MIXED ENERGY WASTE STUDY (MEWS)

March 1987

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
401 M Street, S.W.
Washington, DC 20460

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LIST OF ACRONYMS

AEA	-	Atomic Energy Act
CERCLA	-	Comprehensive Environmental Response, Compensation, and Liability Act
CH-TRU Waste	-	Contact-Handled Transuranic Waste
DOE	-	U.S. Department of Energy
DOT	-	U.S. Department of Transportation
DWPF	-	Defense Waste Processing Facility
EPA	-	U.S. Environmental Protection Agency
GCD	-	Greater Confinement Disposal
HL(W)	-	High-Level (Waste)
ICPP	-	Idaho Chemical Processing Plant
INEL	-	Idaho National Engineering Laboratory
LANL	-	Los Alamos National Laboratory
LLNL	-	Lawrence Livermore National Laboratory
LLW	-	Low-Level Waste
MEWS	-	Mixed Energy Waste Study
MVST	-	Melton Valley Storage Tanks
NTS	-	Nevada Test Site
ORNL	-	Oak Ridge National Laboratory
PREPP	-	Process Experimental Pilot Plant
PUREX	-	Plutonium - Uranium Extraction
RCRA	-	Resource Conservation and Recovery Act
RFP	-	Rocky Flats Plant
RH-TRU Waste	-	Remote-Handled Transuranic Waste
RWMC	-	Radioactive Waste Management Complex
SGS	-	Segmented Gamma Scanner
SRP	-	Savannah River Plant
SWEPP	-	Stored Waste Examination Pilot Plant
TRU	-	Transuranic
TRUPACT	-	Transuranic Waste Package Transporter
USGS	-	U.S. Geological Survey
WAC	-	Waste Acceptance Criteria
WEAF	-	Waste Examination Assay Facility
WHPP	-	Waste Handling Pilot Plant
WIPP	-	Waste Isolation Pilot Plant
WVDP	-	West Valley Demonstration Project

EXECUTIVE SUMMARY

"Radioactive mixed waste" has both radioactive and hazardous chemical properties. Many Department of Energy (DOE) facilities generate or manage radioactive mixed waste, as well as non-radioactive hazardous waste.

In November, 1986, DOE informally proposed an option for the Environmental Protection Agency (EPA) in which current and future mixed high-level radioactive waste (HLW) and transuranic (TRU) waste would be exempted from the hazardous waste control program under Subtitle C of the Resource Conservation and Recovery Act (RCRA). While this proposal may deregulate the hazards associated with both wastes, the DOE contends that controlloing radiation hazards from HLW/TRU waste also controls chemical hazards. In response, EPA formed the Mixed Energy Waste Study (MEWS) task force to evaluate DOE's proposed option. The purpose was to compare DOE's practices to requirements for hazardous waste management under RCRA Subtitle C.

From November, 1986, to February, 1987, the task force analyzed the current DOE management practices for HLW, TRU, and certain other radioactive wastes. This report summarizes the findings of the task force.

This Executive Summary provides:

- a brief definition of high-level and transuranic wastes and their sources.
- a description of current management practices for such waste at DOE facilities.
- a summary of DOE's proposed option for waste management at DOE facilities.
- State government perspectives on the proposed option.
- findings of the MEWS task force.

The MEWS task force concluded that, with some exceptions, current DOE management of mixed HLW/TRU waste is equivalent or superior to RCRA requirements. In other words, management of these wastes would not change significantly if they were required to comply with RCRA Subtitle C requirements for hazardous waste. However, there were a few aspects which probably would not meet RCRA standards.

Most States were concerned about DOE self-regulation of HLW/TRU waste (DOE option), but were willing to consider case-by-case variances or specific exemptions.

A. HIGH-LEVEL AND TRANSURANIC WASTE:

High-level radioactive waste results from the processing of nuclear reactor fuels. One type results from dissolving nuclear reactor fuel elements to recover plutonium. Another results from dissolving naval reactor fuel elements to recover enriched uranium. When formed, HLW is highly acidic ($pH < 1$) and highly radioactive. It contains many fission products and some transuranic elements. Most HLW has hazardous chemical characteristics (corrosivity and toxicity), and may also contain listed RCRA hazardous wastes. Even so, its hazard is due primarily to its intense radioactivity.

When generated, HLW is in liquid form. As a result of treatment, however, it can become a sludge or slurry. It must be remotely handled and contained prior to disposal. HLW is currently stored in double-walled steel, underground tanks. At the Idaho National Engineering Laboratory (INEL), the HLW is further processed via high-temperature flash evaporation into a solid, calcined, sand-like material which is stored in shielded above-ground bins or silos. At the Savannah River Plant, a new $1 billion HLW vitrification (glass) plant is about 50 percent complete and a similar facility is planned for the Hanford site, although it is not yet funded. The vitrified HLW will be solidified and stored inside large stainless steel cylinders. Ultimately, these cylinders will be permanently disposed of in a future High Level Waste Repository which will accept both DOE and commercial HLW.

By definition in EPA's Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-level and Transuranic Radioactive Wastes (40 CFR 191), transuranic (TRU) waste is waste containing alpha-emitting transuranic isotopes with half-lives greater than 20 years and containing more than 100 nanocuries per gram (NCI/G) of waste. TRU waste arises mostly from the processing, shaping, and handling of plutonium-containing materials. Most TRU waste is solid (e.g. gloves, rags, and tools), but some is liquid. Some TRU waste contains listed RCRA hazardous waste such as spent cutting oils or solvents. A small amount of TRU waste is classified. At the Oak Ridge National Laboratory (ORNL), a highly radioactive isotope of uranium (U-233) is also managed with and considered to be TRU waste.

At most facilities, TRU waste is triple-packaged. First, it is sealed in a plastic bag. The bag is then placed in a plastic drum inner liner which in turn is placed in a steel drum or box. This packaging usually provides sufficient shielding because most plutonium isotopes are mainly alpha-particle emitters which are primarily hazardous when inhaled or ingested. Alpha-particles are easily stopped by almost any barrier, and as a result, the radiation level at the surface of the drum or box is relatively low. This type of waste is called "contact-handled" TRU (CH-TRU).

