviewed and approved as the current authorization bases by DOE.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

While the revised Building 325 OSRs are most likely conservative, none the less these requirements have not been reviewed and approved by DOE-RL as the authorization basis for current facility operations.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-7	Site: Hanford
Date: October 13, 1993	Facility: PNL Building 325

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Without formal, independent review and approval of the proposed Building 325 SAR analysis and corresponding OSRs, all ES&H elements are potentially affected.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 Year. In addition to safety implications, the current situation may involve legal considerations thus placing additional emphasis on a timely resolution of the described situation.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

A plan for achieving compliance with DOE Orders 5480.22 and 5480.23 was transmitted to DOE-RL on August 6, 1993 by PNL.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Potential for Building 325 OSR/TSR violations and USQ's due to differences in the approved and implemented authorization basis.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Immediate interactions between DOE-RL and PNL to develop a strategy for resolution based on consideration of interim approval of revised SAR, OSRs and TSRs and subsequent follow-on revisions as directed for compliance with DOE 5480.23.

10/15/93 — Signature, Team Member

10/15/93 — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-8	Site: Hanford
Date: October 13, 1993	Facility: Building 327

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of an Updated Integrated Facility SAR for the PNL Building 327 Postirradiation Testing Laboratory.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The current authorization basis for the 327 facility is the 1987 Building SAR (HEDL-TC-1009). In addition a draft of a Preliminary Hazards Analysis was completed and a Seismic Evaluation initiated in 1993. Efforts to revise the Building SAR for conformance with DOE Order 5481.1B were suspended pending reconciliation of funding requirements and DOE guidance relative to implementation of DOE Order 5480.23. Thus the building operations are being performed in accordance with the 1987 analysis versus the detail and rigor required by referenced order.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Although PNL is committed to provide DOE-RL draft TSRs by August 1994, there is no commitment date for an updated Building 327 SAR. Thus building operations will continue under the 1987 SAR authorization bases.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The described situation is considered to represent an institutional failure relative to the intended operation under the conditions and requirements of the TSRs to be developed from the 1987 SAR and no indication that funding will become available to upgrade the 1987 SAR to the new DOE criteria.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Without a complete hazards analysis, it must be concluded that there are safety, health, and environmentally damaging risks to the public and employees that are not presently defined to be within acceptable standards.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-2-8	Site: Hanford
Date: October 13, 1993	Facility: Building 327

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 Year. Potential safety implications associated with Order compliance should dictate emphasis on a timely resolution of the described situation.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

A plan for achieving compliance with DOE Orders 5480.22 and 5480.23 was transmitted to DOE-RL on August 6, 1993 by PNL.

#8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Potential for Building 327 OSR/TSR violations and USQ's due to potential inconsistencies in the approved and implemented authorization basis.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Immediate interactions between DOE-RL and PNL to develop a strategy for resolution based on upgrade of the 1987 SAR and supporting OSRs and TSRs.

[signature] 10/15/93 — Signature, Team Member

[signature] 10/15/93 — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-2-9	Site: Hanford
Date: October 13, 1993	Facility: Building 327

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of a Current Building 327 Seismic Analysis.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The 1987 SAR states that "the 327 Facility was designed to meet the Uniform Building Code (UBC) level earthquake requirements." and that "no active components are seismically qualified." While the building has been re-categorized to Hazard Category 2 corresponding to a "Moderate Hazard" facility, and a current seismic analysis is in progress, the consequences associated with a seismic event are as yet uncharacterized and therefore may not be covered by the current authorization basis.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Risk to the worker, general public and environment as a result of seismic initiated accident sequences are uncharacterized. It is estimated that direct radiation level would be in the range of 500 thousand to 1 million R/hr if the materials in the storage basin were uncovered as a result of a seismic event breaching and draining of the storage basin. Other considerations would include the potential for the collapse of the storage basin racks, crushing of the fuel, and the release of fission products from the storage basin and cells.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Direct exposure from uncovered fuels in storage basin.

Release of fission products from storage basin and hot cells.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker due to direct radiation and fission product release.

General Public due to fission product release.

Environment due to fission product release.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-2-9	Site: Hanford
Date: October 13, 1993	Facility: Building 327

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 Year. Although the probability of a seismic event is relatively low, the consequence in terms of the direct radiation associated with draining the basin or breach of a hot cell enclosure, unless categorically excluded by the new seismic analysis, warrant the consideration of compensatory measures until such time as the seismic analysis is completed and specific risks are characterized.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The updated seismic analysis is funded and is in progress. However, until the analysis is completed and consequences as discussed above are discounted it would be prudent to consider compensatory measures to prevent or mitigate the consequences associated with such sequences.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

See response to Block #s 4 and 5. Potential exposure to workers.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Consider relocation of materials from storage basin to dry storage if possible or assess the need for a remote auxiliary source of water such as fire hose to flood the storage basin in the event of major leak until such time as seismic analysis demonstrate the acceptable performance of the current building structures such as to preclude draining of the basin.

[signature] 10/15/93 — Signature, Team Member

[signature] 10/15/93 — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-3-1	Site: Hanford
Date: October 12, 1993	Facility: Fast Flux Test Facility

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Potential for Inadequate Funding for Removal and Interim Storage of FFTF Spent Fuel.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The FFTF is presently in hot-standby with a decision as to future mission to be made shortly. If the decision is made to shut down the facility all the fuel which is presently stored in liquid sodium will have to be removed and placed in interim dry storage. It is estimated that this could take five or more years. There is a potential for an institutional failure in that adequate funding may not be available to maintain the existing storage facilities in a safe condition while fuel is being moved to dry storage. The cost for storing FFTF fuel in liquid sodium is significantly higher than for storing comparable fuels in a water storage basin.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

If no sustainable mission is found for FFTF, it is likely to be shut down. Typically, when a facility is in the process of being shutdown, the funding takes a considerable drop. For hot standby the funding for FFTF is about $58 M/year. A large fraction of this cost is associated with maintaining the sodium systems for storage of the FFTF fuel. During the transition from hot standby to shutdown, the sodium systems will have to be maintained hot until the last fuel assembly is removed. Since these sodium systems cannot be abandoned in place, funding will have to be made available until all the fuel is removed, sodium drained and dispositioned, and support systems secured.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Should adequate funding not be available for upkeep and operation of the systems to store the fuel safely, the facility would become susceptible to equipment failures and human errors resulting in enhanced possibility of accidents, sodium fires and releases of fission materials from the spent fuel.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-3-1	Site: Hanford
Date: October 12, 1993	Facility: Fast Flux Test Facility

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This could effect any or all of the above depending on the severity of the accident.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

It is estimated that a minimum of five years will be required for an orderly phase-out of activities and transfer of the spent fuel from liquid sodium storage to dry storage.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Could result in major accident leading to programmatic delays and/or unacceptable radiological releases to the environment.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

The transition of FFTF from hot-standby to shutdown will be a long and expensive process. Once started adequate funding must be ensured to complete the process. The tasks of fuel removal and moving to interim dry storage and securing the sodium storage systems are of major significance and cannot be compromised.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-3-2	Site: Hanford
Date: October 13, 1993	Facility: 308 Building Annex

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Inadequate Technical Safety Requirements for Storage of TRIGA Fuel in the 308 Building Annex.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

In the conversion of the TRIGA reactor from an operating reactor to a storage facility, the Technical Specifications are being eliminated and it has been proposed that no Technical Safety Requirements (TSR) (or Operational Safety Requirements [OSR]) will be needed for the facility. However, it is the intent that certain systems will remain in service and some surveillances will be continued. These will be "required" but will not have the status of TSRs. The vulnerability is that failure of these systems or lack of surveillances in the absence of mandatory requirements could lead to a degraded condition of the storage pool and the fuel stored therein.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The draft Site Report states that the NRF TRIGA has been defueled and in transition to a fuel storage basin. Operation is authorized by the current Technical Specifications as modified by a Shutdown and Standby Plan. This appears to be an ambiguous mechanism to modify Technical Specifications and could lead to misinterpretations of requirements during the transition phase. An Interim Safety Basis (IBS) document has been submitted for DOE approval which will eliminate the need for all Technical Specifications or Technical Safety Requirements. Presently, the Technical Specifications require operation of the water purifications system and surveillance on the water chemistry, conductivity, pH, and H&V system and air stack alpha monitoring system and alpha-beta monitors. The lack of any mandatory safety requirements is an ES&H vulnerability.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Lack of proper TSRs (or OSRs) could lead to the deterioration of the stored fuel and to the release of fission products, resulting in exposure to workers. It is doubtful if the public would receive any significant exposure.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-3-2	Site: Hanford
Date: October 13, 1993	Facility: 308 Building Annex

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety and local site environment could be affected.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

This vulnerability should be corrected in < 1 yr.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Without TSRs (or OSRs) there are no mandatory requirements to maintain the systems operable or to perform the pool water surveillances.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Operate the facility in accordance with approved TSRs (or OSRs) to maintain water purity, chemistry, water level, H&V operation, geometry control, and radiation monitoring as appropriate.

W.C. Fussie R.K. Kharsma

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-3-3	Site: Hanford
Date: October 13, 1993	Facility: 308 Building Annex

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Transport/Storage Casks for Removing the Irradiated Fuel from the NRF TRIGA Storage Basin in the 308 Building Annex Have Not Been Designed or Procured.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

WHC proposes to transfer the TRIGA fuel for storage from the 308 Building Annex to the 200 Area using casks similar to the EBR-II cask. The fuel is to be moved in FY 96. These casks have not yet been designed nor procured.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Currently, the 200 area is not accepting EBR-II casks for storage of materials. No approvals are in place that verify the acceptance of TRIGA fuel storage in EBR-II casks in the 200 Area. Therefore, it is very likely that the TRIGA fuel could remain in the storage pool for much longer duration than the currently planned two years.

Cask transport and storage criteria are changing and becoming more restrictive.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The adverse condition that will exist is the increased risk of direct exposure and release of radioactive materials.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety could potentially be effected.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-3-3	Site: Hanford
Date: October 13, 1993	Facility: 308 Building Annex

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

This issue should be resolved within 1-5 years.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The EBR-II cask proposed for shipping the NRF TRIGA fuel will be a new cask having the same overall dimensions as the current EBR-II cask, but will have a stainless steel exterior. The cask interior will be similar the current EBR-II with the exception of different thickness of shielding (still meeting the 100 mrem surveillance requirement) and a threaded cap on the inner container instead of a welded cap. A new SARP will be made, necessary safety evaluations made, and the SARP approved. The SARP, modified design, and new materials should eliminate the 200 Area's concerns for use of the EBR-II Cask.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Extended storage of TRIGA fuel in a temporary fuel storage facility.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Assure that the 200 Area will accept EBR-II type transport casks for interim long term storage of TRIGA fuel.

Signature, Team Member   Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-1	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

EBR-II Waste Containers May Exceed Expected 25 Year Life Analyzed in the SAR of the 200 W Burial Ground.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The design criteria lifetime stated in the SAR for the EBR-II casks is for 25 years. This is stated in section 3.2 of WHC-SD-WM-SAR-047 Rev 0. Reactor Irradiated Nuclear Materials (RINM) have been stored in the EBR-II casks for 14 years and with no expected disposal site the design lifetime could be exceeded.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

EBR-II casks are used for storage of RINM at the Burial Grounds. The safety analysis for the Burial Grounds (WHC-SD-WM-SAR-047) uses a design basis of 25 years as stated in section 3.2.1. This section states that "the external surfaces of the EBR-II cask will resist atmospheric corrosion in the Hanford Site environment for 25 yr or more without significant failure." Other sections of the SAR rely on the 25 year design lifetime. For example, section 4.5, concludes that periodic maintenance is not required due to the 25 year design.

Without a disposal site identified, the EBR-II cask service could exceed the design lifetime.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Institutional control failure could result because the fuel casks could exceed the design lifetime used in the safety analysis report. The safety analysis report could be violated if storage continued in the casks beyond the 25 year design lifetime.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-4-1	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Environment is potentially affected because the majority of the EBR-II casks are stored above ground in an open trench. Degradation of the casks could release contents to the surrounding environment.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

>5 years as the oldest cask stored in the burial ground is 14 years. Therefore, 11 years remains until the 25 year design lifetime is exceeded.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

See Block #5.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Determine a method/location for permanent disposal. If unable to permanently disposer, reanalyze the casks to ensure that they can exceed the design lifetime.

M W Parrish

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)

Vulnerability # HAN-4-2	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Containers, Other Than EBR-II Casks, Are Not Analyzed in the SARs for Fuel Storage Containers in the 200W Burial Grounds.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The Safety Analysis Reports for the 200 W Burial Grounds only analyzes the EBR-II casks for storage of materials. Other types of containers used include: Concrete Casks, a Zircaloy Container, and 55-gallon concrete filled drums lined with lead. These containers are not evaluated by current SARs.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Table A.5, Miscellaneous radioactive materials stored at the Hanford 200-Area burial grounds, as of December 31, 1991 of the Integrated Database for 1992; U.S. Spent fuel and Radioactive Waste, Inventories, Projections and Characteristics (DOE/WR-006 Rev. 8) indicates the following Reactor Irradiated Nuclear Materials stored in other than EBR-II casks:

1. Material from Fast Critical Facility and SEFOR from GE, Vallecitos, CA which is stored in twenty-two 75.5-in. x 65.5-in. x 65.5-in. concrete casks.

2. 12 Americium target elements from K reactor which are stored in one 30-in. diameter x 69-in. Zircaloy container.

3. Fuel assemblies from the TRIGA Reactor at Oregon State are stored/buried in thirteen 55-gal concrete-filled drums, six to seven assemblies per drum.

The following two Safety Analysis reports exist for the Solid Waste Burial Grounds:

Active and Retired Radioactive Solid Waste Burial Grounds Safety Analysis Report (SD-WM-SAR-038)

Retrieval Storage of Irradiated Fuels in the Solid Waste Burial Grounds (WHC-SD-WM-SAR-047)

Neither of the above Safety Analysis reports discuss storage of RINM in the storage containers discussed above.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-4-2	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

An institutional failure could exist due to the failure to analyze the various containers. Spent fuel is stored in containers that are not specifically analyzed for the container and the conditions under which the containers are stored.

Release of fission products could potentially exist due to fuel being stored in containers which may have deteriorated or the seals on the containers may have deteriorated.

Direct exposure may occur during retrieval of containers that may have deteriorated.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Environment and worker health and safety could be potentially affected. The environment could be potentially affected because the containers may not be able to withstand the adverse conditions for the period that the materials may be stored. Worker health and safety could be affected because during retrieval the containers may not be sound and the workers could be subjected to exposure to materials in those containers.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

1-5 years. Currently the maximum amount of time that RINM has been stored in un-analyzed containers is 20 years. These are concrete containers containing Vallecitos fuel.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The M&O contractor identified additional documents concerning the concrete casks and zircaloy container. The documents provided safety information concerning the containers but did not evaluate the current storage use of containers. Research of current documentation may support a safety analysis of the containers and their current usage.

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # HAN-4-2	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Radioactive release to the burial grounds due to failure of the containers or their seals. Increased exposure due to failure of the containers or seals.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Analyze currently used containers based on the time that they have been stored and projected future storage. Based on the analysis, inspect or repackage material as necessary.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-3	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

__Block #1:__ __Title of Vulnerability__ *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

The Inventory of RINM Cannot Be Determined or Verified at the Hanford Burial Grounds or in Basins at F- and H-Reactors.

__Block #2:__ __Executive Summary of Vulnerability__ *(Approximately 50 words)*

Inadequate records exist and changing methodologies of classification of fuel materials have resulted in irradiated fuel being disposed of and not tracked. Therefore, the amount and location of all irradiated fuel stored in burial grounds at Hanford cannot be determined.

__Block #3:__ *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

In the early years of operation of the burial grounds, inadequate records may have been kept of the inventory and characterization of materials being buried. Therefore, the types of materials, as well as their inventories, in some areas of the burial ground are unknown. Some of this inventory may be comprised of spent nuclear fuel. Furthermore, since the burial ground is not a permanent repository, it will eventually become necessary to move the current inventory to another location.

Examples:

1. F- and H-Basins were filled with sand/gravel and questions exist as to whether fuel may have been left in these basins.

2. DOE/RL-93-49 (Draft A), 618-11 Burial Ground Expedited Response Action Proposal, discusses aspects concerning the disposal of materials from fuel examination activities in the 300 area and their subsequent placement in the 618-11 Burial Grounds. This report indicates that wastes included fuel pieces. The wastes were first disposed of in burial sites near the 300 area (1953 to 1954). The wastes were then sent to 618-10 Burial Ground which was closed in 1963. The 618-11 Burial Ground received waste from 1962 to 1967. The report indicates that the 300 Laboratories shipped waste containing high levels of plutonium to the 200 area starting in 1963. Specific records of storage of fuel materials did not begin until after 1970. Given that wastes from the 300 Laboratories were shipped to at least four different burial grounds the potential exists that undocumented fuel is stored in multiple burial grounds. Two other documents support the disposal of fuel pieces in inactive Burial Grounds 618-10 and 618-11. These are WHC-MR-0415 and WHC-MR-0416.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-4-3	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.* (continued)

3. The response to the EM-37 survey for the Burial Grounds indicates that the number of TRIGA Assemblies from Oregon State University may range from 79 to 90. The amount of material cannot be verified without retrieval.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Depending upon the method used to unearth the buried inventory, the adverse condition resulting from the conditions/symptoms summarized above could be fission product release and/or direct exposure.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

The most likely target is worker health and safety. The worker(s) unearthing inventory of unknown origin may use methods that are inappropriate to the conditions encountered, thus exposing damaged materials, with the possibility of no protective barriers between the material and the worker.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Corrective action is not urgent (>5 years), since the threat is not immediate, since the threat does not manifest itself until the inventory is unearthed.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

VULNERABILITY DEVELOPMENT FORM	(Page 3)
Vulnerability # HAN-4-3	Site: Hanford
Date: October 15, 1993	Facility: Burial Grounds

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Potential consequences if left uncorrected are that the integrity of the buried inventory may continue to degrade and the inventory therefore become more difficult to deal with each passing year.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

NW Parrish
Signature, Team Member

10-15-93
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-4	Site: Hanford
Date: October 14, 1993	Facility: Burial Grounds

Block #1: __Title of Vulnerability__ *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Fuel Stored on Interim Basis in Burial Ground May Exceed Expected Storage Period in the 200 Area Burial Grounds.

Block #2: __Executive Summary of Vulnerability__ *(Approximately 50 words)*

Storage of RINM in the burial grounds was expected to be an interim basis until a disposal repository was opened. RINM has been stored in these interim storage facilities for a period of 19 years with no projected removal date.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Reactor Irradiated Nuclear Material has been stored in the 200 W Burial Ground since 1974 when the Vallecitos fuel was deposited. Additional materials have been stored since that date with the last material stored in 1990.

A projected retrieval date for transfer to a permanent depository has not been identified.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Institutional failure exists in that materials have been placed in an interim storage facility without a projected date for final disposition. Materials have been placed in containers with a limited lifetime on the assumption that the containers will be retrieved and transferred to a permanent repository.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-4	Site: Hanford
Date: October 14, 1993	Facility: Burial Grounds

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

The environment is potentially affected because materials are being stored in containers that are designed on the assumption that the storage is for a limited time period. Also, the storage in burial grounds is based on the assumption that it is for a limited time period. Due to the assumption that interim storage is for a limited time period the methods of storage may not be adequate for the actual time period that the materials may be stored.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

<1 year to verify that present containers used are adequate. Documents concerning the concrete casks indicate that they were designed for 20-year lifetime. They have been in use for 19 years.

1-5 years to determine if present storage methods provide adequate level of safety.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

M. L. Parnell
Signature, Team Member

[illegible]
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-5	Site: Hanford
Date: October 12, 1993	Facility: T-Plant

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Susceptibility of the T-Plant Fuel Pool to Seismic Damage.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The T-Plant was constructed approximately 50 years ago. It was not designed or built to current seismic standards. One wall of the pool has a hairline crack that runs the entire vertical length. The concern is whether or not the pool walls can withstand a seismic event.

WHC has recently completed a seismic analysis of the pool for an earthquake of magnitude 0.09 g, in accordance with the requirements of UCRL 15910. The results of this analysis indicate overstress in the corners of the pool. Although catastrophic failure of the pool walls is not expected, substantial cracking of the walls will result due to the sloshing of the water and consequent leakage of the pool water.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Analysis of the spent fuel pool to the seismic requirements of UCRL 15910 indicates that substantial cracking of the pool walls is likely during a seismic event due to the loading of the basin walls from the pool water sloshing.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Adverse condition could result in direct exposure to the worker, as well as release of contaminated pool water. A seismic event could lead to structural failure of the pool walls followed by draining of the pool water inventory. The unshielded fuel constitutes a hazard to worker health and safety during recovery from the accident.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-5	Site: Hanford
Date: October 12, 1993	Facility: T-Plant

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Both worker health and safety and the environment. Following pool drainage, the fuel will become uncovered, constituting a hazard to worker health and safety.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Corrective action should be taken in the next 1-5 years. While seismic failure of the pool will not result in catastrophic health consequences, the economic consequences of failure could be high. Since a rational fix to the issue is available (see Block #9, below), it makes sense to implement the fix and reduce the risk as soon as possible.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Potential consequences if left uncorrected are that the pool will continue to degrade and become more susceptible to a seismic event.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

The most rational fix to this vulnerability is to convert the pool to a dry storage facility or store the fuel elsewhere. Recent studies by WHC have indicated that conversion of the current pool to a dry storage facility is a viable option. With no water in the pool, its susceptibility to seismic damage is substantially reduced.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-6	Site: Hanford
Date: October 14, 1993	Facility: T-Plant

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Lack of Forward Path for Removal and Ultimate Disposition of the Fuel Currently Stored in the T-Plant Spent Fuel Pool.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Since there is no plan for the ultimate disposition of the spent fuel stored in the T-plant pool, the storage period is indefinite. The initial plan was to store the fuel in the T-plant storage pool for up to 20 years, or to the year 1998. The fuel will remain vulnerable to seismic and other events for as long as it is stored. DOE needs to establish a clear policy for the ultimate disposition of spent fuel and reactor irradiated nuclear materials in order to resolve the situation.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The T-plant currently contains 72 PWR Core II blanket assemblies from the Shippingport Breeder Reactor Program. Although it is planned that these assemblies may remain in the storage pool for up to 20 years (to the year 1998), there is no well-defined plan for the ultimate disposition of the assemblies and the storage period in the T-plant pool is therefore indefinite.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

This is an institutional failure in that DOE has not established a clear policy for the ultimate disposition of spent nuclear fuel.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Both worker safety and the environment are potentially affected. Pool integrity will continue to degrade with the passage of time. A seismic event could lead to structural failure of the pool walls followed by draining of the pool water inventory (see VDF# HAN-4-5). Following pool drainage, the fuel will become uncovered, presenting a hazard to worker health and safety.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-6	Site: Hanford
Date: October 14, 1993	Facility: T-Plant

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

The DOE needs to establish a spent fuel policy within the next 1-5 years that includes provision for the ultimate disposition of spent nuclear fuel.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

The potential consequences if left uncorrected are that the pool will continue to degrade, with the possibility of incurring the consequences of a seismic event (see VDF# HAN-4-5), unless and until pool modifications, such as provisions for dry storage, are implemented, or the fuel is transferred elsewhere for storage.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

The DOE needs to establish a clear policy for the ultimate disposition of spent nuclear fuel and reactor irradiated nuclear materials.

Signature, Team Member

Signature, Team Leader 10-14-93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-7	Site: Hanford
Date: October 14, 1993	Facility: T-Plant

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Poor Housekeeping in the T-Plant Canyon.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

The overall housekeeping in T-Plant canyon is poor. This includes substantial debris throughout the canyon and along the edge of the pool, debris on the pool surface and extraneous materials hanging from the cooling system above the surface of the pool. A potential vulnerability lies in the possibility of the debris close to the pool falling into the pool and clogging the intake of the cooling system. This would necessitate removal of equipment and debris and cooling system repair, leading to increased worker radiation exposure.

Fire is also a vulnerability.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

Substantial debris (tools, electrical cords, plastic bags, wood blocks, etc.) exists throughout the canyon and along the edge of the spent fuel pool. Also, deteriorated tape, wire, and other debris are hanging above the surface of the pool from parts of the pool cooling system. Debris also exists on the water surface in the pool.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The debris could fall into the pool and clog the cooling system intake, leading to failure of the cooling system. This will make repair of the cooling system necessary and result in increased worker exposure. Also, man rem would be expended in recovering fallen material from the pool. This lack of cleanliness also makes the canyon more susceptible to a fire.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-7	Site: Hanford
Date: October 14, 1993	Facility: T-Plant

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety is affected. Repair of the cooling system to restore its capability will lead to increased worker radiation exposure, as would response to a fire.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Corrective action should be immediate (<1 year).

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

See item 4 above.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Remove the debris from around the pool, from the cooling system and from the pool surface. The entire canyon should be cleaned up.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-8	Site: Hanford
Date: October 17,1993	Facility: T-Plant Canyon

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

T-Plant Fuel Pool Cooling System Pump not Qualified for Current Environmental Service Conditions.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The pump for the spent fuel pool cooling system in the T-plant canyon may exist in an environment for which it is unqualified. This will lead to relatively frequent pump failure, pump replacement, and consequent worker radiation exposure.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The pump for the cooling system in the T-Plant spent fuel pool is located approximately a foot above the pool surface which is a very high humidity environment. There is no indication that the pump is qualified for this environment. Therefore, relatively frequent pump failure is possible.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Because of the high humidity environment, relatively frequent failure of the cooling pump is possible. This leads to the necessity of replacing the pump and consequent increased worker radiation exposure.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety is affected. The need to replace the pump will result in increased worker radiation exposure.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

The need for corrective action is not urgent (>5 years), since the consequences of pump failure are not high relative to other potential vulnerabilities.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-8	Site: Hanford
Date: October 17,1993	Facility: T-Plant Canyon

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Pump failure followed by pump replacement and worker exposure in the process.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Replace the current pump with a pump qualified for the high humidity environment.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-9	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Frequency of Fuel Pool Level Monitoring at PUREX.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

PUREX fuel pool has an instrument that monitors fuel pool level directly. The control room alarm panel has the level alarm locked in with no explanation. The level is read directly once per quarter, which seems meaningless. Also, the lack of concern for a continuously alarming control room module reflects the transitioning status of the facility. This is a vulnerability.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The PUREX pool level is monitored by a level instrument that is read locally and that has an alarm in the control room. The pool level gauge has an administrative conversion factor of "1.5x" taped onto the gauge, which is used to multiply the reading on the level gauge in psi to get level in inches, which matches the level transmitter range.

Pool level readings are taken from the gauge every quarter. Cavities adjacent to the pool are monitored by visual walkdowns daily.

The alarm module in the control room is locked in the alarm condition, but there is no tag to explain the situation.

This situation indicates a conduct of operations deficiency. Quarterly pool level readings appear to provide meaningless information. If the pool were to develop a leak, it is more likely to be detected by daily walkdowns in adjacent cavities than by the quarterly level reading.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

If the pool were to develop a leak there would be a resultant spread of contaminated water outside the pool, i.e., release of fission products or hazardous materials, and there would be a potential for higher area radiation levels in the leak areas.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-9	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This would be a worker health and safety problem in that workers would be exposed to higher direct exposures from cleanup activities.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Pool level monitoring should be corrected within the next year.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The weight factor transmitter and alarm switch will be recalibrated within 2 months. The alarm switch will be reset to 60 inches to protect fuel from being uncovered. The monitoring frequency will be changed to daily.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

The SAR does not analyze the fuel for dry storage.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Monitor pool level daily and adjust alarm to a more appropriate level.

Signature, Team Member

Signature, Team Leader 10/15/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-10	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Inaccessibility of Fuel for Inspection at PUREX.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Because of high radiation levels, high airborne contamination hazard, and high worker safety hazard, fuel stored in the PUREX canyon is inaccessible for routine surveillance. The fuel in the fuel pool has not been observed since 1990. For example, the conditions at the bottom of the fuel pool are unknown. The condition of the fuel on dissolver cell floors cannot be assessed routinely.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The PUREX canyon is inaccessible for routine surveillance of the fuel pool and the fuel due to the high area radiation levels and worker safety hazards. Sub-team 4 of the Assessment Team was unable to tour the fuel pool or dissolver cell areas.

There is K-reactor fuel stored in water in the slug storage basin. N- and K-reactor fuel and fuel pieces remain on the dissolver cell floors. This material and these areas cannot be assessed routinely. Due to these hazards and poor visibility in fuel pool cell, conditions at the bottom of the pool are uncertain. It is not known whether or not there is additional fuel, fuel debris, or sludge at the bottom.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Because of the inaccessibility of the K-reactor fuel, the fuel at the bottom of the dissolver cell and the bottom of the fuel pool, it would be difficult to tell if fission product release were occurring.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-10	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Not knowing the condition of the fuel could cause worker safety and health problems when handling or packaging because of advanced deterioration. This could potentially become an environmental problem.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Within 1-5 years, the condition of fuel and fuel storage areas should be assessed.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The program plan for shutdown of PUREX includes transfer of the fuel and cleanout of the basin.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

If the fuel is not transferred or packaged during standby operations, increased exposure will be incurred during D&D.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Within 1 to 5 years, package fuel for storage.

Signature, Team Member   Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-11	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

The Four Fuel Baskets are Only Supported from One Rail at the PUREX Fuel Pool.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

Each fuel basket hangs by a yoke assembly that is supported by a stainless steel beam at one end and the fuel pool wall at the other. However, the stainless steel beam has been displaced by previous crane operations to the extent that the top of the yoke assembly is only supported by the end resting on the fuel pool wall.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

The four fuel baskets hanging in the PUREX fuel pool contain aluminum clad fuel from K reactor. Each basket hangs from a yoke assembly, which rests between a stainless steel beam and a shelf on the fuel pool wall. A remote video was taken of the baskets when they were lifted for observation in 1990. While removing excess stored equipment, the beam was bumped out from under the yoke assemblies by the crane. This causes the yoke assemblies to hang only from the end resting on the shelf of the fuel pool wall. The baskets also appear to be resting on either the fuel pool wall or the bottom of the fuel pool.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Because the baskets are only suspended from one point, the baskets could be easily dislodged during subsequent fuel movements, other activities in the canyon, or a minor seismic event. If the yoke assemblies were to be dislodged and the baskets were to fall into the pool, additional fission product release could occur. In addition, fuel assemblies laying on the fuel pool bottom would complicate recovery efforts, which could result in additional exposures during recovery.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-11	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

There would be a potential worker health and safety vulnerability if fuel elements were scattered on the fuel pool floor or were damaged to the extent that fission products would be released. Recovery efforts would be greatly complicated and result in additional direct exposures. Additional fission product releases to the fuel pool water would increase the potential for higher radiation levels and higher airborne hazards.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Action should be taken to re-support the fuel baskets.

Or, action should be taken to remove the fuel from the pool. The transition plan assumes that the fuel will be removed with high priority.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

The program plan includes transfer and packaging of the fuel. The fuel transfer has been given high priority.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

If the yoke assemblies were to fall, fuel elements could be damaged, thus releasing fission products. The release of fission products would give rise to higher exposures and would contaminate the water.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

When the fuel is being recovered, extra care is required to avoid contact between baskets.

Signature, Team Member

10/15/93

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-12	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

Fuel, Fuel Baskets, and Yoke Assemblies are Corroded at PUREX Fuel Pool.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

Based on what is shown on a 1990 video tape, the fuel, fuel baskets, and yoke assemblies may be severely corroded. They are fabricated from dissimilar materials (aluminum, stainless steel and carbon steel, respectively) and are in close contact with each other. In addition, there is no water quality program for the fuel pool and the quality of the fuel pool water is very poor.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

A 1990 video of a fuel and fuel basket observation showed visible, corrosion of the fuel and yoke assemblies.

Aluminum clad, K reactor fuel is stored in stainless steel baskets, which are suspended by carbon steel yoke assemblies from a stainless steel beam and a shelf in the fuel pool wall. The fuel appears oxidized and corroded. Since the aluminum is in contact with the stainless steel there is a potential for pitting and a breech of the fuel clad. The fuel has not been inspected since 1990.

The yoke assemblies from which the baskets are suspended are made of carbon steel and showed extensive corrosion where the assembly hooks engage the baskets. There is severe oxidation and the yokes are bent.

The quality of the water has not been maintained and there is no chemistry program. The pool does not have a circulation, demineralizer or heat removal system.

PUREX personnel are assuming that the fuel baskets will only be moved one more time, i.e., for retrieval from the pool and shipment elsewhere within 3 years.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # HAN-4-12	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

Yoke assembly corrosion and deformation could lead to a basket and its fuel dropping to the pool floor. Corroded fuel elements, or portions thereof, could break up and spread fission products throughout the fuel pool water and onto the fuel pool floor. Also, if the fuel elements fall into the pool, recovery will be complicated.

Corroded fuel elements could crumble and spread fission products throughout the fuel pool water even without yoke assembly failure.

These are fission product release and exposure hazards.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker health and safety could be potentially affected if the fuel elements were damaged during a spill of the fuel. Broken fuel would result in additional efforts to package the fuel. This could result in additional exposure during the placing of fuel pieces in the containers. Also, the fission product release would complicate the recovery of the liquid in the pool.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

1-5 years because the project plan is expected to remove the fuel from the pool. Action should be taken to remove the fuel from the pool or new yokes installed for long-term storage.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

No comment.

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # HAN-4-12	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Fuel damage could occur if one of the baskets falls during the recovery of the fuel from the pool. This could result in fuel breakage that would be difficult to recover and complicate cleanup of the pool.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

The fuel should be removed from the pool, placed in more stable containers, and stored in a better chemical environment.

Signature, Team Member

10/15/93

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # HAN-4-13	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #1: **Title of Vulnerability** *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

N and K-Reactor Fuel Elements, Both Intact and Broken, Located on Dissolver Cell Floors at PUREX.

Block #2: **Executive Summary of Vulnerability** *(Approximately 50 words)*

Based on a video surveillance of the conditions on the dissolver cell floor, there are corroded fuel elements, broken pieces of fuel, and rubble. There is a vulnerability in that these materials will eventually have to be retrieved and the dissolver cell floor decontaminated.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

During operation of Purex, fuel elements from N- and K-reactors were dumped from baskets into the dissolver units. Routinely, fuel elements fell to the dissolver cell floor. Some of these fuel elements were retrieved. Others are inaccessible.

Some of these fuel elements have been damaged, and broken. All are corroded. There is also substantial rubble on the dissolver cell floor.

During dissolver cell operations, the acidic environment could have contributed to the degradation of the fuel elements at the bottom the cell.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

The fuel elements appear to be damaged and corroded to the extent that recovery could cause the release of fission products. The adverse conditions are fission product release to the ventilation system.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HAN-4-13	Site: Hanford
Date: October 15, 1993	Facility: PUREX

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

Worker safety is affected because the longer it stays in the cell the condition of the fuel will continue to degrade. The fuel will ultimately be packaged and shipped for long-term storage.

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

Corrective action should be identified, planned and implemented within 1-5 years. This is consistent with the PUREX transition plan.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

No comments.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

Further degradation of the fuel elements.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Package the fuel within a reasonable timeframe to prevent further degradation.

Signature, Team Member

10-15-93
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HAN-4-14	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #1: Title of Vulnerability *Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.*

No Path Forward for Ultimate Disposal of Fuel Stored at PUREX.

Block #2: Executive Summary of Vulnerability *(Approximately 50 words)*

The PUREX transition plan assumes that residual fuel stored in the fuel pool and dissolver cell floors will be retrieved, packaged and shipped to the K-basins. This is a vulnerability in that such a pathway is not guaranteed and there is no contingency plan, for example, placing the fuel in dry storage at PUREX.

Block #3: *Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.*

PUREX has a transition plan that includes retrieval of the K-Reactor fuel from the fuel pool, and N- and K-Reactor fuel from the dissolver cell floors and shipment to the K basins. However, the pathway forward from the basins is uncertain.

Block #4: *Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.*

This is an institutional failure in that failure to have a reliable pathway forward for this fuel could severely impact the fuel transfer or storage requirements at PUREX.

Block #5: *Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.*

This is a worker health and safety issue. Not being able to transfer the fuel to K-Basins changes packaging requirements, thus increasing exposure. In addition, future packaging by D&D teams will be more complex.

VULNERABILITY DEVELOPMENT FORM

Vulnerability # HAN-4-14	Site: Hanford
Date: October 14, 1993	Facility: PUREX

Block #6 (Optional): *Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.*

If it is decided that the fuel will not go to K-Basin, PUREX needs to know within the next year.

Block #7 (Optional): *Additional comments, views, or plans by the Site Operations Office and M&O Contractor.*

No comment.

Block #8 (Optional): *To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.*

If the fuel cannot be shipped to K basins, clean-up of the dissolver cell and pool will be delayed and be much more difficult.

Block #9 Optional: *To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.*

Receive assurances that fuel will go to K-Basin as planned.

[signature] Signature, Team Member

[signature] 10/14/93 Signature, Team Leader

SPENT FUEL INITIATIVE

Idaho National Engineering Laboratory Site

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM (Page A-1)	
Vulnerability # ID.A.1.1	Site: INEL
Date: October 21, 1993	Facility: Hot Fuels Examination Facility

Block #1: Title of Vulnerability

Lack of an approved SAR for Hot Fuels Examination Facility (HFEF)

Block #2: Executive Summary of Vulnerability

Irradiated fuels and blanket materials from the EBR-II reactor are examined and stored in HFEF, prior to transfer to the Radioactive Scrap and Waste Facility (RSWF). The current authorization basis for HFEF consists of the HFEF Facility Safety Report (FSR), ANL-7989, issued in February 1975, just prior to startup of the facility, and Operational Safety Requirements (OSRs) last issued in 1985. The FSR was reviewed by DOE but not formally approved. The OSRs were formally approved by DOE. The FSR needs to be upgraded to meet current, more stringent DOE SAR requirements.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Although the existing FSR (1975) and OSRs (1985) are considered adequate to define the safety envelope for continued operation of HFEF, a Technical Safety Appraisal Team in 1988 and a Tiger Team in 1991 both recommended that the FSR be upgraded and updated.

The FSR and OSRs were supplemented by an addendum in 1975 for handling irradiated test loops; by another addendum in 1982 for operation of the Neutron Radiography (NRAD) reactor; and by a separate SAR for the WIPP waste characterization facility recently installed.

The current and projected missions for HFEF need to be defined so that the worst-case hypothetical accident scenarios can be re-defined and analyzed. The existing analyses do not include currently mandated criteria and analysis methodologies required by DOE Order 5480.23.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The lack of an approved SAR for HFEF operation is considered an institutional inadequacy based upon the long-recognized need by DOE and the contractor, and the lack of priority and resources applied to accomplish the upgrade.

VULNERABILITY DEVELOPMENT FORM	(Page A-2)
Vulnerability # ID.A.1.1	Site: INEL
Date: October 21, 1993	Facility: Hot Fuels Examination Facility

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

In the absence of an SAR independently reviewed and formally approved by DOE that meets the detail and rigor of current DOE requirements, there is some uncertainty about the total risk to workers, to the public, and to the environment that is presented by HFEF operation.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<1 year. Potential ES&H implications should dictate timely resolution of this issue.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The M&O contractor is fully committed to upgrading the SAR and an upgrade plan was submitted to DOE in October 1992. Because of resource limitations, the schedule for completion of the SAR is contingent upon DOE approval of the SAR for the Fuel Cycle Facility, now undergoing DOE review, and is estimated to be completed two years after that SAR is approved.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

- It is possible, although not probable, that more restrictive OSRs and operating conditions may be dictated by upgraded accident analyses; and therefore, that current operations are not sufficiently conservative.
- There are potential legal, liability consequences in the event of a serious accident if the authorization basis is not upgraded.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

ANL-W and DOE-NE should develop a resource plan and schedule for timely resolution of this issue.

H G Groh HG

Signature, Team Member

P Lonh.

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-3)	
Vulnerability # ID.A.2.1	Site: INEL
Date: October 21, 1993	Facility: Radioactive Scrap and Waste Facility (RSWF)

Block #1: Title of Vulnerability

Corrosion of inground carbon steel fuel storage containers at RSWF - ANL West.

Block #2: Executive Summary of Vulnerability

Fuel has been stored underground in carbon steel cylinders in excess of 25 years (pre 1978). Some carbon steel cylinders have been excavated and been found severely corroded. There is no continuous site monitoring of the soil for contamination.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Possible soil contamination with radionuclides.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Possible off-site contamination.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Environment - due to leakage of radionuclides.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

ANL-West is moving the 218 cylinders (installed prior to 1978) to a cathodically protected site over the next four years.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potential contamination to environment.

VULNERABILITY DEVELOPMENT FORM (Page A-4)	
Vulnerability # ID.A.2.1	Site: INEL
Date: October 21, 1993	Facility: Radioactive Scrap and Waste Facility (RSWF)

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Monitor soil for contaminants.

Carl J. [illegible] CC — Signature, Team Member

[illegible] — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-5)	
Vulnerability # ID.A.5.1	Site: INEL
Date: October 21, 1993	Facility: Zero Power Physics Reactor (ZPPR)

Block #1: Title of Vulnerability

Potential radioactive releases from cladding separation from fuels stored in ZPPR storage vault.

Block #2: Executive Summary of Vulnerability

A large inventory of plutonium and enriched uranium fuels which were slightly irradiated in ZPPR are being stored in the ZPPR storage vault. Many of the stainless steel clad uranium fuels have corroded, leading to bulging and breaching of the cladding. Although the fission product content of the fuels is negligible, the corrosion increases the probability of worker exposure to uranium contamination or ingestion, and increases the risk of a uranium fire.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Approximately 3000 kg plutonium and 2000 kg 93% enriched uranium are stored in the ZPPR storage vault in approximately 60,000 plutonium and uranium plates and rods clad in stainless steel. The fuels were very slightly irradiated during physics tests in ZPPR and contain negligible quantities of fission products. ZPPR is in non-operational standby, but the fuels must be stored indefinitely. Approximately 25% of the uranium metal plates (about 1900 of 7700 total) have corroded, leading to visible bulges in the cladding and, in some cases, breaching of the cladding. All of the fuel pieces are contained in sealed, cast-aluminum canisters placed in reinforced, boron-impregnated concrete bins. Dry nitrogen cover gas and various getters and dessicants have been placed in the canisters containing the uranium metal plates in an effort to retard corrosion. The plutonium plates and rods have not experienced similar cladding failures although plutonium metal is more reactive to air and moisture than is uranium metal, presumably because a more effective cladding and sealing process was used for the plutonium metal plates. The bulging and breaching of the uranium cladding is probably due to the reaction of uranium metal with air and water vapor to form uranium oxide, uranium hydride and possibly hydrogen gas.

VULNERABILITY DEVELOPMENT FORM (Page A-6)	
Vulnerability # ID.A.5.1	Site: INEL
Date: October 21, 1993	Facility: Zero Power Physics Reactor (ZPPR)

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The corrosion in the stainless steel clad uranium plates and the need for inspection and remedial actions increases the worker exposure to uranium contamination and inhalation. The probability of a uranium metal fire in the vault or in the adjacent workroom is increased by the presence of exposed uranium metal, uranium hydride and hydrogen. A uranium metal fire could, in turn, involve adjacent plutonium fuel pieces, resulting in plutonium release to the room.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The risk to worker safety and health is increased by the possibility of uranium release from breached fuel elements, and by the increased probability of metal fires. Significant releases to the environment would be prevented by the confinement provided by the concrete bins, the concrete vault room, and the ventilation system which contains a sand bed filter and HEPA filters in series for removal of particulate contamination from the exhausted air.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. A program to periodically inspect the fuel and re-encapsulate in inert canisters is underway. Existing radiological safety programs adequately protect the workers. A long-term solution to the corrosion problem should be developed and implemented.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potentially, an unacceptably large number of the uranium fuels could be breached, inerting procedures could have limited effectiveness, leading to a burdensome program to protect the workers.

VULNERABILITY DEVELOPMENT FORM (Page A-7)	
Vulnerability # ID.A.5.1	Site: INEL
Date: October 21, 1993	Facility: Zero Power Physics Reactor (ZPPR)

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

ANL-West and DOE should develop alternative plans for long-term disposition of the uranium plate fuels. Reprocessing of the fuels should be considered.

HG Groh HG

Signature, Team Member

P Lenke

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-9)
Vulnerability # ID.A.5.2	Site: INEL
Date: October 21, 1993	Facility: Zero Power Physics Reactor (ZPPR)

Block #1: Title of Vulnerability

Lack of approved path forward for ultimate disposal of ZPPR fuel stored in ZPPR storage vault.

Block #2: Executive Summary of Vulnerability

A large quantity of very slightly irradiated plutonium and uranium fuels is stored in the ZPPR storage vault. The material has been in storage from 2-20 years. ZPPR is in operational standby status. In the event that ZPPR is not restarted, no long range plan exists for the ultimate disposal of the fuel, leading to the possibility that the fuel will continue to degrade, complicating ultimate disposal.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Approximately 3000 kg plutonium and 2000 kg 93% enriched uranium are stored in the ZPPR storage vault in approximately 60,000 plates and rods clad in stainless steel. The fuels were slightly irradiated during physics tests in ZPPR and contain negligible quantities of fission products. ZPPR has been in non-operational standby for two years. Some of the fuels have been in storage for possible reuse in ZPPR for nearly 20 years. Some of the uranium plate fuels have corroded; this issue is addressed in a separate vulnerability #ID.A.5.1.

The ZPPR may be reactivated to support the Integral Fast Reactor program, in which case some of the test fuels would be needed for physics experiments. However, no long-term disposal plan exists for ultimate disposal of the unused fuels. Therefore, the storage period in the ZPPR storage vault is indefinite.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

While storage of the ZPPR fuels in the storage vault is adequate temporary storage, there is no permanent pathway defined for the ultimate disposal or recycle of these fuels. This is a long-term planning inadequacy.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The current potential impact to worker safety is small, but long-term storage in the existing location could lead to fuel degradation with increased potential for worker contamination or irradiation.

VULNERABILITY DEVELOPMENT FORM (Page A-10)	
Vulnerability # ID.A.5.2	Site: INEL
Date: October 21, 1993	Facility: Zero Power Physics Reactor (ZPPR)

<u>Block #6 (Optional):</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. Within 1-5 years the future of the ZPPR and the consequent need for the stored ZPPR fuels should be determined. In that period it is reasonable to assume that a contingency plan for ultimate disposal of the fuels could be developed. Implementation of the disposal plan would be beyond 5 years.

<u>Block #7 (Optional):</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

<u>Block #8:</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The potential consequences are that the fuel may continue to degrade with the result that removal, packaging, and transport of the fuel to the ultimate reprocessing or disposal site will involve greater risk to the workers and to the public.

<u>Block #9:</u> To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

DOE should develop, with the assistance of ANL-West and other contractors, and long-term plan for ultimate disposal of the ZPPR fuels.

HG

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-11)	
Vulnerability # ID.E.1.1	Site: INEL
Date: October 18, 1993	Facility: TAN

Block #1: Title of Vulnerability

Corrosion monitoring inadequate at TAN.

Block #2: Executive Summary of Vulnerability

EG&G does not have corrosion coupons installed at TAN. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Fuel elements/bundles are not removed for evaluations (visual), so some areas are not evaluated. Must rely on coupons.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel elements/bundles are only visually inspected from above and they cannot be fully inspected.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission product.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety of people in close proximity to stored fuel.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year. Install corrosion monitoring coupons.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Not maintaining ALARA.

VULNERABILITY DEVELOPMENT FORM	(Page A-12)
Vulnerability # ID.E.1.1	Site: INEL
Date: October 18, 1993	Facility: TAN

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

See # 6.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-13)	
Vulnerability # ID.E.1.2	Site: INEL, EG&G Idaho
Date: October 22, 1993	Facility: Test Area North Storage Pool

Block #1: Title of Vulnerability

Lack of Leak Detection and Leak Trending of Test Area North (TAN) Storage Pool Water Inventory.

Block #2: Executive Summary of Vulnerability

The TAN Storage Pool was designed without a leak detection capability to standards and codes in effect at the time of construction, and does not meet the requirements existing today. Deficiencies exist in seismic design and a pool liner is not installed.

Draining the water inventory due to a pool failure incident presents a vulnerability to the environment in the release of fission products. The public health and safety would be jeopardized, if the presently low Curie content increases due to corrosion damage to the fuel that could result in potentially significant releases of radionuclides to the environment. Potential worker exposure during recovery actions would impact worker safety due to the radiation field from the exposed fuel.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The TAN Storage Pool and related facilities were constructed about 40 years ago. The facilities suffer from a number of deficiencies in comparison to requirements for new facilities. The pool is made of unlined concrete, and is not in compliance with the leak detection and leak control requirements specified in DOE Order 6430.1A. Accordingly, all of the spent nuclear fuel and related materials are to be removed from the storage pool into dry cask storage. The final disposition of the spent nuclear fuel is presently not known.

The storage pool level is monitored daily and a level indication system was designed, but not presently installed. This would enable the monitoring of pool level for potential leaks as evidenced by decreasing levels. A recent engineering study has analyzed evaporation rates and the total water inventory dynamics of the pool. The collected data suggested that the present water loss in the pool represents normal evaporative losses. It is estimated that water inventory leaks above the typical monthly make up of about 1000 gallons could be determined with appropriate trending using the baseline data already collected.

VULNERABILITY DEVELOPMENT FORM (Page A-14)	
Vulnerability # ID.E.1.2	Site: INEL, EG&G Idaho
Date: October 22, 1993	Facility: Test Area North Storage Pool

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Radioactivity of the pool water is monitored and is about 10^{-3} (mu)Ci/ml, or 3 Ci over the total volume of the storage pool. The specific isotopic composition of the activation and fission products present in the pool is not determined. If the Curie content increases due to corrosion damage to the fuel coupled with increasing leakage, than significant releases of radionuclides to the environment could occur.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

This vulnerability affects the environment through the release of fission products present in the storage pool. It potentially impacts worker safety as a result of the possible exposure during recovery actions as a result of the radiation field from the exposed fuel. The remediation activities associated with any recovery program related to soil contamination could require large resources and significant adverse public reaction.

<u>Block #6 (Optional):</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years

Small leaks are difficult to detect, however, a significant leak could occur anytime. The urgency of this vulnerability is classified as 1-5 years.

Leaks due to a seismic event depends on the frequency of exceedance of the design basis earthquake, which is estimated to be low, thus the urgency of that vulnerability is classified as >5 years.

<u>Block #7 (Optional):</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

<u>Block #8:</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Adverse public reaction to damage to the environment and eventual cleanup costs. Worker safety would be impacted as a result of possible exposures during recovery actions due to the radiation field from the exposed fuel.

VULNERABILITY DEVELOPMENT FORM (Page A-15)	
Vulnerability # ID.E.1.2	Site: INEL, EG&G Idaho
Date: October 22, 1993	Facility: Test Area North Storage Pool

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Implement a trending program that will detect any water loss in the storage pool. If leakage is found use the information obtained to evaluate the impact of the leakage and adjust schedules for moving fuel out of the pool.

Pete Kolut PH P Gonha

Signature, Team Member Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-17)
Vulnerability # ID.E.1.3	Site: INEL
Date: October 21, 1993	Facility: TAN Pool

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Long Term Ownership of TAN Pool and Disposition of Residual RINM Inventory.

Block #2: Executive Summary of Vulnerability

The current mission of the TAN pool is the temporary storage of RINM. The TAN pool was not designed for the long term storage of RINM. A five year program to remove and to transfer the majority of the pool inventory (TMI fuel debris) is expected to commence in FY 94. At the end of this program and without further institutional planning, a residual inventory of RINM will remain in the pool. The lack of programmatic ownership at that point could result in no clear ownership of the facility and a de facto mission of continued temporary storage of the residual RINM inventory (LOFT and commercial assemblies and pieces).

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

In the absence of future programmatic ownership, potential shortfalls in the levels of surveillance and preventative maintenance of the facilities would occur. As an example of a facility currently in this status, see Vulnerability # ID.E.4.2.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Potential institutional failures,e.g., to provide adequate surveillance and maintenance, could arise.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

A release to the environment could resulting from undetected pool leakage is a potential event that might occur if adequate surveillance is not performed.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Institution planning within 1 to 5 years to ensure an orderly transition in mission of the facility beyond its present mission.

VULNERABILITY DEVELOPMENT FORM	(Page A-18)
Vulnerability # ID.E.1.3	Site: INEL
Date: October 21, 1993	Facility: TAN Pool

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

If an environmental release were to occur, increased worker exposure would be incurred in the restoration.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

All RINM should be removed from the facility.

Richard E Evans 10/21/93
Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-19)
Vulnerability # ID.E.1.4	Site: Test Area North (TAN)
Date: October 20, 1993	Facility: TAN 607

Block #1: Title of Vulnerability

Potential Deficiency in Seismic Design of TAN 607 Basin.

Block #2: Executive Summary of Vulnerability

The TAN storage pool is nearly 40 years old and does not meet the current seismic design criteria. If a earthquake with a ZPA of 0.19 g or greater occurs at the site, it could fracture the pool wall and drain the pool water completely. The stored TMI-2 core debris could be exposed due to loss of pool water. The consequences of this direct exposure from uncovered fuels in the storage basin and loss of pool water may not be covered by the current authorization basis.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Risk to the worker, general public, and environment as a result of seismic initiated accident sequences are of concern. It is estimated the direct radiation level at the pool wall-side would be in the range of 1.5 to 6.9 rad/hr, if the materials in the storage basin were uncovered as a result of draining of the pool water. Even through the rate of radiation is relatively low, it is a health concern for workers working at the pool site. The other concerns would be the public health, safety, and soil contamination.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Direct exposure from uncovered fuels in storage basin. Release of fission products from storage basin. Contamination of soil.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker due to direct radiation and fission product release. General public due to fission product release. Environment due to fission product release and soil contamination.

VULNERABILITY DEVELOPMENT FORM (Page A-20)	
Vulnerability # ID.E.1.4	Site: Test Area North (TAN)
Date: October 20, 1993	Facility: TAN 607

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

> 5 years. Even through the probability of a seismic event of a ZPA of 0.19 g or greater is relatively low, the consequence in terms of the direct radiation associated with draining of basin water, soil contamination, and public perception to DOE mission warrant the consideration of compensatory measures and corrective actions.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

A seismic analysis with current criteria should be performed. Until the analysis is completed and consequences and concerns as described above are discounted, it would be prudent to consider corrective measures to prevent or mitigate the consequences associated with such sequences.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

See response to Blocks #4 and #5.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Wet storage facilities are not designed for long term storage of SNF. Deficiency in seismic design will increase the risk of failure of pool wall under seismic loads. It is suggested relocation of materials from storage basin to dry storage be considered as one of the corrective actions.

Yan Wen Chang YC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-21)
Vulnerability # ID.E.3.1	Site: INEL
Date: October 18, 1993	Facility: MTR

Block #1: Title of Vulnerability

Corrosion monitoring inadequate at MTR (EG&G).

Block #2: Executive Summary of Vulnerability

EG&G does not have corrosion coupons installed at MTR. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Not all fuel elements/bundles are removed for evaluations (visual), so some areas are not evaluated. Must rely on coupons.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel elements/bundles are only visually inspected from above and they cannot be fully inspected.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission product.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety of people in close proximity to stored fuel.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year. Install corrosion monitoring coupons.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Not maintaining ALARA.

VULNERABILITY DEVELOPMENT FORM (Page A-22)	
Vulnerability # ID.E.3.1	Site: INEL
Date: October 18, 1993	Facility: MTR

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

See # 6.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-23)	
Vulnerability # ID.E.3.2	Site: INEL, EG&G Idaho
Date: October 22, 1993	Facility: Material Test Reactor Canal

Block #1: Title of Vulnerability

Lack of Leak Detection and Leak Trending of Material Test Reactor (MTR) Canal Water Inventory.

Block #2: Executive Summary of Vulnerability

The MTR Canal was designed without a leak detection and monitoring capability to standards and codes in effect at the time of construction, and does not meet the requirements existing today. Deficiencies exist in seismic design, however, a stainless steel pool liner is installed.

Draining the water inventory due to a pool failure incident presents a vulnerability to the environment in the release of fission products. The public health and safety would be jeopardized, if the presently low Curie content increases due to corrosion damage to the fuel that could result in potentially significant releases of radionuclides to the environment. Potential worker exposure during recovery actions would impact worker safety due to the radiation field from the exposed fuel.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The MTR Canal and related facilities were constructed about 40 years ago. The facilities suffer from a number of deficiencies in comparison to requirements for new facilities. The pool is made of stainless steel lined concrete. The canal has experienced leakages in the past. A canal bulkhead was welded in place to isolate the unlined portion of the canal. There has been no known leakage since the installation and welding of the bulkhead. The final disposition of the spent nuclear fuel is presently not known.

The MTR Canal level is periodically monitored and a large leakage would be detected as evidenced by decreasing levels. However, water level trending is not done to monitor small leakage rates.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Gross radioactivity of the pool water is monitored is presently very low. If the Curie content increases due to corrosion damage to the fuel coupled with increasing leakage, than significant releases of radionuclides to the environment could occur.

VULNERABILITY DEVELOPMENT FORM	(Page A-24)
Vulnerability # ID.E.3.2	Site: INEL, EG&G Idaho
Date: October 22, 1993	Facility: Material Test Reactor Canal

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

This vulnerability affects the environment through the release of fission products present in the MTR Canal. It potentially impacts worker safety as a result of the possible exposure during recovery actions as a result of the radiation field from the exposed fuel. The remediation activities associated with any recovery program related to soil contamination could require large resources and significant adverse public reaction.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years

Small leaks are difficult to detect, however, a significant leak could occur anytime. The urgency of this vulnerability is classified as 1-5 years.

Leaks due to a seismic event depends on the frequency of exceedance of the design basis earthquake, which is estimated to be low, thus the urgency of that vulnerability is classified as >5 years.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Adverse public reaction to damage to the environment and eventual cleanup costs. Worker safety would be impacted as a result of possible exposures during recovery actions due to the radiation field from the exposed fuel.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Implement a trending program that will detect any water loss in the MTR Canal. If leakage is found use the information obtained to evaluate the impact of the leakage and determine the appropriate disposition of the spent fuel.

Peter Kohut PH

Signature, Team Member

P Lanha

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-25)
Vulnerability # ID.E.3.3	Site: INEL
Date: October 21, 1993	Facility: MTR Canal

Block #1: Title of Vulnerability

The MTR Canal has no clear DOE ownership: it is on **orphan facility**.

Block #2: Executive Summary of Vulnerability

The MTR canal originally supported the operation of the MTR. Subsequently, this facility provided support to PBF experimentation. The MTR canal now provides temporary storage for PBF fuel and variety of fuels tested in the PBF. The MTR canal currently has no mission and no clear ownership.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Current support, for the limited surveillance and preventative maintenance operations that is being preformed, is not funded. Facility walkdown and interviews with cognizant staff revealed no indication of eminent hazard. However, the potential exists for near term shortfall in surveillance and maintenance of the facility, until the fuel can be transferred to a long term storage facility.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

A portion of the fuel stored at the MTR canal is sealed in aluminum containers. High water quality at the MTR canal has controlled container corrosion. Loss of water quality will enhance corrosion and will lead to container failure. Exposed fuel will result in fission product release to the MTR canal.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Elevated fission product concentrations in the MTR canal could result in increased worker exposure.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<1 year. ??

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

VULNERABILITY DEVELOPMENT FORM (Page A-26)	
Vulnerability # ID.E.3.3	Site: INEL
Date: October 21, 1993	Facility: MTR Canal

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Elevated worker exposure during maintenance, fuel removal and D&D.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Richard E Dawes 10/21/93 PK

Signature, Team Member

P Gorha

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-27)
Vulnerability # ID.E.4.1	Site: INEL
Date: October 18, 1993	Facility: ARM

Block #1: Title of Vulnerability

Corrosion monitoring inadequate at ARM (EG&G).

Block #2: Executive Summary of Vulnerability

EG&G does not have corrosion coupons installed at ARM. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Fuel elements/bundles are not removed for evaluations (visual), so some areas are not evaluated. Must rely on coupons.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel elements/bundles are only visually inspected from above and they cannot be fully inspected.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission product.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety of people in close proximity to stored fuel.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year. Install corrosion monitoring coupons.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Not maintaining ALARA.

VULNERABILITY DEVELOPMENT FORM	(Page A-28)
Vulnerability # ID.E.4.1	Site: INEL
Date: October 18, 1993	Facility: ARM

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

See # 6.

CC

Signature, Team Member

P Gorka

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-29)	
Vulnerability # ID.E.4.2	Site:INEL
Date:	Facility:ARMF/CFRMF Canal

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

The ARMF/CFRMF Facility has no programmatic ownership: it is on **orphan facility**.

Block #2: Executive Summary of Vulnerability

The ARM and CFRM reactors are located in a single canal in the TRA-660 building. These facilities have no current or foreseeable programmatic mission. The de facto mission of the canal is the temporary storage of the contained RINM. The canal inventory consists of the cores of both fueled reactors, one spare CFRM core element and material remaining from several experiments. The canal was not designed for the long term storage of RINM. Defueling of the reactors and transfer the fuel to a storage facility is awaiting authorization and funding.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

In the absence of programmatic funding, scarce funds exists for surveillance and preventative maintenance of the facilities. Facility walkdowns and interviews with cognizant staff revealed no indication of eminent hazard. However, a TSR inspection for control rod cadmium must be postponed: presently, there are no trained fuel handlers. Furthermore, the potential exists in the near term for an inadequate level of surveillance and maintenance of the facility until the fuel can be transferred to a long term storage facility.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

At least a portion of the fuel stored at the AFRM/CFRM canal is cladded in aluminum. High water quality is necessary to controlled clad corrosion. Loss of water quality will enhance corrosion and can lead to clad failure. Exposed fuel will result in fission product release to the AFRM/CFRM canal.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Elevated fission product concentrations in the AFRM/CFRM canal could result in increased worker exposure.

VULNERABILITY DEVELOPMENT FORM (Page A-30)

Vulnerability # ID.E.4.2	Site:INEL
Date:	Facility:ARMF/CFRMF Canal

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Surveillance and maintenance should be provided in < 1 year. Removal of the RINM should be accomplished in 1 to 5 years, since the canal is not designed for the long term storage of RINM.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Elevated worker exposure during maintenance, fuel removal and D&D.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

10/4/93

Richard E Dawes PK — Signature, Team Member

P Lanka — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-31)
Vulnerability # ID.E.5.1	Site: INEL
Date: October 18, 1993	Facility: PBF

Block #1: Title of Vulnerability

Corrosion monitoring inadequate at PBF.

Block #2: Executive Summary of Vulnerability

EG&G does not have corrosion coupons installed at PBF. These are necessary to assess the extent of corrosion/stress corrosion which may be occurring to stored fuel elements. Fuel elements/bundles are not removed for evaluations (visual), so some areas are not evaluated. Must rely on coupons.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel elements/bundles are only visually inspected from above and they cannot be fully inspected.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission product.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety of people in close proximity to stored fuel.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year. Install corrosion monitoring coupons.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Not maintaining ALARA.

VULNERABILITY DEVELOPMENT FORM (Page A-32)

Vulnerability # ID.E.5.1	Site: INEL
Date: October 18, 1993	Facility: PBF

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

See # 6.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-33)	
Vulnerability # ID.W.1.1	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

Block #1: Title of Vulnerability

Corrosion of aluminum associated with fuel and release of fissile material and radionuclides into the CPP-603 basin environment.

Block #2: Executive Summary of Vulnerability

Continual corrosion of fuel, some clad with aluminum or in corroded aluminum canisters in water-filled storage basins causes increasing amounts of fission products, uranium, and TRU in pool and pool sludge with attendant risks of increased exposure to workers, accidental nuclear criticality, and release of radionuclides to the environment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel in a few corroded aluminum canisters shows significant corrosion, exposing a zirconium hydride-uranium matrix to basin environment. This fuel is a small portion of the storage and has had little impact on overall basin water activity. However, this basin contains significant quantities of aluminum clad fuel in aluminum racks which have shown some corrosion. Potentially approximately 10% of total fuel storage could be breached. Water chemistry is relatively poor compared to other basins and promotes corrosion.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products, uranium, and TRU in the basin increases exposure to workers. Corrosion of aluminum canisters, fuels, and associated racks or other storage devices increases risks of accidental criticality by loss of control over geometry and spacing of fissile material. Increase of radionuclide activity in the basin could increase intrusion into the environment should the basin leak.

Block #5: Identify who or what is potentially affected and explain reasoning:

Worker health and safety are affected by increased radionuclide activity. To date, soluble activity increase is small and sludge shows less than 200 ppm U near the few completely corroded canisters. The basin has shown no sign of leaking so the potential for significant releases to the environment is low.

VULNERABILITY DEVELOPMENT FORM	(Page A-34)
Vulnerability # ID.W.1.1	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

a) < 1 year. Recovery of the contents of the few completely corroded fuel canisters is ongoing; continuing degradation makes this urgent. Current plans are to place this material into stainless steel cans in less than 1 year.

b) < 1 year. Detailed inspection of all aluminum fuels and their storage racks is urgent to determine the potential for cladding breach or criticality from fuel and rack degradation.

c. < 5 years. Depending on results from a and b, encapsulate all aluminum canisters and aluminum fuel in stainless steel.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The M&O contractor has performed extensive video taping of fuel in two of three basins and plans are to complete videotaping of all fuel and storage devices within a year, with priority on aluminum components. To date, the small quantity of fissile material in sludge precludes criticality and completion of planned activities as outlined above should prevent excessive buildup in sludge.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Disintegration into sludge of approximately 10% of the stored fuel may occur with a distinct possibility of criticality. Release to environment may occur and exposure to workers may increase if other events, e.g., seismic, occur in the interim.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Encapsulation of the exposed fuel should be expedited and all aluminum fuel, should be rencapsulated and relocated to another facility on a priority basis.

IF

Signature, Team Member   Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-35)	
Vulnerability # ID.W.1.2	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

<u>Block #1:</u> <u>Title of Vulnerability</u>

Uncharacterized water content of fuel now stored or to be encapsulated in containers at CPP-603 Basins.

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u>

Fuel now stored in containers or to be encapsulated should be dry to avoid corrosion, overpressurization, or criticality concerns when transferred to dry storage. Risks are exposure to workers, accidental criticality, and release of radionuclides.

<u>Block #3:</u> Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

EBR-II fuel presently stored underwater in canisters contains small amounts or sodium; WINCO does not check for water inleakage. These are stainless steel canisters, leakage is unlikely, and leakage will become important for long term dry storage. WINCO is in the planning stage of a process to dry aluminum fuel now under water prior to encapsulating it.

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Depending on other factors, accidental criticality may occur if water filled containers are placed into dry storage. Water in containers may cause corrosion and overpressurization due to chemical reactions or radiolysis of water. These unwanted conditions can lead to worker exposure and release of radionuclides to the environment. However, encapsulation facility and dry storage facility details are to be developed and may lessen or eliminate this vulnerability.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety are affected by criticality or radionuclide releases. Environment may be affected if canisters overpressurize and leak during transfer from one facility to another.

<u>Block #6 (Optional):</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

a) <1 year. Develop a method to non-destructively determine water content in fuel canisters; method should also be able to dry canisters.
b) <5 years.

VULNERABILITY DEVELOPMENT FORM (Page A-36)	
Vulnerability # ID.W.1.2	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Accidental criticality, disintegration of canisters from corrosion and over pressurization.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Ensure complete dryness of encapsulated fuel.

IF

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-37)
Vulnerability # ID.W.1.3	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basin

<u>Block #1:</u> <u>Title of Vulnerability</u>

Institutional criticality control of stored RINM is a concern.

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u>

Fuel containers and engineered safety features providing criticality safety control degraded and administrative controls were not implemented such that the facility was outside its safety basis.

<u>Block #3:</u> Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

a. Numerous lower bumpers on fuel hangers were overlapped and thus could not perform their safety function during fuel movement. The pertinent contractor safety analysis did not address criticality safety of fuel movement.

b. Five severely corroded fuel containers could not provide geometry control. These containers were declared highly reactive.

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products, uranium, and TRU in the basin as well as exposure could occur.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety would be affected slightly by a criticality accident in a shielded area.

<u>Block #6 (Optional):</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

a. < 1 year. Contractor should adopt a policy of submitting a safety basis for recovery activities to DOE except in emergencies.

<u>Block #7 (Optional):</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

VULNERABILITY DEVELOPMENT FORM	(Page A-38)
Vulnerability # ID.W.1.3	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basin

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

IF

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-39)
Vulnerability # ID.W.1.4	Site:ICPP
Date: October 22, 1993	Facility: CPP-603

Block #1: Title of Vulnerability

A repacking capability, required to help minimize the effects of corrosion on the fuel assemblies and ensure safe storage of the fuel, does not exist at CPP-603.

Block #2: Executive Summary of Vulnerability

Currently there is no capability at CPP-603 to repack the corrosion damaged fuels stored in the CPP-603 basins. Some of the fuel cladding has already been breached and the situation will continue to degrade with time. An essential process step required to ensure the safety of the stored fuel involves repacking the fuel in stainless steel canisters with a sealed, dry, inert atmosphere. However such a facility is not currently planned to be in service until Fiscal Year 2003. A fuel repacking station is planned to be operational during FY 1995 which will be used to provide temporary dry storage for some of the fuel in CPP-603. However, even with these interim measures, it is likely that some of the fuel cladding and containers that are currently intact will be damaged during the repackaging operations.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Inspections of the fuel in CPP-603 have found significant corrosion to fuel assemblies, the containers holding the fuel and the yoke assemblies suspending the fuel in the pool. This corrosion, which has already resulted in breached fuel, disintegrated canisters, and yoke failures, will continue to degrade the components and fuel assemblies in the basins. Interim measures to protect against yoke failures have been implemented, however, breaches in the cladding and failures in the canisters will continue. This will result in increased levels of radioactivity in the pool resulting in increased worker exposure, increased costs in preparing and moving fuel assemblies to alternative interim storage locations on site, and increased costs of decommissioning the facility.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Adverse Condition: Fission or Activation Product Release and Direct Exposure. Failure to prevent further deterioration of the fuel until a repacking facility can be put into service at CPP-603 will result in continued failures of cladding, containers, and yokes used in the basins.

VULNERABILITY DEVELOPMENT FORM (Page A-40)	
Vulnerability # ID.W.1.4	Site:ICPP
Date: October 22, 1993	Facility: CPP-603

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The corrosion related failures increase the potential for occurrence of nuclear criticality and will result in the release of fission and activation products which then increase the dose rates for workers. The increase in radioactivity will be dependent on the nature and extent of failures experienced. As Low As Reasonably Achievable (ALARA) programs require that mitigating actions be taken to reduce worker exposure.

In addition, particles of fission products will likely transit from the pool increasing the spread of fission products causing radiation protection problems in other areas of the building.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Immediate corrective actions <1 year, need to be taken to mitigate the situation so that adequate time >5 years, will be allotted for the design and fabrication of a repacking facility.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Increased exposures to workers involved in fuel handling and decommissioning of the facility.

Recovery of fuel, when containers and cladding fail, is a time consuming and costly activity that will impact the movement of fuel. In addition the increased contamination created by these events will increase the costs of performing decontamination and decommissioning activities.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Joe Duccio for — DW

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-41)
Vulnerability # ID.W.1.5	Site:ICPP
Date: 10/22/93	Facility: CPP-603

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

There is no path for the ultimate disposal of fuel stored in the CPP-603 basins.

Block #2: Executive Summary of Vulnerability

The 2.0 metric tons of uranium in the CPP-603 spent fuel basins currently is deteriorating and requires actions to be taken to improve the safe storage of this spent fuel. These facilities were not intended for long term storage of spent fuel and do not have adequate designs to ensure the safety of the spent fuel. Since the ultimate disposition of the fuel is not known, multiple, interim actions requiring handling the spent fuel will be necessary. Each of these handling operations impact worker exposure and increase the risk of a release of fission and activation products to the environment which could impact the health and safety of the workers and eventually, the public. A decision regarding the disposition of spent fuel and the packaging requirements needs to be made so that reprocessing and packaging of fuel can be accomplished in a minimum number of handling operations and in a cost effective manner.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

There are currently 2.0 metric tons of End of Life Uranium at CCP-603 excluding naval fuel. Although, DOE has been allocated 156.5 metric tons of uranium storage (MTU) from INEL, at the Monitored Retrievable Storage facility, the disposition of the fuel in CCP-603 has not been determined. This spent fuel is scheduled for shipment beginning in 1998 and ending in 2007. However, before fuel can be shipped it must be characterized, and packaged to meet the Monitored Retrievable Storage facility requirements and eventually those of the Federal Repository where they will ultimately be stored. However, the facilities required to reprocess, package and store spent fuel are not currently available.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

This is an institutional failure in that direction needed to determine the disposition, reprocessing, and packaging of spent fuel at CCP-603 is not available.

VULNERABILITY DEVELOPMENT FORM	(Page A-42)
Vulnerability # ID.W.1.5	Site:ICPP
Date: 10/22/93	Facility: CPP-603

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The Worker health and safety, the environment and public health and safety can all be affected if ultimate disposal of the spent fuel in CPP-603 is not determined. CCP-603 was not designed for long term storage of spent fuel. Using the facility in this manner increases the risk to site personnel due to the potential for a criticality and release of fission or activation products. These conditions also affect the consequences of airborne or effluent releases to the environment which could eventually impact public health and safety.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. Effective interim storage methods need to be implemented as soon as possible. The disposition of spent fuel, if known could reduce the number of handling operations required to get the fuel into its ultimate storage configuration. This information, when available, will enable the site to develop effective processes and reduce the exposures of workers and the overall costs of handling and storage of the spent fuel at CCP-603.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequences of not knowing the ultimate disposition of the spent fuel is that it will be necessary to build new facilities, and increase the number of handling operations that must be performed to prepare the fuel for interim storage and then again for ultimate storage. During these handling operations, workers will be exposed to ionizing radiation and there is increased likelihood for damage to the fuel with the subsequent release of fission and activation products.

Leaving the spent fuel in CPP-603 increases risk of release of fission and activation products due to equipment and structural failures since the basins and building do not meet current design safety requirements and equipment aging issues could result in reduced reliability of systems.

Since the length of interim storage is not known, evaluation of storage options is difficult and the costs for developing an interim term storage capability for the spent fuel will be impacted in that design assumptions will require additional conservatism to keep risks to acceptable levels over an unspecified facility life.

VULNERABILITY DEVELOPMENT FORM	(Page A-43)
Vulnerability # ID.W.1.5	Site:ICPP
Date: 10/22/93	Facility: CPP-603

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Additional emphasis needs to be placed on developing a policy and guidance on disposition of fuel for ultimate disposal.

Rhoccio for DW

Signature, Team Member

PLenta

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-45)
Vulnerability # ID.W.1.6	Site: INEL
Date: October 21, 1993	Facility: ICPP-603

Block #1: Title of Vulnerability

Excessive corrosion of fuel handling units at ICPP-603

Block #2: Executive Summary of Vulnerability

Excessive corrosion of carbon steel FSU's are in evidence at ICPP-603. The type and extent of corrosion make it almost impossible to predict if/or when a FSU might fail and cause a prompt criticality.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Excessive corrosion and cracking has occurred on carbon steel yokes/baskets which contain stored nuclear fuel. Various yokes are severely corroded (visual inspection) and there is no way to quantify when or if these yokes will fail.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The unanticipated/unexpected cracking of one of these fuel storage units can result in a prompt criticality (release of fission product).

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker safety would be compromised with a prompt criticality event.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<1 year. Re-rig all of the affected yokes with stainless steel cable (or corrosion resistant alloy). 1-5 years discard all carbon steel yokes and replace with corrosion resistant materials.

VULNERABILITY DEVELOPMENT FORM (Page A-46)	
Vulnerability # ID.W.1.6	Site: INEL
Date: October 21, 1993	Facility: ICPP-603

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Prompt criticality - worker safety compromised.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Move fuel to racks or replace all carbon steel racks with corrosion resistant materials.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-47)	
Vulnerability # ID.W.1.7	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FCF)

Block #1: Title of Vulnerability

Lack of leak detection and leak trending of release of Fission Products into the environment from the spent fuel storage basins at CPP-603.

Block #2: Executive Summary of Vulnerability

Undetected releases of radionuclides into the environment at the CPP-603 facility potentially exists due to deficiencies in the original design of the north and middle basins and the south basin. The unlined pools have no leak detection system. A number of sampling wells has been located in the vacinity of CPP-603 and no leakage has been detected in these wells. Other means of identifying leakage such as trending the amount of makeup water required to maintain level, have not been employed at the site.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The pools were built in 1950's and are unlined concrete basins. The original design of the CPP-603 basins did not include a leak detection system, consequently leakage from the pools cannot be determined directly. There is no apparent scheme that could install a leak detection system. There are sampling wells located in the area, however, they may not provide reliable indication of basin leakage. Finally, there are no trending processes being used to identify changes in the rate of makeup water usage in the basins. It is possible that a sudden increase in water useage might be noticed, however a slowly increasing leakage rate would not likely be identified. Currently there is no quantifiable or qualitative measure of makeup to the fuel storage basins in CPP-603.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Adverse Category: Fission or Activation Product Release

The problems associated with the potential for increasing amounts of uranium and fission products in the basin are exacerbated by lack of a leak detection system for the basins at CPP-603. There is a potential for an unmonitored release of radionuclides into the environment due to an undetected leakage of the spent fuel pool inventory over a prolonged period of time. Currently, the basins curie content is low, .6 Curies total volume, ~1.7 uC/ml. However, if the Curie content increases due to corrosion damage, and there is an incremental increase in leakage of less than about 400 liters/day (minimum likely to be identified by date sheet reviews) significant releases of radionuclides to the environment could occur or may be occuring.