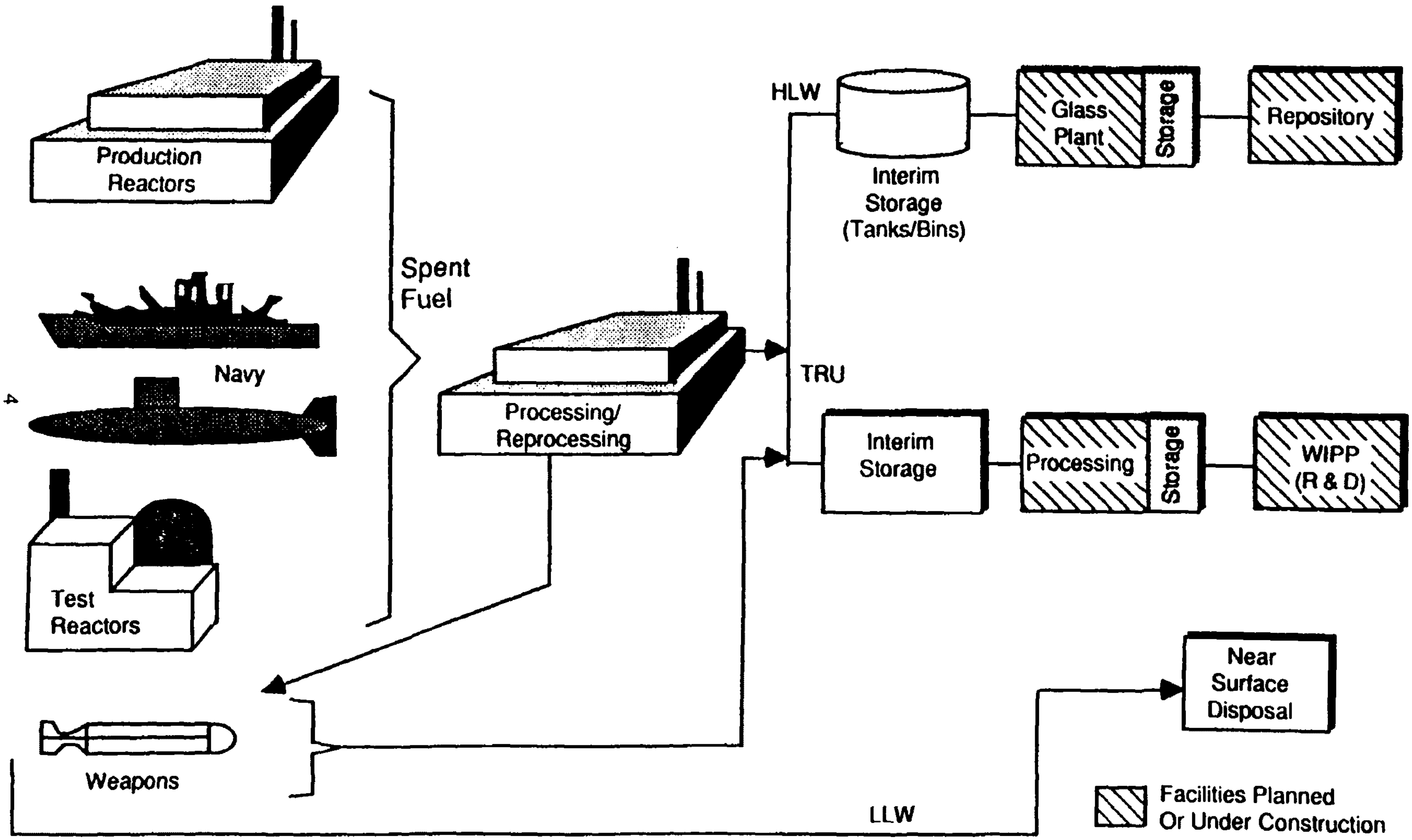
Some TRU waste, however, also contains beta- and gamma-ray emitters. These wastes must be handled remotely if the radiation level at the surface of the drum or box exceeds 200 milirems/hour (mrem/hr). This type of waste is called "remote-handled" TRU (RH-TRU).

Since 1970, DOE has stored its TRU waste in drums or boxes in earth-covered trenches or in above-ground mounds. Waste stored at these sites is called "retrievable TRU waste". In recent years, some DOE sites have started storing TRU drums or boxes on open concrete pads or in air-inflated or steel-hoop buildings. Ultimately, most stored (and newly generated) unclassified TRU waste will be disposed of at the Waste Isolation Pilot Plant (WIPP), an excavation in a salt deposit 2,100 feet below ground near Carlsbad, New Mexico.

Classified TRU waste, however, is disposed of at the Nevada Test Site (NTS). TRU may be classified because of its shape or form; its isotopic, chemical, or alloy composition; or because the waste contains tools that may be classified. All classified TRU waste is solid (such as graphite, steel, or plastic) and does not contain known RCRA hazardous chemicals. Classified TRU waste was disposed in unlined shafts 10 feet wide and 120 feet deep. DOE refers to this practice as greater confinement disposal (GCD). Disposal of TRU waste in GCD shafts is currently suspended pending DOE demonstration of compliance with 40 CFR 191.

Sources and general management schemes for HLW and TRU waste are shown in Figure ES-1. Low-level radioactive waste (LLW) also arises from the same sources, but is handled differently. LLW is outside the scope of this study.

FIGURE ES-1
SOURCES AND DISPOSITIONS OF RADIOACTIVE WASTE



B. DOE'S PROPOSED OPTION FOR HLW/TRU WASTE MANAGEMENT:

On November 1, 1985, under the Atomic Energy Act (AEA), DOE proposed in the Federal Register a definition of the term "by-product material" as it pertained to DOE activities under RCRA. Precise definition of the term is important because "by-product material" is excluded from the RCRA statutory definition of solid waste and, therefore, from regulatory control under the RCRA Subtitle C hazardous waste program. DOE's proposed definition was based on the process from which a material is produced rather than defining the chemical by its intrinsic properties. Under the proposal, all mixed HLW and TRU waste, as well as some mixed LLW be excluded from RCRA control.

In March 1986, DOE initiated a policy review of the proposed "by-product material" rulemaking, including an exploration of other options.

In early November, 1986, DOE informally proposed that EPA evaluate an option to the "by-product material" rule. The option was based on the premise that controlling radiological hazards from HLW and TRU waste also manages their chemical hazards in a manner equivalent or superior to RCRA hazardous waste controls. DOE's proposed option had the following elements:

- LLW mixed waste would be subject to RCRA regulations.
- Current and future HLW and TRU waste would be exempted from RCRA Subtitle C control via EPA rulemaking [Note: while past disposal practices would be subject to RCRA as Solid Waste Management Units (SWMUs), and NEPA, the AEA, and RCRA Subtitle I (Underground Storage Tanks) would still apply. This rulemaking requires finding inconsistency with the AEA under RCRA Section 1006].
- State laws would not apply to HLW/TRU Waste.
- DOE would make an annual report to EPA on HLW/TRU waste management; EPA could verify the report's findings via site visits.
- DOE would revise its internal waste management directives to make them consistent with RCRA regulations.
- Certain other radioactive wastes would also be exempt from RCRA and State control. (DOE has identified uranium-233 contaminated waste and decommissioned submarine reactor compartments in this category.)