VULNERABILITY DEVELOPMENT FORM	(Page A-48)
Vulnerability # ID.W.1.7	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FCF)

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

A release of fission or activation products into the ground under the basins would impact the eventual decommissioning and decontamination of the site, increase dose rates of workers involved with excavation in the area and create restoration cleanup problems which could have significant economic implications.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<1 year.

Immediate action is required to evaluate and determine if there is leakage from the basin pools. If there is leakage, the impact of the release would need to be determined so that it could be factored into the decommissioning plans for CPP-603.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Adverse public reactions to damage to the environment and eventual cleanup costs. Increased exposures to operating staff and D&D personnel.

VULNERABILITY DEVELOPMENT FORM (Page A-49)	
Vulnerability # ID.W.1.7	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FCF)

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Review operating logs on a sampling basis back to 1961 when the current basin configuration was achieved. In addition, perform engineering calculations to approximate the expected water losses from the basin in backwashing operations, evaporation, and other routine operating conditions. Use this information to determine the integrity of the basins.

If no leakage is found implement a trending program that will track water usage.

If leakage is found use the information obtained to evaluate the impact of the leakage and adjust schedules for moving fuel out of the facility.

Margaret Sobiecki DW/AS
Signature, Team Member

P Lonka
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-51)	
Vulnerability # ID.W.1.10	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

Block #1: Title of Vulnerability

Worker exposures and releases to the environment during encapsulation of fuel in CPP-603 basins.

Block #2: Executive Summary of Vulnerability

This vulnerability is related to ID.W.1.1 and comprises risks associated with re-encapsulating fuel from aluminum containers or encapsulating aluminum clad fuel. Risks are accidental criticality, increased exposure to workers, and release of radionuclides to the environment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The condition of some fuel is very poor; for example, aluminum canister corrosion products are holding unclad fuel rods together. Re-encapsulating activities may fragment this fuel, causing release of radionuclides to pool and pool sludge.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products, uranium, and TRU in the basin water increases exposure to workers. Activities to encapsulate or re-encapsulate fuel involve a risk of accidental criticality.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety are affected by increased radionuclide activity and potential for criticality.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

a) <5 years. Complete design, safety analysis, and construction or interim aluminum clad fuel repackaging station because of the rate or deterioration or this fuel.

b) <5 years. Complete design, safety analysis, and construction of fuel encapsulating facility because aluminum clad fuel continues to deteriorate in interim packages.

VULNERABILITY DEVELOPMENT FORM (Page A-52)	
Vulnerability # ID.W.1.10	Site: INEL
Date: October 20, 1993	Facility: CPP-603 Basins

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Disintegration into sludge of approximately 10% of the storage fuel may occur with a distinct possibility of criticality. Release to environment may occur and exposure to workers may increase if other events, e.g., seismic, occur in the interim.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Use geometry and spacing controls coupled with fixed neutron poisons, if necessary, to ensure criticality safety of encapsulation process.

IF

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-53)
Vulnerability # ID.W.1.11	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FSF)

Block #1: **Title of Vulnerability**

Basin Wall Failure and Superstructure Collapse due to a Large Seismic Event.

Block #2: **Executive Summary of Vulnerability**

The three fuel storage pools do not meet the current site-specific seismic design criteria. If a design basis earthquake occurs, it could breach the pool wall and collapse the superstructure. This would drain the water from the pool, exposing the fuel to the environment. The consequences of this direct exposure from the uncovered fuel presents a vulnerability to the environment in the release of fissionable materials.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Each of the 40 ft x 60 ft x 21 ft north and middle storage pools were built in 1951, while the 45 ft x 88 ft x 21 ft south pool was added in 1959. Spent fuel is hung from the yokes near the floor of the two older basins either with inserts or in buckets. The south pool uses free standing fuel storage racks. The walls of these pools are reported to be built with 2.5 feet reinforced concrete without any liner. In the event of a large earthquake, the walls and floor would crack and leak. The sloshing of the water might collapse the basin walls. Again, collapse of the overall facility, including the superstructure and monorail systems, is a possible outcome.

As part of the scoping study, the superstructure along with the cranes for the north and middle basins was analyzed using dynamic models for a ground motion of 0.18g. This model has not included the sloshing of the pool water, although its total mass has been factored. Several overstress conditions are noted, presenting a possible collapse of the crane and its structure, and the roof. However, the analysis could not ascertain the structural adequacy of the unreinforced walls and their joints with the floor. Failure of these joints or collapse of walls may provide a pathway for the basin's cooling water to enter to the environment.

VULNERABILITY DEVELOPMENT FORM	(Page A-54)
Vulnerability # ID.W.1.11	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FSF)

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Total End of Life Uranium for this facility is 1.96 MT which does not include naval fuel. Again, significant corrosion on the aluminum fuel and storage containers, as well as the carbon steel fuel storage hangers in the north and middle basin affect the criticality safety margins of the storage array. Some release of fission products into the basin water is expected because of the spent fuel cladding failures. Therefore, leakage of water from these basins would contaminate the soil and the environment. Direct exposure of the environment from uncovered fuel can be a possibility.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

This vulnerability affects the workers with direct radiation. Release of fission products to the environment will affect the general public. Leakage of pool water will contaminate the soil and the ground water.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. Since the probability of a large seismic event of 0.19g or greater is relatively low, the consequences in terms of the direct radiation associated with the draining the basin and breach of the enclosure warrant the consideration of corrective measures.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

A three phase scoping study of this vulnerability is being conducted by WINCO. Phase I effort which includes a soil-structure interaction 2-D model of the superstructure of the north and middle basins has been completed. Phase II and Phase III will include the south basin, the ion-exchange room, cranes and the column buckling effects. WINCO also should consider the effects of pool water sloshing on the walls, evaluation of potential cracking at the wall joints with the floor, collapsing of the pool walls, probability of crane and other superstructure falling into the pool, and other probable scenarios that could happen as a result of an earthquake. Lastly, since these pools are built in 1950's the degraded properties of the concrete and its steel rebars should be considered in the analysis.

VULNERABILITY DEVELOPMENT FORM	(Page A-55)
Vulnerability # ID.W.1.11	Site: Idaho CPP-603 Basin
Date: October 19, 1993	Facility: CPP-603 Underwater Fuel Storage Facility (FSF)

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potential consequences if left uncorrected are that the facility will collapse under a large seismic event. This will later result in a financial disaster in cleaning up the spent fuels, a significant release of radiation to the environment, and a potential to contaminate the soil and the ground water.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Since this kind of underground storage is not suitable for long-term storage of spent fuels, the most rational fix is to convert the pool inventory to a dry storage facility or store elsewhere. In the interim, the facility structures should be stiffened to withstand a large earthquake causing minimal damage to the stored spent fuels.

AM

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-57)
Vulnerability # ID.W.1.12	Site: INEL
Date: October 21, 1993	Facility: ICPP-603

Block #1: Title of Vulnerability

Carbon steel yokes not rigged associated with fuel at CPP-603 basin and potential for criticality.

Block #2: Executive Summary of Vulnerability

Excessive corrosion of carbon steel are in evidence at ICPP-603. The type and extent of corrosion make it almost impossible to predict if/or when a might fail and cause a prompt criticality. Thirty-six carbon steel FSUS (34 double yoke and 2 single) containing fuel have not been rigged.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Excessive corrosion and cracking has occurred on carbon steel yokes/baskets which contain stored nuclear fuel. Various yokes are severely corroded (visual inspection) and there is no way to quantify when or if these yokes will fail.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The unanticipated/unexpected cracking of one of these cans or fuels coming together can result in a prompt criticality (release of fission product).

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker safety would be compromised with a prompt criticality event.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Less than 1 year - Rig all of the affected yokes with stainless steel cable (or corrosion resistant alloy). 1-5 years discard all C/S yokes and replace with corrosion resistant materials.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

This was identified in NS assessment in February 1993.

VULNERABILITY DEVELOPMENT FORM (Page A-58)	
Vulnerability # ID.W.1.12	Site: INEL
Date: October 21, 1993	Facility: ICPP-603

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Prompt criticality - worker safety compromised.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Rig fuel.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-59)	
Vulnerability # ID.W.2.1	Site: INEL
Date: October 20, 1993	Facility: CPP-666 Basins

Block #1: Title of Vulnerability

Corrosion of aluminum clad fuel and release of fissile material and radionuclides into the CPP-666 basin environment.

Block #2: Executive Summary of Vulnerability

Continual corrosion of aluminum clad fuel in water-filled storage basins can cause fission products, uranium, and TRU to accumulate in pool and pool sludge with attendant risks of increased exposure to workers, accidental nuclear criticality, and release of radionuclides to the environment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

To date there has been no impact on overall basin water activity. Current water quality meets drinking water standards and does not promote rapid corrosion. However, this basin contains significant quantities of aluminum clad fuel which has shown some microscopic corrosion. Potentially approximately 10% of total fuel storage could be breached.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products, uranium, and TRU in the basin increases exposure to workers. Corrosion of aluminum clad fuel increases risks of accidental criticality by loss of control over geometry and spacing of fissile material. Increase of radionuclide activity in the basin could increase intrusion into the environment should the basin leak.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety are affected by increased radionuclide activity and could be affected by criticality. The thick water shield of the basins reduce dose consequences of a criticality to a few Rem. The basin has shown no sign of leaking so the potential for significant releases to the environment is low.

VULNERABILITY DEVELOPMENT FORM (Page A-60)	
Vulnerability # ID.W.2.1	Site: INEL
Date: October 20, 1993	Facility: CPP-666 Basins

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

a. < 5 years. Detailed inspection of all aluminum fuels is necessary to determine the potential for cladding breach or criticality from fuel degradation.
b. < 5 years or > 5 years, depending on results from a. Encapsulate all aluminum clad fuel in stainless steel.

These inspections and actions have less urgency than similar activities at CPP-603 because the water quality at CPP-666 is far superior to that at CPP-603 basins and only microscopic corrosion has been observed.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Disintegration into sludge of approximately 10% of the stored fuel may occur with a possibility of criticality. Release to environment may occur and exposure to workers may increase if other events, e.g., seismic occur.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Aluminum clad fuel should be dried, encapsulated in stainless steel, and relocated to a dry storage facility pending ultimate disposal. Aluminum clad fuel at CPP-603 should have priority, but all aluminum clad fuel should be assigned deadlines for encapsulation and interim surveillance frequency with appropriate corrosion checks, limits, and action statements and deadlines to accomplish actions if beyond limits.

IF

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-61)	
Vulnerability # ID.W.2.2	Site: INEL
Date: October 21, 1993	Facility: CPP-666 BASINS

Block #1: Title of Vulnerability

Susceptability and downgrading or engineered safety features at CPP.666 basins.

Block #2: Executive Summary of Vulnerability

Some engineered safety features at CPP-666 basins are exposed to being stepped on and broken. Other engineered safety features were downgraded and declared not required (without performing a USQ). Analyses involving these engineered safety features were flawed, after the fact, or incomplete.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

a. The pool seal air supply valves, pipes, and connecting hoses are exposed to being stepped on and broken. Loss of air pressure will cause the pool gate to leak and lower water level. The SAR did not address the worst case scenario - the transfer canal being isolated and one pool gate leaking into the transfer canal and cutting facility with gate at cutting facility not installed.

b. Criticality barriers in storage rack were declared not to be required as engineered safety features via internal memo. These barriers prevent adding another fuel element into a rack tube. The rationale for downgrading them from engineered safety features was that no two fuel elements may be placed side-by-side in a fuel rack position (with one exception that the memo addressed). However,some fuel elements have been cut or partially disassembled. The memo did not address combinations of full assemblies and one or more partial assemblies side-by-side per rack tube and the potential for criticality in the rack under such conditions.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Lowering the water level in the worst case pool gate leak scenario would reduce shielding and cause direct exposure to workers. A criticality with full water level would have minimal dose consequences. Uranium, fission products, and TRU could increase in the pool and pool sludge; however, the large volume of water would dilute these a radionuclides and there is practically no dissolved or particulate activity at present.

VULNERABILITY DEVELOPMENT FORM	(Page A-62)
Vulnerability # ID.W.2.2	Site: INEL
Date: October 21, 1993	Facility: CPP-666 BASINS

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

a. Worker health and safety would be affected by lowering the pool level and reducing the shielding..

b. A criticality would have relatively minimal effect due to the shielding and clean conditions at the CPP-666 basin.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<5 years WINCO should formally resolve safety issues by the USQ process, not by internal memos or responses to assessment findings. USQ determinations and resolutions are formally tracked and this provides assurance that safety assumptions will remain valid or will be reexamined during SAR updates.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

WINCO response with regard to the pool gate air supply issue was that there were not enough pool gates to isolate all fuel pools and even allow draining the transfer channel to set up the worst case scenario discussed above. However, it does appear that a single point failure can disrupt the functionability of an ESF.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Susceptability of engineered safety features to damage or downgrading engineered safety features can result in an challenges to safety, possibly unwanted events and accidents of various kinds.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

DOE should provide additional guidance on engineered safety features to protect them and to control designation, use, and downgrading if they are no longer necessary for safety.

Signature, Team Member IF

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-63)
Vulnerability # ID.W.2.3	Site:ICPP
Date: 10/22/93	Facility: CPP-666

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

There is no path for the ultimate disposal of fuel stored in the CPP-666 Fuel Storage Facility.

Block #2: Executive Summary of Vulnerability

The spent fuel stored at CCP-666 was not intended for long term storage of spent fuel. The facility was designed to provide safe storage for 40 years. Since the ultimate disposition of the fuel is not known, and the Monitored Retrievable Storage facility will not accomodate the fuel that is stored in CCP-666, multiple, interim actions requiring handling the spent fuel will be necessary. Each of these handling operations impact worker exposure and increase the risk of a release of fission and activation products to the environment which could impact the health and safety of the workers and eventually, the public. A decision regarding the disposition of spent fuel and the packaging requirements needs to be made so that reprocessing and packaging of fuel can be accomplished in a minimum number of handling operations and in a cost effective manner.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Although, DOE has been allocated 156.5 metric tons of uranium storage (MTU) from INEL, at the Monitored Retrievable Storage facility, the disposition of the fuel in CPP-666 has not been determined. The 156.5 metric tons of uranium planned for shipment to the Monitored Retrievable Storage facility is comprised of spent fuel from commercial nuclear power plants. This spent fuel is scheduled for shipment beginning in 1998 and ending in 2007. However, before fuel can be shipped it must be characterized, and packaged to meet the Monitored Retrievable Storage facility requirements and eventually those of the Federal Repository where they will ultimately be stored. However, the facilities required to reprocess, package and store spent fuel are not currently available.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

This is an institutional failure in that direction needed to determine the disposition, reprocessing, and packaging of spent fuel at CPP-666 is not available.

VULNERABILITY DEVELOPMENT FORM

Vulnerability # ID.W.2.3	Site:ICPP
Date: 10/22/93	Facility: CPP-666

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The Worker health and safety, the environment and public health and safety can all be affected if ultimate disposal of the spent fuel in CPP-666 is not determined. CPP-666 was not designed for long term storage of spent fuel. Using the facility in this manner for greater than 40 years potentially increases the risk to site personnel due to the potential for a criticality and release of fission or activation products. These conditions also affect the consequences of airborne or effluent releases to the environment which could eventually impact public health and safety.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

>5 years. The disposition of spent fuel, if known could reduce the number of handling operations required to get the fuel into its ultimate storage configuration. This information, when available, will enable the site to develop effective processes and reduce the exposures of workers and the overall costs of handling and storage of the spent fuel.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequences of not knowing the ultimate disposition of the spent fuel is that it will be necessary to build new facilities, and increase the number of handling operations that must be performed to prepare the fuel for interim storage and then again for ultimate storage. During these handling operations, workers will be exposed to ionizing radiation and there is increased likelihood for damage to the fuel with the subsequent release of fission and activation products.

Leaving the spent fuel in CPP-666 potentially increases risk of release of fission and activation products if facility is operated beyond its intended design life.

Since the length of interim storage is not known, evaluation of storage options is difficult and the costs for developing an interim term storage capability for the spent fuel will be impacted in that design assumptions will require additional conservatism to keep risks to acceptable levels over an unspecified facility life.

VULNERABILITY DEVELOPMENT FORM (Page A-65)	
Vulnerability # ID.W.2.3	Site:ICPP
Date: 10/22/93	Facility: CPP-666

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Additional emphasis needs to be placed on developing a policy and guidance on disposition of fuel for ultimate disposal.

Joe Boccio for DW
Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-67)	
Vulnerability # ID.W.3.2	Site: INEL-ICPP
Date: October 21, 1993	Facility: IFSF

Block #1: Title of Vulnerability

Ignition of Brittle Cardboard Fuel Containers at IFSF

Block #2: Executive Summary of Vulnerability

Loss of forced cooling, due to loss of AC power, can result in ignition of the brittle carboard fuel containers that are stored in the IFSF. If unmitigated, propagation to graphite fuels is probable.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

It has been reported that the utility systems at ICPP which provide such things has plant air, demineralized water, and emergency power have been proven unreliable. The availability and reliability of standby safety systems such as emergency power for providing forced cooling to the IFSF assures that atmospheric conditions in the vault are within the safety envelope. Demand-related failures can increase the likelihood of fire-induced scenarios.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

If in the unlikely event of a fire within the IFSF vault, the probable consequences can lead to release of hazardous material to the environment.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The most direct consequence of the event is worker health and safety.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Implementation of corrective actions is directly related to the demand failure rate of the emergency AC system and the frequency with which the site loses offsite power. Based upon generic failure rate data, corrective actions should be taken in less than 1 year.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

WINCO is in the process of upgrading system reliability. Operating funded projects are planned to complete upgrades and modifications by 1996.

VULNERABILITY DEVELOPMENT FORM	(Page A-68)
Vulnerability # ID.W.3.2	Site: INEL-ICPP
Date: October 21, 1993	Facility: IFSF

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

If system reliabilities are not upgraded, the likelihood of a severe accident increases.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Improve reliability of emergency AC power system and develop emergency operating procedures for quick response fire-fighting activities.

J Boccio JB

Signature, Team Member

P Lrlk

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-69)	
Vulnerability # ID.W.3.3	Site: Idaho CPP-603 IFSF
Date: October 19, 1993	Facility: CPP-603 Irradiated Fuel Storage Facility (IFSF)

Block #1: Title of Vulnerability

Roof Collapse and Control Room Equipment Failure due to a Large Seismic Event.

Block #2: Executive Summary of Vulnerability

This is a remotely-operated dry vault storage facility which was designed and built in 1974 to withstand a design basis earthquake at the time. A recent scoping analysis indicates that the massive roof structure will collapse in the event of a large earthquake. All safety equipment are not seismically qualified nor restrained to perform their safety functions. The consequences of a possible direct exposure of the storage vaults to the environment presents a vulnerability to the workers and the environment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The IFSF consists of a truck bay, a cask transfer car system, a fuel handling cell, a fuel storage room, a crane maintenance area, and other room including the control room and standby diesel generator room. Of the 636 18" diameter x 11' long storage canisters, 309 are currently used for fuel storage with a total End of Life Uranium of 0.5 MT.

As part of the scoping study, the facility has been analyzed using a 2-D dynamic finite element model for the current site-specific seismic load. Overstress conditions at the roof and crane connections with the support columns present a possible collapse of these massive structural elements into the fuel storage area. In the event of an earthquake, the impact of these structures on the fuel storage rack array will probably expose the fuel canisters to the environment.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Direct exposure of fission products to the environment from the uncovered fuel storage cells is a possibility.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

This vulnerability affects the workers with direct radiation. Release of fission products to the environment will affect the general public and the environment.

VULNERABILITY DEVELOPMENT FORM	(Page A-70)
Vulnerability # ID.W.3.3	Site: Idaho CPP-603 IFSF
Date: October 19, 1993	Facility: CPP-603 Irradiated Fuel Storage Facility (IFSF)

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

>5 years. The need for corrective action is not that urgent, since the possibility of fuel elements exposed to the atmosphere is not that high relative to other potential vulnerabilities.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Since the Contractor is planning to preserve this facility for future dry storage of spent fuels currently stored elsewhere, the facility should be modified to withstand the current design basis earthquake. This should include both the structures and the safety equipment.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Roof/crane failure due to the collapse of the superstructure will have significant impact on the workers exposure to radiation and cleanup cost.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Rebrace the structural columns supporting the roof and the crane(s). The control room equipment and other safety components should be tied to the building structures as appropriate.

Manoont Subhi AM — Signature, Team Member

P Lonha — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-71)	
Vulnerability # ID.W.4.1	Site:ICPP
Date: 10/22/93	Facility: CPP-603 Fuel Cutting Facility

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

There is no path for the ultimate disposal of fuel stored in the CPP-603 Fuel Cutting Facility.

Block #2: Executive Summary of Vulnerability

The CPP-603 Fuel Cutting Facility not intended for long term storage of spent fuel and does not have an adequate design to ensure the safety of the two spent fuel assemblies stored there. The INEL Site Assessment Report does not specifically address the removal of this fuel. In addition since the ultimate disposition of the fuel is not known, multiple, interim actions requiring handling the spent fuel will be necessary. Each of these handling operations impact worker exposure and increase the risk of a release of fission and activation products to the environment which could impact the health and safety of the workers and eventually, the public. A decision regarding the disposition of spent fuel and the packaging requirements needs to be made so that reprocessing and packaging of fuel can be accomplished in a minimum number of handling operations and in a cost effective manner.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Although, DOE has been allocated 156.5 metric tons of uranium storage (MTU) from INEL, at the Monitored Retrievable Storage facility, the disposition of the fuel in CCP-603 Fuel Cutting Facility has not been determined. The 156.5 metric tons of uranium planned for shipment to the Monitored Retrievable Storage facility is comprised of spent fuel from commercial nuclear power plants. This spent fuel is scheduled for shipment beginning in 1998 and ending in 2007. However, before fuel can be shipped it must be characterized, and packaged to meet the Monitored Retrievable Storage facility requirements and eventually those of the Federal Repository where they will ultimately be stored. However, the facilities required to reprocess, package and store spent fuel are not currently available.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

This is an institutional failure in that direction needed to determine the disposition, reprocessing, and packaging of spent fuel at CCP-603 is not available.

VULNERABILITY DEVELOPMENT FORM	(Page A-72)
Vulnerability # ID.W.4.1	Site:ICPP
Date: 10/22/93	Facility: CPP-603 Fuel Cutting Facility

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The Worker health and safety, the environment and public health and safety can all be affected if ultimate disposal of the spent fuel in CPP-603 is not determined. CCP-603 was not designed for long term storage of spent fuel. Using the facility in this manner increases the risk to site personnel due to the potential for a criticality and release of fission or activation products. These conditions also affect the consequences of airborne or effluent releases to the environment which could eventually impact public health and safety.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. Effective interim storage methods need to be implemented as soon as possible. The disposition of spent fuel, if known could reduce the number of handling operations required to get the fuel into its ultimate storage configuration. This information, when available, will enable the site to develop effective processes and reduce the exposures of workers and the overall costs of handling and storage of the spent fuel at CCP-603.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequences of not knowing the ultimate disposition of the spent fuel is that it will be necessary to build new facilities, and increase the number of handling operations that must be performed to prepare the fuel for interim storage and then again for ultimate storage. During these handling operations, workers will be exposed to ionizing radiation and there is increased likelihood for damage to the fuel with the subsequent release of fission and activation products.

Leaving the spent fuel in CPP-603 increases risk of release of fission and activation products due to structural failures since the building does not meet current design safety requirements.

Since the length of interim storage is not known, evaluation of storage options is difficult and the costs for developing an interim term storage capability for the spent fuel will be impacted in that design assumptions will require additional conservatism to keep risks to acceptable levels over an unspecified facility life.

VULNERABILITY DEVELOPMENT FORM	(Page A-73)
Vulnerability # ID.W.4.1	Site: ICPP
Date: 10/22/93	Facility: CPP-603 Fuel Cutting Facility

<u>Block #9:</u> To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Additional emphasis needs to be placed on developing a policy and guidance on disposition of fuel for ultimate disposal.

DW

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-75)	
Vulnerability # ID.W.4.2	Site: INEL
Date: October 21, 1993	Facility: ICPP-603 (FECF)

Block #1: Title of Vulnerability

Possible degraded Peach Bottom Fuel

Block #2: Executive Summary of Vulnerability

Peach Bottom fuel has been stored in a hot cell facility for over ten years without an inspection. There are no manipulator arms in the hot cell and the lights have not worked in 4-6 years. There is an open water conveyor in the FECF which may allow moisture into the cell.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Peach Bottom fuel has shown degradation of the fuel can in a dry storage environment at the INEL. This same type of fuel has not been inspected for over ten years and has a potentially moist environment.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Worker safety on fuel removal may be compromised - hazardous release.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year. Fuel has lain uninspected for 10 years.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Worker safety compromised.

VULNERABILITY DEVELOPMENT FORM (Page A-76)	
Vulnerability # ID.W.4.2	Site: INEL
Date: October 21, 1993	Facility: ICPP-603 (FECF)

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Fix lights; inspect fuel.

CC

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page A-77)	
Vulnerability # ID.W.5.1	Site:ICPP
Date: 10/22/93	Facility: CPP-749 drywell and CPP-603 dry storage

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

There is no path for the ultimate disposal of fuel stored in the CPP-749 drywell storage area or the CPP-603 Irradiated Fuel Storage Facility.

Block #2: Executive Summary of Vulnerability

CPP-749 and the CPP-603 Irradiated Fuel Storage Facility were not intended for long term storage of spent fuel and consequently do not have adequate designs to ensure the safety of the spent fuel for a protracted period of time. In the case of CCP-603 Irradiated Fuel Storage Facility, the design does not meet seismic requirements. Since the ultimate disposition of the fuel is not known, multiple, interim actions requiring handling the spent fuel will be necessary. Each of these handling operations impact worker exposure and increase the risk of a release of fission and activation products to the environment which could impact the health and safety of the workers and eventually, the public. A decision regarding the disposition of spent fuel and the packaging requirements needs to be made so that reprocessing and packaging of fuel can be accomplished in a minimum number of handling operations and in a cost effective manner.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Although, DOE has been allocated 156.5 metric tons of uranium storage (MTU) from INEL, at the Monitored Retrievable Storage facility, the disposition of the fuel in CPP-749 and the CCP-603 Irradiated Fuel Storage Facility has not been determined. The 156.5 metric tons of uranium planned for shipment to the Monitored Retrievable Storage facility is comprised of spent fuel from commercial nuclear power plants. This spent fuel is scheduled for shipment beginning in 1998 and ending in 2007. However, before fuel can be shipped it must be characterized, and packaged to meet the Monitored Retrievable Storage facility requirements and eventually those of the Federal Repository where they will ultimately be stored. However, the facilities required to reprocess, package and store spent fuel are not currently available.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

This is an institutional failure in that direction needed to determine the disposition, reprocessing, and packaging of spent fuel at CPP-749 and the CCP-603 Irradiated Fuel Storage Facility is not available.

VULNERABILITY DEVELOPMENT FORM	(Page A-78)
Vulnerability # ID.W.5.1	Site: ICPP
Date: 10/22/93	Facility: CPP-749 drywell and CPP-603 dry storage

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The Worker health and safety, the environment and public health and safety can all be affected if ultimate disposal of the spent fuel in CPP-749 and the CCP-603 Irradiated Fuel Storage Facility is not determined. CPP-749 and the CCP-603 Irradiated Fuel Storage Facility were not designed for long term storage of spent fuel. Using the facility in this manner increases the risk to site personnel and the environment due to the potential for a release of fission or activation products.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. The disposition of spent fuel, if known could reduce the number of handling operations required to get the fuel into its ultimate storage configuration. This information, when available, will enable the site to develop effective processes and reduce the exposures of workers and the overall costs of handling and storage of the spent fuel.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequences of not knowing the ultimate disposition of the spent fuel is that it will be necessary to build new facilities, and increase the number of handling operations that must be performed to prepare the fuel for interim storage and then again for ultimate storage. During these handling operations, workers will be exposed to ionizing radiation and there is increased likelihood for damage to the fuel with the subsequent release of fission and activation products.

Leaving the spent fuel in CPP-749 and the CCP-603 Irradiated Fuel Storage Facility for an undetermined amount of time increases risk of release of fission and activation products due to the potential of failures since the storage locations were not designed for long term storage.

Since the length of interim storage is not known, evaluation of storage options is difficult and the costs for developing an interim term storage capability for the spent fuel will be impacted in that design assumptions will require additional conservatism to keep risks to acceptable levels over an unspecified facility life.

VULNERABILITY DEVELOPMENT FORM (Page A-79)	
Vulnerability # ID.W.5.1	Site:ICPP
Date: 10/22/93	Facility: CPP-749 drywell and CPP-603 dry storage

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Additional emphasis needs to be placed on developing a policy and guidance on disposition of fuel for ultimate disposal.

DW

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page A-81)
Vulnerability # ID.W.5.2	Site: INEL
Date: October 21, 1993	Facility: ICPP-749

<u>Block #1:</u> <u>Title of Vulnerability</u>

Potentially degrading aluminum fuel cans and baskets at ICPP-749 (WINCO).

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u>

Forty-six sites of Peach Bottom fuel are in underground storage at the facility. These fuel elements are in aluminum cans in an aluminum basket lowered into a carbon steel cylinder. This environment is moist and could cause deterioration of the aluminum.

<u>Block #3:</u> Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Fuel cans of a similar type have shown corrosion.

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Possible hazardous/fission product release if fuel is dropped during transfer.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker safety if fuel is dropped and fuel can is breached.

<u>Block #6 (Optional):</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years.

<u>Block #7 (Optional):</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

WINCO plans to relocate 20 fuel storage sites to newer design tubes in the next year and the balance the following year.

<u>Block #8:</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Worker safety on fuel transfer.

VULNERABILITY DEVELOPMENT FORM (Page A-82)	
Vulnerability # ID.W.5.2	Site: INEL
Date: October 21, 1993	Facility: ICPP-749

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Eliminate aluminum fuel cans - substitute stainless steel.

CC — Signature, Team Member

P Lorenz — Signature, Team Leader

SPENT FUEL INITIATIVE

Savannah River Site

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-1	Site: SRS
Date: October 4, 1993	Facility: L Rx Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Potential unmonitored build-up of radionuclide and/or fissile materials in sand filters.

Block #2: Executive Summary of Vulnerability (~ 50 words)

There is no current administrative controls in place to determine the radionuclide content of sand filter materials. SRS has indication that corrosion and potential breaching of SNF is occurring.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Radionuclide constituency of Sand Filter, Fissile constituent of sand filter.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Criticality, Rad

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Analysis procedures should be implemented ASAP.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-1	Site: SRS
Date: October 4, 1993	Facility: L Rx Basin

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Have some past analysis on back flushing of filter.

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

KE Basin sand filter fissile material scenario.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

~~Minimal~~. Perform crit analysis.

B. Harrison

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-2	Site: SRS
Date: October 4, 1993	Facility: General

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Incomplete Inventory of RINM.

Block #2: Executive Summary of Vulnerability (~ 50 words)

The Site Assessment Team did not identify all RINM stored on-site, addressing only reactor basins and separations facilities. A review of a WSRC inventory report resulted in the unconfirmed identification of RINM in the following areas:

- K-Reactor tank (lithium control rods and Mark 60B targets)
- L-Reactor tank (lithium control rods)
- C-Reactor tank (lithium control rods)
- 235-F (irradiated fuel)
- 773A (irradiated fuel and target assemblies)

Several other areas, such as 723A and 777A, are believed to contain RINM as a result of inventory report reviews and discussions with DOE/SR and WSRC personnel.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

A review of an unclassified inventory report (WSRC ASD-NMP-93-0016) indicates significant quantities of RINM was not reported by the Site Assessment Team.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Unknown - The status of the RINM and storage conditions is not known.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Inventory of site RINM should be completed in accordance with direction provided to site assessment team, < 1 year.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-2	Site: SRS
Date: October 4, 1993	Facility: General

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The Site Assessment Team may not have considered all facilities housing RINM, focusing only on the reactor and separations facilities.

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Block #7 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Mark Zagar

Mark H Zagar

Signature, Team Member

Signature, Team Leader

This VD was reviewed and facts incorporated in Report

10/15/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-3	Site: SRS
Date: October 4, 1993	Facility: L - Rx Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Different load bearing bolts installed in I beam RINM and target hanger trolleys.

Block #2: Executive Summary of Vulnerability (- 50 words)

Reliability of load bearing material is suspect due to the noted non conformancy of bolts. Failure of these bolts could result in dropping of spent fuel rods or irradiated targets.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Load bearing bolts for suspension of RINM and targets are of different make and material. May involve counterfeit or suspect bolts.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products due to dropped bucket or RINM rod.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 yrs. Review of suspect/counterfeit bolts program is already established in DOE. Review of failure probability should not be a heavy burden.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-3	Site: SRS
Date: October 4, 1993	Facility: L - Rx Basin

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Magnitude is small as criticality calculations require 5 or more RINM's to fail. May increase crud loading of filtration system.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Cost minimal except where it may be determined necessary to move/exchange RINM rods.

B. Harrison

Signature, Team Member

Signature, Team Leader

This is not a Vul.

10/5/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-4	Site: SRS
Date: October 4, 1993	Facility: "P" and "K" Areas Disassembly Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Characterization and Safety Analysis for Fissile Material Sludge on "P" and "K" Basin Floors and Sand Filters Systems.

Block #2: Executive Summary of Vulnerability (~ 50 words)

Sludge characterization and related safety/criticality analysis have not been completed for the Sand Filters and basin floors in the "P" and "K" Basin Disassembly Areas. This vulnerability relates to the high corrosion and relocation of fissile material currently identified within the Basin areas. Excessive amounts of sludge and debris bearing fissile material have accumulated on the basin floors in excess of "3" inches. Similar amounts of sludge material has been identified on the horizontal surfaces of the hanger in the vertical tube section, machine basin, storage and transfer basins. The potential mobility of this material is such that significant quantities of material can be transferred to other locations within the basin during handling/transfer operations and through the sand filter system during operation. Because of the dynamic nature of this fuel corrosion process and the potential increase in the relative ratios of fissile to corrosion product material, a continuing characterization/safety assessment program maybe needed in conjunction with basin cleanup and chemistry controls. The current ES&H risk associated with the sludge material appears low but has the future potential to increase personnel exposures and the possibility of creating critical mass conditions. There currently are no identified limits for operation nor operational controls that would limit the amounts of potential fissile material which could be collected and concentrated on the sand filters or other potential locations. Additionally there has been no safety analysis performed to determine the safety envelope and consequences for the fissile material contained in the sludge material. SRS has initiated a comprehensive characterization and criticality assessment program to better evaluate and preclude the possibility of fissile material relocation, criticality and worker exposure events.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The potential exist for a measurable quantity of fissile material to be deposited within the sand filters used in the "K" and "P" area basin cleanup system. No safety analysis nor comprehensive characterization program has been identified for system operation of the "sand filters" which provide a safety envelope for high sludge/debris loading. Higher than expected corrosion and degradation of cladding material, higher fissile material in basins, can produce higher fissile material loading on sand filters, and other system components.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Potential high radiation exposure and criticality condition within the Basin piping and sand filtering system.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety issue because of localized potential criticality and higher than expected radiation conditions.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-4	Site: SRS
Date: October 4, 1993	Facility: "P" and "K" Areas Disassembly Basin

<u>Block #6:</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year; high corrosion and potential degradation of fuel and target material could lead to transport of fissile material to sand filter systems. No solution has been identified to reduce the higher than expected corrosion rates.

<u>Block #7:</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Need to verify that site M&O has identified for corrective action and authorization basis.
A program plan has been identified ~~in ....~~.

<u>Block #8 (Optional):</u> To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Needs to be analyzed in more detail.

<u>Block #9 (Optional):</u> To the best of your collective abilities, suggest or recommend of the most rational fix to this vulnerability:

Perform safety analysis and develop institutional/administrative controls.

Phil Grant
Philip J. Grant
Signature, Team Member

~~Program plan # to be provided~~)
Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-5	Site: SRS
Date: October 4, 1993	Facility:

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Block #2: Executive Summary of Vulnerability (~ 50 words)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Corrosion of Al-clad fuel and targets and Al components. See Attachment A.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # SRS-5	Site: SRS
Date: October 4, 1993	Facility:

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend of the most rational fix to this vulnerability:

Burt Johnson

Signature, Team Member

Signature, Team Leader

details in Report
10/16/93

Attachment A

Suggested Approach to Define Vulnerabilities Due to Corrosion

1. Summarize corrosion phenomena at various SRP facilities. Compare commonalities and divergences.

2. Analyze potential factors and compare interpretations at each site.
   - water chemistry
   - mechanical damage
   - galvanic
   - sludge
   - other

3. Identify potential mitigations.

4. Identify potential impacts.
   - with reprocessing
   - without reprocessing

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-6	Site: SRS
Date: October 4, 1993	Facility: "L" Basin

<u>Block #1:</u> <u>Title of Vulnerability</u> (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

^{137}Cs activity level in "L" Basin.

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u> (~ 50 words)

Corroding and leaking fuel stored in the basin is increasing the ^{137}Cs radiation level at a rate that is becoming limiting for the capability of the ion exchange columns to maintain the limit below the admin. limit of 500 dpm/ml.

<u>Block #3:</u> Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Increasing ^{137}Cs activity level in the basin water. Approaching 500 dpm/ml admin. limit.

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Adverse condition relates to high radiation levels and ALARA concerns.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety and environment.

<u>Block #6:</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year because the situation is currently near the capability of the ion exchange to maintain < 500 dpm/ml.

<u>Block #7:</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

At the direction of DOE, the M&O contractor is preparing the necessary paper work to bring in an outside contractor and additional ion exchange capacity to maintain the radiation level below the administrative limit of 500 dpm/ml. M&O contractor has not evaluated increasing the administrative limit.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-6	Site: SRS
Date: October 4, 1993	Facility: "L" Basin

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Increased worker doses.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

M. Freshley

Signature, Team Member

Signature, Team Leader

detailed in Report
10/15/93

VULNERABILITY DEVELOPMENT FORM (Page 1)

Vulnerability # SRS-7	Site: SRS
Date: October 4, 1993	Facility:

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Determine whether gas bubbles release is a potential hazard above the bucket storage area at L-Reactor.

Block #2: Executive Summary of Vulnerability (~ 50 words)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Gas bubbles are being released from the corroding targets in the L Reactor basin (in the bucket storage area).

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Hydrogen is almost certainly the predominant gas in the bubbles, but it seems relevant to explore whether significant concentrations of fission products (e.g., ^{85}Kr) accompany the hydrogen.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The significant impact would be to workers who spend considerable time above the bucket storage area. Currently tritium is the only gaseous species that is monitored. Also, high rates of air replacement are not routine.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

The urgency for an initial assessment seems to be near-term. The gas discharge rate currently appears to be relatively low, but an early assessment would offer the basis for corrective actions, if justified, particularly if the gas release rate increases.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-7	Site: SRS
Date: October 4, 1993	Facility:

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Unknown.

Block #8 (Optional): To the best of your collective abilities, describe the potential magnitude of the consequence(s) of this vulnerability if left uncorrected:

Radioactive species inhaled by operations and maintenance staff that spend considerable time above the bucket storage area. Currently minimal or inconsequential; recommend characterization to anticipate consequential impacts if fuel corrosion rate and associated bubble release rate increases.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

a. Sample gas bubble contents to assess whether significant radioactive species are released.

b. Increasing air flow or use of protective clothing could offer satisfactory fixes at nominal cost.

B. Johnson

Signature, Team Member

Signature, Team Leader

Not a separate Vul. included in/a part of Corrosion issue

10/15/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-8	Site: SRS
Date: October 5, 1993	Facility: Reactors

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Lack of Reactor Authorization Basis.

Block #2: Executive Summary of Vulnerability (- 50 words)

DOE has directed that L-Reactor and P-Reactor be placed in a cold shutdown condition with no provision for restart. K-Reactor was to be placed in a cold standby condition. In response, WSRC developed shutdown/standby plans affecting facility hardware, employees, and programs. Hardware changes include blanking sources for emergency makeup water for the disassembly basin (river water and cooling water headers). Control room operators are no longer in place at some reactors. Casualty response would rely on building personnel and operators from other facilities. The authorization basis for this condition, referred to as the Basis for Interim Operation (BIO), has not been developed.

Block #3: Describe conditions or symptoms which portend or imply a potential EG&H vulnerability:

The current operation of the reactors is not addressed by approved or safety authorization. WSRC plans to issue a Basis for Interim Operation (BIO) within 2 years.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Institutional failure - The reactors are currently operating in a mode (staffing levels, equipment condition) not addressed by the Safety Analysis Report.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-8	Site: SRS
Date: October 5, 1993	Facility: Reactors

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

< 1 year - A formal review of the operating conditions, equipment requirements, and personnel staffing levels is needed.

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

BIO to be developed within 2 years.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Mark Zagar

Mark H Zagar

Signature, Team Member

Signature, Team Leader

Details in report
10/15/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-9	Site: SRS
Date: October 6, 1993	Facility:

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Corrosion of Mark 31 A and B target slugs in K and L disassembly basins.

Block #2: Executive Summary of Vulnerability (~ 50 words)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Corrosion products are readily identifiable on slugs and gas bubbles indicate that corrosion is continuing.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

a. Elevated fission product inventories (principally C_s-137) are routinely measured in basin water and enhanced water treatment has been instituted to control activity below 500,000 dpm. Increases in corrosion will result in higher radioactive inventories in the water and possibly in air (see SRS-7).

b. Extended progression of the slug corrosion could result in increased difficulty in retrieving and handling ability of slugs in storage, processing or disposal.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

a. The increased radioactive burdens in pool water result in increased doses to personnel who deal with operations related to activity management (e.g., ion exchange column handling and regeneration); also, there may be increased airborne activity from evaporation and gas bubble releases that could affect staff who work above the bucket storage area.

b. Substantial difficulty in handling of severely corroded slugs could increase doses to basin or packaging staffs.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective actions (i.e., sludge removal and improved water chemistry) are underway and box covers are being implemented. The potential impacts of these measures need to be evaluated over the next 1-5 years to allow time for further actions, if justified.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-9	Site: SRS
Date: October 6, 1993	Facility:

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

See #6.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Scenario 1 (Reprocessing): If expanding corrosion products lock the slugs inside the buckets, removal for dissolution may be difficult.

Scenario 2 (No Reprocessing): Corrosion product expansion or gross fragmentation could complicate handling and packaging of the slugs for final disposal. Potential impacts of radiation releases on plant staffs was addressed in #5.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Assure that corrosion phenomena and methods to mitigate them are understood and demonstrated. In the reprocessing mode, mitigated corrosion to the extent that slugs will remain readily retrievable. In the disposal mode, mitigate corrosion such that post-storage handling and packaging will not be seriously impacted.

Burt Johnson

D Johnson

Signature, Team Member

Signature, Team Leader

See Report
10/15/93
VUS

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-10	Site: SRS
Date: October 6, 1993	Facility: P-Reactor Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility (20 words or less).)

Hoist Rod Corrosion.

Block #2: Executive Summary of Vulnerability (~ 50 words)

The Hoist Rods on the Twin Hook Hoist in the P-Reactor storage basin are severely corroded which may compromise lifting capacity.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

A below-water mechanical joint that joins 6061 aluminum and 304 stainless steel using four stainless bolts appears severely corroded. The two Hoist Rods are used to lift fuel bundles in the horizontal position from the fuel storage racks. The severe corrosion may compromise lifting capacity. If breakage were to occur during lifting, the fuel bundle containing up to four fuel assemblies would drop possibly causing damage to the fuel and those on the floor of the basin.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The adverse condition is potential release of fission products in the basin or in the extreme, violating criticality spacing requirements.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety could be affected by the release of fission products if the cladding was penetrated or if droppage violate criticality spacing requirements.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective actions should be completed before the Twin Hook Hoist is used. Apparently, this is original equipment ~35 years old.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-10	Site: SRS
Date: October 6, 1993	Facility: P-Reactor Basin

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

To the best knowledge of the Spent Fuel Vulnerability Team, the condition of the Hoist Rods has not been considered.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Max Freshley

Signature, Team Member

Signature, Team Leader

See Report
WB 10/15/93

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # SRS-11	Site: SRS
Date: October 6, 1993	Facility: Reactor Disassembly Basins

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Reactor Disassembly Basin Safety Analysis Envelope

Block #2: Executive Summary of Vulnerability (~ 50 words)

With the current configuration, and future lay-up plans identified for each of the Reactor Disassembly Basins, new potential and more credible accidents can occur than those previously identified and evaluated in the facility SARs. The existing SARs identify accidents, consequences, limiting conditions for operations, and mitigation controls for that of an operating reactor facility (Category I facility). The current configuration and proposed operations reflect new conditions and operational considerations potentially of that for a Cat II or III facility. This vulnerability does not indicate a higher potential risk condition at SRS but addresses the lack of more accurately bonding and comprehensive safety envelope for the disassembly basins for their present and future operations. Safety events associated with the present and future corrosion conditions, loss of pool water, equipment failure, load drops, fissile material movement, loss of shielding, etc., need to be more accurately analyzed to reflect these conditions. Other changes in the facility configurations, system isolation, and operational considerations relative to the corrective actions for corrosion of cladding and fissile material need to be addressed as part of the credible events and risk mitigation.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The potential exist with the current configuration and conditions, and obsolete SAR that different accident events, their consequences and mitigation needs may change and thereby not be adequately addressed in the facilities SARs, and operating procedures. These conditions may lead to system operations and corrective actions which have a measurable ES&H impact.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Institutional failure

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety, and environment

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-11	Site: SRS
Date: October 6, 1993	Facility: Reactor Disassembly Basins

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

<1 year because of the need to adequately address those events and operational requirements which impact each of the disassembly area basins and their configuration

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The M&O is currently planning to complete an updated Safety Analysis Report for the Reactor Disassembly Basins by April, 1994. ~~(See Memorandum ....)~~

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Needs to be evaluated in more detail

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Proceed with the proposed M&O plans in updating the existing Safety Analysis.

J. Grant

Signature, Team Member

comments to be provided

Signature, Team Leader

See Report
10/5/93

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-12	Site: SRS
Date: October 7, 1993	Facility: L-Reactor Disassembly Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadvertent flooding of L-Reactor Disassembly Basin.

Block #2: Executive Summary of Vulnerability (~ 50 words)

(To be supplied)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Uncontrolled sources of water to basin could cause overflow and flooding of facility. Loss of control could be the result of human error (such an event has occurred at least once), or could be initiated by a seismic event that disables key components of, for example, the make-up water system. Components such as the level sensing interlocks need to be seismically qualified to preclude this condition.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Fission products contained in overflowing basin water would be released to the disassembly area, in general, and ultimately to the environment via the facility sewer.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The postulated event would impact adversely on the environment and public and worker health and safety.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective actions should be undertaken within the 1-5 year window. This judgment is based on the low probability of a DBE coupled with the current relatively low reactivity levels in the basin. However, these reactivity levels can be expected to increase due to the ongoing corrosion that exists. Long term delay in initiating corrective actions (i.e., to > 5 years) would not be prudent or advisable.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-12	Site: SRS
Date: October 7, 1993	Facility: L-Reactor Disassembly Basin

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

N/A

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

N/A

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

N/A

Constantine Economos Signature, Team Member	Signature, Team Leader

See Report

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-13	Site: SRS
Date: October 7, 1993	Facility: K-Reactor Disassembly Basin

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadvertent flooding of K-Reactor Disassembly Basin.

Block #2: Executive Summary of Vulnerability (~ 50 words)

(To be supplied)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Uncontrolled sources of water to basin could cause overflow and flooding of facility. Loss of control could be the result of human error (such an event has occurred at least once), or could be initiated by a seismic event that disables key components of, for example, the make-up water system. Components such as the level sensing interlocks need to be seismically qualified to preclude this condition.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Fission products contained in overflowing basin water would be released to the disassembly area, in general, and ultimately to the environment via the facility sewer.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The postulated event would impact adversely on the environment and public and worker health and safety.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective actions should be undertaken within the 1-5 year window. This judgment is based on the low probability of a DBE coupled with the current relatively low reactivity levels in the basin. However, these reactivity levels can be expected to increase due to the ongoing corrosion that exists. Long term delay in initiating corrective actions (i.e., to > 5 years) would not be prudent or advisable.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # SRS-13	Site: SRS
Date: October 7, 1993	Facility: K-Reactor Disassembly Basin

<u>Block #7:</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

N/A

<u>Block #8 (Optional):</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

N/A

<u>Block #9 (Optional):</u> To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

N/A

Constantine Economos

Signature, Team Member

Signature, Team Leader

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VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-14	Site: SRS
Date: October 7, 1993	Facility: P-Reactor Disassembly Basin

<u>Block #1:</u> <u>Title of Vulnerability</u> (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadvertent flooding of P-Reactor Disassembly Basin.

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u> (~ 50 words)

(To be supplied)

<u>Block #3:</u> Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Uncontrolled sources of water to basin could cause overflow and flooding of facility. Loss of control could be the result of human error (such an event has occurred at least once), or could be initiated by a seismic event that disables key components of, for example, the make-up water system. Components such as the level sensing interlocks need to be seismically qualified to preclude this condition.

<u>Block #4:</u> Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Fission products contained in overflowing basin water would be released to the disassembly area, in general, and ultimately to the environment via the facility sewer.

<u>Block #5:</u> Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The postulated event would impact adversely on the environment and public and worker health and safety.

<u>Block #6:</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective actions should be undertaken within the 1-5 year window. This judgment is based on the low probability of a DBE coupled with the current relatively low reactivity levels in the basin. However, these reactivity levels can be expected to increase due to the ongoing corrosion that exists. Long term delay in initiating corrective actions (i.e., to > 5 years) would not be prudent or advisable.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-14	Site: SRS
Date: October 7, 1993	Facility: P-Reactor Disassembly Basin

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

N/A

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

N/A

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

N/A

Constantine Economos

Signature, Team Member

Signature, Team Leader

See report

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-15	Site: SRS
Date: October 6, 1993	Facility: RBOF; P,K,L,C,R rx's

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)
Conduct of Operations:

Block #2: Executive Summary of Vulnerability (~ 50 words)
Conduct of operations to emphasize the extended storage role of the fuel storage basins is necessary.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Storage of spent nuclear fuel and targets has continued on an open-ended basis with delays of the plans to process the fuel and targets occuring and resulting in extended storage of the fuel and targets well beyond the time ever envisioned for these materials.

There was a recent incident in which a fuel bundle in the L reactor disassembly basin was dropped and a recovery plan was begun prior to proper management notification, review, and approval.

In the P Reactor disassemble basin one chain hoist was observed to be improperly "dogged" or secured so as to prevent inadvertent or unauthorized movement of the hanger.

Data as to the addition of makeup water to the production reactor disassembly basins is being recorded but is not being analyzed to determine trends in the addition of water that would be useful in determining the condition of the basins.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

With the revised role for production reactors and the implementation of reactor layup plans, reduced funding and staffing and the retirement of many experienced workers, and the potential for increased spent nuclear fuel shipments there is concern that proper conduct of operations of the facilities concerned with the receipt, storage, and processing of fuel may be adversely affected. Improper conduct of operations may lead to significant nuclear incidents affecting the proper operation of these facilities and could result in release of fissile material to the environment, and exposure of operating personnel.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Improper conduct of operations has the potential to affect worker health and safety at the reactor fuel disassembly basins currently storing spent nuclear fuel and the Receiving Basin for Offsite fuels and also has the potential to affect the environment if a basin leaks and the leak goes undetected.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Corrective plans to emphasize training in conduct of operations to address the extended storage role of the production reactor disassemble basins, Receiving Basin for Offsite fuels, and the F-and H-Canyon fuel storage basins should be approved and implemented in less than one year.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-15	Site: SRS
Date: October 6, 1993	Facility: RBOF; P,K,L,C,R rx's

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Additional training in the conduct of operations necessary to maintain safe operations of the spent nuclear fuel storage locations can emphasize the nature of the extended storage role for the facilities and may help to reduce the chance of operator error leading to a significant nuclear incident.

John Scorah

John Scorah

Signature, Team Member

Signature, Team Leader

included in report summary

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-16	Site: Savannah River
Date: 10/7/93	Facility: RBOF

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadequate Tornado Protection at RBOF

Block #2: Executive Summary of Vulnerability (~ 50 words)

The roof of the RBOF facility over the cask basins is constructed of standard roof decking over a structural steel frame. This portion of the roof structure appears to be inadequate to prevent penetration of the roof by tornado generated missiles. In addition, the transite wall structure of the facility is also inadequate to prevent penetration by a tornado missile.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The roof of the RBOF facility over the cask basins is constructed of standard roof decking over a structural steel frame. Such construction would not be capable of preventing penetration by significant tornado generated missiles. The transite walls of the facility exhibit the same vulnerability. If such an event were to occur, the missile could then continue into a pool and destroy the safe geometry of fuel located there which is needed to prevent criticality.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Criticality: The impact of a tornado generated missile on the fuel in the storage rack could cause a criticality.

Direct Exposure: A criticality in the pool could expose RBOF personel in the area of the pool to excess levels of radiation.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety: Exposure of workers to excess radiation would adversely affect their health.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years: The event is initiated by a tornado, an infrequent event.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-16	Site: Savannah River
Date: 10/7/93	Facility: RBOF

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

None

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potential consequences include criticality in the pool, possible exposure of personnel in the area to excess radiation.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

The portion of the roof without a concrete deck should be hardened against missiles. This would involve pouring a concrete slab of adequate thickness, and reinforcing the supporting structural steel for the additional loading. Missile barriers should be erected outside the transite walls.

Mark Russell

Signature, Team Member

Signature, Team Leader

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VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS-17	Site: Savannah River
Date: 10/7/93	Facility: RBOF

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility (20 words or less).)

Seismic Vulnerability of RBOF

Block #2: Executive Summary of Vulnerability (~ 50 words)

RBOF was constructed at a time when Design Codes and Standards contained seismic provisions which do not meet the current requirements for High Risk Facilities. Since the initial design, there has been no deterministic evaluation of the facility.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Walkdown of the facility established that it has features which could adversely affect its performance during an earthquake. These include (1) masonry walls above pools which are designed to handle fuel, (2) a buried line which penetrates the foundation of the facility as the only significant source of pool make up water, and (3) unanchored 500 gallon tanks of nitric acid and caustic stored adjacent to the facility.

Block #4: Identify adverse condition category(s) (criticality, release of fission product of hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Criticality: Impact of blocks from a seismically failed masonry wall located above the pools could cause a criticality.

Direct Exposure: Damage to the fittings on the nitric acid and/or caustic tanks could expose personnel in the area to these chemicals.

Leaks in the storage pools in combination with loss of make up water by a piping failure at the penetration to the facility foundations, both resulting from an earthquake, could cause loss of significant amounts of pool water. Mitigation efforts would then result in exposure of personnel to radiation.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker Health and Safety: The adverse conditions described in Block 4 above could result in worker exposure to both corrosive chemicals and excess radiation.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years: All adverse conditions are generated by a seismic event, which is a low frequency event.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS-17	Site: Savannah River
Date: 10/7/93	Facility: RBOF

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

None.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Injury to workers.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Perform a seismic evaluation of the facility and implement the modifications identified.

Mark Russell

Mark Russell

Signature, Team Member

Signature, Team Leader

all Agree

VULNERABILITY DEVELOPMENT FORM (Page 1)

Vulnerability # SRS-18	Site: Savannah River
Date: 10/7/93	Facility: H-Canyon

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility (20 words or less).)

Seismic Vulnerability of H-Canyon.

Block #2: Executive Summary of Vulnerability (~ 50 words)

H-Canyon was constructed at a time when Design Codes and Standards contained no seismic provisions. Since the initial design, there has been no acceptable seismic evaluation of the facility.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Initial seismic calculations indicate that portions of the H-Canyon facility which houses the target storage vault are not structurally adequate for the Design Basis Earthquake. Although failure in these areas will not directly threaten the target storage area, it could cause a direct release path from the facility. A criticality could occur in the storage area as a result of seismic damage to the storage racks. This could intensify the release.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Criticality: Seismically induced damage to the target storage racks could place the targets in a critical geometry.

Release of Fission Product: Seismically induced damage to the building could result in an uncontrolled release of fission products from the facility.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker Health and Safety; the environment: Workers in the area of the facility could be exposed to unacceptable levels of radiation.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years: All adverse conditions are generated by a seismic event, which is a low frequency event.

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

None.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Injury to workers.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Perform a seismic evaluation of the facility and implement the modifications identified.

Mark Russell

Mark Russell

Signature, Team Member

Signature, Team Leader

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VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS.19	Site: Savannah River
Date: 10/7/93	Facility: F-Canyon

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Seismic Vulnerability of F-Canyon.

Block #2: Executive Summary of Vulnerability (~ 50 words)

F-Canyon was constructed at a time when Design Codes and Standards contained no seismic provisions. Since the initial design, there has been no acceptable seismic evaluation of the facility.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Initial seismic calculations indicate that portions of the F-Canyon facility which houses the fuel storage vault are not structurally adequate for the Design Basis Earthquake. Although failure in these areas will not directly threaten the fuel storage area, it could cause a direct release path from the facility. A criticality could occur in the storage area as a result of seismic damage to the storage racks. This could intensify the release.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Criticality: Seismically induced damage to the fuel storage racks could place the targets in a critical geometry.

Release of Fission Product: Seismically induced damage to the building could result in an uncontrolled release of fission products from the facility.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker Health and Safety; the environment: Workers in the area of the facility could be exposed to unacceptable levels of radiation.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years: All adverse conditions are generated by a seismic event, which is a low frequency event.

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

None.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Injury to workers.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Perform a seismic evaluation of the facility and implement the modifications identified.

Mark Russell

Mark Russell
Signature, Team Member

Signature, Team Leader

SW Myers

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS -20	Site: SRS
Date: 10/7/93	Facility: L,K & P Reactor Disassembly Basins and RBOF

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadequate leak detection system in the underground water filled RINM storage basin

Block #2: Executive Summary of Vulnerability (~ 50 words)
There are no direct and quantitative leak detection system to monitor any leakage from the underground water filled RINM storage basin. This can result in any fission product leakage to the environment going undetected and without prompt mitigation measures being implemented.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The underground water filled storage basins are vulnerable to leakage either through cracks in the concrete walls or through the expansion joints and water stops as they exist in the L,K & P Reactor Disassembly basins. Leakage through the thick concrete wall have been noted in L Reactor basin wall adjoining the reactor building. The concrete wall had cracks and being constructed of relatively low design strength concrete, it is more permeable. Waterstops can also provide an easy path for leakage if they are not properly installed and are susceptible to damage due to differential movement when located in across expansion joints. Although there are three monitoring wells per basin, one on each side, they are not sufficient to properly monitor and provide reliable information regarding any leakage of fission product from the basin.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Without a reliable leak detection system in place, any leakage of basin water and release of fission product will potentially remain undetected.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The leakage of basin water can potentially release fission products in the environment.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

The near term improvement in leak detection monitoring can be accomplished in < 1 year. The long term corrective actions should be accomplished in 1-5 years.

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The site team report indicates that the current inability to detect small leaks is a matter of concern. The report cites the inherent uncertainty regarding the capability of the existing monitoring wells to detect activation product release due to the masking effect caused by other sources. The site team report also indicates that a near term program is being developed and implemented for the L,K, & P basins to improve the current surveillance program, instrument resolution and trending of basin water inventory.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Release of fissile product to the environment.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # SRS -20	Site: SRS
Date: 10/7/93	Facility: L.K & P Reactor Disassembly Basins and RBOF

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

In the near term the existing system can be enhanced by improved surveillance of basin water level and trending of basin water inventory together with a comparative check, as being currently done for RBOF only, between the quantity of periodic make up water being added and a calculated estimate of the evaporative losses

In the long run a network of monitoring wells, strategically located around the basins, can further enhance the leak detection capability.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # SRS -21	Site: Savannah River Site
Date: 10/7/93	Facility: L, K & P Reactor Disassembly Basins

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadequate Seismic evaluation and potential inadequacies of structures, systems and components to withstand a DBE.

Block #2: Executive Summary of Vulnerability (~ 50 words)

A DBE event can potentially cause, (a) failure of the expansion joints and flexible waterstops in the basin walls and floor mat if the differential movement is excessive, (b) collapse of VTS concrete frames supporting RINM handling hangers and monorails, and dropping of heavy objects in the basin. This would result in a leakage of radioactive water from the basin and damage to the fuel in it and release of fission materials to the environment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The disassembly basin(s) is used to store RINM material and its failure in the SAR has been considered to be incredible. However the existing seismic analysis in Section 3.7 of SAR do not address the seismic adequacy of the basin whose original design did not consider a DBE event either. There are nevertheless significant vulnerabilities to SSCs due to a DBE as noted below:

a) The basin structure above the base mat is effectively separated into two segments via an expansion joint. There is also abrupt change in base mat continuity at the same location. To prevent leakage through the expansion joints, water stops have been installed. Because of the differences in the mass and rigidity of the two sections, the waterstops are potentially vulnerable to failure due to differential motion during a seismic event.

b) Due to inadequate steel reinforcements, the vertical frames in the Vertical Tube Storage (VTS) area have been identified to be inadequate to withstand a DBE. Since the VTS frames support the monorails and hangers from which RINMs are kept suspended under water, failure of the frames will cause failure of the RINM storage system in the VTS area.

c) Since none of the SSCs (eg. fuel handling crane and supports) inside the basin have been seismically qualified, their failure during a DBE can result in dropping of such items on the horizontally stored fuel assemblies. Similarly the dislodging of the cask handling crane with and without a suspended cask over the transfer bay pit during a DBE can not only damage any RINM that may happen to be in the pit, but also potentially perforate the pit floor. Additionally, stacking of slug buckets in the vicinity of the horizontally stored fuels can potentially cause the buckets to impact the fuel assemblies and damage them.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The failure of the water stops as well as a perforation of the transfer bay pit floor will result in a loss of water from the basin and may result in loss of necessary shielding and in severe situation uncovering of the RINM since the make up water system will not readily be available as it is not a seismically qualified system.

The failure of the VTS concrete frames, monorail and hanger structures as well as dropping of various non seismically qualified SSCs can result in nuclear criticality through rearrangement of the storage array, mispossitioning of fissile assemblies and crushing of fuel.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The leakage of basin water can release fission product in the environment depending on the release of the fissile materials in the basin water from a DBE event or from corrosion.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years since DBE is a relatively infrequent event.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # SRS -21	Site: Savannah River Site
Date: 10/7/93	Facility: L, K & P Reactor Disassembly Basins

<u>Block #7:</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

None

<u>Block #8 (Optional):</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potential consequences include criticality in the pool, leakage of fission product in the environment, and radiation exposure to workers.

<u>Block #9 (Optional):</u> To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Perform a detailed seismic analysis and upgrade structures, systems and components.
as necessary to provide seismic stability. However, fixing expansion joints and waterstops will be very involved.

Signature, Team Member

Signature, Team Leader

SPENT FUEL INITIATIVE

Oak Ridge Site

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM

Vulnerability # 1	Site: ORNL
Date: 10/6/93	Facility: Molten Salt Reactor Experiment (MSRE)

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Radioactive Material Migration from the Molten Salt Reactor Storage Tanks.

Block #2: Executive Summary of Vulnerability (- 50 words)

Apparently there has been some migration of radioactive materials into piping associated with the drain tanks where the MSRE is stored. The indication of a problem comes from elevated radiation within a restricted area of the facility. The source of the radiation is still within the primary containment.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The reactor salt is stored in solid form in two drain tanks, with a small fraction of the uranium salt in a third "flush" tank. The drain lines have been cut and plugged, but the cover gas lines and process lines are intact. Higher than expected radiation has been noted in the basement of the facility near the lines. Sampling is being done to determine the nature of the source, which is expected to be mobile daughter products of U-232.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Direct exposure of personnel is the immediate concern, although the problem is in an area of the facility that is rarely visited. Barring a major seismic event, there is little chance for release of contamination.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Worker health and safety. Any concern is confined to the facility.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years. The reactor salt has been in storage since shutdown in 1969. It is frozen; any evolution of its condition seems to be gradual.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The radiation level could increase to the point where access to effect a solution could be difficult. Currently unexplained migration of radioactive material may be indicative of minor degradation of the fuel material in its storage tanks.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # 1	Site: ORNL
Date: 10/6/93	Facility: Molten Salt Reactor Experiment (MSRE)

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Administrative control is probably best for the short term. Sampling of the pipes and modeling of the conditions should be done before a fix is implemented.

H. E. McDaniel HM — Signature, Team Member

William C. Dinning — Signature, Team Leader

Simple Sol'n

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # 2	Site: ORNL
Date: 10/5/93	Facility: TSR-II

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Possible collapse of steel truss tower structure of TSR-II facility due to earthquake loads.

Block #2: Executive Summary of Vulnerability (~ 50 words)

The dominant structural feature of TSR-II are the four (4) 315 ft. high steel towers arranged on a 100 ft. x 200 ft. rectangle. Each tower is pinned at its base and is stayed at its top by substantial cables. Designed in 1953-54, it is likely that earthquake loads were not directly included in the design. While the seismic resistance may be substantial, collapse of one or more towers during a seismic event is possible. No direct damage to the stored fuel is expected, but it is possible that the 11-in. thick lead shield door could be toppled off the reactor shield, thus resulting in a high, direct radiation exposure to workers.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The 11-in. thick lead shield door panel located on the east face of the TSR-II biological shield seals off the radiation emanating from the spent fuel stored in the reactor vessel. It was opened intermittently during reactor operation to allow radiation to strike various shielding materials. The heavy door slides on fairly tight-fitting guides and is restrained by a heavy aluminum plate bolted to the concrete. During a significant seismic event it is judged that the door will remain in place. However, the door could be dislodged if struck by a collapsing tower.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

If the lead shield falls away from its mounting, there is essentially no biological shielding of the shutdown reactor. The resulting radiation level would be quite high and could hamper recovering operations following an earthquake, or it could result in excessive radiation dose to recovery workers.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The health and safety of workers is potentially threatened.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Less than 1 year. The reactor is scheduled for D&D in the next 2-3 years. While the probability of a significant seismic event is low over that period, the potential fix seems simple and inexpensive.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # 2	Site: ORNL
Date: 10/5/93	Facility: TSR-II

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Possible exposure of any workers trying to restore the facility following a seismic event.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Placing several large concrete shield blocks (already on the TSR-II site) against the lead shield door would effectively block the lead door and prevent its falling during an earthquake.

Ralph Weidenbaker — Signature, Team Member

William C. Dimmel — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # 3	Site: Tower Shielding Facility
Date: 10/5/93	Facility: Building 7708

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Potential for fire and activity release from stored reactor fuel.

Block #2: Executive Summary of Vulnerability (~ 50 words)

A gasoline-fueled forklift truck is parked close to 20 steel drums containing 1200 reactor fuel pins that had been irradiated by the Tower Shielding Facility reactor. If the gasoline leaks and causes a fire the fuel could be engulfed causing the release of activity in extreme cases.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Gasoline leaks could be the cause of a fire in building 7708. Ignition could occur from faulty electrical connections in the forklift truck.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

If there is a sustained fire in the fuel storage drum area then fuel damage and activity release could conceivably occur.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Most released activity would be expected to stay within the building. Workers would be exposed during fire fighting and cleanup.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Less than one year. The urgency is moderate but keeping the forklift truck and all flammable fluids outside of the building would remove the vulnerability.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The stored fuel is supposed to be shipped offsite "within a few weeks." The forklift was removed from the building during the WGAT visit, thereby removing the vulnerability.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # 3	Site: Tower Shielding Facility
Date: 10/5/93	Facility: Building 7708

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequence involves local release of activity and worker exposure during remediation. As mentioned above, the forklift truck was removed from Building 7708 during the WGAT visit, and the current plan is to ship the fuel to another site "within a few weeks." These actions remove the vulnerability.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Immediately remove all flammable fluids from the building and relocate the irradiated fuel as soon as practicable (less than one year).

Peter Soo PS — Signature, Team Member

William C. Dennis — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # 4	Site:ORNL
Date:October 5. 1993	Facility:7823A/7827/7829 Wells

Block #1: **Title of Vulnerability** (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Release of radioactive material to the environment as the result of corrosion failure of stainless steel wells 7823A, 7827, and 7829.

Block #2: **Executive Summary of Vulnerability** (~ 50 words)

There is a potential for corrosion failure of stainless steel wells 7832A, 7827, and 7829 to release irradiated fuel and associated fission products to the environment. The long-range plans identify that the contents of these wells must be retrieved and placed in above-ground storage. Funding for the retrieval of this material and the above-ground storage facility has not yet been committed

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The irradiated fuel is stored in stainless steel wells which are exposed to the underground environment and will eventually fail. The funding for an above-ground storage facility and retrieving the material has not been committed.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of irradiated fuel and associated fission products to the environment.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The environment will be potentially affected and possibly the public health and safety via ground water flow.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Greater than 5 years. The stainless steel will eventually fail after exposure to environmental conditions.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # 4	Site:ORNL
Date:October 5, 1993	Facility:7823A/7827/7829 Wells

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

The long-range plan identifies that this fuel must be retrieved and placed in above-ground storage. Ground water monitoring will provide an indication of whether the wells have failed.

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The wells could fail and release radioactive material to the environment.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Provide appropriate funding for an above-ground storage facility and retrieval of the material when the above-ground storage facility has been completed.

Paul E Rutto PR — Signature, Team Member

William C Dennis — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # 5	Site: ORNL
Date: October 5, 1993	Facility: HRE Wells

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Irradiated fuel and associated fission products released to the environment from HRE storage wells.

Block #2: Executive Summary of Vulnerability (~ 50 words)

In 1964, 135 gallons of 4M sulfuric acid containing 4.5 kg of uranium and associated fission products were placed in 7 wells, each of which were 1 foot in diameter and 17 feet deep. Each well was then filled with dirt and marked with a brass plate (apparently imbedded in concrete cap). The status of the material is unknown and possibly free to migrate through the groundwater environment into White Oak Creek.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The material, which was the HRE fuel in sulfuric acid solution, was not contained when it was placed in the wells. Rain seepage and groundwater flow could potentially cause the material to migrate to White Oak Creek. Mitigating circumstances may be the small inventory, limited burnup, and soil which slow the migration. The need for remedial action has been identified, but not yet scheduled.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products and uranium to the environment.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The environment is affected and offsite releases would be affected if the material reaches White Oak Creek and flows downstream.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Greater than 5 years based on the fact that monitoring wells in the vicinity of these wells have not yet indicated that migration has reached White Oak Creek.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

These wells have been included in future remediation plans, but have not yet been scheduled.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # 5	Site: ORNL
Date:October 5, 1993	Facility:HRE Wells

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The fission products (Sr-90 and Ru-106, and probably Cs-137) would be detectable in the stream and the downstream impoundment and contribute to offsite releases.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

The remediation program has identified the potential corrective action; but some additional ground water monitoring would indicate if migration had begun and the extent of the potential problem.

Paul E. Barkett PR — Signature, Team Member

William C. Dermott — Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 1)
Vulnerability # 6	Site:Oak Ridge National Laboratory
Date:10/6/93	Facility:Classified Burial Ground

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Uranium of unknown quantity was placed in unknown locations within the Classified Burial Ground in the 1970's.

Block #2: Executive Summary of Vulnerability (- 50 words)

Current retrievable records indicate that enriched uranium (not certain that the material was irradiated) was placed in an active waste disposal area in the 1970's. Available records contain a partial listing of material inventory; however, the exact location of each unit is not known.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The uncertainty of the quantities, packaging, and exact location increases the risk to workers during remediation work and increases the cost of planning the remediation effort and make it difficult to establish an appropriate priority

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

The lack of information concerning the location of this material will adversely affect any remediation efforts planned. Also, because the burial packaging is not known, the current condition of the fuel cannot be determined. The site criticality committee has reviewed this situation and has determined, based on their evaluation of the records, that the potential for a criticality event is low and that attempts to locate the material could place the worker at a higher risk. The contractor is currently researching the records and plans to contact the originator for additional information.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Lacking the exact location of these materials creates a hazard to the worker during the remediation process for the waste disposal area. Also, the burial packaging of this material is not known. Because of this, the potential exists that the material has leaked to the environment, resulting in an impact on the environment and potentially the public.

VULNERABILITY DEVELOPMENT FORM	(Page 2)
Vulnerability # 6	Site:Oak Ridge National Laboratory
Date:10/6/93	Facility:Classified Burial Ground

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years: The contractor is currently working this issue and has developed a program to actively research the origin of this material. This effort should be continued with the anticipation that most of the unknowns will be resolved. The site has an active environmental monitoring program that should identify any concerns associated with environmental releases.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8: To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Left unmitigated, this vulnerability could result in remediation workers being exposed to higher levels of radiation than necessary. If the material was not appropriately packaged prior to burial, radionuclides could be introduced in to the environment.

Block #9: To the best of your collective abilities, describe abilities, suggest or recommend the most rational fix to this vulnerability:

Allow the contractor to continue with the current plan. The local DOE operations office should monitor the progress of this effort to ensure that adequate progress is made.

William C Dennis WD
Signature, Team Member

William C Dennis
Signature, Team Leader

SPENT FUEL INITIATIVE

West Valley Demonstration Project Site

VULNERABILITY DEVELOPMENT FORMS

File "WestVall.VuL"

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # FRS 01	Site: West Valley
Date: 10/04/93	Facility: Fuel Receiving and Storage

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Lack of Systems for Leak Detection and Mitigation.

Block #2: Executive Summary of Vulnerability (- 50 words)

The FRS has no leak detection system. Small leakage under normal conditions is uncertain. There is no secondary containment or other means to mitigate leakage.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Pool leaks were repaired after construction and in 1972 when pool was drained to stop inward seepage due to the site's high water table. Little is known about repair techniques and materials and their aging properties. The current process for detecting leakage is based on knowing differences in pool levels and subtracting out evaportation estimated from trending data. This process can not detect a leak of two gallons or less. (Tests will be conducted soon which will seal pool from evaporation and measure leakage from current pool conditions. Additionally, a more accurate means of measuring pool levels was installed in September 1993.) There is also no secondary containment or other systems to mitigate leaks from normal or accident conditions. There is also no alternate on-site storage facilities for the fuel. Events causing cladding failure and breach of pool integrity (e.g. an earthquake) could result in the escape of radionuclides that could not be measured and easily controlled following the event. Mitigation of accidents leakage would need to be handled on an ad-hoc basis.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Fission products released to ground water could not be measured with certainty and leakage could not be easily stopped.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Environment.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # FRS 01	Site: West Valley
Date: 10/04/93	Facility: Fuel Receiving and Storage

<u>Block #6:</u> Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years.

<u>Block #7:</u> Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

WVNS and DOE have raised this concern earlier, and note it in the response to Question #4 and Question #8.

<u>Block #8 (Optional):</u> To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

<u>Block #9 (Optional):</u> To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Proceed with planned removal of fuel.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # FRS 02	Site: West Valley
Date: 10/4/93	Facility: Fuel Receiving and Storage

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Inadequate water chemistry monitoring program for the spent fuel pool.

Block #2: Executive Summary of Vulnerability (- 50 words)

The current water chemistry monitoring program does not ensure the structural and material integrity of fuel assemblies. Incomplete chemical analyses and lack of trending of analytical results prevent early warning of potential corrosion problem of the fuel assemblies.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The current water chemistry monitoring program requires only monthly pH analysis. No chloride, sulfate, and hydroxyl ion analyses are required. In addition, conductivity measurements were not made. There are no in-line or on-line chemistry monitors installed. No trending of analytical results are available either. These deficiencies contribute to the vulnerability of potential corrosion and cracking damage to the fuel assemblies.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

If potential corrosion and cracking problems exist, depending on the extent of damage and total number of cracked fuel rods, the potential release of fuel from a large number of damaged rods could lead to a fission product release concern. Especially there is no requirement for chemical and radiochemical analysis of the sludge in the fuel pool.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

The immediate threat is to the workers, the next is to the environment, and then to the public health and safety. The current practice does not meet the intent of ALARA.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

WVDP agrees with some of the deficiencies and has already initiated corrective actions including improved water chemistry monitoring program. These actions are expected to be fully implemented by mid 1994.

VULNERABILITY DEVELOPMENT FORM	(Page 4)
Vulnerability # FRS 02	Site: West Valley
Date: 10/4/93	Facility: Fuel Receiving and Storage

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor: (The following was faxed to NS on 10/8/93:)

West Valley agrees with the Assessment Team, for conductivity and pH. As stated in block 5, the current water chemistry monitoring program requires only pH analysis. However, in an un-buffered solution (like the FRS pool water), measurement of ph will indicate hydroxyl ion concentration. Monthly conductivity measurements will be added to the facility procedure by November 1993. Conductivity measurements have been performed on an as-needed basis. Analysis performed in April 1993 indicates agreement between the conductivity at 18.4 micro hos/cm^2 and the concurrent pH measurement of 7.8. In-line concurrent pH and conductivity probes will be placed in service by mid 1994. After the new instrumentation and a data acquisition computer are placed in service, the data will be trended.

WVDP and its consultants are in technical disagreement with the Assessment Team concerning corrosion of zirconium fuel. Elevated levels of sulphate can attack aluminum, not zirconium. Elevated levels of chloride will cause pitting corrosion of zirconium, not stress corrosion cracking. Zirconium corrosion at ambient temperature, in pool water will be minimal. The 40 PWR and the 85 AWR spent fuel assemblies stored in the pool at West Valley are made with zirconium cladding, and are stored in aluminum canisters.

Additionally, West Valley monitors the pool water for gross beta activity monthly. There has been no step increase in pool water activity that would indicate fission product release from a large number of damaged rods.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Potential contamination of environment is the threat if left uncorrected.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Fully implement a new water chemistry monitoring program comparable to that employed in commercial nuclear industry.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM	(Page 5)
Vulnerability # FRS 03	Site: West Valley
Date: 10/4/93	Facility: Fuel Receiving and Storage

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Unknown Condition of Fuel Cladding.