In response to DOE's proposed option, EPA formed the Mixed Energy Waste Study (MEWS) task force. The project involved visits to 10 DOE facilities and discussions with seven State governments where DOE facilities are located.

The major facilities affected by DOE's proposed option and the states and facilities visited by the MEWS task force are shown in Figure ES-2.

C. STATE PERSPECTIVES:

The MEWS task force discussed the DOE option with personnel from the states of California, Colorado, Idaho, New Mexico, South Carolina, Tennessee, and Washington. Each State is directly concerned with current and future oversight and regulation of DOE facilities within their borders.

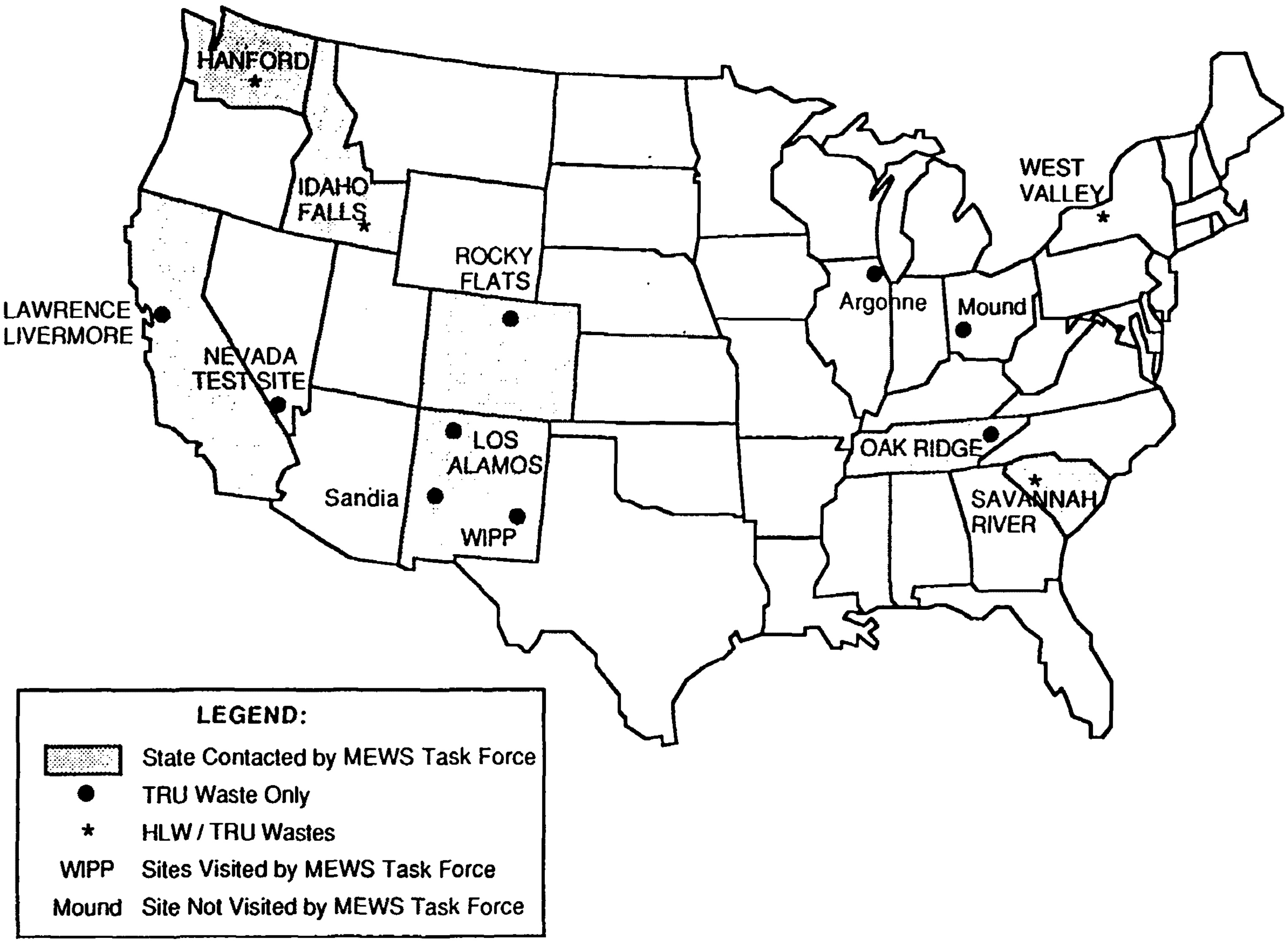
The States response to the DOE option varied from strong opposition to mild reservations. A consensus of State opinions is as follows:

- DOE/EPA/States must reach agreement on the precise definition of terms and their application to specific wastes at specific facilities. Arbitrary definitions and "moving targets" have caused past problems.
- States want more control and oversight of DOE facilities. They are concerned about DOE self-regulation of HLW/TRU waste because of past problems.
- States are willing, however, to consider specific variances or limited exemptions for HLW/TRU waste where warranted.
- Most States are concerned about the resources and technical skills needed to control HLW/TRU waste, but some are willing to prepare to meet the challenge.

D. MEWS FINDINGS:

The MEWS task force findings concerning DOE's current management of HLW and TRU waste are summarized below. These findings are based on brief visits to the ten DOE facilities that generate and manage all the HLW and over 95% of the TRU waste in the DOE system. In-depth visits might uncover other details but most likely would not change the overall

FIGURE ES-2
MAJOR FACILITIES AFFECTED BY DOE OPTION



impressions of the task force. These findings do not apply to DOE's past management practices. Reviews of HLW/TRU waste management at each of the ten DOE facilities are presented in the main report. More detailed visit reports for each facility and each State are provided in Appendices A and B respectively.

The MEWS task force findings include the following:

A. HLW/TRU WASTE MANAGEMENT IS COMPLEX.

- HLW/TRU wastes arise from numerous, variable sources and are managed in many different ways.
- Definitions of terms are not universally consistent.
- There are four different categories of TRU waste; each is managed through different methods.

B. TRU WASTE IS OFTEN MANAGED WITH LLW AND WITH RCRA HAZARDOUS WASTE.

- TRU waste management is not a separable problem.
- Old HLW/TRU waste management sites are RCRA SWMUs.

C. THE HLW/TRU WASTE SYSTEM DEPENDS HEAVILY ON FUTURE ACTIONS.

- HLW repository.
- Vitrification plants (Hanford, Savannah River, West Valley).
- WIPP operation/expansion.
- RH-TRU waste processing facility at Oak Ridge.

D. THERE ARE SPECIAL CASES THAT DO NOT FIT THE "NORMAL" MANAGEMENT SCHEME

- Submarine reactor compartments.
- Classified TRU.
- TRU waste unacceptable at the WIPP.

E. MOST DOE PRACTICES FOR HLW/TRU WASTE SEEM COMPARABLE TO RCRA STANDARDS, AND SEVERAL PRACTICES SEEM SUPERIOR TO RCRA REQUIREMENTS.

- Security.
- Contingency plans and emergency response.

- Continuous control of HLW tank systems.
- Waste tracking systems and documentation.
- WIPP deep containment for TRU waste (future).
- Deep repository for HLW (future).

F. SEVERAL ASPECTS PROBABLY WOULD NOT MEET RCRA STANDARDS

- Chemical analysis of waste.
- Ground-water monitoring systems.
- Retrievable storage for TRU waste.
- Classified TRU waste disposal.
- Self-inspection.

G. RCRA VARIANCES OR PROPOSED SUBPART X COULD APPLY TO SOME ASPECTS, BUT CASE-BY-CASE EVALUATION IS NECESSARY.

RCRA variances may be applicable to some aspects noted above, such as waste analysis or ground-water monitoring requirements. Each facility, however, must be evaluated on a case-by-case basis before variances can be granted. The new RCRA Subpart X regulation may provide a mechanism by which unusual management options could be evaluated separately for each facility or for new facilities or treatment units. Examples of possible application of proposed Subpart X include the WIPP and the HLW vitrification plants.

H. CURRENT MANAGEMENT WOULD NOT CHANGE SIGNIFICANTLY IF HLW/TRU WASTE WERE CONTROLLED UNDER RCRA.

The general management of HLW/TRU waste at DOE facilities would not change significantly if the facilities were subject to RCRA Subtitle C hazardous waste controls. Areas that would need to be addressed through improved practices or case-by-case variances include chemical analyses include chemical analyses of water, ground-water monitoring, and independent oversight.

1.0 INTRODUCTION

In November, 1986, DOE informally proposed an option for the Environmental Protection Agency (EPA) in which current and future mixed high-level radioactive waste (HLW) and transuranic (TRU) waste would be exempted from Subtitle C of the Resource Conservation and Recovery Act (RCRA) hazardous waste control program. While this proposal may deregulate the hazards associated with both wastes, the DOE contends that controlling radiation hazards from HLW/TRU waste also controls chemical hazards. In response, EPA formed the Mixed Energy Waste Study (MEWS) task force to evaluate DOE's proposed option. The purpose was to compare DOE practices to requirements for hazardous waste management under Subtitle C of RCRA. This report summarizes the findings of the task force.

From November, 1986, to February, 1987, the task force analyzed the current DOE management practices for HLW, TRU, and certain other radioactive wastes. This report summarizes the findings of EPA's MEWS task force.

1.1 BACKGROUND

This section outlines the events which led to the formation of the MEWS task force. The Atomic Energy Act (AEA) of 1954 set a statutory mandate to develop and use atomic energy. RCRA, passed in 1976, established a broad regulatory scheme governing the generation, transportation, and management of solid wastes. With the differing purposes of the AEA and RCRA, it is not surprising that conflict has arisen over the applicability of RCRA to the management of wastes at DOE facilities. Section 6001 of RCRA explicitly subjects all Federal facilities and their activities to State and Federal regulation under RCRA. Section 1006(a) of RCRA relieves facilities operating under the authority and control of the AEA from compliance with RCRA; this occurs when it can be demonstrated that RCRA regulations or requirements would be inconsistent with specific requirements mandated by AEA. Thus, RCRA regulations would not apply if they were in direct conflict with the directives contained in the AEA (e.g., disclosing restricted data or preventing of the production of nuclear materials or their components).

Furthermore, Section 1004(27) of RCRA exempts special nuclear or by-product material defined by the AEA from the definition of "solid waste" (e.g., the only materials that can be regulated under RCRA). Those radioactive materials which are naturally occurring or accelerator-produced radioactive material (NARM) are not included in this exemption.

In August, 1983, EPA and DOE entered into negotiations to address the control of hazardous waste at DOE facilities and to determine what role EPA would play in controlling RCRA hazardous wastes that are mixed with source, special nuclear, or by-product material.

On September 20, 1983, the Legal Environmental Assistance Foundation (LEAF) filed suit against DOE in Tennessee, seeking a summary judgment that RCRA applies to DOE's Oak Ridge plant "to the same extent as any other individual facility in the United States." This suit addressed non-radioactive RCRA hazardous waste.

By February, 1984, EPA and DOE had negotiated a Memorandum of Understanding (MOU) stating that DOE would manage its RCRA-type wastes and radioactive mixed wastes under a program that would be the functional equivalent of RCRA and would include a comprehensive EPA oversight program. Many of the provisions included in the MOU were superseded on April 13, 1984, when the U.S. District Court for the Eastern District of Tennessee ruled that RCRA applied to DOE's Oak Ridge facility (LEAF v. Hodel, No. 3-83-562). DOE accepted that opinion for all its facilities nationwide. The LEAF case did not address the applicability of RCRA to radioactive mixed wastes. The lack of clarity on this issue has hampered the implementation of the court's order to DOE to file for and seek a permit for the treatment, storage, and disposal of hazardous waste "with all deliberate speed."

On November 1, 1985, under the AEA, DOE proposed in the Federal Register a definition of the term "by-product material" as it pertained to DOE activities under the RCRA. Precise definition of the term is important because "by-product material" is excluded from the RCRA statutory definition of solid waste and, therefore, from regulatory control under the RCRA Subtitle C hazardous waste program. DOE's proposed definition was based on the process from which a material was produced rather than defining the chemical by its intrinsic properties. Under the proposal, all mixed HLW and TRU waste, as well as some mixed low-level waste (LLW), would be excluded from RCRA control.

In March, 1986, DOE initiated a policy review of the proposed "by-product material" rulemaking, including an exploration of other options.

In a related matter, on July 3, 1986, the EPA published a notice in the Federal Register announcing that in order to obtain and maintain authorization to administer and enforce a RCRA Subtitle C hazardous waste program, States must apply for authorization to regulate the hazardous waste components of radioactive mixed wastes.