Block #2: Executive Summary of Vulnerability (- 50 words)

Only a visual external surface inspection of the fuel elements has been performed causing uncertainty of the structural integrity of fuel cladding to contain fission products during handling.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Seven fuel elements with perforated and broken fuel rods exist in the pool, as determined by visual inspection of the exterior surfaces of all 125 bundles. The condition of the interior fuel rods of fuel elements stored is unknown.

The unknown water chemistry and general condition of the fuel elements prior to 1982 creates uncertainty of the structural integrity of fuel rods.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Release of fission products could occur as fuel elements are moved for shipment off-site.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Workers may be exposed to elevated exposure rates due to release of fission product gases.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Probably 1-5 years since WVNS is planning to ship all fuel off-site by end of 1995.

VULNERABILITY DEVELOPMENT FORM (Page 6)	
Vulnerability # FRS 03	Site: West Valley
Date: 10/4/93	Facility: Fuel Receiving and Storage

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Accelerated fuel structural failures were not evident during the inspection performed in 1989. Installation of new demineralizer system and trending of water quality and radioactivity removed should give some indication of future cladding failures.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Personnel performing handling operations during shipping could be exposed to unusually high levels of radiation exposure.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Precautions and procedures to handle situations where a fuel bundle (element) falls apart will be necessary when fuel shipment is authorized.

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 7)	
Vulnerability # FRS 04	Site: West Valley
Date: 10/15/93 (after site visit)	Facility: Fuel Receiving and Storage

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Seismic vulnerability of building and fuel storage racks.

Block #2: Executive Summary of Vulnerability (~ 50 words)

The building housing the Fuel Receiving and Storage Facility and the fuel storage racks will could collapse at levels below the design basis earthquake. Criticality accidents resulting from gross seismic and wind failures have not been analyzed. Such accidents would affect worker safety.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The Fuel Receiving and Storage Facility building housing the pool apparently has not been rigorously evaluated for earthquakes and winds. As stated in the Site Team Report (response to Question 4), a potential concern is the "lack of" .... a "building designed to prevent massive collapse of building structures or the dropping of heavy objects onto the stored IFM" (i.e, spent fuel) "as a result of building structural failures."

A large masonry wall is at the end of the facility near the fuel elements. If un-reinforced (the Site Team was unable to verify that the wall had reinforcement), this wall is a significant seismic vulnerability in that it could fail at moderate earthquake levels and fall on top of the spent fuel.

EM's Technical Review Group found a number of non-conservative assumptions in analyses intended to show the fuel storage racks could marginally withstand earthquakes near the DBE (0.2g). The SAR thus conservatively considers failure of all 125 fuel assemblies in its bounding wind/earthquake accident for radiological release. However, the unfavorable geometries resulting from gross building, rack, canister, and fuel failure has not be evaluated for potential criticality accidents.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Gross failures of the building and storage rack could lead to crushing of the canisters and fuel or other un-analyzed geometries which may have a potential for criticality accidents. The likelihood, or frequency, of such an accident is unknown since the failure levels of the affected structures are unknown.

VULNERABILITY DEVELOPMENT FORM (Page 8)	
Vulnerability # FRS 04	Site: West Valley
Date: 10/15/93 (after site visit)	Facility: Fuel Receiving and Storage

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Un-analyzed criticality accidents resulting from gross seismic and wind failures could affect worker safety.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

This potential vulnerability was developed after the site visit. Thus unlike the other potential vulnerabilities, it was not subject to review discussion by the Site Team during the visit. This potential vulnerability is discussed in detail in the version of the Assessment Team report now undergoing factual accuracy review by West Valley. It input from West Valley gives justification that this issue is not a potential vulnerability, then this form will be withdrawn and the report changed to reflect the new information.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

The consequences could be severe to site and emergency rescue workers. The frequency of these accidents need to be estimated using realistic failure analyses. The use of the DBE frequency would be non-conservative.

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Potential criticality accidents resulting from gross seismic and wind failures should be addressed in the SAR.

Signature, Team Member

Signature, Team Leader

SPENT FUEL INITIATIVE

Los Alamos National Laboratory

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # LA-1	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #1: **Title of Vulnerability** ***(Begin Title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.)***

Spent Fuel And Pool Vulnerability To Damage From Falling Boulders At The Omega West Reactor Facility.

Block #2: **Executive Summary of Vulnerability** ***(Approximately 50 words)***

The Omega West Reactor (OWR) is located at the bottom of the Los Alamos Canyon between the North and South mesas of Los Alamos, NM. The OWR spent fuel pool (SFP) could be vulnerable to damage from missiles generated by natural phenomena events (i.e., earthquakes, erosion). The missiles would consist of large boulders dislodged from the canyon walls above the facility and concrete blocks or other debris resulting from a large boulder impacting the facility. The exterior walls of the OWR building are constructed of unreinforced concrete block which would provide no effective resistance to penetration from boulders falling from canyon wall above the facility. Boulders have fallen in the past (15 detected in a 25 year period), and the walkdown inspection indicated large boulders have fallen to the bottom of the canyon. It should also be noted that other facilities (TA-41) and personnel located in this same canyon are exposed to this same vulnerability to falling boulders.

Block #3: ***(Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.)***

The facility is located in a canyon with large boulders (many in the range of 3500-7000 ft^3) located above on the canyon walls. Natural forces (seismic, erosion, etc.) could result in dislodging large boulders that could penetrate the OWR building and damage the spent fuel pool and/or rearrange the fuel element configuration. The facility's outer walls are constructed of unreinforced concrete block, which historically performs very poorly in a seismic event. Blocks from the walls could become missiles during a seismic event or as the result of a boulder impacting the building. The unreinforced wall construction would offer no effective resistance to penetration from a boulder. A boulder could be dislodged by a seismic event; however, historical data show that it is more likely that a boulder would be dislodged by erosion. It should be emphasized, however, that a seismic event is not necessary to create this problem. Natural erosion, including rainfall, freeze-thaw cycles, and other natural daily events could initiate a boulder fall.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # LA-1	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #4: ***(Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.)***

Adverse conditions that could result from falling boulders or other missile damage to the SFP include release of fission products and/or criticality concerns.

Block #5: ***(Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.)***

Worker safety and health and the environment could be affected by the event. Damage to the SFP could result in increased worker exposure and possible contamination of the environment in proximity to the facility.

Block #6 (Optional): ***(Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.)***

The urgency of any corrective action will depend on the operational status of the reactor. If the reactor is restarted, no fuel elements will be stored in the SFP and this vulnerability becomes moot. If the reactor is not restarted the fuel elements in the SFP will be relocated to the CMR facility and this vulnerability becomes moot. This vulnerability should be addressed in the 1-5 year time frame, if fuel continues to reside in the SFP. It should also be noted that boulders have fallen (15 detected in a 25 year period), and the walkdown inspection indicated large boulders have fallen to the bottom of the canyon.

Block #7 (Optional): ***(Additional comments, views, or plans by the Site Operations Office and M&O Contractor.)***

Block #8 (Optional): ***(To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.)***

If spent fuel remains in the SFP and this vulnerability is not addressed, the consequences of a boulder (or other missile) impact could include wide spread physical damage to the facility, injury to personnel, increased personnel exposure, and environmental damage.

VULNERABILITY DEVELOPMENT FORM (Page 3)	
Vulnerability # LA-1	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #9 Optional: ***(To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.)***

One possible fix to this vulnerability is to determine a viable method of stabilizing the boulders on the canyon walls above the facility and then perform the appropriate remedial action.

M. E. [illegible] Peter K Nagata
[illegible]
[illegible] Miller

Signature, Team Member

[illegible]

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # LA-2	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #1: Title of Vulnerability ***(Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.)***

Potential Damage to Spent Fuel and Pool from Dislodging of the Overhead Crane during a Seismic Event at the Omega West Reactor.

Block #2: **Executive Summary of Vulnerability** ***(Approximately 50 words)***

No procedural controls currently exist to prevent parking of the overhead crane above the spent fuel pool (SFP). The crane was not constructed to prevent possible dislodging from the rails and subsequent damage to the SFP during a seismic event.

Block #3: ***(Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.)***

The 12K (rated load) overhead crane is routinely parked over the SFP. The crane has no retainers that would prevent its dislodging during a seismic event.

Block #4: ***(Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.)***

Criticality, release of fission product's or hazardous materials direct exposure, and institutional failure are adverse conditions that could arise form the conditions described in Block 3.

Criticality, release of fission product's or hazardous materialsand worker exposure could be affected in the event the crane became dislodged during a seismic event and impacted the SFP. This could be an institutional failure since no procedure exists to prevent the crane from being parked over the SFP while fuel is in the pool.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # LA-2	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #5: ***(Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.)***

Environment and worker safety could be affected by these conditions.

Worker safety could be affected directly if the crane became dislodged. Increased worker exposure could result from damage to the SFP if the crane were dislodged during a seismic event. The environment in the proximity of the facility could also be affected in this scenario by the possible release of contamination from the SFP.

Block #6 (Optional): ***(Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.)***

Institutional control of the parking location of the crane should be addressed immediately (< 1 year) by a relatively simple procedural change. Modifications to the crane to prevent dislodging during a seismic event could be addressed on a longer time scale (1-5 years) due to the reduced probability of the event.

Block #7 (Optional): ***(Additional comments, views, or plans by the Site Operations Office and M&O Contractor.)***

A memorandum to the operations staff's directing them to park the crane away from the pool as long as fuel is stored there.

Block #8 (Optional): ***(To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.)***

Block #9 Optional: ***(To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.)***

1. Develop procedural controls to prevent parking the crane over the SFP while fuel elements are in the pool.

2. Modify the crane to prevent possible dislodging during a seismic event.

Peter K. Nagata

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # LA-3	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

<u>Block #1:</u> <u>Title of Vulnerability</u> ***(Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.)***

Lack of Long Term Safety Analysis for Fuel Storage at Omega West Reactor (OWR).

<u>Block #2:</u> <u>Executive Summary of Vulnerability</u> ***(Approximately 50 words)***

The effects of long term storage of fuel elements at the OWR have not been formally evaluated. Unspecified hazards may however, exist outside the current safety envelope.

<u>Block #3:</u> ***(Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.)***

Because of the expected short term storage of spent fuel from the OWR in the OWR pool, the current safety analysis does not formally address potential long term effects. However, with the uncertainty of reactor restart for the OWR, and the uncertainty of shipping date for fuel from the CMR, the adequacy of the current safety analysis is challenged. Examples of items which would be considered for the long term safety analysis are 1) differential aeration cells from bio-fouling (bacteria or algae growth) which eventually can lead to pitting and 2) adequacy of emergency actions (e.g., response to pool drainage).

<u>Block #4:</u> ***(Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.)***

All categories may exist and should be examined in a study of long term storage.

<u>Block #5:</u> ***(Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.)***

The risks to environment, worker, and public should be better quantified in a study of long term storage.

VULNERABILITY DEVELOPMENT FORM (Page 2)

Vulnerability # LA-3	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #6 (Optional): ***(Describe urgency of corrective actions (if any). Use < 1 year, 1-5 years, and > 5 years). Explain reasoning.)***

Urgent - < l year.

If perforation of the aluminum fuel cladding has untoward consequences, the possibility of pitting the cladding by bio-fouling should be ascertained by a literature search, consultation, experiments, or all three.

1-5 years

Hazards as a result of long term storage would not be expected to result in any immediate risk.

Block #7 (Optional): ***(Additional comments, views, or plans by the Site Operations Office and M&O Contractor. These would not negate a potential vulnerability.)***

LANL expects a decision from DOE regarding the future status of the OWR within the next 1-2 months. At that time, fuel will be removed from the pool. Hence, no long term safety analysis is deemed necessary.

Block #8 (Optional): ***(To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.)***

Possible fuel degradation leading to increased risks of exposure.

Block #9 Optional: ***(To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.)***

Perform long term safety analysis specific to the expected length of time of pool residency of the aluminum cladding. Determine whether pitting can occur by bio-fouling, and if it can, determine the speed at which it might occur.

Peter K Nagata

Signature, Team Member

Signature, Team Leader

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # LA-4	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #1: **Title of Vulnerability** ***(Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.)***

Vulnerability of Criticality Unsafe Storage Configuration at Omega West Reactor.

Block #2: **Executive Summary of Vulnerability** ***(Approximately 50 words)***

Recent need for additional fuel element storage in the OWR storage pool has been met by placing fuel in arrays which meet theoretical critical-safe configurations. Administrative oversight is used to limit the number of elements so stored. The possible failure of administrative oversight, together with ambiguities of configuration could present a vulnerability to criticality.

Block #3: ***(Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.)***

The OWR pool has critical-safe racks for 32 elements. When more than 32 elements are stored in the pool, there is a potential for inadequate control to prevent either the number or the configuration of stored fuel elements from reaching criticality. The practice of seeking ad hoc criticality safe fuel storage locations to accommodate unusual fuel numbers, but without defining these locations by structures which provide <u>unambiguous positioning and prevention of misplacement,</u> leaves the vulnerability of criticality since personnel still have latitudes in positioning of additional fuel.

Block #4: ***(Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.)***

Criticality resulting in both fission product release (to a storage pool) and direct exposure to workers.

Block #5: ***(Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.)***

Worker health and safety.

Potential destruction of stored fuel configuration resulting in criticality will lead immediately to gamma and neutron doses to workers.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # LA-4	Site: Los Alamos
Date: 10-4-93	Facility: Omega West Reactor (OWR)

Block #6 (Optional): ***(Describe urgency of corrective actions (if any). Use < 1 year, 1-5 years, and > 5 years). Explain reasoning.)***

Urgent. (< 1 year). Administrative controls, including training and signing, should prohibit the number of fuel elements residing outside of critically safe racks from exceeding a number determined critically safe in any configuration (including moderators and reflectors).

Block #7 (Optional): ***(Additional comments, views, or plans by the Site Operations Office and M&O Contractor.)***

A criticality analysis has been performed for a Unreviewed Safety Question Determination (USQD) regarding this situation. In that analysis, eight elements were considered as being free to migrate about the pool. Currently only six elements reside in the pool outside the baskets. The analysis concluded that even if all eight elements were to assemble in a planer array, side by side, K would be < 0.75. Hence, given that pool storage is anticipated to be only temporary, no further controls are believed to be required at this time.

Block #8 (Optional): ***(To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.)***

See Block #3.

Block #9 Optional: ***(To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.)***

As described in Block #6 for near term. If the OWR is to continue operation, additional criticality-safe racks should be fabricated.

M. E. Vigil   Peter K. Nagata

Signature, Team Member   Signature, Team Leader

SPENT FUEL INITIATIVE

Brookhaven National Laboratory

VULNERABILITY DEVELOPMENT FORMS

File "HFBR.VUL"

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # HFBR-1	Site: Brookhaven
Date: 10/7/93	Facility: High Flux Beam Reactor

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Unevaluated seismic resistance of spent fuel and racks.

Block #2: Executive Summary of Vulnerability (~ 50 words)

Spent fuel racks are unanchored. Earthquake response (including tipping and sliding impact) could lead to fuel damage and unfavorable geometries. Potential post-earthquake criticality appears to be of greater significance than fuel leakage.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

The spent fuel racks are not anchored to the canal and might slide and tip during earthquakes. Racks could also impact canal walls and other racks. The racks, baskets, and fuel have not been analyzed for earthquakes, although the fuel itself appears to be inherently rugged and maintained in good condition.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Earthquakes might damage racks, (crush, tip) and baskets might fail and drop fuel. This could lead to unfavorable geometries and possible criticality. Breaking of fuel cladding might also occur, but the likelihood and consequences of this appears to be less significant than criticality due to the fuel element ruggedness and form of fuel.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

Workers - from criticality effects.

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

1-5 years.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # HFBR-1	Site: Brookhaven
Date: 10/7/93	Facility: High Flux Beam Reactor

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

BHO and BNL identified the seismic resistance of the spent fuel and racks as the most important ES&H concern in their Site Team Report (response to Questions #5 and #8). A plan to evaluate this seismic issue was issued to NE-44 in September 1993.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

BHO and BNL should continue with plans to evaluate issue and implement fixes needed.

Signature, Team Member

Signature, Team Member

File " BMRR.INV "

FUEL SUMMARY FORM	(Page 1)
Site: Brookhaven	Facility: Medical Research Center
Date: 10/7/93	Location: Upton, New York

Fuel Information

1 Fuel Name. BNL Medical Reactor (BMRR) Spent Fuel-type (DOE project BNL Medical Reactor C-KP-0601-000)

2 Owner: Brookhaven National Laboratory under DOE prime contract # DEAC02-76CH00016. ER owns fuel.

3 Reactor Name/Reactor Type: Brookhaven Medical Research Reactor (BMRR). Research Reactor - light water moderated and cooled.

4 Fuel Unit/Number of Fuel Units: Fuel Element / 4 elements stored inside reactor vessel in storage ring above reactor core. (Fuel normally is kept inside reactor core - there are currently 31 elements inside the 32 locations of the reactor core.)

5 Total Mass: Approximately 140-190 gms depending upon the type of element used. <u>Note:</u> Use of 70g elements is not planned at this time.

6 EOL U: At least 58% present of original U-235 for 190g element - 110g or 140g element - 81g. 70g element - 41g.

7 Total metric tons of initial heavy metal: 3.77×10^{-4} MTIHM per fuel unit.

8 Fuel Configuration: Curved plate MTR type consisting of 18 or 19 curved fuel bearing plates, two grooved side plates, three types of FE are in use 19 plate (190g), 18 plate (140g) and partial element with thimble passages for incore experiments (70g).

9 Length: 60.0 to 62.5 cm.

10 Fuel Compound or Alloy: U-AL alloy.

11 Fuel Condition: Remaining fuel and MFP are completely contained within cladding. Burnup of U235 atoms limited to 42% maximum. One of four stored elements gave off gas when in operation - but not when removed from the core.

12 Initial Enrichment: 89 - 93% U235 nominal.

13 Cladding Material: Aluminum Type 1100.

14 Cladding Condition: Good, based on weekly monitoring and samples of the vessel light water, there is no indication of deterioration of the fuel cladding (same monitoring as for elements in reactor core).

15 Heat Generation: Depends on power history: Currently in watt range for 4 stored fuel elements (less than 1,000 watts for all four).

Signature, Team Member

Signature, Team Leader

FACILITY BACKGROUND FORM	(Page 2)
Site: Brookhaven	Facility: Medical Research Reactor
Date: 10/7/93	Location: Upton, New York

Facility Information

1-1 Classified Fuel: None

1-2 Owner: Department of Energy Funded by ER, managed by NE-44.

1-3 Operating Contractor: Associated Universities Incorporated (AUI).

1-4 Facility Description: The BMRR is a 3 MW unpressurized water reactor. It is moderated and cooled with light water.

1-5 Facility Age: 34 years.

1-6 Facility Mission: The primary purpose of the BMRR is to provide neutron beams for developing an effective tumor treatment by Neutron Capture Therapy NCT). In addition, the BMRR has the capability for isotope production and activation analysis. The reactor is designated user facility and is available to all qualified researchers.

1-7 Facility Future Plans: Funding has been requested to support Boron Neutron Capture Therapy (BNCT) clinical trials. BNCT clinical trials will not significantly impact fuel usage.

1-8 Future Expansion Plans: None.

1-9 Leak Detection in Operation: Monitoring of reactor primary coolant.

Storage Information

2-1 Storage Unit. Fuel Storage Rack Position.

2-2 Number of Storage Units. 4 in reactor storage ring (as of 10-4-93)

2-3 Fuel Units/Storage Unit. Fuel Element (FE) - consists of fuel bearing section of assembly with moderator/coolant inlet and outlet structures removed.

2-4 Time in Storage: The oldest fuel element presently stores was discharged to the spent fuel storage rack approximately 4 years ago.

2-5 Storage Condition: There is no indication of deteriorating conditions. One of four stored elements leaked gas while in core, but not outside core.

2-6 Maximum Cask Handling Capability: Not certified DOT cask.

2-7 Fuel Handling Limitations: Can handle only one element at a time.

2-8 Storage Mode: Wet.

2-9 Number of Storage Locations: 24.

2-10 Number of Storage Locations Available: 20.

2-11 Lined or unlined: Unlined.

2-12 Cleanup System Status: Use reactor water cleanup system.

2-13 Brief Description: Fuel stored in storage ring inside reactor vessel and above the core.

2-14 Storage Medium: reactor coolant - light water

2-15 Cover Gas: No cover gas on reactor.

Signature, Team Member

Signature, Team Leader

SPENT FUEL INITIATIVE

Sandia National Laboratories

VULNERABILITY DEVELOPMENT FORMS

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability # SNL-1	Site: Sandia National Laboratory
Date: 10-7-93	Facility: Monzano Storage Structures, Sandia Pulse Reactor, Hot Cell Facility, and an SNM Storage Facility.

Block #1: Title of Vulnerability Begin title by identifying or naming the inadequacy and end with identification of the facility. Use 20 words or less.

Lack of Current Approved Safety Analysis for Spent Fuel and RINM Located in Storage Facilities Associated with the Sandia National Laboratory.

Block #2: Executive Summary of Vulnerability (Approximately 50 words)

The current approved safety analyses do not adequately address the storage of spent fuel and RINM for Manzano Storage Structures, Sandia Pulse Reactor (SPR), Hot Cell Facilities (HCF), and one classified location. The need for upgrading Sandia National Laboratories (SNL) nuclear facility Safety Analysis Reports (SARs) to meet DOE 5480.23 has been recognized, and an implementation plan has been sent to DOE. This plan, in conjunction with the old SARs, is considered the authorization basis for the facilities. The updated SARs will specifically provide safety analysis for spent fuel and RINM storage locations when implemented.

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability.

Safety analysis for spent fuel and Reactor Irradiated Nuclear Material (RINM) storage does not exist for Manzano and the current safety analysis for SPR does not include the yard storage area (preliminary hazard assessments (PHAs) do exist). The currently approved HCF SAR and the PHAs for the HCF describe storage facilities and potential releases, but are not comprehensive in covering all potential accident scenarios. Safety analysis for storage of spent fuel at a classified facility could not be verified.

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning.

All other categories, except criticality, could exist with magnitudes unknown without safety analysis. Criticality controls and procedures exists and a criticality safety program is in place at all storage locations.

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning.

The purpose of Safety Analysis is to quantify the risk to the worker, public, and the environment.

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability # SNL-1	Site: Sandia National Laboratory
Date: 10-7-93	Facility: Monzano Storage Structures, Sandia Pulse Reactor, Hot Cell Facility, and an SNM Storage Facility.

Block #6 (Optional): Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning.

1-5 years.

Based on review of the site team report, discussion with facility personnel, and the walkdown, the current storage locations are considered to be in a stable condition. However, proper risk management cannot be accomplished without a current safety analyses that address storage facilities.

Block #7 (Optional): Additional comments, views, or plans by the Site Operations Office and M&O Contractor.

The need for upgrading SNL nuclear facility SARs to meet DOE 5480.23 has been recognized, and an implementation plan has been sent to DOE. The updated SARs will specifically provide safety analysis for spent fuel and RINM storage locations when implemented.

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected.

Inadequate risk management and safety documentation of storage location.

Block #9 Optional: To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability.

Complete implementation plan for DOE Order 5480.23.

for Peter Nagata

Signature, Team Member   Signature, Team Leader

SPENT FUEL INITIATIVE

VOLUME II

SECTION 3

WORKING GROUP DOCUMENTS

The Secretary of Energy
Washington, DC 20585
August 19, 1993

MEMORANDUM FOR PETER N. BRUSH
ACTING ASSISTANT SECRETARY
ENVIRONMENT, SAFETY AND HEALTH

FROM: HAZEL R. O'LEARY Hazel R. O'Leary

SUBJECT: VULNERABILITY REVIEW OF IRRADIATED NUCLEAR MATERIALS CURRENTLY IN STORAGE

Recent events have highlighted the need for a thorough assessment of the environment, safety, and health vulnerabilities associated with the storage of irradiated nuclear reactor fuel and other reactor irradiated nuclear materials. This assessment will provide valuable base line information for important policy issues being addressed by this Department.

I am assigning the Office of Environment, Safety and Health the primary responsibility to identify, characterize, and assess the safety, health, and environmental vulnerabilities of the Department's existing storage conditions and facilities. Although the Office of Environment, Safety and Health is designated as the focal point for this initiative, I expect the full involvement and support from the program offices, operations offices, and management and operating contractors to gather information and conduct appropriate assessments.

By September 20, 1993, the Office of Environment, Safety and Health should provide the affected Headquarters and field elements a project plan that outlines needed support and schedules. The Assistant Secretary for Environment, Safety and Health will submit an initial report to me by November 20, 1993.

Attachment 1

SPENT FUEL INITIATIVE

Working Group Meeting
September 9-10, 1993

Location:

Bethesda Marriott
5151 Pooks Hill Road
Bethesda, MD 20814
(301) 897-9400

Time:

8:30 am Thursday September 9, 1993 to
3:00 pm Friday September 10, 1993

AGENDA:

Discuss Scope, Approach, Schedule
Identify Applicable Safety Criteria
Develop Question Set
Develop Project Plan
Discuss Assessment Output and Format
Team Criteria and DOE Team Visits
Tentative Schedules
Report Outline and Prioritization Approaches

EH Contacts:

Dan Guzy (301) 903-2428	Richland Field Office Facilities San Francisco Field Office Facilities
Pranab Guha (301) 903-7089	Idaho Field Office Facilities Nevada Field Office Facilities
Terry Mountain (202) 586-2775	Oak Ridge Field Office Facilities Chicago Field Office Facilities Rocky Flats Field Office Facilities
Sarbes Acharya (202) 586-1418	Albuquerque Field Office Facilities Savannah River Field Office Facilities

Department of Energy
Washington, DC 20585

SEP 2 1993

MEMORANDUM FOR ALL DEPARTMENTAL ELEMENTS

FROM: PETER N. BRUSH
ACTING ASSISTANT SECRETARY
ENVIRONMENT, SAFETY AND HEALTH

SUBJECT: SPENT NUCLEAR FUEL INVENTORY AND VULNERABILITY ASSESSMENT

On August 19, 1993, the Secretary directed a department-wide inventory and vulnerability assessment of stored spent nuclear fuel and other irradiated nuclear materials. A report, containing the inventory and assessment, is due to the Secretary by November 20, 1993. The purpose of this memo is to establish a Spent Fuel Working Group and to request personnel from Cognizant Secretarial Offices, Operations Offices, and Management and Operating Contractors to participate in the Working Group.

The Office of Environment, Safety and Health (EH) is coordinating the effort to establish a Working Group, to formulate the project plan by September 20, 1993 and coordinate the project. All Department of Energy sites having facilities containing spent nuclear fuel or irradiated production reactor or research reactor targets are included in this activity. DOE Operations Offices are requested to direct the Laboratories and Management and Operating Contractors to designate personnel that have the best technical knowledge of the inventory data, operations, and safety basis for storage facilities at their sites to participate as Working Group members in this project through November 1993. Large sites should designate at least two participants. It is recognized that cognizant personnel may be involved in the NEPA EIS activities and that this review presents a temporary dual assignment for some personnel. In considering your selections for Working Group participants, please note that, this review requires the development of a complete inventory and focusses on the environment, safety and health aspects of the storage conditions. The working group meeting is scheduled for September 9-10, 1993, at the Bethesda Marriott Hotel, 5151 Pooks Hill Road, Bethesda, MD. Attachment 1 contains the tentative meeting agenda, EH will coordinate further arrangements.

The inventory and vulnerability assessment should be conducted by the Management and Operating Contractors, Laboratories, and the line organizations with the Working Group members serving a coordination and validation role. The Project Plan will provide the assessment criteria and the Working Group will organize small validation teams to assist in finalizing the site report. The Working Group teams will visit the sites and meet periodically to create the November report to the Secretary.

Full participation of the responsible organizations in the Working Group activities will result in representing the report as the Department's assessment of its inventory and associated vulnerabilities.

This initiative has been coordinated with the Office of the Associate Deputy Secretary for Field Management. EH will continue to work with staff and contractors to minimize the impact on operations. Those sites that do not contain material subject to the inventory should simply consult with the EH staff members listed in the attachment. Please do not hesitate to contact EH with any questions.

Please contact the appropriate EH person listed on Attachment 1 to provide names and contact information of personnel selected as Working Group members.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

Attachments

cc:
Laboratories
All Management and Operations Contractors

CONCURRENCES: Field Management/DPearman 9 / 1 /93
Spent Fuels & Special Projects/JJicha 9 / 1 /93

SPENT FUEL INITIATIVE

September 20, 1993

PROJECT PLAN

DOE Working Group on Spent Fuel
Coordinated by the Office of
Environment, Safety and Health

PROJECT PLAN

For Initial Report on Assessment of Vulnerabilities of Department of Energy Storage of Irradiated Reactor Fuel and Other Reactor Irradiated Nuclear Materials

DOE Spent Fuel Working Group

September 20, 1993

TABLE OF CONTENTS

1.0 OBJECTIVE

The objective of this project is to produce Department-wide inventory data and environmental, safety and health (ES&H) vulnerability assessment of storage and handling of irradiated nuclear reactor fuel and other types of reactor irradiated nuclear materials. The assessment will provide base line information for important policy issues that are being addressed by the Department.

2.0 BACKGROUND

The Department of Energy's facilities for storing reactor irradiated nuclear materials (defined below in Scope) were designed and constructed for interim storage. For many cases, fuel reprocessing was to be the means to dispose of these materials in the long-term. However, the Department has ceased or is phasing out such operations. Thus, existing storage facilities may be used for extended storage periods pending future decisions on the long-term disposition of these materials. Also, many of these storage facilities are near the end of their intended life and degradation is a concern.

On August 19, 1993, the Secretary assigned the Office of Environment, Safety and Health the responsibility to lead the Department's initial assessment of the ES&H vulnerabilities associated with the storage of irradiated nuclear reactor fuel and other reactor irradiated nuclear materials (Reference 1). A project plan (this document) is to be issued by September 20, 1993, and an initial report is to be presented to the Secretary by November 20, 1993.

On September 2, 1993, the Acting Assistant Secretary for Environment, Safety and Health provided additional guidance for the implementation of the Secretary's initiative (Reference 2). DOE Operations Offices were requested to direct the Laboratories and Management and Operating (M&O) Contractors to designate site personnel with the best technical knowledge of the inventory data, operations and safety basis for the storage facilities under their cognizance to participate in the assessment process. These M&O personnel, along with participants from the Cognizant Secretarial Offices, Operations Offices and the Office of Environment, Safety and Health are now participating as members of the recently formed Spent Fuel Working Group. The Working Group met on September 9 and 10, 1993 and developed the basic elements of this project plan. For each site having stored reactor irradiated nuclear materials, Site Teams comprised of the M&O contractors and line organization personnel will provide their own assessment of inventory and ES&H concerns. The Working Group will serve to 1) coordinate the activities, 2) validate the site data through site visits and interactions with the Site Teams, and 3) write the summary report to the Secretary for transmittal by November 20, 1993.

This baseline vulnerability identification could lead to further evaluation of specific vulnerabilities and corrective action. The results from this initiative will also support the longer-term effort now underway by the Office of Spent Fuel Management and Special Projects (EM-37) in the Office of Environmental Restoration and Waste Management. A strong liaison is being maintained between that Office and the Working Group. It is expected that identification of facility-specific and generic vulnerabilities will facilitate Departmental policy-making.

3.0 SCOPE

The project will provide itemized inventory data of reactor irradiated nuclear materials and an initial report on an assessment of the environmental, safety and health vulnerabilities associated with the current storage and handling of these materials. Reactor irradiated nuclear materials (RINM) are defined as spent nuclear fuel (in any condition) and irradiated nuclear targets from production and research reactors. These materials have been withdrawn from nuclear reactors following irradiation or, in a few cases, still reside within inactive reactors. Their constituent elements have not been separated by processing. Other radioactive and hazardous materials stored in the facilities will be identified and evaluated to the extent they contribute to environmental, safety and health vulnerabilities, but reactor waste products and reactor irradiated structural materials (other than fuel cladding) are considered outside the scope of this project.

Current quantities and projected quantities from domestic and foreign origins, characteristics, and conditions of reactor irradiated nuclear materials will be identified for each storage facility. Fuel currently in use in a reactor should not be counted in the current inventory, but should be considered in near-term inventories if it is soon to be removed from the reactor and stored. Facilities, structures, systems, operating conditions, and procedures necessary to protect the workers, the public, and the environment during the storage and in-facility handling of these materials will be evaluated. Packaging, transportation (onsite and offsite), and physical security of these materials or storage facilities will not be addressed. Future corrective actions will not be identified or recommended during this assessment; however, corective actions already underway will be considered in the assessment.

Based on input from the Working Group, the initial assessment will be limited to the following Department of Energy sites having reactor irradiated nuclear materials stored in basins, pools, canals, dry storage, inactive reactors, hot cells, buried and other known locations.

- Hanford
- Idaho National Engineering Laboratory
- Argonne National Laboratory - West
- Savannah River Site
- Oak Ridge
- West Valley Demonstration Project
- Brookhaven National Laboratory
- Argonne National Laboratory - East
- Babcox & Wilcox
- General Atomics
- Los Alamos National Laboratory
- Sandia National Laboratories

A detailed listing of specific Department of Energy sites and facilities under evaluation and preliminary site-wide inventory data are provided as Attachment 1.

4.0 PROJECT APPROACH AND ACTIVITIES

The project's basic approach consists of the following elements:

- Development of project plan, review processes and question set using input from the September 9-10, 1993 Working Group Meeting

- Collection of data and identification of ES&H concerns using question set, and preparation of Site Reports by Site Teams consisting of M&O and Operation Office personnel

- Validation and evaluation of Site Report information, identification and organization of facility vulnerabilities, and preparation of Site Assessment Reports by Working Group Assessment Teams

- Characterization of overall vulnerabilities and preparation of project report by the Working Group

Figure 1 provides a graphic overview of the project's approach.

4.1 Preparation

The following preparation tasks have been completed and their results are reflected in this project plan:

- Conduct a Spent Fuel Working Group meeting on September 9 and 10, 1993 to develop a project plan including project coordination (Attachment 2 lists participants)

- Develop qualifications for project team members (Attachment 3)

- Develop question set for information needed (Attachment 4)

- Develop process for identifying, organizing and characterizing vulnerabilities (Attachment 5)

- Select team members for Working Group Assessment Teams and schedule site visits (Attachment 6)

- Establish format and content guidance for the Site Reports

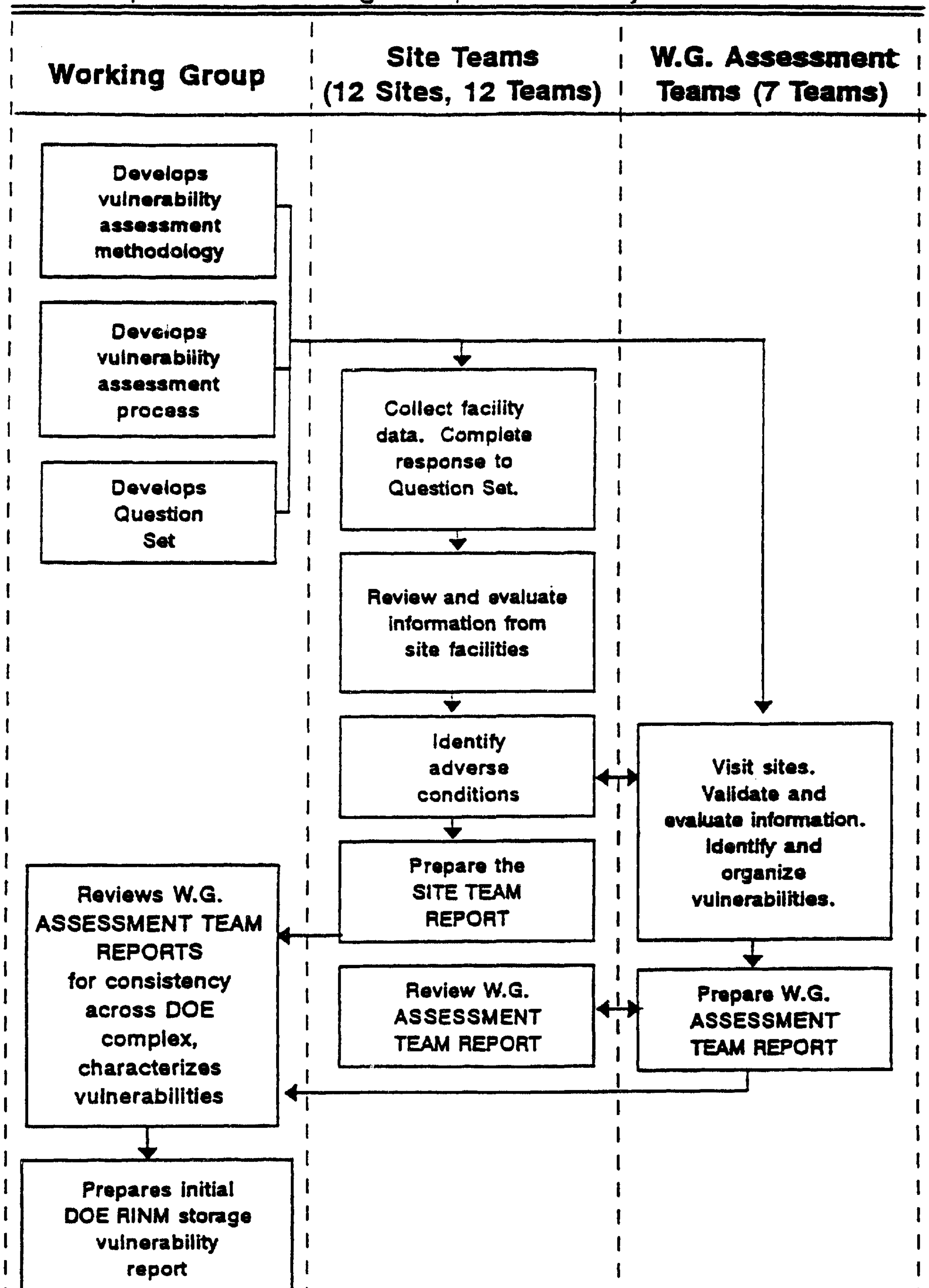
- Establish procedures for Working Group Assessment Teams, and report format and content guidance for their Site Assessment Reports

- Establish format and content guidance for the initial Working Group Project Report to the Secretary.

- Establish logistics for preparation, review, and issuance of the project report

Figure 1

Responsibility/Flow Chart
for
Spent Fuel Working Group Vulnerability Assessment



4.2 Site Team Evaluation and Report

The Site Teams will consist of M&O contractor and Operations Office personnel for each site. Each Site Team will perform data collection and identify ES&H concerns relative to reactor irradiated nuclear material storage by preparing responses to the detailed question set (Attachment 4) for each storage facility. The Site Team's identification of ES&H concerns should be in a form which is sufficient to allow the Working Group Assessment Teams (see next section) to identify and organize vulnerabilities using the process of Attachment 5.