1.2 DESCRIPTION OF DOE OPTION

In early November, 1986, DOE informally proposed that EPA evaluate an option to the "by-product material" rule. The option was based on the premise that controlling radiological hazards from HLW and TRU waste also controls their chemical hazards in a manner equivalent or superior to RCRA hazardous waste controls. DOE's proposed option had the following elements:

- Mixed LLW waste would be subject to RCRA standards.
- Current and future HLW and TRU waste would be exempt from RCRA Subtitle C control via EPA rulemaking [Note: past disposal practices would be subject to RCRA as Solid Waste Management Units (SWMUs), and NEPA, the AEA, and RCRA Subtitle I (Underground Storage Tanks) would still apply. This rulemaking requires finding inconsistency with the AEA under RCRA Section 1006].
- State laws would not apply to HLW/TRU waste.
- DOE would make an annual report to EPA on HLW/TRU management: EPA could verify the report's findings via site visits.
- DOE would revise its internal waste management directives to make them consistent with RCRA standards.
- Certain other radioactive wastes would also be exempted from RCRA and State control. DOE has identified uranium-233 contaminated waste and decommissioned submarine reactor compartments in this category.

DOE contends that its practices for controlling the radiological hazards of HLW, TRU waste, and certain other radioactive wastes provide a level of protection that is equivalent or superior to RCRA requirements. DOE proposes to demonstrate this equivalency by supplying data to the Agency and providing tours of the facilities.

1.3 MEWS TASK FORCE

In response to DOE's proposed option, EPA formed the Mixed Energy Waste Study (MEWS) task force. The objective of the study was to provide EPA senior management with technical information on present and future DOE management practices for controlling HLW, TRU waste, and certain other radioactive wastes that may also be RCRA hazardous wastes. Another group conducted a concurrent legal review of the DOE option. The MEWS task force limited its examination of present and projected DOE practices. It did not review the management practices for previously generated wastes. The task force assumed that problems arising from past practices will be fully regulated under RCRA or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The task force also limited its investigation of DOE's compliance with hazardous waste management requirements under Subtitle C of RCRA. Compliance with other RCRA requirements, such as Subtitle I, was not part of the evaluation under this task. RCRA Subtitle I establishes a comprehensive program for the regulating underground storage tanks containing regulated substances. An underground storage tank is defined, with certain exclusions, as a tank with 10 percent or more of its volume underground (including the volume of underground pipe connected thereto). Regulated substances include petroleum products and all substances including radioactive materials defined under Section 101 (14) CERCLA, except for hazardous wastes which are already subject to regulation under Subtitle C. Currently, most of the DOE facilities visited use tanks for both short-term and long-term storage of HLW and TRU wastes.

The project involved visits to 10 DOE facilities and discussion with seven State governments where DOE facilities are located. The facilities and States visited by the MEWS task force are shown in Figure ES-2 (Executive Summary). The task force schedule of events is presented in Table 1-1..

The major DOE facilities which are candidates for exemption under the DOE option include several minor generators and onsite storage facilities that were not visited by the task force. Although these facilities (Bettis, Mound, Argonne) handle TRU wastes, they generate smaller quantities in relation to the other facilities visited. The objectives and operations at these sites are similar to at least one of the visited facilities. The task force, however, realizes that the findings are based on an incomplete review of the facilities. In addition, the facility visits were short; most were one day or less. Time restraints prevented the task force from performing detailed evaluations about waste management systems and practices at each facility. Although the the findings of this report are general, the task force believes that additional investigations would not lead to substantially different results.

TABLE 1-1

MEWS TASK FORCE SCHEDULE OF EVENTS

November 24, 1986	Briefing of MEWS staff at DOE HQ
November 25, 1986	State of Washington
December 2-3, 1986	Savannah River Plant (South Carolina)
December 4, 1986	State of South Carolina
December 4, 1986	State of Tennessee
December 4, 1986	State of Idaho
December 8, 1986	Waste Isolation Pilot Plant (New Mexico)
December 9, 1986	Rocky Flats Plant (Colorado)
December 10, 1986	Idaho National Engineering Laboratory (Idaho)
December 11-12, 1986	Hanford Site (Washington)
December 17, 1986	Briefing for Dr. J. Winston Porter, EPA Assistant Administrator
January 8, 1987	West Valley Demonstration Project (New York)
January 12, 1987	State of New Mexico
January 13, 1987	Los Alamos National Laboratory (New Mexico)
January 14, 1987	Nevada Test Site (Nevada)
January 15, 1987	Lawrence Livermore National Laboratory (California)
January 16, 1987	State of California
January 19, 1987	State of Colorado
January 21, 1987	Oak Ridge National Laboratory (Tennessee)
February 20, 1987	Briefing for Lee M. Thomas, EPA Administrator

2.0 HIGH LEVEL AND TRANSURANIC WASTE MANAGEMENT

The MEWS task force visited 10 DOE facilities over a two month period to evaluate the DOE option. The facilities are located throughout the United States and exhibit diverse characteristics. The climates range in different geographical locations from arid to humid; facility size ranges from one square mile to 1,300 square miles. Some have been operated by the same contractor; others have been operated by a series of contractors; some are operated by multiple contrators. The mission of the facilities either focuses on the production of materials for nuclear weapons or for weapons research. Specific facts about each facility are presented in Table 2-1; individual facility reports appear in Appendix A.

2.1 HIGH-LEVEL WASTE (HLW)

High-level radioactive waste is usually generated as a liquid resulting from processing nuclear reactor fuels. One type results from dissolving production reactor fuel elements to recover plutonium. Another results from dissolving submarine reactor fuel elements to recover enriched uranium. When formed, high-level waste (HLW) is highly acidic ($pH < 1$) and highly radioactive. It contains many fission products and some transuranic elements. Most HLW has hazardous chemical characteristics (corrosivity and toxicity), and may also contain listed RCRA hazardous wastes. Even so, its hazard is due primarily to its radioactivity and must be remotely handled and contained prior to disposal.

At SRP and Hanford, the liquid waste is made alkaline ($pH > 12$) resulting in the formation of sludge which is composed primarily of oxides and hydroxides of manganese, iron and, to a lesser degree, aluminum. It contains essentially all of the actinides and fission products originally contained in the irradiated fuel except cesium. The sludge also contains small amounts of other hazardous constituents such as mercury.

High-level waste is generated only at certain DOE facilities and the process of producing and storing HLW is unique to each facility. The steps can be characterized as generation, on-site transfer and tank storage, treatment, characterization, control, and long-term storage and disposal.

TABLE 2-1
DOE FACILITY DESCRIPTION

FACILITY	LOCATION	NUMBER OF EMPLOYEES	MAJOR CONTACTOR-OPERATOR(S)	BUDGET FY 87 ($ MILLION)	MISSION
HANFORD	RICHLAND, WASHINGTON	14,400	• ROCKWELL • UNITED NUCLEAR • WESTINGHOUSE • BATTELLE PACIFIC • NORTHWEST LABORATORY • BOEING	$1,013	• PRODUCTION OF NUCLEAR MATERIALS • REACTOR DEVELOPMENT
IDAHO NATIONAL ENGINEERING LABORATORY (INEL)	IDAHO FALLSL, IDAHO	5,700	• EG&G • WESTINGHOUSE	$500 - $600	• REACTOR DEVELOPMENT • MAJOR PROCESSOR OF SPENT FUEL
LOS ALAMOS NATIONAL LABORATORY (LANL)	LOS ALAMOS, NEW MEXICO	10,200	UNIVERSITY OF CALIFORNIA	$500 - $600	• NUCLEAR WEAPONS DEVELOPMENT • RESEARCH ON DEFENSE SYSTEMS AGAINST NUCLEAR ATTACK
LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)	LIVERMORE, CALIFORNIA	7,000 - 8,000	UNIVERSITY OF CALIFORNIA	$800	• NUCLEAR WEAPONS DEVELOPMENT • ENERGY RESEARCH
NEVADA TEST SITE (NTS)	LAS VEGAS, NEVADA	5,300	REYNOLDS ELECTRICAL & ENGINEERING CO.	$1,000	• NUCLEAR WEAPONS TESTS
OAK RIDGE NATIONAL LABORATORY (ORNL)	OAK RIDGE, TENNESSEE	5,000	MARTIN MARIETTA ENERGY SYSTEMS, INC.	$400	• DEFENSE RESEARCH • HEAVY ELEMENT PRODUCTION
ROCKY FLATS PLANT (RFP)	GOLDEN, COLORADO	6,000	ROCKWELL INTERNATIONAL	$400	• PRODUCTION OF NUCLEAR WEAPONS COMPONENTS
SAVANNAH RIVER PLANT (SRP)	AIKEN, SOUTH CAROLINA	16,000	DU PONT de NEMOURS, INC.	$1,200	• PRODUCTION OF NUCLEAR MATERIALS
WEST VALLEY DEMONSTRATION PROJECT (WVDP)	WEST VALLEY, NEW YORK	500	WESTINGHOUSE	72	• PROCESS HLW
WASTE ISOLATION PILOT PLANT (WIPP)	CARLSBAD, NEW MEXICO	700	• WESTINGHOUSE • INTERNATIONAL TECHNOLOGIES	55	• STORE DEFENSE • ESTABLISHMENT TRU WASTE

2.1.1 GENERATION

Four DOE facilities generate or treat HLW: (1) Hanford, (2) Savannah River Plant (SRP), (3) Idaho National Engineering Laboratory (INEL), and (4) West Valley Demonstration Project (WVDP; Table 2-2). Hanford, SRP, and WVDP use the PUREX (Plutonium-Uranium Extraction) process, which was developed to recover plutonium and uranium from spent fuel or irradiated fuel rods in production reactors. At INEL, spent naval reactor fuel is processed by a variation of the PUREX method to recover U-235 and krypton.

In both processes the first step is acid dissolution of the cladding from the spent fuel rods. This is followed by acid dissolution of the fuel rod. The choice of acid for each of these steps is dependent of the cladding and the fuel. Solvent extraction is then used to separate out desired products such as plutonium and uranium. The fuel from the decladding dissolution and the solvent extraction steps make up the HLW.

2.1.2 ON-SITE TRANSFER AND TANK STORAGE

HLW generated during the PUREX process is acidic and, at Hanford and SRP, is treated with a caustic to make it strongly alkaline before it is routed through pipe systems to storage tanks. At most sites, transfer systems are double-walled pipe-in-pipe with annular space which can be monitored. Other systems, however, are steel cased in ceramic or concrete or steel suspended in concrete lined trenches. The piping systems are generally upgrades from the original single pipe systems which have failed at several facilities, producing leaks.

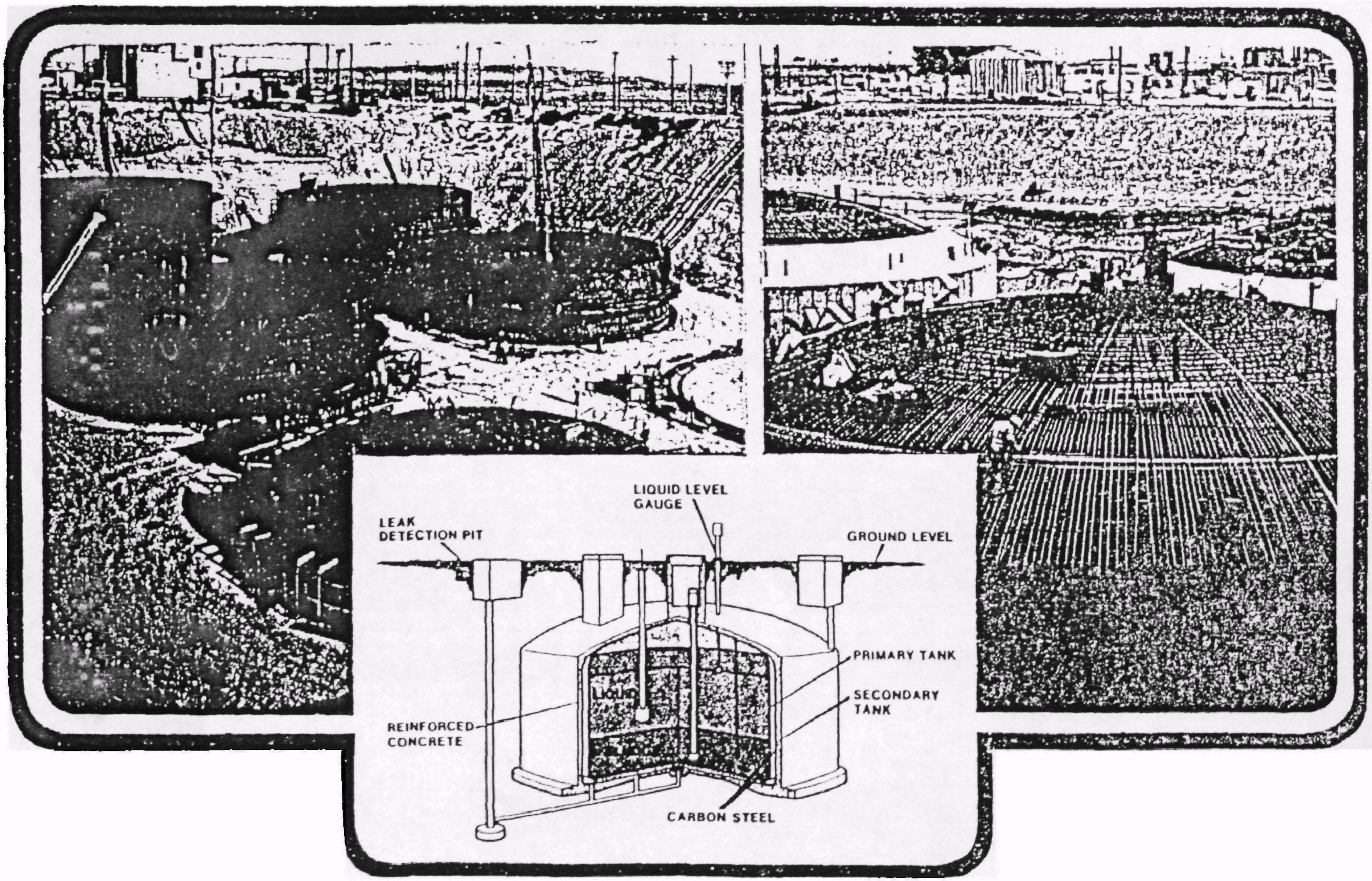
The waste is sent to "aging" tanks where short-lived fission products decay, evaporation occurs, and sludge settles. This usually takes several years. The storage tanks originally used at Hanford and SRP were single-walled steel. These tanks were susceptible to leaks and were difficult or impossible to monitor. They have generally been replaced by double-walled, carbon steel tanks, which may be placed on "saucers" of steel or concrete. The capacity of these tanks ranges from 300,000 to 1,300,000 gallons of waste (Figure 2-1). The old single-shelled tanks are being decommissioned by removing the supernatant to new tanks and gradually removing the sludge for treatment. The old single-shell tanks no longer receive new wastes. At INEL and WVDP, the HLW is left in an acidic state and stored in double walled stainless tanks.