The Site Team will prepare the Site Team Report according to the following outline:

<u>SITE TEAM REPORT</u>

- Executive Summary
    - Summary by facility
    - Site-wide conclusions
- Facility Description (one paragraph to one page length for each facility)
    - Identify M&O, CSO, Operations Office
    - Facility Mission
    - Important Characteristics
    - Brief Summary of RINM Inventory
- Discussion
    - Summary of Response to Question Set
    - Identification of ES&H Concerns

<u>APPENDICES</u>

- Responses To Question Set (each facility)
- Site Team Membership
- References

4.3 Validation and Site Assessment Report

After each Site Team has completed its responses to the question set and finished its initial evaluation, a Working Group Assessment Team (Attachment 6) will visit the site to review the Site Team Report and to perform an independent validation and evaluation of the data supporting the reports. Using the process described in Attachment 5, the visiting Working Group Assessment Team will identify and organize facility vulnerabilities.

The Working Group Assessment Teams will then prepare an individual Site Assessment Report according to the following outline:

WORKING GROUP ASSESSMENT TEAM REPORT

- Executive Summary
- Discussion of Site Visit
  - Review of Site Team Report
  - Facilities Visited
- Validation
  - Personal Interviews
  - Walkdown Results of Facilities Visited
- Discussion (by Facility)
  - Identification and Organization of Vulnerabilities

APPENDICES

- Assessment Team Membership
- References (including Site Reports)

4.4 Characterization of DOE-Wide Vulnerabilities and Preparation of Project Report

The Working Group will characterize the potential vulnerabilities identified at each facility and site, and across the DOE complex using the process described in Attachment 5. As recommended during the September 9 and 10, 1993 Working Group meeting, the Working Group members will convene a small review panel of Working Group members who will review presentations from the Site and Working Group Assessment Teams. This panel will judge the potential impact of facility-specific vulnerabilities. The panel will resolve any differences in the conclusions made by Site and Working Group Assessment Teams, normalize the results from all Working Group Assessment Teams, and characterize vulnerabilities on a Department-wide basis.

The Initial Project Report will be prepared by the Working Group. This will provide a DOE-wide overview of the inventory data and vulnerability assessments. The report will be subjected to a factual accuracy review by the M&O contractors, Operations Offices, and Cognizant Secretarial Offices before submittal to the Secretary.

The Site Team Reports and the Working Group Assessment Team Reports will become appendices to the project report. The Initial Project Report will be approved by the Assistant Secretary, Office of Environment, Safety and Health before submittal to the Secretary. The following outline will be used for the project report:

PROJECT REPORT

- Executive Summary
- Inventory of RINM
- Vulnerability Characterization
- Recommendations for Follow-on Assessments

APPENDICES

- Site Team Reports
- Working Group Assessment Team Reports

4.5 Assessment Schedule

The assessment schedule includes planning, on-site evaluations, completion of Working Group Assessment Team reports, and completion of the initial project report on DOE-wide inventory data and vulnerabilities. Planning and logistics for the assessments were established during the Working Group meeting on September 9 and 10, 1993. The Working Group Assessment Teams will visit sites between October 4 and October 22, 1993. The Working Group will reconvene on November 1 through 5, 1993. Per the Secretary's directive, the initial project report will be issued by November 20, 1993.

See Attachment 7 for detailed activity schedule.

5.0 PROTOCOL

The Office of Environment, Safety and Health will coordinate and lead this Department-wide project. Once the Spent Fuel Working Group, Working Group Assessment Teams, and Site Teams are established, communications between different organizations will be facilitated by the active participation of organization representatives on each of the project teams. To work within the current time constraints, information will be exchanged primarily at the working level.

Each Working Group Assessment Team leader will conduct a formal exit meeting at the conclusion of on-site review. During this meeting the team leader will summarize the potential vulnerabilities identified. The team leader will also identify any remaining information required from the Site Team to conclude its assessment activities.

6.0 DEPARTMENT COORDINATION

DOE Headquarters elements will coordinate with each other and the Office of Field Management to minimize the impact of this effort on the Operations Offices, the M&O's and Laboratory personnel. This project will maintain a continuous liaison with and, to the extent practical, combine with the ongoing fuel storage effort of the Office of Spent Fuel and Special Projects (EM-37) in the Office of Environmental Restoration and Waste Management.

7.0 REFERENCES

1. Memorandum; Hazel R. O'Leary to Peter N. Brush; Subject: Vulnerability Review of Irradiated Nuclear Materials Currently in Storage; August 19, 1993.

2. Memorandum; Peter N. Brush to all Departmental Elements; Subject: Spent Nuclear Fuel Inventory and Vulnerability Assessment; September 2, 1993.

Hanford

(Estimated Inventory MTIHM - special fuels 31.2[8] - production fuels 2,099[8])

105 KE Storage Basin
- N-reactor fuel
- Single Pass Reactor (SPR) fuel

105 KW Storage Basin
- N-reactor fuel
- Single Pass Reactor (SPR) fuel

PUREX Storage Basin & Dissolver Cell
- N-reactor fuel
- Single Pass Reactor (SPR) fuel

FFTF: FFTF Vessel, IDS vessel, and FSF
- FFTF fuel

T Plant Storage Pool (200 West Area)
- PWR Core II fuel

200 Area Burial Grounds
- Small fuel fragments and pellets in sealed containers

308 Building - TRIGA Reactor
- TRIGA reactor fuel

PNL 324 Building "B Cell"
- Commercial reactor bundles

PNL 325 Building Hot Cells
- Sample pieces of fuel rods

PNL 327 Postirradiation Testing Laboratory
- Pieces of fuel rods

INEL

(Estimated Inventory MTIHM - special fuels 139[2] - TMI 83[2] - at Ft. St. Vrain 16[1])

TAN Test Pad concrete and metal storage casks
- Consolidated and unconsolidated commercial PWR fuel

TAN Pool
- TMI fuel debris
- LOFT fuel
- Rods from Peach Bottom, HB Robinson and Dresden
- Loose rod storage basket: BWR and PWR rods and pieces

ATR Canal
- Advanced Test Reactor fuel

MTR Canal
- Commercial fuel pins
- PBF Driver Core Rods
- Other experimental fuel

ARMF/CFRMF Canal
- MTR-type ARMF and CFRMF core

PBF Canal
- Power Burst Facility Driver Core

ICPP 603 Pool
- Naval reactors fuel
- Advanced Test Reactor fuel
- High Flux Beam Reactor fuel
- Oak Ridge Reactor fuel
- EBR-II fuel
- MURR
- Pulstar
- TORY IIA
- APPR
- Battelle Memorial Institute
- TRIGA-A1
- BORAX V
- GCRE
- Pathfinder
- SM-1A
- SPEC
- SPSS
- Vallectos BWR
- SNAP
- Atomics International
- GE Test Reactor
- TRIGA-SST
- TRIGA-FLIP

ICPP IFSF (GSF)
- Parka
- Ft. St. Vrain graphite fuel
- Peach Bottom fuel
- Rover fuel
- TORY - IIC
- TRIGA Ber II

ICPP 666 Pool
- Naval reactors fuel
- Advanced Test Reactor fuel
- High Flux Beam Reactor fuel
- EBR-II fuel
- Fermi Core I & II
- MURR
- University of Washington
- ARMF
- Shippingport PWR Core I & II

ICPP 749 Drywells
- Peach Bottom Core I
- FERMI Blanket
- Shippingport LWBR

Argonne National Laboratory - West
- Experimental Breeder Reactor II (EBR-II)
- EBR-II fuel

Hot Fuel Examination Facility (HFEF)
- EBR-II fuel

Radioactive Scrap and Waste Facility (RSWF)
- EBR-II fuel and blanket and waste materials

Zero Power Physics Reactor (ZPPR) and storage vault
- ZPPR fuel

Tranient Reactor Test Facility (TREAT) and storage pits
- TREAT fuel and some NRAD fuel elements

Neutron Radiography Reactor (NRAD)
- TRIGA-type NRAD fuel

Naval Reactors Facility (NRF) Expended Core Facility (ECF)
- Shippingport PWR Core 1 & 2
- Naval reactors fuel

Savannah River Site

(Estimated Inventory MTIHM - special fuels 21.8[1] - production fuels 147[2] target materials 213[8])

Receiving Basin for Offsite Fuels (RBOF)
- CANDU rods and pieces
- Carolinas-Virginia Tube Reactor bundle
- Dresden intact assemblies
- Elk River Reactor assemblies
- LWR rod pieces
- Nereide fuel assembly
- HB Robinson fragments
- Saxton rods in cans and 1 bundle
- VBWR pieces
- B&W scrap
- EBR-2 rods
- EBWR assemblies and pieces
- GCRE pieces
- HWCTR assemblies and pieces
- HTRE segments and pieces
- ML-1 assemblies
- SIW-1 rods
- ORNL mixed oxide
- Shippingport canned pieces
- SPERT-3 canned pieces
- SRE rods
- SRS can
- ORR-LEU cans
- possibly other materials scheduled for reprocessing

K, L, P Reactor Basins
- production reactor fuel
- production target material

F Canyon Bucket Storage
- production reactor fuel
- production target material

Oak Ridge National Laboratory
(Estimated Inventory MTIHM - 1.5[1,7])

HFIR pool
    HFIR fuel assemblies
Bulk Shielding Reactor pool (BSR)
    BSR and ORR fuel assemblies
Molten Salt Reactor Experiment vessel
    MSR fuel
Tower Shielding Reactor (TSR)
    TSR fuel
Dry wells at Buildings 3019 and 4501
    Commercial fuel spend\t fuel rod sections
    U_3O_8 material
Y-12 Warehouse Building 9720-5
    HPRR fuel and materials
    SNAP-10A fuel and NaK coolant

West Valley Demonstration Project
(Estimated Inventory MTIHM - 27.[1])

Fuel Receipt and Storage Building
    BWR and PWR commercial fuel assemblies

Brookhaven National Laboratory
(Estimated Inventory MTIHM - 0.2[3])

High Flux Beam Reactor Canal
    HFBR fuel

Argonne National Laboratory
(Estimated Inventory MTIHM - <0.1[6])

ANL-E Hot Cell

Babcox & Wilcox
(Estimated Inventory MTIHM - .085[1])

Lynchburg Technology Center - Hot Cell
    Rods and pieces from commercial reactors

General Atomics
(Estimated Inventory MTIHM - very small)

San Diego - Hot Cell

Los Alamos

(Estimated Inventory MTIHM - .004[1])

INC Division research reactor tank and dry storage
Research reactor fuel
IDB also lists EBR-2

Sandia National Laboratories

Sandia Pulse Reactors (still operating - no spent fuel)

Foreign Research and Test

(Estimated Inventory MTIHM - 3.7[4])
41 reactors in 23 countries
Aluminum-based fuel elements

(Estimated Inventory MTIHM - very small)
8 reactors in 8 countries
SS clad TRIGA fuel elements

University Reactors

(Estimated Inventory MTIHM - Total <0.6[3])

(Estimated Inventory MTIHM - Total DOE Fuel 2570)

Sources of information:

(1) Integrated Data Base, DOE/RW-0006, Rev. 8
(2) WINCO input to 1993 IDB, May 14, 1993
(3) FAX, Ed Burns to D. G. Abbott, May 10, 1993
(4) FAX, J. Matos to D. G. Abbott, March 29, 1993
(5) Hanford Handout at SNF Workshop April 28, 1993
(6) Personal Communication, July 1, 1993
(7) OR Database submittal
(8) Input from David Burke

ATTACHMENT 2: Spent Fuel Working Group

(Participants of September 9 and 10, 1993 Working Group Meeting)

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Obenchain, C. F.	EG&G Idaho	208-526-9696
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Andrade, Tony	LANL	505-657-4151
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Ward, Pat	Scientech	202-488-1464
Burton, Harold	Scientech	301-468-6425
Heitman, Tom	Scientech	202-488-1404

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Benjamin, Dick	WSRC	803-725-5320
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John Connelly	DOE/EH-40	301-903-5722
Jim Cannon	DOE/NE-442	301-903-5016
Kevin Buchanan	DOE/SR	803-557-3750

ATTACHMENT 3: Team Member Qualification Criteria

The following criteria will be used for selecting members of the Site and Working Group Assessment Teams:

Site Teams (M&O Contractors and Operations Office Personnel)

Best knowledge in:

- Operations, maintenance, radiological protection, occupational safety and health, configuration management associated with reactor irradiated nuclear materials storage facilities
- Site or lab data on inventory of spent nuclear fuel, and irradiated target materials from production and research reactors
- Storage facilities' authorization, safety and operational bases
- Limiting conditions for operation and administrative controls
- Operational history and occurrences
- Storage facilities' safety considerations including:
    - design basis, including natural phenomena hazard considerations
    - conditions of reactor irradiated nuclear materials and associated safety systems and structures
    - criticality potential
    - pool chemistry
    - dry storage, buried storage
    - potential accidents involving loss of pool cooling, pool heat up and boiling, fuel damage, and potential radionuclide release
    - other related technical information

Working Group Assessment Team (Selected Working Group Members and Staff and Consultants from the Office of Environment, Safety and Health)

Best knowledge in:

- spent fuel storage facility/pool design and operation
- storage rack design and analysis

- cooling system design and analysis
- seismic and structural analysis
- pool chemistry analysis and control
- dry storage, buried storage
- criticality safety
- natural phenomena hazard design
- corrosion, aging and overloading issues
- accident analysis; potential for pool boiling, fuel damage, radionuclide release and consequence, etc...
- vulnerability identification
- national, international, industry and government standards on spent nuclear fuel storage and handling, and
- field experience with above technical issues

Question #1

What is your inventory of Reactor Irradiated Nuclear Material (RINM) ?

The question above applies to the site and should be answered considering all the elements listed below. If there are ES&H concerns about lack of knowledge of site inventories, please describe in three pages or less.

Elements for Question #1

- Has your EM-37 questionnaire on spent fuel been submitted? (yes or no) If no, describe status of the questionnaire.
- Is there buried fuel on site not identified in your EM-37 questionnaire? (yes or no). If yes, describe.
- Is there irradiated nuclear material stored in inactive reactor(s) not identified in your EM-37 questionnaire? If yes, describe.
- Are there reactor target materials in storage facilities on site? (yes or no) If yes, describe:
    - Target type
    - Location
    - Quantity
    - DOE program (e.g., EM, RW, etc.)
- Are there classified RINM? (yes or no)
- Are there other hazardous materials in the spent nuclear fuel storage facilities? (yes or no) If yes, describe:
    - Type
    - Location
    - Quantity

Question #2

What is the material condition of your Reactor Irradiated Nuclear Materials (RINMs) ?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should *provide identification and assessment of concerns and is not intended to be solely a data collection effort.*

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

1) accurately define ES&H concern(s) relative to existing or projected conditions;

2) note where elements have not been programmatically addressed, or there is a significant lack of knowledge about the elements; and

3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #2

- Basis for understanding material condition (surveillance, monitoring, etc.)
- Corrosion, loss of structural integrity of RINM
- Fission products release
- Container condition of repackaged RINM

Question #3

What is your water quality (or coolant quality) condition?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should provide identification and assessment of concerns and is not intended to be solely a data collection effort.

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

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3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #3

- Chemistry (pH, conductivity, chloride on concentration, etc.), controls for corrosion
- Control of radionuclides in coolant
- Biological control
- Sludge (including fissile material and radionuclide content)
- Dry Storage Conditions (e.g., humidity)

Question #4

What is the condition of your facility ("facility" includes safety systems, structures, and equipment)?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should provide identification and assessment of concerns and is not intended to be solely a data collection effort.

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

1) accurately define ES&H concern(s) relative to existing or projected conditions;

2) note where elements have not been programmatically addressed, or there is a significant lack of knowledge about the elements; and

3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #4

- Basis for understanding conditions (e.g., surveillance, monitoring, etc.,)
- Preventative maintenance
- Monitoring
  - Leak detection
  - Leak control
- Confinement
- Ventilation
- Contamination

Question #5

Are there any significant ES&H open items?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should provide identification and assessment of concerns and is not intended to be solely a data collection effort.

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

1) accurately define ES&H concern(s) relative to existing or projected conditions;

2) note where elements have not been programmatically addressed, or there is a significant lack of knowledge about the elements; and

3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #5

- Unresolved USQs
- Unresolved UORs (occurring in the past five years)
- Tiger team findings
- Findings and concerns from other DOE reviews
- DNFSB concerns (including implementation of Recommendation 90-2 on standards compliance)
- State oversight
- Repeated issues from the above (denoting trends)

Question #6

What is the current authorization basis for your facility?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should provide identification and assessment of concerns and is not intended to be solely a data collection effort.

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

1) accurately define ES&H concern(s) relative to existing or projected conditions;

2) note where elements have not been programmatically addressed, or there is a significant lack of knowledge about the elements; and

3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #6

Consideration of the following in the authorization basis:

- Mission(s)
- Interim measures
- Criticality control
    - Moderator
    - Geometry (including migration)
    - Reflection
    - Poison
    - Inventory Control
- Current configuration (consistent with safety envelope?)
- Loss of cooling system accidents
- Loss of coolant inventory accidents
    - Shielding
    - Environmental release
- Natural phenomena (e.g., earthquakes, flood, winds, etc.)
- Other external events

Question #6 (cont.)

- Fires
- Loss of power
- Beyond Design Basis Accidents
- Handling accidents
- Human factors
- Support services (in other facilities?)

Question #7

What are your conduct of operations and institutional controls?

The question above applies to the facility and should be answered considering all the elements listed below. It is expected that the response to this question would be a paragraph or less if no significant ES&H concerns exist, and not more than three pages per question if concerns exist. Please note that the response to this question should provide identification and assessment of concerns and is not intended to be solely a data collection effort.

If there are no concerns associated with an element below, then briefly acknowledge this in the response. If there are concerns associated with any of the elements, or if there are any other concerns related to the question subject, then describe these concerns in sufficient detail to:

1) accurately define ES&H concern(s) relative to existing or projected conditions;

2) note where elements have not been programmatically addressed, or there is a significant lack of knowledge about the elements; and

3) provide sufficient information to perform the vulnerability identification, organization, and characterization process as outlined in Attachment 5 of the project plan

Elements for Question #7

Consideration of the following in conduct of operations and institutional controls:

- Emergency operating procedures
  - Drills/evaluations
- Training and qualifications
- Preventative maintenance
- Radiation protection
  - ALARA
  - Monitoring
- Industrial hygiene and industrial safety
- Quality assurance
- Permits

Question #8

Describe your site's most important ES&H concerns regarding the storage and handling of Reactor Irradiated Nuclear Materials.

Purpose

The purpose of this Attachment is to describe the Spent Fuel Working Group vulnerability review process. The Working Group has developed this process to identify, organize and characterize the vulnerabilities of facilities storing reactor irradiated nuclear materials.

Overview

Since the vulnerability review applies to a variety of reactor irradiated nuclear materials and storage facilities, and is to be completed in a short period of time, only a simple and straight forward approach shown in Figure 5-1 has been developed by the Working Group. Major elements in the process flow are identified by the top five boxes of the figure.

Following the elements depicted in Figure 5-1, reactor irradiated nuclear materials inventory data and other related information are collected at storage facilities in response to a Question Set. (See Attachment 4 and the first box of Figure 5-1.) The gathered data and information are reviewed for certain conditions/symptoms and for potential adverse conditions. (See boxes 2 and 3.) Then, potential adverse conditions are assigned to environmental, worker safety and health, and public safety and health categories to identify Environmental, Safety and Health (ES&H) hazards. (See box 4.) In parallel, judgement will be made as to how soon the adverse conditions need to be corrected. (See box 4.) Finally, an aggregation of these evaluations will be reviewed by a Working Group Review Panel to consider all of the information above and characterize the ES&H vulnerability. (See box 5.)

The vulnerability review process will provide a foundation for a thorough and detailed review later, if warranted.

Approach

The vulnerability review process consists of the following steps:

Site Teams will be formed for sites where reactor irradiated nuclear material is stored. Site Teams will consist of DOE Operations Office and Management and Operations (M&O) contractor personnel. Site Teams will respond to the Question Set for each facility. Question Set responses will provide reactor irradiated nuclear material inventory data and related information in a prescribed format.

Site Teams will prepare draft Site Reports that present the information and data collected in response to the Question Set. Site Reports will also document certain conditions and symptoms that have been identified and potential adverse conditions for the storage of reactor irradiated nuclear material. For those sites that have more than one storage facility, the Site Team will address each facility in the Site Report.

There will be seven Working Group Assessment Teams consisting of members from the Working Group and selected consultants. These teams will visit the sites and review the draft Site Reports. They will review and validate the information and data, associated conditions and symptoms, and linkages to potential adverse conditions. They will also walkdown the storage facilities at each site.

Potential adverse conditions, identified either individually or collectively by the Site Teams and Working Group Assessment Teams, will be assigned to the ES&H categories of interest, and thereby, ES&H hazards are identified. Both teams will make judgements as to how soon the potential adverse conditions should be corrected. This is done iteratively and cooperatively by the teams.

Working Group Assessment Teams will prepare draft Assessment Reports. Assessment Reports will document the team evaluation process and conclusions.

Both teams will prepare their respective reports for submittal to the Spent Fuel Working Group for subsequent consolidation.

The Working Group will establish a Review Panel that will review these reports. The Review Panel will cull the information provided in these reports, settle differences between Site Team and Assessment Team conclusions, normalize the results, and organize and characterize vulnerabilities.

The Working Group will prepare a draft Project Report for subsequent review within DOE organizations. The Working Group will incorporate review comments and prepare the initial Project Report for submittal to the Secretary.

Figure 5-2 shows an illustration of how this process would work for a hypothetical case.

Figure 5-1

VULNERABILITY REVIEW PROCESS

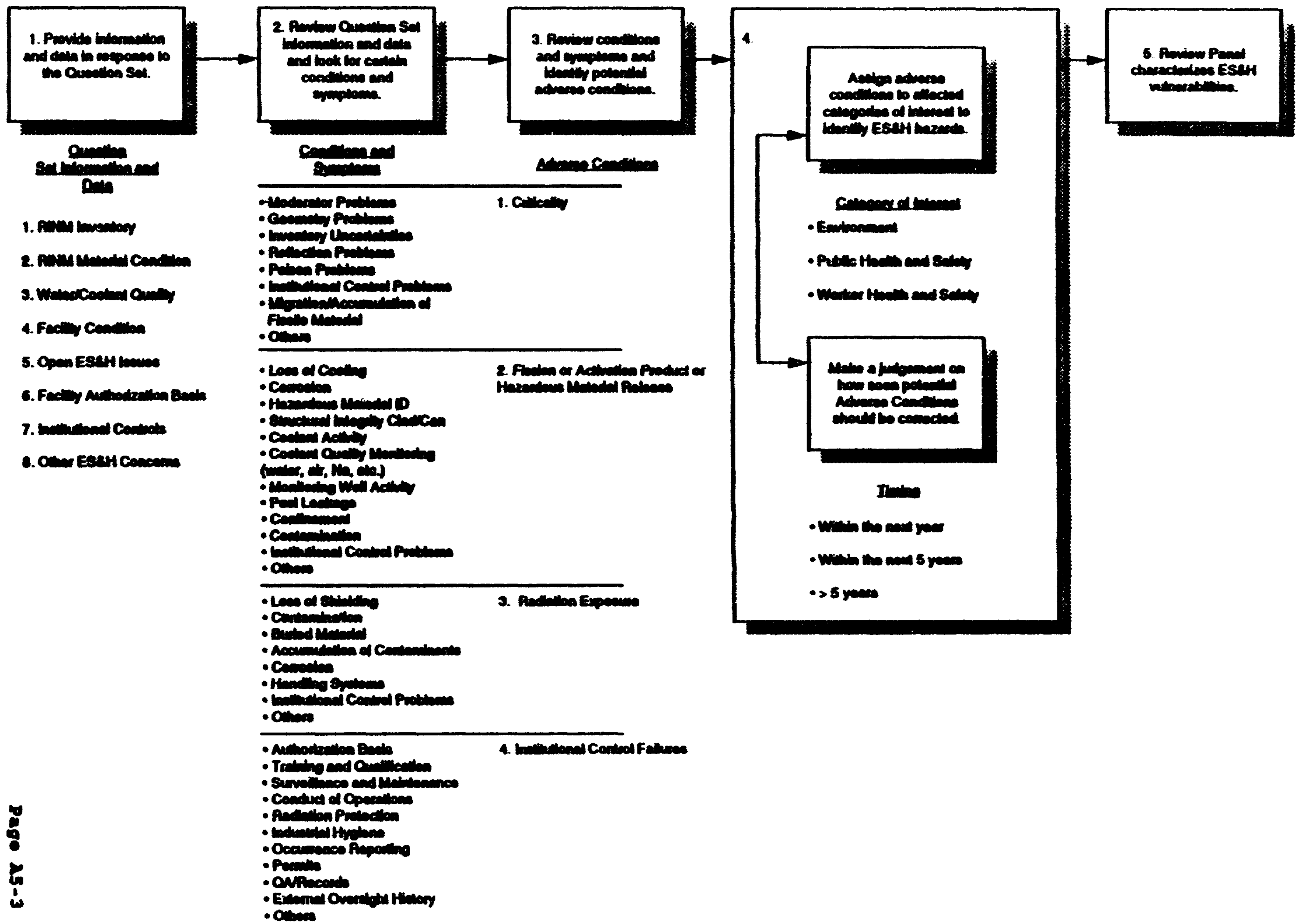
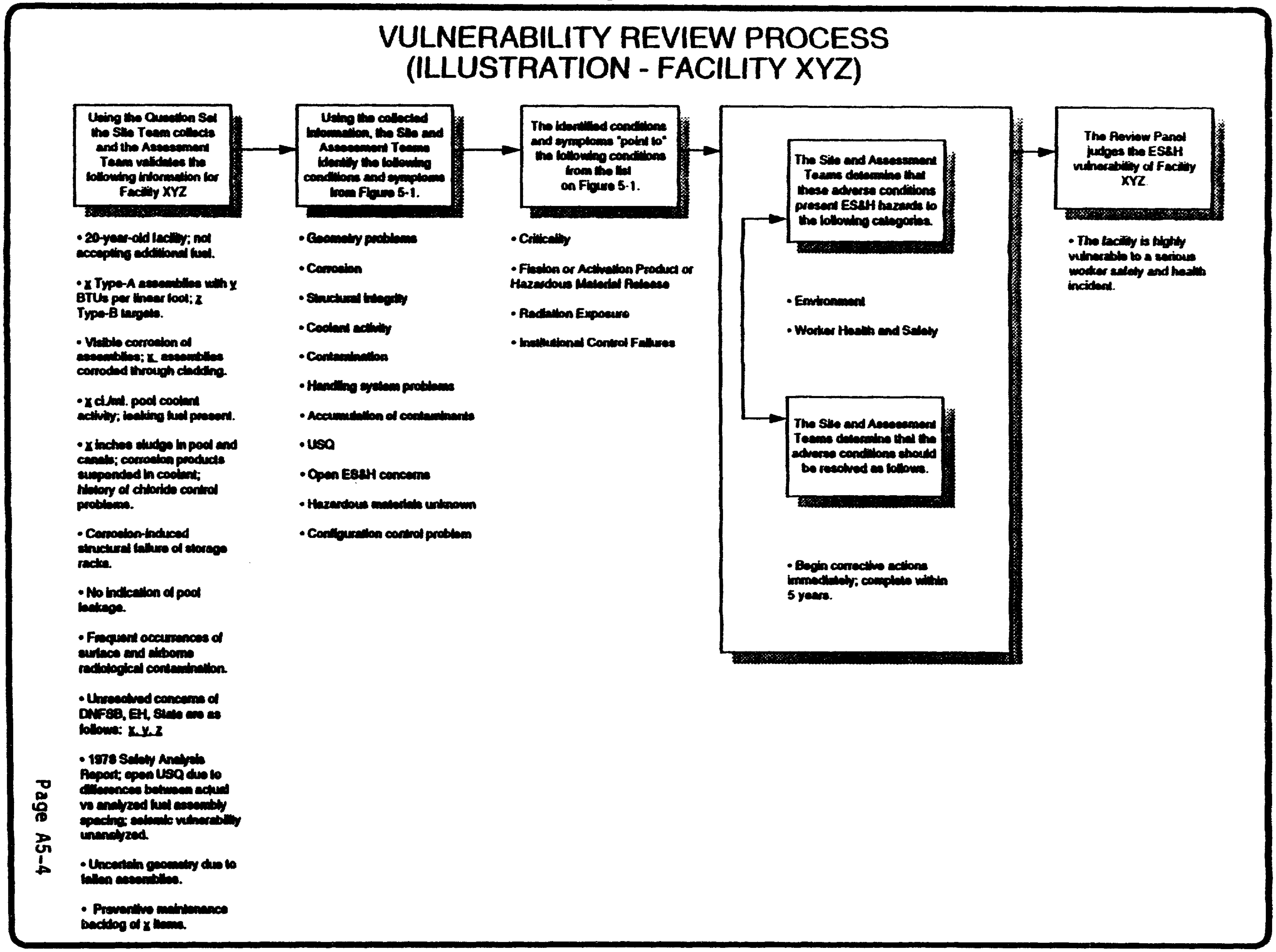


Figure 5-2


VULNERABILITY REVIEW PROCESS
(ILLUSTRATION - FACILITY XYZ)
Using the Question Set the Site Team collects and the Assessment Team validates the following information for Facility XYZ
• 20-year-old facility; not accepting additional fuel.
• x Type-A assemblies with y BTUs per linear foot; z Type-B targets.
• Visible corrosion of assemblies; x assemblies corroded through cladding.
• x ci./ml. pool coolant activity; leaking fuel present.
• x inches sludge in pool and canals; corrosion products suspended in coolant; history of chloride control problems.
• Corrosion-induced structural failure of storage racks.
• No indication of pool leakage.
• Frequent occurrences of surface and airborne radiological contamination.
• Unresolved concerns of DNFSB, EH, State are as follows: x, y, z
• 1978 Safety Analysis Report; open USQ due to differences between actual vs analyzed fuel assembly spacing; seismic vulnerability unanalyzed.
• Uncertain geometry due to fallen assemblies.
• Preventive maintenance backlog of x items.
Using the collected information, the Site and Assessment Teams identify the following conditions and symptoms from Figure 5-1.
• Geometry problems
• Corrosion
• Structural integrity
• Coolant activity
• Contamination
• Handling system problems
• Accumulation of contaminants
• USQ
• Open ES&H concerns
• Hazardous materials unknown
• Configuration control problem
The identified conditions and symptoms "point to" the following conditions from the list on Figure 5-1.
• Criticality
• Fission or Activation Product or Hazardous Material Release
• Radiation Exposure
• Institutional Control Failures
The Site and Assessment Teams determine that these adverse conditions present ES&H hazards to the following categories.
• Environment
• Worker Health and Safety
The Site and Assessment Teams determine that the adverse conditions should be resolved as follows.
• Begin corrective actions immediately; complete within 5 years.
The Review Panel judges the ES&H vulnerability of Facility XYZ.
• The facility is highly vulnerable to a serious worker safety and health incident.

ATTACHMENT 6: Working Group Assessment Teams

TEAM # 1 Oak Ridge National Laboratory (ORNL)

Draft Site Team Report - Oct. 1, 1993
Assessment Team Site Visit - Oct. 4-8, 1993
Issue Site Team Report - Oct. 15, 1993
Draft Assessment Team Report- Oct. 15, 1993

Team Members:

- William (Bill) Dennis, DOE-SR - Team Leader (803-725-5546) [*maint, ops*] (Fax 5017)
- Pat Worthington, DOE-EH (301-903-6929) [*chem, safety anal, mgmt*]
- Peter Soo, BNL (516-282-4094) [*mtrls, corr*]
- Harold McFarlane, ANL-W, (208-533-7106) [*crit*]
- Peter Cybulskis, Battelle Columbus (614-424-7509) [*maint, ops*]
- Ralph Seidensticker, ANL (708-252-4492) [*seis, struct*]

Site Contact - Doyle Brown, DOE-ORO (615-574-9244)

Team Coordinator Debby Myler (208-526-1441)
Cindy Dillard - Typist

TEAM # 2 Idaho National Engineering Laboratory (INEL), Argonne West, and Naval Reactor Fuel

Draft Site Team Report -	Oct. 15, 1993
Assessment Team Site Visit -	Oct. 18-22, 1993
Issue Site Team Report -	Oct. 22, 1993
Draft Assessment Team Report-	Oct. 29, 1993

Team Members:

- P. Guha, DOE-EH, Team Leader (301-903-7089) [*systems, safety anal*]
- M. Williams, DOE-EH (202-586-2407) [*mgmt*]
- S. Acharya, DOE-EH (301-903-2419) [*safety anal*]
- Jim Meyer, Scientech (301-468-6425) [*mgmt, safety anal*]
- Dennis Walters, PNL (509-376-4078) [*maint, ops*]
- J. Boccio, BNL (516-282-7690, FAX -5730) [*safety anal*]
- I. Fergus, DOE-EH (301-903-6364) [*crit*]
- Peter Kohut, BNL (516-282-4982) [*crit*]
- Harry J. Groh, IC, (803-648-5704) [*maint, ops*]
- Jim Oliver, DOE-NE (301-903-5845) [*fuel, ops, corr, sys*]
- Carl Czajkowski, BNL (516-282-4420) [*mtrls, corr*]
- Yao Chang, ANL-E (708-252-4680) [*seis, struct*]
- Richard Davis, BNL (516-282-4950) [*maint, ops, chem*]

Site contact - *INEL*: Brian Edgerton, (208-526-1081)
Tom Solinsky, (208-526-7547)
Argonne West: W.R. Vroman, (208-533-7091)
Naval Reactors: Donald Doharty (703-602-1752)

Team Coordinator - Debby Myler (208-526-1441, FAX -2930)
Typist - onsite support

<u>TEAM # 3</u> West Valley and Brookhaven National Laboratory (BNL)

Draft Site Team Report -	Oct. 1, 1993
Assessment Team Site Visit -	Oct. 4-8, 1993
Issue Site Team Report -	Oct. 11, 1993
Draft Assessment Team Report-	Oct. 15, 1993

<u>Team Members:</u>

- Dan Guzy, DOE-EH, Team Leader (301-903-2428) [*seis, struct, safety anal*]
- S. Bhatnagar, DOE-EH (301-903-6358) [*crit*]
- Terry Mountain, ORISE (301-427-1615) [*mgmt, ops*]
- Paul Wu, DOE-EH (301-903-5632) [*mtrl, corr*]

<u>Site contact</u> - *West Valley* : Alan Yeazel, DOE (716-942-4313)
BNL : Peter Kelley, DOE (516-282-5784)

<u>Team Coordinator</u> Julie Sellers (208-526-8263)
Janet Miceli - Typist

TEAM # 4 Los Alamos, Sandia Lab, and General Atomics

Draft Site Team Report - Oct. 4, 1993
Assessment Team Site Visit - Oct. 4-8, 1993
Issue Site Team Report - Oct. 8, 1993
Draft Assessment Team Report- Oct. 15, 1993

Team Members:

- Calvin Lai, DOE-EH - Team Leader (301-903-6357) [*safety anal*]
- Richard W. Miller, EG&G (208-526-9957) [*crit, safety anal, mgmt*]
- Carl Cooper, INEL (208-526-9183) [*safety anal*]
- Peter Nagata, INEL (208-526-9112) [*mtrl, corr*]
- Michael E. Nitzel, INEL (208-526-1008) [*seis. struct*]

Site contact - *Los Alamos* : Tony Andrade, LANL (505-667-4151)
Jim Ledbetter, LANL (505-667-2612)
Sandia Lab : Ted Schmidt (505-845-3058)
General Atomics: Chet Wisham (619-455-4171)
Phil Warner (619-455-3196)

Team Coordinator Jan Hill (208-526-8566)
Typist - onsite support

TEAM # 5 Savannah River Site (SRS)

Draft Site Team Report -	Oct. 1, 1993
Assessment Team Site Visit -	Oct. 4-8, 1993
Issue Site Team Report -	Oct. 15, 1993
Draft Assessment Team Report-	Oct. 15, 1993

Team Members:

- W. C. Harrison, DOE-EH, Team Leader (615-574-8006) [*mgmt, maint, ops*] (FAX x8004)
- S. Sen, DOE-EH (301-903-6571) [*seis, struct*]
- Mark J. Russell, INEL (208-526-1608) [*sys, safety anal, struct*]
- Mark Zagar, Scientech (706-724-2006) [*maint, ops*]
- Michael Todosow, BNL (516-282-2445) [*crit*]
- Maxwell Freshley, PNL (509-376-1554) [*spent fuel*]
- John Scorah, DOE-DP (301-903-3201) [*maint, ops*]
- A. Burtron Johnson, Jr., PNL (509-376-2382) [*fuel, corr*]
- Phil Grant, Wastren (301-540-0022) [*mtrl, corr*]
- C. Economos, BNL (515-282-2594) [*safety anal*]

Site contact - Kevin Buchanon DOE-SR (803)-557-3750

Team Coordinator Cindy Jensen (208-526-9144)
Barbara Kneece - Typist (301-353-9757)

TEAM # 6 Hanford Site

Draft Site Team Report - Oct. 8, 1993
Assessment Team Site Visit - Oct. 11-15, 1993
Issue Site Team Report - Oct. 18, 1993
Draft Assessment Team Report- Oct. 22, 1993

Team Members:

- Tom Hull, DOE-DP - Team Leader (301-903-5677, FAX 4581) [*maint, ops*]
- M. Williams, DOE-EH (202-586-2407) [*mgmt*]
- Raj Sharma, DOE-NE (301-903-2899) [*mgmt, ops*]
- P. Ward, Scientech (202-488-1464) [*safety anal, maint, ops*]
- Carl Obenchain, INEL (208-526-9696) [*safety anal*]
- Bill Lussie, INEL (208-526-9696) [*safety anal*]
- John Weeks, BNL (516-282-2617) [*mtrl, corr*]
- Dimitrios M. Cokinos, BNL (516-282-2146) [*crit*]
- Hans Dahlke, EG&G-ID (208-526-9777) [*seis, struct*]
- Kirby Dawson, INEL (208-525-5667) [*maint, ops*]
- Mark W. Parrish, INEL (208-526-9356) [*maint, ops*]

Site contact - Al Colburn, DOE-RL (509-376-6671)

Team Coordinator Jan Hill (208-5526-8566)
Typist - onsite support

TEAM # 7 B&W- Lynchburg, and Argonne East

Draft Site Team Report - Oct. 8, 1993
Assessment Team Site Visit - Oct. 12-15, 1993
Issue Site Team Report - Oct. 15, 1993
Draft Assessment Team Report- Oct. 22, 1993

Team Members:

- D. A. Huff, DOE-EH, Team Leader (301-903-2136) [*safety anal*]
  (FAX x8817)
- Harold Davis Oak, EG&G (208-526-9931) [*maint, ops, safety anal*]
- Paul Ruhter, INEL (208-526-1973) [*spent fuel*]
- Tom Heitman, Scientech (202-488-1464) [*mgmt, ops, safety anal*]