TABLE 2-2
HIGH-LEVEL WASTE INVENTORIES AS OF DECEMBER 31, 1985*

SITE	VOLUME (M^3)
Hanford (DOE)	123,000
Idaho (DOE)	10,100
Savannah River (DOE)	222,000
West Valley (commercial)	2,315

* Adapted from Table 3.5, "Integrated Data Base for 1986: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics", DOE/RW-0006, REV. 2, September 1986.

FIGURE 2-1
DOUBLE SHELL TANKS



2.1.3 TREATMENT

HLW is often reduced in volume by evaporation to conserve tank capacity. For example, at SRP, the supernatant is transferred to an evaporator for dewatering. The concentrate from the evaporator is then transferred to a cooling tank where the suspended salts settle. The supernatant is then returned to the evaporator for further concentration. This process is repeated until the waste has been converted to a damp salt cake which consists of $NaNO_3$, Na_2CO_3, $NaNO_2$, Na_2SO_4, and $NaAl(OH)_4$. The radionuclide concentration in the salt is approximately three times that of the supernatant.

At Hanford, after evaporation, the aged supernatant in the old, single-shell tanks was sent to the B-plant where the cesium (Cs-137) and strontium (Sr-90) are removed through an ion exchange process. This process was initiated in about 1983 to remove the dominant heat and radiation sources from the waste.

At WVDP, the supernatant treatment will include extensive liquid waste treatment. Supernatant HLW from the tanks will be pumped and cooled using a chiller. The supernatant will then be pumped through cesium removal ion exchange columns. The ion exchange effluent will be solidified with cement and disposed on site or as a low-level waste (LLW).

At INEL, a unique process has been developed and is presently in use that changes HLW into a sand-like material which can be stored for centuries. There, the wastes from decladding and fuel rod dissolution are solidified in the New Waste Calcining Facility (NWCF). This facility, which began hot (radioactive) operations in September, 1982, has a 3,000-gallon-per-day capacity. It uses a highly automated, remote-handled, high temperature fluidized bed calcination process.

At all other facilities handling, HLW will be vitrified in a glass material. At the WVDP, the vitrification has been completed unit and entered the cold test phase in February, 1987. The Hanford vitrification plant is in the planning stages with a completion date projected for the mid-1990s. SRP's Defense Waste Processing Facility (DWPF) is 46 percent complete and will be operational in 1990.

The WVDP vitrification system, scheduled to be operational in April, 1989, is the most fully developed example of the process and will serve as a prototype for SRP. The sludge and resin treatment will involve vitrification using a melter and will result in the production of 300 glass logs (2 feet x 10 feet) of waste suitable for HLW repository disposal. HLW sludge will be pumped through access risers with mobilization pumps into the main process tank which will contain a zeolite ion exchanger system to remove cesium from the waste. Once the cesium is removed, the waste will be routed to a feed concentration make-up tank. After glass formers are introduced, the waste will be routed to a melter, then to a feed delivery system which will fill the canister. Off-gases will being sent to a submerged bed scrubber. Once the canisters are filled, they will be cooled, decontaminated, rinsed, welded, and placed in interim canister storage. The canisters will remain in storage until a HLW repository is available.

2.1.4 WASTE ANALYSIS

HLW analysis for hazardous constituents has been minimal at DOE facilities. The wastes are usually characterized only in terms of the percentage of hazardous constituents. However, the three generating facilities as well as WVDP have a fair understanding of the overall make-up of their waste streams. Analyses of pH, temperature, radio activity, and other characteristics are performed at sufficient frequencies in most pipelines for process control purposes.

DOE argues that quantitiative analyses of HLW are unneccessary since personnel exposure is high during an adequate sampling and analysis program, and that quantitative data of hazardous constituent concentrations at various points within the system would not change operations. At the older facilities, obtaining representative samples from a one-million-gallon storage tank requires the use of large equipment and many workers for several days. These samples must then be sent to specialized, remote-handling laboratory facilities where some further personnel exposure occurs. For the few times when such analyses were performed at SRP, the findings did not indicate the need for modification of either hazardous waste treatment or disposal practices. On the other hand, INEL has a remote analytical laboratory (RAL) which began operations in 1986. Because this laboratory meets the "as low as reasonably achieved (ALARA) exposure criteria, many chemical analyses can be routinely conducted. The laboratory is capable of analyzing the RCRA Appendix IX list of parameters.

2.1.5 PROCESS CONTROLS

Process controls for HLW include the monitoring of valves, pumps, tank levels, and of the outer shells of the pipes and tanks for leaks. Controls for HLW at the DOE facilities visited by the task force are sophisticated; they resemble the process controls at chemical plants rather than the monitoring controls at RCRA waste management sites.

These DOE facilities are, in fact, related to industrial chemical processing plants where tanks and pipes are closely monitored to protect the integrity of the product. Since deviations in mixes during treatment would result in unwanted products or reactions the operations are carefully controlled. There are elaborate systems where valves, pumps, tank levels, and other important parameters can are continuously monitored from a central area. The system may also employ interlocks and fail-safe systems (i.e., shutdown for power failure). In the system seen at Hanford, a computer-automated surveillance system makes 5,700 readings a day.