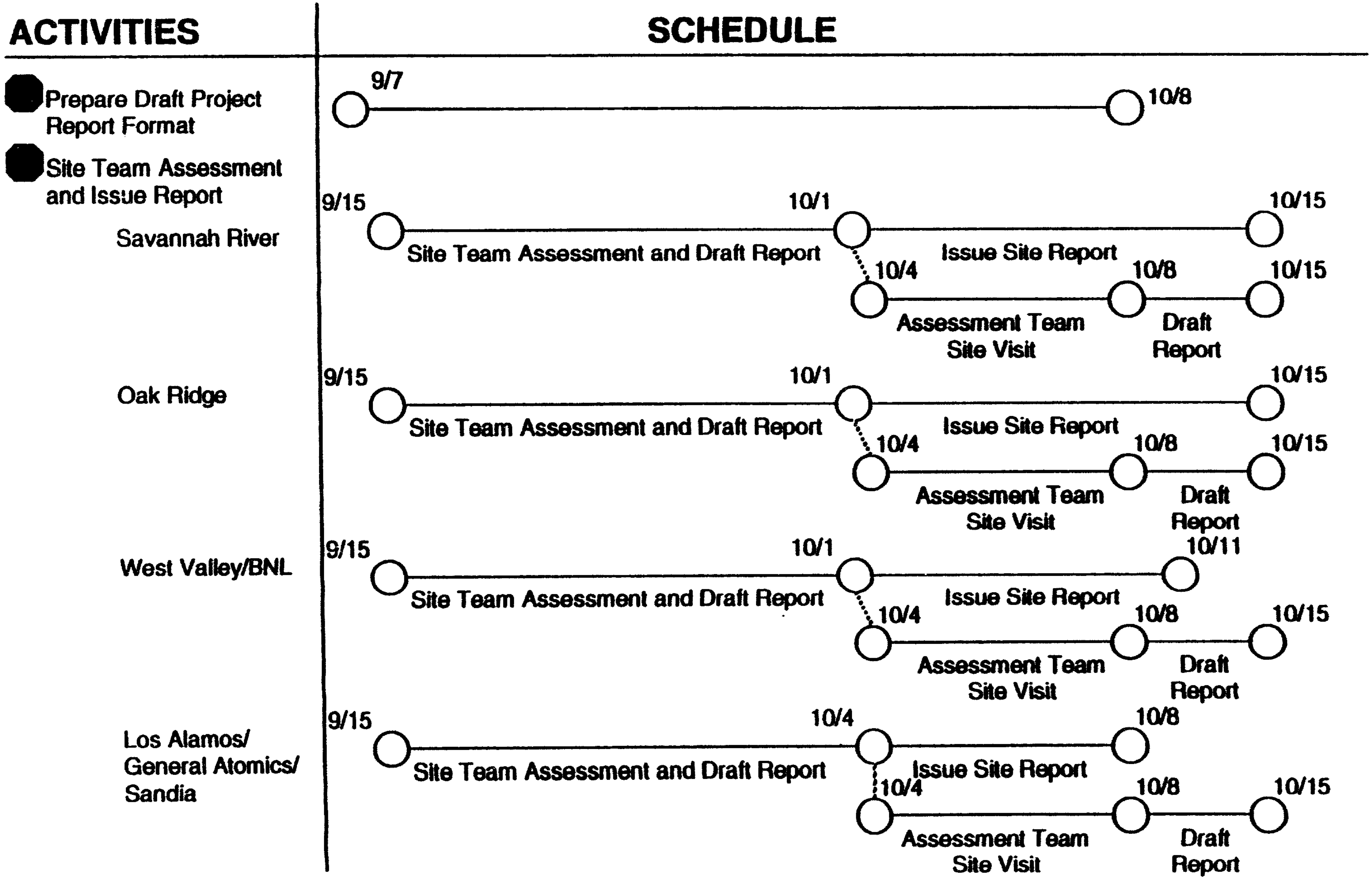
Site contact - *B&W - Lynchburg*: Charles Boyd (804-522-5753)
Argonne East: Larry Neimark (708-252-2000)

Team Coordinator Freadie Frost (301-816-7789)

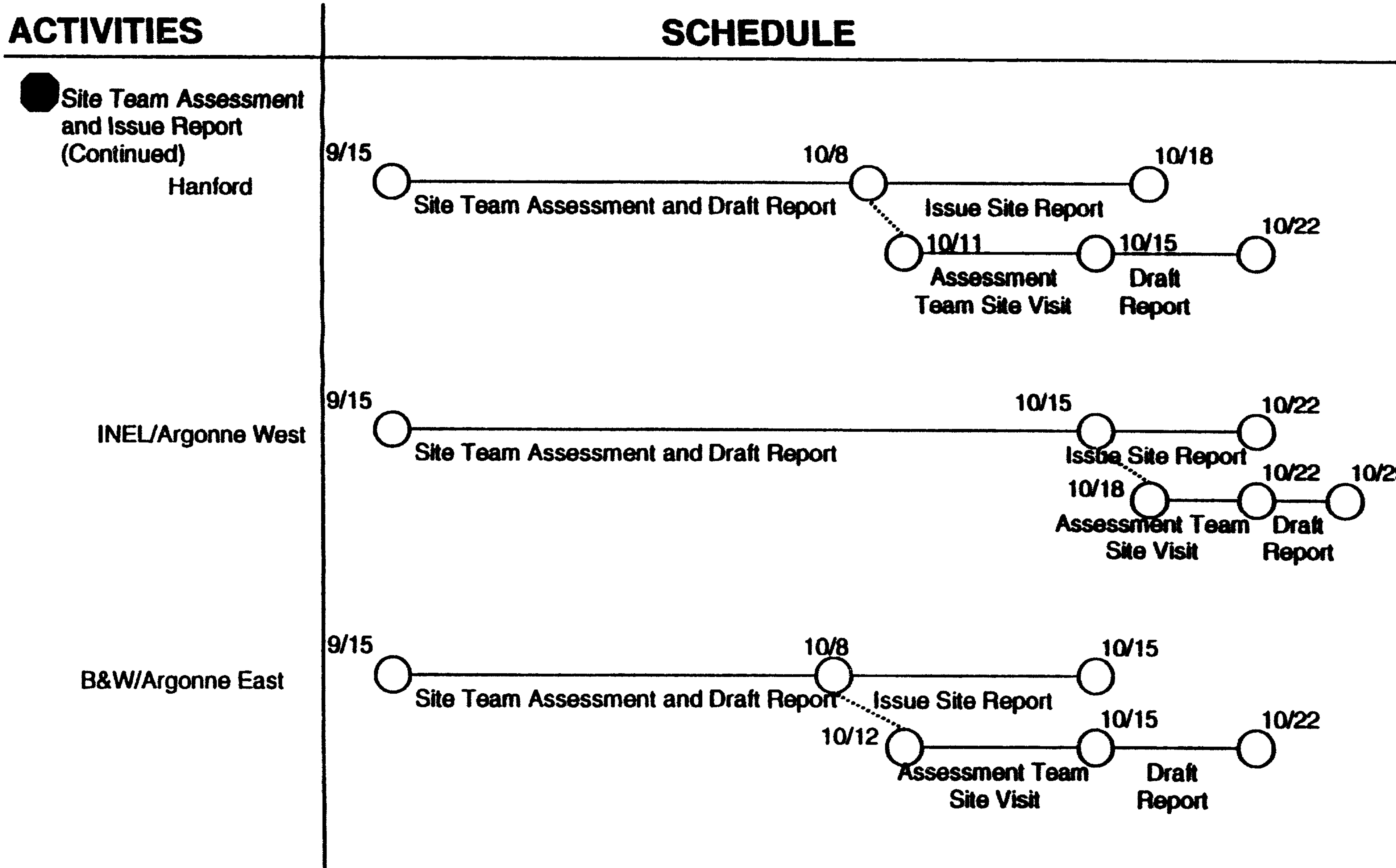
PROJECT SCHEDULE - Spent Fuel Vulnerability Study

ACTIVITIES	SCHEDULE
Preparation of Draft Program Plan	9/3
Preparation of Draft Q-Set	9/3
Working Group Meeting	9/9 – 9/10
Issue Finalized Q-Set and Program Plan	9/13
Prepare Draft Vulnerability Process	9/7 – 9/8
Prepare Draft M&O Site Team Report Format	9/7 – 9/20
Prepare Draft Assessment Team Report Format	9/7 – 9/27
Finalize Program Plan	9/20

PROJECT SCHEDULE - Spent Fuel Vulnerability Study



PROJECT SCHEDULE - Spent Fuel Vulnerability Study



PROJECT SCHEDULE - Spent Fuel Vulnerability Study

ACTIVITIES	SCHEDULE	
Expert Panel Review Draft Assessment Team Reports	10/18	10/29
Working Group Meeting and Preparation of Initial Draft of Project Report	11/1	11/5
Comment Resolution and Final Draft	11/8	11/12
DOE Management Review and Sign-Out Project Report	11/15	11/19

SPENT FUEL INITIATIVE

Working Group Meeting

September 9 - 10, 1993

Bethesda Marriott
Bethesda, Maryland

SPENT FUEL INITIATIVE WORKING GROUP MEETING

CONTENTS OF PACKET

SPENT FUEL WORKING GROUP

AGENDA - September 9, 1993

Congressional Salon 3

8:30	Welcome	Peter Brush (EH)
8:40	Introduce Agenda	Terry Mountain (ORISE)
8:45	Overview	Mark Williams (EH)
	- Goals of meeting - Approach - Site visits - Evaluation and prioritization process - Second Working Group Meeting - Question/Answer	
9:15	Related Work	Alan Cohlmeyer (VPA)
	- Spent fuel and facilities database - EIS	
9:45	Break -- Congressional Foyer	
10:00	Draft Project Plan	
	- Overview of evaluation criteria and question sets	Dan Guzy (EH)
	- Overview of prioritization criteria	John Boccio (BNL)
	- Overview of schedule	Pranab Guha (EH)
10:45	Project Plan Discussion	Mark Williams/Terry Mountain
11:30	Subgroup Activities	Sarbes Acharya (EH)
	- Subgroup structure and goals - Introduction of subgroup moderators - Identify subgroup members	
12:00	Lunch -- Chesapeake Room	
1:30	Convene Subgroups (same schedule for all subgroups)	
	- Revisit goals/approach	Moderators
1:45	- Work session	
3:15	Break -- Congressional Foyer	
3:30	- Continue work session	
4:30	- Subgroup day summary	Moderators

SPENT FUEL WORKING GROUP

AGENDA - September 10, 1993

Congressional Salon 3

8:30	Reconvene Entire Working Group .... - Moderator Summaries (20 min. each) - Accomplishments and outstanding issues - Questions/Answers - Resolve issues - Site schedules	Terry Mountain
9:30	Subgroups Reconvene (complete the question set and annotated outlines for the reports)	
10:30	Break -- Congressional Foyer	
10:45	Continue Subgroup Activity	
12:00	Lunch -- Chesapeake Room	
1:30	Summary .... - Status - Future plans	Mark Williams
2:00	Adjourn	

SUBGROUP RESPONSIBILITIES

<u>Group #1</u> - Congressional Salon 3 (front)

(Moderators: Dan Guzy and Alan Cohlmeyer)

- General Information Questions
- Evaluation Criteria #1 Questions
- Evaluation Criteria #2 Questions
- Evaluation Criteria #3 Questions
- Evaluation Criteria #4 Questions
- Evaluation Criteria #5 Questions

<u>Group #2</u> - Congressional Salon 3 (back)

(Moderators: Darrell Huff and Richard Miller)

- Evaluation Criteria #6 Questions
- Evaluation Criteria #7 Questions
- Evaluation Criteria #8 Questions
- Evaluation Criteria #9 Questions
- Evaluation Criteria #10 Questions

<u>Group #3</u> - Gaithersburg Room

(Moderators: Harold Burton and John Boccio)

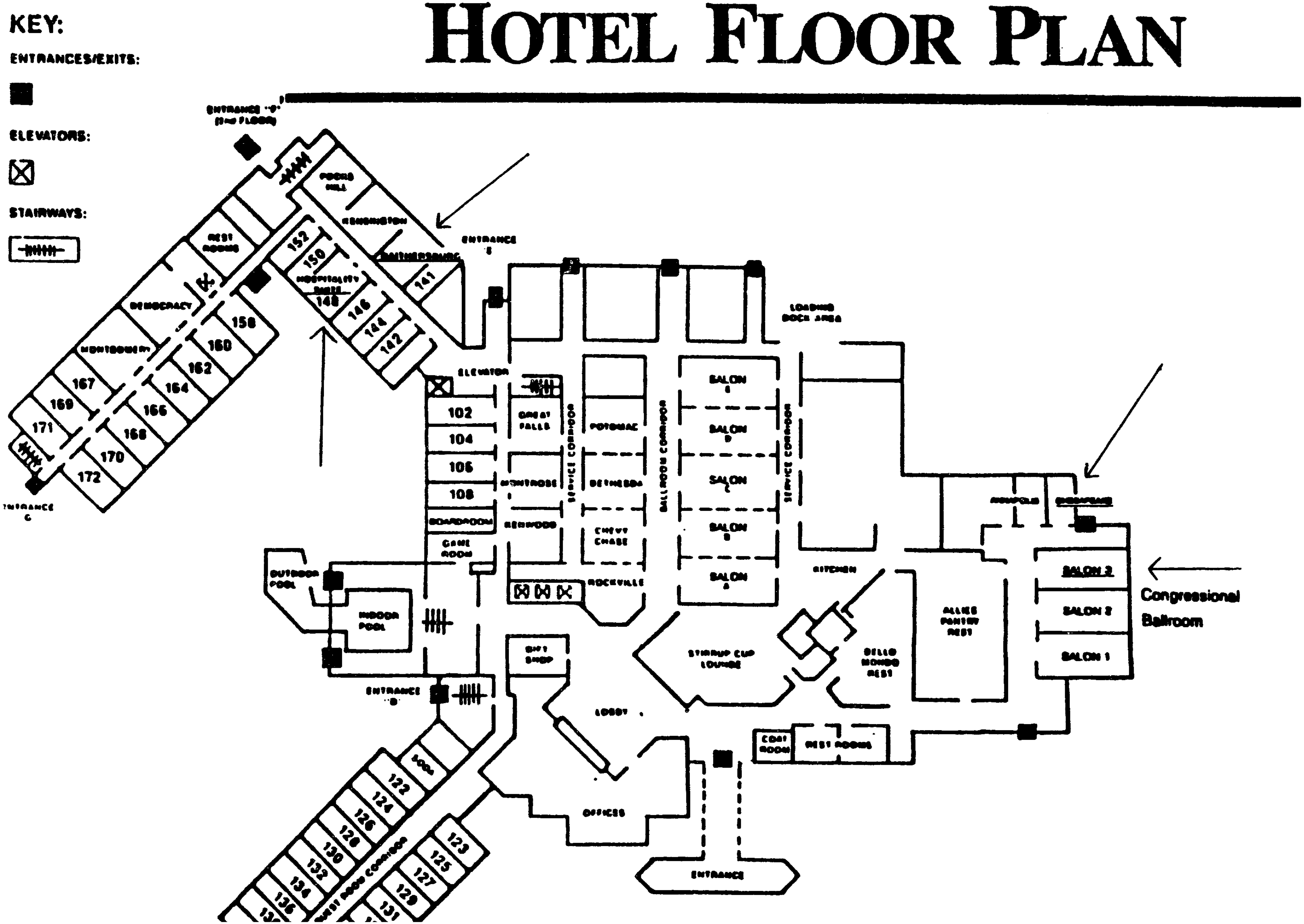
- Evaluation and Prioritization Process

<u>Group #4</u> - Suite 148

(Moderators: Pranab Guha and Carl Obenchain)

- Project Plan and Reports
  - Schedules
  - Outline of M&O site team report
  - Outline of WG assessment team reports
    Outline of report to the Secretary
  - Identification of site team contacts
  - Identification of assessment team members
    (technical and organizational criteria)
  - Assessment methodology

HOTEL FLOOR PLAN



SPENT FUEL VULNERABILITY ASSESSMENT

- Baseline information for policy making
- Mechanism for bringing resources to bear where most needed
- DOE-wide coordination and cooperation

MEETING AGENDA

- Overview
  - Goals
  - Approach
  - Site Assessments
- Related Work
- Draft Project Plan
- Subgroups
  - Goals
  - Assignments
- Subgroup Activities
  - Finalize Drafts
  - Daily Updates
- Identify Issues
- Establish Schedules
- Future Plans/ Requirements

SPENT FUEL VULNERABILITY ASSESSMENT

- Establish Working Group
- Conduct Working Group Meeting
- Conduct Assessments
- Evaluate Information
- Report and Follow-up Actions

SCOPE OF THE VULNERABILITY STUDY

IS	IS NOT
* A DOE assessment	* Compliance audit
* Storage facilities	* Off-Site transport
* Inventories	* Off-Site emergency plans
* ES&H Vulnerabilities	* Future needs
* Maintenance, Operation, and Design	* Ultimate disposal
	* Rule or Order changes
	* Security & sabotage

ESTABLISH WORKING GROUP

- DOE Hqtrs, Field Office, M&O Contr, Lab.
  - Field Coordination (FM)
  - EH (incl site reps), EM, CSO (opt.)
  - FO coordination and M&O Support
  - Letter to FO, M&O

- Technical and Administrative Support (BNL, INEL)

- Working Group Functions
  - Planning and Coordination
  - On-Site Participation (Consistency, Accuracy, Completeness)
  - Program Plan and 90-Day report

CONDUCT WORKING GROUP MEETING

- Objective - To prepare Project Plan
  - Criteria and Schedules for On-Site Vulnerability Assessments

- Meeting Activities
  - General Intent, Approach, and Schedule
  - Question Set
  - Assessment Output Format and Content
  - Team Criteria and DOE Team Site Visit
  - Tentative Schedules (confirmed later)
  - Report Outlines and Prioritization Approaches

- Start Site Work

CONDUCT ASSESSMENTS

- Site Personnel Perform Initial Assessment
  - Criteria Established by Working Group (WG)
  - Consultation with WG

- WG Team Visits
  - Primary Sites
    - Consistency and Completeness of Information
    - Validate and Complete Q-set and Documentation
  - Participation by NS and EH-30 Representatives

EVALUATE INFORMATION

- Inventory Information
  - Location, Amount, Physical Characteristics
- Potential Constraints
  - Storage Limits, Legal issues, Expected problems
- ES&H Information
  - Safety Screening Criteria and Questions
- Prioritization Criteria

REPORT AND FOLLOW-UP

- November 20th Report
  - Complete Inventory
  - Known Constraints
  - Prioritization of Spent Fuel Facility Issues
    - ES&H Vulnerabilities
    - Administrative Issues

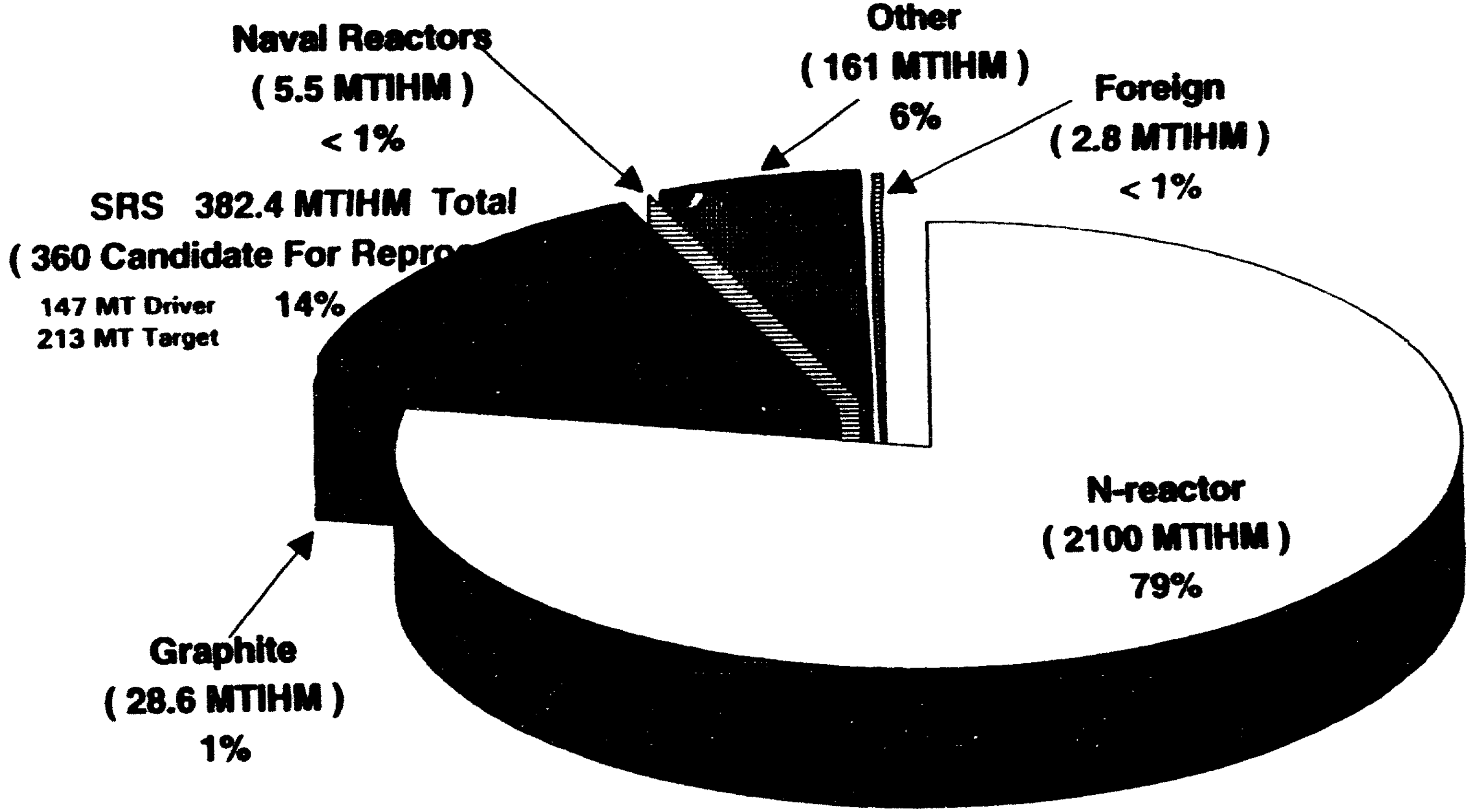
- DOE Action and ES&H Follow-up Assessments
  - Facility Specific

- Periodic Reporting

MEETING GOALS

- Complete Question Set
- Prioritization Criteria
- Project Plan
- Report Outlines

DOE SNF Fuel Types (MTIHM)



STORAGE LOCATIONS

Hanford

- 105 KE/KW Basins
- PUREX
- FFTF
- T Plant Storage Pool
- 200 Area Burial Grounds
- 308 Building
- PNL Buildings 324/325/327

Inventory:	Special Fuels:	31.2 MTIHM
	Production Fuels:	2009 MTIHM

STORAGE LOCATIONS (Continued)

Savannah River

- RBOF
- K/L/P Reactor Basins
- F/H Canyons

Inventory:	Production Fuels:	139 MTIHM
	Targets:	221 MTIHM
	Special Fuels:	22.4 MTIHM

STORAGE LOCATIONS (Continued)

Oak Ridge

- HFIR Pool
- BSR Pool
- Molten Salt Reactor Experiment Vessel
- Tower Shielding Reactor
- Drywells
- Y-12 Warehouse Buildings

Inventory: Special Fuels: 1.5 MTIHM

STORAGE LOCATIONS (Continued)

Idaho

• Test Area North:	Pool/Metal Storage Casks
• ATR	
• MTR	
• Power Burst Facility	
• Chemical Processing Plant:	603/666 Pools Independent Fuel Storage Facility Drywells
• ANL West	
• Naval Reactors Facility	

Inventory:	Special Fuels:	139 MTIHM
	TMI Core Debris	83 MTIHM

STORAGE LOCATIONS (Continued)

West Valley

- Fuel Receipt and Storage Building

  Inventory: Commercial Fuel: 27 MTIHM
  (125 Fuel Assemblies)

Others

- Brookhaven
- ANL East
- B & W Lynchburg
- General Atomics
- Los Alamos

SPENT FUEL NEPA DOCUMENTATION

- Environmental Assessment for Foreign Research Reactors
  - 550 Fuel Assemblies
  - Limited Scope

- Environmental Impact Statement for Foreign Research Reactors
  - Remainder of return of fuel of U.S. origin
  - Support U.S. non-proliferation policy
  - Consider ports of entry, transportation, and storage

- Environmental Impact Statement for INEL
  - Environmental Restoration and Waste Management (ER&WM) Activities
  - Result of Idaho Court Case

ER&WM INEL EIS SCOPE

- Expansion of previous INEL EIS
- Include alternatives for transport, processing and storage at other sites:
  (1) Hanford
  (2) Savannah River
- Includes
  (1) Fort St. Vrain Fuel
  (2) Naval Fuel
  (3) University Fuel
  (4) Other DOE Fuel
  (5) Foreign research reactor fuel of U.S.-origin
  (6) West Valley Fuel
- Spent Fuel to be removed from EM Programnatic EIS

ER&WM INEL EIS SCOPE

- Agreement reached between DOE, Navy, Governor of Idaho to allow limited receipt of naval fuels
- Implementation plan due November 1, 1993
- Public comment on scope expansion via Federal Register notification process
- Must consider past, present, and reasonably foreseeable future actions, "cumulatively and synergistically"

GENERAL PURPOSE OF EVALUATION CRITERIA AND QUESTION SETS

- Evaluation criteria meant to be the basis for assessing and prioritizing RINM storage vulnerabilities
- Question sets meant to support each evaluation criterion
- Additional questions to gather general information about inventories and storage
- Questions are intended to yield factual rather than judgmental information
- This Working Group will take ownership of evaluation criteria and question sets and finalize during this meeting

STRAWMAN EVALUATION CRITERIA AND QUESTION SETS

- Pre-meeting strawman evaluation criteria and question sets drafted by representatives from EH, EM-37, and one M&O

- Distributed before and during today's meeting

- Strawman approach to evaluation criteria was focussed on
  - general, "management," vulnerabilities
  - looked for accountability and programs to minimize vulnerabilities

- Approach recommended for this meeting workshop will focus on:
  - identifying all important safety system functions
  - identifying "real" vulnerabilities that threaten functions

- Strawman acceptance criteria will be replaced by product from this meeting (from Subgroup 3) however, fundamental questions will be similar to strawman set

- WG subgroups will refine questions to define information needs

STRAWMAN EVALUATION CRITERIA

1 The site and facility inventories of reactor irradiated nuclear materials are well controlled and documented.

2 The current condition of reactor irradiated nuclear materials, the storage facility, and safety systems are known and documented.

3 Incidents are documented, and the facility has implemented lessons-learned programs as demonstrated by past actions.

4 The safety analyses for storage and handling of reactor irradiated nuclear materials are thorough, current, and well documented.

5 There are limiting conditions for operation and administrative controls for the storage of reactor irradiated nuclear materials that have been derived from documented safety analyses.

STRAWMAN EVALUATION CRITERIA (continued)

6 Safety systems, structures, and components are clearly identified, and have safety classes derived from documented safety analyses.

7 Operator actions for normal and emergency events for storage of materials are well defined and are consistent with assumptions made in the safety analyses.

8 Reactor irradiated nuclear materials, and the safety systems, structures, and components needed for their storage and handling, are subject to regular preventive maintenance, inspection, testing, servicing, and configuration management.

9 In-facility and site workers are adequately protected from normal and emergency conditions.

10 There are sufficiently detailed plans for near-term storage, and interim long term storage pending Department resolution of ultimate disposition of reactor irradiated nuclear materials.

SPENT FUEL VULNERABILITY STUDY PROJECT SCHEDULE

Milestone	Date
Project Start	9/2
Transmit Draft Program Plan and Q-set to M&O Participants	9/7
Working Group (WG) Meeting	9/9-10
Issue Finalized Q-set and Program Plan	9/14
Sites Complete Assessment Reports	10/1
Complete WG Assessment Reports	10/18
Issue Initial Draft of Project Report	10/22
Issue Final Project Report	11/19

MEETING GOALS

- Review, Discuss, Finalize
  - Question Sets
  - Evaluation and Prioritization Process
  - Project Plan and Report Structure

- For establishing reactor irradiated nuclear materials inventories and assessing storage facility vulnerabilities as directed by the Secretary

SUBGROUP ACTIVITIES

Structure

- 4 Subgroups
  - 2 Question Set Subgroups
  - 1 Evaluation and Prioritization Subgroup
  - 1 Project Plan and Reports Subgroup
- Subgroup Membership Determined By
  - Sign-up Sheet Information
  - Distribution of Expertise
  - Balanced Subgroup Size
  - Minimum Adjustments
- Moderators and recorders for each subgroup

SUBGROUP ACTIVITIES
Subgroup Goals

- Support Working Group Goals
- Subgroup 1 - Question sets for General Information and Evaluation Criteria No. 1 - 5
  (Inventory, Current Conditions, Safety Analyses, LCOs and Administrative Controls)
- Subgroup 2 - Question sets for Evaluation Criteria No. 6 - 10
  (Safety Systems, Operator Actions & Procedures, Maintenance & Inspection, Worker Safety, Future Storage Plans)
- Subgroup 3 - Evaluation and Prioritization Process
- Subgroup 4 - Project Plan and Reports
  (Schedules, Report Formats, Site Contacts, Team Structure, Assessment Methodology)

SUBGROUP ACTIVITIES

Subgroup Moderators

- Supgroup 1 - Dan Guzy, Alan Cohlmeyer
- Subgroup 2 - Darrell Huff, Richard Miller
- Subgroup 3 - Harold Burton, John Boccio
- Subgroup 4 - Pranab Guha, Carl Obenchain

SUBGROUP ACTIVITIES

Subgroup Members

- Identify Members of Each Subgroup
- Assign Meeting Rooms

SPENT FUEL INITIATIVE

(September 1993)

WORKING GROUP ASSESSMENT PLAN

DOE Working Group on Spent Fuel
Coordinated by the Office of
Environment, Safety and Health

WORKING GROUP ASSESSMENT PLAN
for
Assessment of Vulnerabilities of DOE Storage
of Irradiated Reactor Fuel and
Other Reactor Irradiated Nuclear Materials

Preface

This Working Group Assessment Plan is an implementing document pertaining to the Secretary's initiative to determine the Department's inventory and ES&H vulnerability stemming from the storage of spent fuel and other reactor irradiated nuclear materials (RINMs). A project plan (as named in the above title) has been written. The project plan describes all essential features of the initiative and describes the role of this Working Group Assessment Plan. The user of this Assessment Plan is advised to be familiar with details of the Project Plan. Users of this Plan are expected to be members and leaders of Working Group Assessment Teams who have primary responsibility to identify and characterize vulnerabilities.

Objective

The objective of this plan is to provide Working Group Assessment teams with a simple, effective methodology to assess and validate information supplied by site representatives (the "Site Teams") and to identify and document vulnerabilities for further evaluation by the Department. A further objective is that this methodology can be uniformly applied at all sites to minimize disparate interpretations, ensure commonality of language among the dozen or so reports, and facilitate the efforts of the Working Group to normalize and coalesce vulnerabilities from the several assessment teams for the final report which will go to the Secretary.

Overview

The **Site Team** consists of M&O contractor and Operations Office personnel selected for their knowledge about stored fuel and RINM at the site. The Site Team is responsible for preparing the Site Team Report.

The **Working Group Assessment Team** consists of members of the Spent Fuel Working Group, EH staff members, and EH and EM-37 consultants selected for their experience in areas important to the safe storage and handling of spent fuels and other RINM.

The Working Group Assessment Team will visit each selected site to accomplish the following:

1. Review site's response to EM-37 questionnaire on inventory, material conditions, and facility missions.

2. Review the site's responses to the Question Set (Attachment 4 of the Project Plan)

3. Validate the responses (data) via thoughtful independent sampling, exploratory questioning, direct observation of facilities (walkdowns), and review of programs.

4. Evaluate (and validate as necessary) the site's list of issues and exercise the methodology of this document to define and characterize vulnerabilities.

5. Write the Working Group Assessment Team report.

Visit Agenda

Each Team Leader should develop a site visit agenda specific to the needs of the site and team. Attached for consideration is a generic agenda (Attachment 1) for the visit of an Assessment Team to a site.

Larger sites such as INEL and Hanford need larger Working Group Assessment Teams to subdivide and work in parallel, taking several days to accomplish all elements. Small sites may use small teams to assess all storage locations. The Team Leader, therefore, may refer to the attached generic agenda but develop an ad hoc agenda suitable for each specific site. The agenda should be developed as early as possible so that both the site and the Working Group Assessment Team are aware of what is planned and expected. The agenda should be developed in concert with site contacts.

Protocol

The Assessment Team review should include a complete and open exchange of information between the Assessment Team, the DOE Operations Office staff, and the M&O contractor personnel. The following are key aspects of successful communication:

- Entrance discussions between the Assessment Team, DOE Operations Office, and M&O contractor regarding the objectives of the assessment and the DOE and M&O contractor perspectives on facility operations.

- Establishment of technical and administrative contacts (operations office and contractor) for the Assessment Team.

- Candid verbal communications should occur among all parties. Forms used should be administratively controlled to facilitate information flow and ensure that the cognizant elements of the M&O organization and DOE Operations Office are fully aware of and involved in responding to potential issues.

- Daily meetings between the Assessment Team and other parties should be held during the assessment. These meetings should be used to arrange/schedule activities, such as interviews, walkdowns, and information exchange. Published schedules should be used for planned activities and most activities should be planned.

- At the end of the assessment, the M&O contractor, DOE Operations Office, and the Assessment Team should agree that the issues presented are factual and reflect the best knowledge at that time. If some technical reviews are incomplete, issues finalization should await the technical reviews. Issues in this category delay the completion of the assessment report and have the potential to affect schedules. Schedules should be formalized to the extent possible.

- Recognition by all parties that the assessment is an integral part of the Department's activities to ensure the safety of the workers, the public and the environment, and that all personnel involved in the activity share that common goal.

Procedure

The following is the procedure to be followed by each assessment team during its site visit. It covers the essential functions of the visit: Review, Evaluation, and Validation of Site Team responses to the question set, as well as the identification and compilation of symptoms and adverse conditions. The procedure begins after the in-briefing with the first meeting between the Working Group Assessment Team and the Site Team (see Generic Agenda in Attachment 1).

At the outset, this procedure requires and presumes that the Assessment Team leader has assigned responsibilities to all team members. It is crucial to this process that specific team members be directed to focus their evaluation towards conditions and symptoms outlined in Attachment 5 of the Project Plan.

All conditions and symptoms must be assigned and the designated Assessment Team member(s) must know that he/she is responsible to conduct a thorough review, to identify potential vulnerabilities, and at the close of the review period, to defend the potential vulnerabilities to the Working Group Select Committee which will prepare the final vulnerability report.

Specific procedure steps are as follows:

Step 1. Facility Review

(a) The Site Team begins by describing the site and storage facilities, and explaining the mission(s) of the storage facilities at the site.

(b) The Site Team describes operations at the storage facilities to provide the Assessment Team an understanding of the complexity, frequency, and volume of RINM movements and other activities pertaining to RINM storage.

Step 2. Review Draft Question Set Responses

The attention of the teams next turns to the Question set responses. Each response to the Question Set will now be discussed in sufficient depth for Assessment Team members to have a clear understanding of the condition of spent fuel stored, condition of storage facilities, facility operations, and institutional controls. Assessment team members will, in most cases, have to be aggressive in pursuit of information to ensure that the team has a thorough basis for its conclusions. Nevertheless, team members should remember that this study is not a compliance audit, and lines of inquiry should be oriented toward the objective of the assessment.

This procedure step (#2) is further broken down into four sub-steps (a through d).

(a) The site response to the EM-37 questionnaire and Question #1 of the Question Set will be used in completing forms on RINM inventory and general facility descriptions. (Attachment 7 and Attachment 8 give forms) The Site Team will help clarify their responses and provide additional information as needed.

(b) Beginning with Question #2, the Site Team describes their response to each of Questions 2 through 8. Discuss the criteria that reflects a thorough response (see Attachment 3)

(c) For each response, the Assessment Team next pursues additional information to clarify and ensure thoroughness and accuracy. This is done by asking additional questions, such as those in Attachment 4, to stimulate further discussion. The Assessment Team should ensure that all "elements" of the Question Set have been considered. Requests may be made for additional or clarifying information, and followup interviews may be scheduled as necessary to clarify information needed to identify or categorize symptoms, adverse conditions, and potential vulnerabilities. Team members should consider the criteria provided in Attachment 3 to ensure that the formal response to any question is complete. Assessment Team members should be familiar with the Exploratory Topics provided in Attachment 4.

(d) Any reported information or data that could be related to a potential vulnerability should be questioned extensively to reveal and characterize that vulnerability. If an Assessment Team member feels that an ES&H issue exists he should make his opinions known to the team so that it can be discussed. The Vulnerability Development Form (Attachment 5) should be completed for review by the Assessment Team during the assessment and as it develops its report.

Step 3. Review of Potential Vulnerabilities

Upon completion of the eight questions, it is expected that the Assessment Team will have developed an expanded perspective. This Step provides the two teams with an opportunity to review the accumulated potential vulnerabilities and to search for others which may have been overlooked. If new potential vulnerabilities are identified, each should be entered on a Vulnerability Development Form.

Step 4. Facility Walkdown

A facility walkdown is conducted to become knowledgeable of facility layout and features and to further explore the material condition of the facility and any spent nuclear fuel or co-located materials stored. Assessment Team members should be assigned responsibilities that are complementary to their areas of expertise and contribute to the overall goal of identifying and quantifying symptoms, adverse conditions, and potential vulnerabilities. Information gained during the review of the Site Team Report should be used to formulate a plan for the performance of a walkdown. Areas identified as potential vulnerabilities must be explored fully to document the causes of the adverse condition. See Attachment 4 for candidate activities to be performed by the Assessment Team during the walkdown.

A facility representative knowledgeable of facility operations should conduct the walkdown.

Personnel performing walkdowns must be observant of the following:

- Material condition of facility
- Posted hazards, warnings, operational conditions
- Facility access requirements such as dosimetry, clothing, RWPs, security
- Safety equipment such as ventilation, atmospheric monitoring, area radiation monitoring, coolant systems
- Fuel movement equipment such as cranes and special tools
- Radioactive and hazardous materials stored in the facility that are not RINM
- Symptoms for potential accidents
- Gross configuration verification

Other suggested activities during the walkdown include:

- Verify that safety systems are similar to those specified in the authorization bases.

- Look for seismic or wind structural weaknesses that could damage RINM and safety systems.

- Look for explosive and flammable materials that might threaten the storage of RINM and safety systems.

- Observe condition of storage containers, casks; particularly for dry storage areas.

- Determine if any special operations are performed at the facility in addition to fuel storage and movement. Examples would be fuel sampling, bundle disassembly and reconstitution, cutting up fuel rods, etc.

- Observe large quantities or oversized co-located materials.

- Determine the status of any of the following conditions observed:

  - Posted airborne contamination areas as an indicator of coolant activity.
  - Posted loose surface contamination areas.
  - Posted high radiation areas (> 100mr/hr) as an indicator of loss of shielding and institutional control problems.
  - Inoperative equipment as an indicator of institutional control problems.
  - Obviously corroding materials, particularly spent fuel containers, support structures, and fuel elements.
  - Fuel bundles leaking gases as an indicator of structural integrity failure.
  - Sludge material at the bottom of pools as an indicator of corrosion.
  - Equipment/materials hung from the pool wall or structures on ropes as an indicator of institutional control problems.
  - Material or equipment in obvious disrepair as an indicator of institutional control problems.
  - Suspended particles in water or lack of clarity of water as an indicator of coolant activity problems and corrosion.

- Determine if cranes used to handle fuel are certified.

- Determine if operators of fuel handling equipment are qualified.

- Determine the frequency with which the facility updates the records of the physical condition of materials stored, and why management feels that is adequate.

- Determine how facility personnel find out what is stored where. Does it work? Is it current?

- Determine the frequency of fuel movement activities.

- Additional areas identified during the review of question set responses.

During the walkdown personnel in the facility should be questioned to determine their job responsibilities and other information they may be willing to offer which an Assessment Team member feels is pertinent. For instance, technicians may be asked to explain what they know about the materials stored, how movement operations are performed, and their understanding of the hazards involved.

The walkdown activities in Attachment 4 should be used as guidance for the completion of a walkdown for each of the adverse conditions.

Each Assessment Team member should tailor his walkdown activities according to his individual assignments, and to obtain all the information needed to initiate a Vulnerability Development Form. As in previous cases, the Vulnerability Development Form will be reviewed later by the Assessment Team.

Step 5. Summary Meeting

The two teams reconvene with the objectives of: (1) clearing all questions or unfinished business needed so the Site Team can finish the Site Report; (2) reviewing and condensing all potential vulnerabilities to a reduced set; (3) systematically addressing each residual potential vulnerability for substance and factual accuracy; (4) completing data entry on each remaining Vulnerability Development Form.

NOTE: Any one member of the site or assessment team can initiate a potential vulnerability form.

Step 6. Identification and Compilation of Symptoms and Adverse Conditions

This activity is to be conducted by the Assessment Team. It consists of "Boxes" 2 and 3 shown in Table 5-1 of the Project Plan. The Site Team may be present during this activity but will act only as a resource.

In this activity, the Assessment Team formally identifies "conditions and symptoms" and "adverse conditions." This process will use the Vulnerability Development Forms which were filled out during previous activities. Each potential vulnerability initiated on one of these forms should be developed. Only if full consensus is reached that a potential vulnerability is not, in fact, a reportable vulnerability, may it be closed. In all other cases, the potential vulnerability will become reportable in the Assessment Team report.

Once all potential vulnerabilities have been identified by this process, they will again be reviewed with the Site Team for factual accuracy. Consensus is not required. The support of only one person on the Assessment Team and the Team Leader (see Attachment 5) will be sufficient for a potential vulnerability to be reported in the final Assessment Team report.

Step 7. Assessment Team Report

The Assessment Team will reconvene (without the Site Team) in order to draft the Working Group Assessment Team Report.

NOTE: The Table of Contents for the Assessment Team Report is provided in Attachment 6.

Other things to remember:

- *To the extend practicable, all supporting material should be typed in Word Perfect 5.1. Hand written information, such as relevant field notes from interviews or walkdowns, should be retained by the team member and the team leader. All material for the report including appendices should be typed.*

- *Facility and material descriptive material will be brief and concise, limited to that detail required to support assessment conclusions and relying heavily on references for more detailed descriptions (e.g., either the Site Team Report or facility documentation such as SARs, System or Component Design Descriptions).*

- *The report will provide clearly defined technical bases for conclusions and identified vulnerabilities.*

- *If classified information is involved, such information will be prepared in the form of a classified addendum and handled in accordance with the specific material classification requirements.*

Generic Agenda for Working Group Assessment Teams

Day "0" (Assembly on day prior to visit, usually Sunday)

- Team arrives at designated hotel
- Meeting (in hotel) (Team Leader responsible for time and place of meeting)
  Purpose: to organize site visit and responsibilities
  1- Introductions with background (if needed)
  2- Leader reviews activities of site visit, names, locations
  3- Leader reviews agenda for first on-site day and schedule for entire visit
  4- Leader reviews protocol, reviews assessment plan, and assigns responsibilities.
  5- Discussion

Day 1 (First on-site day)

- Team processes through access gates, takes required training, goes to first meeting

<u>In-Briefing</u>

- Leader/host conduct introductions
- Leader provides briefing to hosts covering background, purpose, activities (see generic introduction in this Plan, Attachment 2)
- Depending on size of site (# of storage facilities) host will provide overview briefing describing site, mission, history, locations of storage facilities, and logistics (i.e., tours, meeting facilities, etc.), make-up of site teams, physical security requirements, other.
- At this point the assessment team may divide into two or more smaller teams to address multiple storage sites. Subsequent items below may, therefore, be done in parallel.

<u>First Meeting(s) with Site Team</u>

Begin procedure. The following items correspond approximately with the procedure.

- Site Team describes facility to be discussed.
- Using EM-37 questionnaire and clarifications by Site Team, Assessment Team completes forms on site inventory and facility description (Attachments 7 and 8).
- Site Team presents response to each question in Question Set.
- Assessment Team evaluates and validates response, records potential vulnerabilities using Attachment 5.
- The last two steps will be repeated for each remaining question in the question set.
- List of ES&H concerns presented by Site Team.
- Assessment Team evaluates and validates concerns, records potential vulnerabilities.
- Assessment Team may then tour facility(s), record additional potential vulnerabilities.
- Summary meeting of the two teams review previous results (especially the potential vulnerabilities) for additional information and factual accuracy.

Note: The above activities <u>should result in concurrences and/or advisories to the Site Team so the Site Team report can be culminated</u>.

- The Assessment Team then concentrates on development of vulnerabilities using the methodology described in the Procedure.
- Assessment Team organizes vulnerabilities, begins assembly of report.
- Assessment Team conducts factual accuracy review with Site Team as required.
- Assessment Team finishes draft of report (or section for that facility).
- Assessment Team conducts out-briefing including review of draft report.
- Departure.

Note: The above process will repeat as needed to complete reports for each facility and then to assemble the final Site Assessment Report. At the end of each day's activity, the team leader will assemble the team for a status meeting to organize the next day's activities.

Attachment 2

GENERIC IN-BRIEFING SUMMARY
TEAM LEADERS-TO-M&O HOSTS

PURPOSE/OBJECTIVE:

- Produce environment, safety and health vulnerability assessment of storage fuels.
- Produce Department-wide spent fuel inventory data.
- Provide baseline information for important policy issues being addressed by the Department.

BACKGROUND:

- Secretary assigned Office of EH the responsibility to lead Department's initial assessment of ES&H vulnerabilities (August 19, 1993 letter).
- Project plan issued September 20, 1993, with copies to all M&O contractors, Field Offices and others.
- Initial project report to be presented to the Secretary by November 20, 1993.
- Results also expected to support longer-term EM-37 effort.

SCOPE:

Will provide itemized inventory data of RINM and initial report on assessment of the ES&H vulnerabilities associated with storage and handling of RINM.

RINM defined as spent nuclear fuel (in any condition) and irradiated nuclear targets from production and research reactors.

APPROACH (CONSULT FIGURE 1 OF PROJECT PLAN):

- Project plan, including a review process and question set, developed.
- Collection of data, identification of ES&H concerns using the question set, and preparation of Site Report by Site Teams consisting of M&O and Operations Office personnel.
- Validation and evaluation of Site Report information , identification and organization of facility vulnerabilities and preparation of Site Assessment Reports by Working Group Assessment Teams.

- Characterization of overall vulnerabilities and preparation of project report (to Secretary) by Working Group.

ASSESSMENT ACTIVITIES (THIS VISIT)

- Review of Site Report--response to Project Plan question set.
- Discussion with Site Team relative to question set answers.
- Further discussions with Site Team relative to potential or suspected vulnerabilities.
- Walkdown of subject facilities.
- Interviews with Site Team and operations personnel.
- Sampling verification of inventory data supporting documentation/records.
- Reconciliation of discrepancies between Assessment Team observations and information or observations reported by the Site Team.

PRODUCT:

- Assessment Team report as basis for identification of vulnerabilities and a judgement relative to urgency of corrective actions.
- Factual review of the Assessment Team Report by the Site Team.
- Assessment Team reports will collectively provide basis for identification of vulnerabilities and a judgement relative to urgency of corrective actions.

GUIDELINES FOR JUDGING COMPLETENESS OF RESPONSES TO QUESTIONS

QUESTION 1: What is your inventory of Reactor Irradiated Nuclear Material (RINM)?

- Have all the "elements" identified under Question 1 been considered/discussed?
- Have the "exploratory questions" given in Attachment 4 been considered/discussed?
- Have the EM-37 inventory quantities been clearly identified? (This question is particularly pertinent if the EM-37 questionnaire has not yet been completed).
- Have known RINM inventories in excess of the EM-37 inventory been quantified?

GENERIC FOR QUESTIONS 2-7:

- Have all the "elements" identified under this Question been considered/discussed?
- Have the "exploratory questions" given in Attachment 4 been considered/discussed?
- Is the completeness of the answer to this question supported by information obtained through the facility walkdown?
- Have all requests for additional information been closed?
- Is the Question Set information on material conditions (facility, RINM, and coolant) consistent with relevant information given in the EM-37 questionnaire?

QUESTION 8:

- Is the answer to this question supported by/consistent with the answer to Question 5?
- Is the answer to this question supported by the answers to the other questions?

SPENT FUEL INITIATIVE
TABLE TOP DISCUSSION / WALK DOWN MATRIX

Adverse Condition - Criticality

Conditions or Symptoms	Table Top Discussion	Walk Down Activities
Moderator Problems - Pool	Does the safety documentation address variation of moderation due to a change in water level in the pool? Q6	
	Does the safety documentation address change of moderation due to change in temperature of the water? Q6	
	Is water level verified to assure appropriate moderation? Q4	
		Check procedure to determine if it addresses the maintenance of water within specified bounds.
		Check water level to confirm that it is within the specified bounds.
Moderator Problems - Dry Storage	Is it possible to have foam accumulate on the fuel from fire fighting efforts? Q3	Check fire fighting procedure to confirm that it addresses use of foam in fighting fires in the vicinity of spent fuel storage areas.
		Interview 2 fire fighters to determine their knowledge of fire fighting restrictions.
	Does the safety documentation address the potential for entry of water in storage areas? Q6	Look for piping whose rupture could result in water entry in area.

		Interview facility personnel to determine if they understand the concern with entry of water in storage areas.
	Does the safety documentation address the method, quantity, and rate of water removal? Q6	Inspect area for debris which could clog water removal drains.
		Interview facility personnel to determine if they have a program for assuring good housekeeping and prompt debris removal.
	Are there emergency procedures to respond to flooding of the storage area? Q6	Review emergency procedure with facility personnel. have them explain the procedure.
	Does the safety documentation specify a minimal height above the floor for fuel storage? Q6	Have facility personnel check the storage height of a sample fuel element.
Geometry Problems	Are there analyses supporting the nominal geometry of fuel storage? Q6	Review criticality safety limits to determine if they conform to the analyses.
		Check to see if criticality safety limits are posted at fuel movement control stations.
	Is the geometric configuration of the fuel regularly verified? Q6	Have the analyzed array spacing verified for 3 random samples.
	Does the fuel storage array (e.g., designated empty spaces) mitigate the consequences of a criticality accident? Q6	Using available analyses results, check to confirm that actual arrays contain the specified empty spaces.

	What accident conditions (e.g., seismically induced rack failures) are considered in the safety documentation? Q6	Check to see if fuel rod supports are corroded or otherwise damaged so as to be vulnerable to shocks
		Visually check pool to see if water is clear free of debris which could affect geometry.
	Are there procedures to control fuel movement and heavy loads in the vicinity of spent fuel? Q6	Review fuel movement and control of heavy loads procedures for compliance with criticality safety limits (with safety margin)
		Interview fuel movement operator to check understanding of criticality safety limits and fuel handling procedure.
Inventory Uncertainties	Are conservative values of U-235 and or Pu-239 content available? Q6	
	Is the fuel stored in configurations that are enveloped by safety analyses? Q6	Select 3 random samples to determine if serial numbers correspond to inventory and fuel handling records.
	Are analytical and materials uncertainties (e.g., upper bounds on enrichment, burnup, etc.) accounted for in a conservative manner in criticality determinations? Q6	Interview the fuel custodian to determine knowledge of the inventory system and commitment to accurate inventory records.
Reflection Problems	Does the criticality analysis account for water and concrete reflection? Q6	Verify that reflector material is located in positions assumed in the criticality analysis.

	Do the analyses include realistic or simplified cell models? Q6	Interview fuel handling personnel to determine their knowledge of the effect of reflector material.
Poison Problems	Are poisons provided in a form that can not be displaced (i.e., irremovable structures)? Q6	Spot check inventory and location of fixed poisons to determine consistency with analyses.
	Can the concentration of soluble poisons be assured within limits specified in the criticality safety analysis? Q6	Review the procedure for checking soluble poison concentrations and soluble poison monitoring records to determine if poison concentrations are being maintained within prescribed limits.
	Is the uniformity of the poison concentration assured? Q6	
	If poison plates are not enclosed is there a system to detect the leaching out of boron? Q6	Look for build-up of soluble poison on equipment (e.g., crusty deposits or heavy corrosion).
		Interview storage facility personnel to determine their knowledge of the effects of poison materials.
Migration or Accumulation of Fissile Material	Does the safety documentation specifically address the accumulation of fissile material in ductwork, filters, resin beds, sludge, or piping? Q6	Observe if any ductwork, filters, resin beds, or piping is posted as a radiation area.
		Interview facility personnel to determine if they are aware of or concerned about migration or accumulation of material.
	How are estimates of fissile material accumulation made? Q6	

	Is the thickness of any sludge containing fissile material monitored? Q3	Review monitoring records.
Institutional Controls	Are surveillance logs and maintenance records for equipment important to criticality prevention accurately maintained? Do these logs and records identify deviant conditions and corrective actions? Q5 & Q7	Review 3 surveillance logs and 3 maintenance records of equipment important to criticality prevention to confirm that surveillnces and maintenance actions are being performed in a timely manner.
	Is the Double Contingency Rule being applied to all criticality safety analyses? Q 6	
	Are OSR/TSR controls adequately supported by the safety documentation? Q6	
	Are inspections for configuration control regularly performed and documented? Q6 & Q7	
	Are their independent audits of the facility surveillance, and maintenance programs? Q6	
		Review fuel handling procedure for protection against placing fuel in wrong storage locations.
		Review posted criticality safety limits to determine if they are clear and will not lead the fuel handler to exceed safety limits.

Other	Does the SAR analyses satisfy the requirements of DOE 5480.24 and the relevant ANSI standards? Q6	
	Are there analyses that address accidental criticality configurations? Q6	

SPENT FUEL INITIATIVE
TABLE TOP DISCUSSION / WALK DOWN MATRIX

Adverse Condition - Fission or Activation Product or Hazardous Material Release

Conditions or Symptoms	Table Top Discussion	Walk Down Activities
Loss of Cooling	What are the required conditions and limits for heat removal, and are these conditions and limits derived from documented safety analyses? Q6	
	Is the temperature of the coolant periodically monitored? How and how often are these temperature measurements made? How long can cooling be interrupted to the storage facility? What criteria and assumptions are intrinsic to the heat balance? What is the maximum temperature reached upon interruption of cooling? Does heat removal from the RINM depend on the cooling system? Q6	
		Inspect physical and material condition of associates pumps or fans and determine if belts are loose or worn, electrical connections are secure, excessive vibration, high temperatures, evidence of corrosion, etc.

	Does the storage facility have a design capability to resist seismic events? What level of seismic acceleration is tollerable (is this consistent with UCRL 15910 or STD-1024-92)? What damage would occur if seismic limits were exceeded, i.e., piping systems, cable trays, facility walls? Q6	Inspect cooling component supports for structural integrity, security of fasteners, and ability of system to withstand severe shock, for example seismic event, etc.
	Have seismic system interactions (failure of overhead cranes, masonry walls, fire protection equipment, and other overhead or nearby structures and equipment) been addressed?	
	What activities are routinely conducted in the vacinity of the storage area? Do these activities involve high kinetic or high potential energies? Q6	Inspect systems and components containing coolant to determine exposure or susceptability to vehicle or pedestrian traffic.
	What type of logkeeping is employed at the facility? What types of operating records or machinery history are maintained for the facility? Does the facility have Technical Operational Requirements? Operational Safety Requirements? Are surveillances designed to be consistent with TSR/OSRs? Q6	Review material history records for active components, for example pumps, fans valves, dampers, etc. Determine if surveillances are performed as required, frequency of corrective actions and repeating problems, average downtimes for equipment. Determine what actions have been taken to determine the root causes of repetitive failures or problems.

		Review machinery logs to see if trends and anomolies have been identified and their causes investigated. Determine if out-of-specification readings are corrected by operators and analyzed to determine the root causes for the out-of specification condition. Determine if operators understand the factors that can result in out-of-specification readings.
	What causalty or emergency procedures apply to the facility? How often are these procedures exercised? updated? Q7	Interview facility operations personnel and determine if they understand the causes and immediate actions required for loss of coolant events.
Hazardous Materials Identification	What hazardous materials are stored in the storage area (e.g., hafnium, cadmium, etc.)? Is there a sampling or monitoring program for these materials? Q6	
	What materials, e.g., combustible or flammable materials, explosives, hydrogen, propane or natural gas systems, etc.) are stored in the vacinity of the storage area? Has the hazard of storing these materials in the vacinity of the storage area been evaluated. What assumptions and criteria were used in the evaluation? What is the worst case scenario? Q6	Inspect the storage area to observe what hazardous materials are stored in the facility, and how much. Determine whether or not what is observed is consistent with hazard evaluations.

		Review air or effluent records to determine if release of hazardous materials is monitored.
Structural Integrity of Spent Fuel Cladding or Canning		Observe cladding and canning for signs of material degradation. If observation is not possible, review fuel handling records to identify the material condition of cladding or cans in the storage facility as recorded in the fuel handling records.
		Review the pool cleanup maintenance records. Determine if surveillances are performed as required, frequency of corrective repairs is excessive, and if the length of equipment downtime appears excessive. Determine what actions have been taken to identify root causes for equipment that undergoes frequent repair. Look for radiation postings or radiation survey maps that indicate high quantities of radioactive material in the filters or resins.
Coolant Activity	Is coolant activity sampled on a regular basis? Have trends or anomolies been identified or evaluated? Are instances of elevated activity investigated and corrected? Do operations personnel understand the causes of changes in coolant activity? Q4	Walkdown the coolant sampling station. Review coolant sampling records and any analyses performed to explain a change in coolant activity.

	Do facility procedures provide warnings to personnel about factors that can result in sample activity errors? Q4	If possible, observe a coolant sample being obtained. Observe the use of procedures in obtaining the sample and computing the results.
Coolant Quality Monitoring	Has the water chemistry control program been effective? (Analogous question for air and liquid sodium storage facilities.) Q4	Review coolant sampling records to determine if water chemistry is monitored and adjusted to control corrosion rates. Review records for trends and anomalies.
		Review water quality monitoring records to determine if water is sampled for suspended solids (early indicator of possible corrosion problems). Review for trends and anomalies.
		If soluble absorbers are used, interview personnel to determine the process used to ensure the required concentration is maintained in the pool.

Monitoring Well Activity		Review monitoring well records. Note proximity of wells to storage pool and if site personnel have determined hydrologic conditions (e.g., ground water flow direction and rate) in the vacinity of the pool. Compare recorded contamination to contaminates present in the pool. Verify that facility personnel have analyzed recorded cases of high well readings and have determined the source of contaminationn and implemented corrective actions. If contamination is explained by reference to a previous spill or as coming from another area, ask to review the records of the spill or the analysis that identifies the source of the contamination.
Pool Leakage		Review facility design to determine if other leak detection features (e.g., annulus or sump pit level instrumentation, pool coolant level monitors, etc.) are provided.
		Review facility logs for evidence of routine monitoring of such equipment and if prior leakage had occurred. If leakage had occurred, determine if causes were identified and corrective actions implemented.

		Review maintenance records to determine if the equipment is routinely maintained or has required repeated repairs. Determine if the causes for repeated equipment failures are understood and if actions been taken to correct them.
		If administrative controls are relied on for leak detection, determine the level of management control (e.g. Operational Safety Requirement) over such actions and the rigor of their implementation.
		Determine if facility records document make-up water addition quantities and frequency. Review pool coolant level records for trends or anomalies. Determine if actual practice is to simply add water "to the water mark"whenever the level appears low.
		Determine if the facility has performed a coolant inventory balance analysis that explains changes in the pool coolant level and make-up water addition records. Note the number and size of openings between the pool room and the outside area.
Confinement	Is good physical and material condition of facility systems and components important to the mission of the storage facility? What are the down-sides of poor conditions? Q4	

		Review air or effluent release records for trends or anomalies. Examine if monitors are located near bends in the ductwork or near the fans. Look for long runs of tubing between the detection point and the monitor. Ask if there are single or multiple sampling ports for the monitor.
		Inspect ventilation ductwork/system piping/storage cask (as appropriate) to determine system integrity and identify indications of material degradation (open penetrations in ductwork; excessive corrosion of system or system supports; evidence that valves can function as required, such as a valve maintenance program). Confirm that position indicators for duct dampers are labeled and that the dampers are in the correct position. Examine differential pressure across filters for evidence of blockage or burn-through.
		If system components are danger-tagged: determine how long tags have been present, are personnel aware of components tagged-out and impact on system operability.

		Inspect hot cells to determine if there is evidence that corrosive materials (e.g., hydroflouric acid) are used in the hot cell. If so, inspect to determine if scrubbers are placed upstream of the HEPA filters to prevent filter burn-through.
		Review surveillance records to determine if filters are replaced on a regular interval and if the basis for the interval is explained.
Contamination		Review radiation survey records for indications of soil contamination in the vicinity of the storage area. Interview personnel to determine the cause of the contamination and planned or taken corrective actions. Verify this information against records. Determine basis for eliminating the RINM storage facility as a source of the contamination.
		Inspect storage areas for posted contamination areas. Interview personnel to determine the cause of the contamination and verify this information against operating logs. If areas are not posted, review recent radiological survey maps of the facility.

SPENT FUEL INITIATIVE
TABLE TOP DISCUSSION / WALK DOWN MATRIX

Adverse Condition - Radiation Exposure

Conditions or Symptoms	**Table Top Discussion**	**Walk Down Activities**
Loss of Shielding	Have penetrations in the shielding been evaluated for dose contribution? Q6	Spot check radiological survey documentation to confirm that required surveys are being performed in areas where shielding is needed.
	Are radiation monitors provided to signal a loss of shielding? Are radiation monitors maintained operable and calibrated at the required frequency? Are scattering doses considered when fuel is moved? Q6	Review radiation monitor calibration records and maintenance records.
	What is the minimum depth of water required to maintain acceptable radiation levels in the vacinity of the storage area? Are specifications established for shielding dimensions, e.g., fuel pool water level, wall thickness? Q6	Review monitoring records for frequency of measurements and compliance with specifications.
	Are special dams, bellows seals or other equipment used when fuel is added or removed from the storage pool? Has failure of this equipment been analyzed and if so can coolant inventory be lost due to failure? Q6	Review the maintenance records of equipment used during RINM movement.

	Are pool coolant or water filtration systems used? Can improper maintenance or other damage to these systems cause inadvertent loss of coolant inventory? Q6	Examine the physical condition of pool cleanup system for evidence of damage or excessive wear. Ask about activities performed in the vacinity of these systems to determine if such activities could cause damage resulting in loss of inventory.
		Review reports on occurrences involving the cleanup systems.
	Are ALARA principles invoked when determining allowable doses to the operators? Q7	Review occupational exposure records for trends or anomalies. Review radiation survey documentation to confirm that "hot spots" are either not present or are properly shielded.
	Could loss of shielding result in activation of material in and around the storage facility? Q4	
Contamination	What are the limits on releasing fission products or fissile material into the storage media or in-facility atmosphere? Are these limits derived from facility safety documentation? Q6	
	Are samples taken at locations which have been established as the most adverse? Q4	
	Are contamination doses figured into total dose calculations? Q4 &Q6	
	Do dose assessments use latest values for quality factors or flux conversions? Q4	

	Are area contamination surveys routinely conducted in the facility? Q4	Review the type of equipment used and calibration and maintenance performed. Review records to confirm that contamination surveys are performed at a specified frequency
		Observe if source checks are done on the survey equipment prior to each use.
		Inspect all radiological postings in and around the storage facility.
	Is coolant periodically sampled to determine the radionuclide content? Q4	Determine the type of sampling equipment used and the frequency and method of sampling.
		Verify that sampling equipment is calibrated and maintained acording to specifications.
		Verify that procedures are used for periodic sampling of the coolant.
	Is routine sampling for airborne and surface contamination performed? Q4	Review sampling methods and frequency and verify that procedures are used.
		Review radiological surveys for contaminated areas in and around the storage facility.
		Review the process for identifying the source of any contamination found and implementing corrective action.

	What is the design basis and current physical condition of the facility ventilation system? Q4 & Q6	Review records to verify that the ventilation system exhaust is routinely sampled for radionuclides.
	Will high radiation levels result from prolonged inoperability of the ventilation system? Q4	
Buried Material	Are all buried radioactive materials identified? Q1	
	Are the locations of buried radioactive material clearly marked? Q1	Determine how these sites are monitored (e.g., periodic area surveys, groundwater or soil sampling, etc.).
		Review radiological postings and surveys in and around buried material.
	What safety documentation exists for the buried radioactive material? Q1	
Accumulation of Contaminants	Are HEPA filters and prefilters checked at a specified frequency and replaced when criteria is exceeded? Q4	
	Are the filter bypass streams monitored? Q4	
	Is there a water chemistry control program? Q3	
		Observe if any ductwork, filters, resin beds, or piping is posted as a radiation area.

Corrosion	Are there clearly defined limits on acceptable corrosion levels on stored fuel or storage facility structural components? Q2 & Q3	
	Is there a corrosion monitoring program which can predict acceptable remaining life of storage system components? Q2 & Q3	
	Has the potential impact of corrosion or other degradation of the fuel cladding been evaluated for radiation expsoure rates? Q7	
Handling Systems		Compare the occupational exposure records of fuel handling personnel to those of other radiation workers at the site.
Institutional Controls	What is the status of the facility program to implement the RadCon Manual? Q7	
	Have ALARA design reviews been performed for the current storage configuration? Q7	
	Is there a defined process for determining the impact of design modifications on personnel radiation exposures? Q7	
		Determine the proximity of the storage facility to other areas and facilities.

SPENT FUEL INITIATIVE
TABLE TOP DISCUSSION / WALK DOWN MATRIX

Adverse Condition - Institutional Control Failures

Conditions or Symptoms	Table Top Discussion	Walk Down Activities
Authorization Basis	Is there a DOE approved Safety Analysis Report for the storage facility? If so, specify the date and approval authority. If not, what is the authorization basis for Unreviewed safety Questions? Q6	
	Are there Operational safety Requirements or Technical Safety Requirements for the storage facility? If so, specify the date and approval authority. If not, what is the authorization basis for Unreviewed safety Questions? Q6	
	Have plans for implementing DOE 5480.22 and 5480.23 at the storage facility been submitted to DOE for approval? Q6	
	What potential environmental (e.g. Fire), external (e.g. earthquake) and operational (e.g. operator error) occurrences have been considered that can either initiate an accident in your facility and/or contribute to the progression of an accident?	
	How has the impact of these individual potential events been analyzed?	

	For each category of occurrences what are the systems, structures and/or procedures that are in place to either prevent and/or mitigate accidents that contribute to the impairment of safety function performance?	
	What are the systems (e.g. electric power, cooling water) that provide support to these safety systems and how are they designed and addressed in the authorization basis?	
		Review SAR and other relevant safety documentation (e.g., criticality analysis) and list 5 or 6 components identified as important to the safety of workers or the public or relied upon to prevent or mitigate an environmental release. Tour the facility to determine if this list of equipment exists in the facility as described in the safety documentation. If not, interview the facility personnel most directly responsible for the anomalous equipment or system to determine when it was last modified, where the most recent drawuings are, and if they are knowledgable of the safety documentation description.
	Is the current mission and purpose of the facility consistent with those assumed in the authorization basis? Q6	

	Is the facility operating beyond its anticipated design life? If so has an aging management program been implemented at the facility? Q6	
Surveillance Programs		Look for unexplained gaps in the log entries, notations of deviant conditions, indications that corrective actions have or have not been implemented and completed. Note any management reviews and approvals. Interview responsible managers on anomalous indications.
		Determine if the surveillances are controled at the Operational Safety Requirements level or some lower level established by contractor policy.
		Determine if the bases for the surveillance frequency is explained and if actions are explined and required if a surveillance is missed.
Conduct of Operations		Review operations logs for trends or anomalies. Determine if out-of-specification readings are corrected by operators and analyzed to determine the root cause for the out-of-specification condition.
		Interview one or two operators to determine if they understand the factors that can result in out-of-specification readings.

		Determine if repeated out-of-specification occurrences are referred to the engineering or maintenance organizations for correction. and if the response from those organizations is timely and effective.
Maintenance Program		Look for repeated repairs of the same item and for missed maintenance requirements.
		Determine if preventative maintenance actions and intervals are specified and the bases explained.
		Determine if maintenance personnel have current vendor documentation for key safety equipment.
		Ask maintenance personnel what the current backlog is and how they determine which items receive maintenance and on what schedule. Determine if the defacto maintenance policy is "operate until failure".
		Determine if operations and maintenance personnel closely coordinate their actions before performing maintenance and returing the equipment to service.
Environmental Monitoring Programs		Determine if personnel responsible for environmental monitoring systems are aware of radioactive or hazardous materials present in storage facilities.

		For any unusually high readings, determine if there is objective evidence available to eliminate the storage facilities as the cause.
Training	Describe the procedures and methods used to qualify storage facility operators? Q7	
	Are written examinations and periodic retraining classes required? Q7	Determine if operators are current with their training requirements?
		Question facility personnel about loss of coolant or other accident scenarios.
Occurrence Reporting	Have any events at the facility led to the release of radioactive or toxic material outside of the facility? Q5	Review occurrence report for identification of root cause and verify that corrective action has been implemented.
	Have any events at the facility been evaluated as a precuser to a radioactive or toxic material release outside the facility? Q5	
	Has the facility implemented any corrective actions based on an evaluation of an event at a similar facility at the site or another DOE site? Q5	

ATTACHMENT 5

VULNERABILITY DEVELOPMENT FORM (Page 1)	
Vulnerability #	Site:
Date:	Facility:

Block #1: Title of Vulnerability (Title begins by identifying/naming the inadequacy and ends with identification of the facility [20 words or less].)

Block #2: Executive Summary of Vulnerability (~ 50 words)

Block #3: Describe conditions or symptoms which portend or imply a potential ES&H vulnerability:

Block #4: Identify adverse condition category(s) (criticality, release of fission product or hazardous material, direct exposure, or institutional failure) that could result from the conditions and symptoms listed above, and explain reasoning:

Block #5: Identify who or what is potentially affected (environment, public health and safety, or worker health and safety) and explain reasoning:

VULNERABILITY DEVELOPMENT FORM (Page 2)	
Vulnerability #	Site:
Date:	Facility:

Block #6: Describe urgency of corrective actions (if any). Use <1 year, 1-5 years, and >5 years). Explain reasoning:

Block #7: Additional comments, views, or plans by the Site Operations Office and M&O Contractor:

Block #8 (Optional): To the best of your collective abilities, describe the potential types of consequence(s) of this vulnerability if left uncorrected:

Block #9 (Optional): To the best of your collective abilities, suggest or recommend the most rational fix to this vulnerability:

Signature, Team Member

Signature, Team Leader

Attachment 6

TABLE OF CONTENTS

WORKING GROUP ASSESSMENT TEAM REPORT

FACILITY BACKGROUND FORM (Page 1)	
Site:	Facility:
Date:	Location:

Facility Information

1-1 Classified Fuel:
1-2 Owner:
1-3 Operating Contractor:
1-4 Facility Description:

1-5 Facility Age:
1-6 Facility Mission:

1-7 Facility Future Plans:

1-8 Future Expansion Plans:

1-9 Leak Detection in Operation:

Storage Information (Wet/Dry)

2-1 Storage Unit:

2-2 Number of Storage Units:

2-3 Fuel Units/Storage Unit:

2-4 Time in Storage:

2-5 Storage Condition:

2-6 Maximum Cask Handling Capability:

2-7 Fuel Handling Limitations:

2-8 Storage Mode:

2-9 Number of Storage Locations:

2-10 Number of Storage Locations Available:
2-11 Lined or unlined:
2-12 Cleanup System Status:

2-13 Brief Description:

2-14 Storage Medium:
2-15 Cover Gas:

Signature, Team Member

Signature, Team Leader

Facility Information

1-1 Classified Fuel - Does this facility have in storage any fuel that is classified (Y or N)? Please do not send any classified information.

1-2 Owner - Who owns the facility (Generally, this will be DOE-HQ organization)?

1-3 Operating Contractor - What contractor operates the facility?

1-4 Facility Description - Provide a brief description of the facility.

1-5 Facility Age - How long has the facility been in operation?

1-6 Facility Mission - What is current mission of the facility?

1-7 Facility Future Plans - Are there any plans to upgrade the facility or change its mission?

1-8 Future Expansion Plans - if any.

1-9 Leak Detection in Operation - Is there a leak detection system in operation?

Storage Information (Wet/Dry)

2-1 Storage Unit - What is the unit the fuel is stored in - this could be a canister or other container?

2-2 Number of Storage Units - How many storage units are there?

2-3 Fuel Units/Storage Unit - How many fuel units are stored in each storage unit?

2-4 Time in Storage - How long has the storage unit been in storage?

2-5 Storage Condition - Provide a brief description of the condition of the storage unit.

2-6 Maximum Cask Handling Capability - Measured in tons.

2-7 Fuel Handling Limitations - if any.

2-8 Storage mode - Wet or Dry?

2-9 Number of Storage Locations - How many fixed positions are there, or how many square feet are available for storage, etc.?

2-10 Number of Storage Locations Available - How many fixed positions are open, or how many square feet of space is available for additional storage?

2-11 Lined or unlined - Is the pool/canal lined or unlined?

2-12 Cleanup System Status - Is the pool/canal cleanup system functioning?

2-13 Brief Description - Please explain the dry storage system.

2-14 Storage Medium - What is the storage medium (cask, vault, etc.)?

2-15 Cover Gas - What is the cover or fill gas (helium, nitrogen, etc.)?

Attachment 8

FUEL SUMMARY FORM (Page 1)	
Site:	Facility:
Date:	Location:

Fuel Information

1 Fuel Name:

2 Owner:

3 Reactor Name/Reactor Type:

4 Fuel Unit/Number of Fuel Units:

5 Total Mass:

6 EOL U:

7 Total metric tons of initial heavy metal:

8 Fuel Configuration:

9 Length:

10 Fuel Compound or Alloy:

11 Fuel Condition:

12 Initial Enrichment:

13 Cladding Material:

14 Cladding Condition:

15 Heat Generation:

Signature, Team Member

Signature, Team Leader

Fuel Information

1 Fuel Name - Provide the most common name used, and a name that agrees with the Inventory of Accountability of Nuclear Materials (Nuclear Materials Management Safeguards and Security [NMMSS]).

2 Owner - Who owns the fuel (specific DOE organizations, Nuclear Regulatory Commission, etc.)?

3 Reactor Name/Reactor Type - What reactor was the fuel used in? What is the type of reactor (Pressurized Water Reactor [PWR], gas cooled, etc.)?

4 Fuel Unit/Number of Fuel Units - What is the common unit for managing this particular fuel? Often this will be a fuel assembly, but may be a rod, canister, etc. What is the number of fuel units in storage?

5 Total Mass - What is the total mass of the fuel unit?

6 EOL U - total (Kg) - What is the total end of life (EOL) Uranium content for the fuel unit measured in kilograms?

7 Total metric tons of initial heavy metal -

8 Fuel Configuration - What is the configuration of the fuel (e.g., 15 x 15 rod array, concentric plates, etc.)?

9 Length - What is the length measured in centimeters?

10 Fuel Compound or Alloy - What is the compound or alloy of the fuel (metal, UO_2, etc.)?

11 Fuel Condition - Provide a brief description of condition of the fuel.

12 Initial Enrichment - What is the percent by weight of initial enrichment of U^{235}?

13 Cladding Material - What material is the cladding (Zircaloy, Stainless Steel, etc.) with specific alloy (Zr-4, 304L, etc.)?

14 Cladding Condition - Provide a brief description of condition of the cladding.

15 Heat Generation - What is the heat generation for this fuel measured in watts/hour?

SPENT FUEL INITIATIVE

September 29-30, 1993

WORKING GROUP ASSESSMENT TEAM TRAINING

DOE Working Group on Spent Fuel
Coordinated by the Office of Environment, Safety and Health

Purpose/Objective

- Department-wide spent fuel inventory data
- ES&H vulnerability assessment of fuels storage
- Baseline information for Department policy issues

Working Group Assessment Team Protocol

- Entrance Discussions
- Technical and Administrative Contacts
- Candid Communications
- Daily Meetings
- Agreement on the Issues
- Recognition of Roles and Common Goal

Scope

- Complete inventory of reactor irradiated nuclear material (RINM)

- Evaluate and Report on assessment of potential ES&H vulnerabilities

- RINM
  - Defined in Project Plan
  - Spent nuclear fuel (in any condition) and irradiated nuclear targets from production and research reactors

Background

- DOE-wide Project Team
  - EH has lead responsibility (August 19, 1993 letter)

- Project plan issued September 20, 1993

- Initial project report to Secretary by November 20, 1993

- Results will support longer-term EM efforts
  - Followup work, potential reviews and semi annual report to S-1

Approach

- Project plan, including a review process and question set, developed
- Site Teams collect data, identify ES&H concerns using question set, and prepare Site Report
- Working Group Assessment Teams validate and evaluate Site Report information , identify and organize facility vulnerabilities and prepare Site Assessment Reports
- Working Group characterizes overall vulnerabilities and prepares project report (to Secretary)

Assessment Activities During Site Visit

- Review of Site Report--response to Project Plan question set
- Discussions with Site Team relative to question set answers
- Discussions with Site Team relative to potential or suspected vulnerabilities
- Walkdown of subject facilities

Assessment Activities During Site Visit
(continued)

- Interviews with Site Team and other personnel
- Sampling verification or review of ES&H issues
- Formulation of results by Assessment Team and discussion with the Site Team

Product

- Assessment Team report as basis for identification of vulnerabilities and a judgement relative to urgency of corrective actions

- Factual review of the Assessment Team Report by the Site Team

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