A leak monitoring system also exists at Hanford; double-walled pipelines have redundant leak detection controls which include encasement alarms, diversion box alarms, diversion and catch-tank air monitoring, material balance discrepancies, radiation monitoring above grade, and periodic swabbing of encasements. Any liquid escaping from the primary pipe flows by gravity to a collection tank or diversion box. From there, it can be pumped back into the system.

Tanks at all the facilities are controlled or monitored using various combinations of tank liquid level measurements, annulus air monitoring, annulus liquid level, and leak detection pit monitoring for liquids and air. The annulus of the doubled-wall tanks at SRP is equipped with at least two single-point conductivity probes located at the bottom of the annulus on opposite sides of the tank. When a conductivity probe detects liquid, it activates audio-visual alarms in the waste management control room. Each alarm is investigated, including visual inspection of the annulus, and a formal investigation report is issued to operating and technical supervisors describing each incident and the corrective action. All annuli are visually inspected and conductivity probes are tested on a monthly basis.

For inventory control and as an additional backup to the leak detection system, liquid levels inside the tanks may be measured and recorded at various facilities on a regular basis. In practice, however, these mass balance records are often the most sensitive indication of leaks, particulary when long distances between detectors and pipelines exist.

SRP is unique because it also performs inspections of waste storage tanks. These inspections are difficult due to radiation and contamination problems, but SRP has developed techniques for remote inspection and evaluation. These include visual inspection by means of a periscope, photography, ultrasonic measurement of wall thickness, and corrosion specimens.

Double-walled tanks at SRP with a history of leaking are inspected through a selected annulus-top opening at least once a year. All other double-walled tanks are inspected every two and four years, respectively.

2.1.6 LONG-TERM STORAGE, TRANSPORT, AND DISPOSAL

Final disposal of treated HLW will be at the planned HLW repository, which is scheduled for operation in the 21st century (Figure 2-2). The DOE is presently in the site-characterization phase for three sites, one of which will be selected for the repository. They are located in three different states and in three different geologic media. The site in basalt is located at Hanford; the site in welded tuffs is located at Yucca Mountain, Nevada; and the site in bedded salt is located in Deaf Smith County, Texas. The canisters of vitrified waste are designed to be sent to the repository. Since the repository is not yet available, means of storing wastes on site are still required.

The INEL is storing calcined waste, which has the texture of sand, in cylindrical storage bins set in a reinforced concrete silo (Figure 2-3). There are three to twelve bins per silo and there are six silos currently in use; a seventh is under construction. Each silo provides storage for 3,500 cubic feet of calcine and they are designed to provide storage for a minimum of 500 years.

FIGURE 2-2
CONCEPTUAL DESIGN CUTAWAY
HIGH-LEVEL WASTE GEOLOGIC REPOSITORY

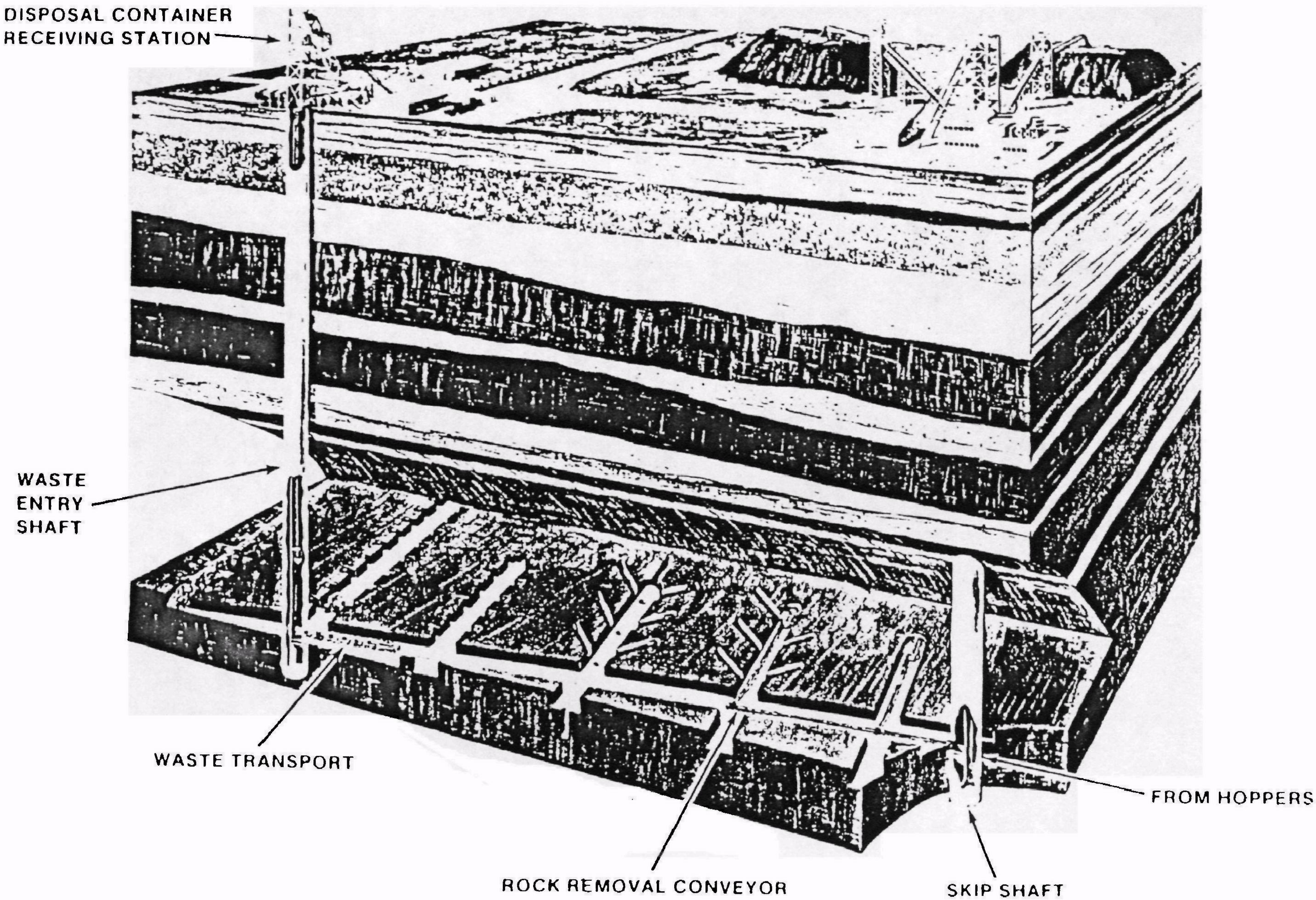
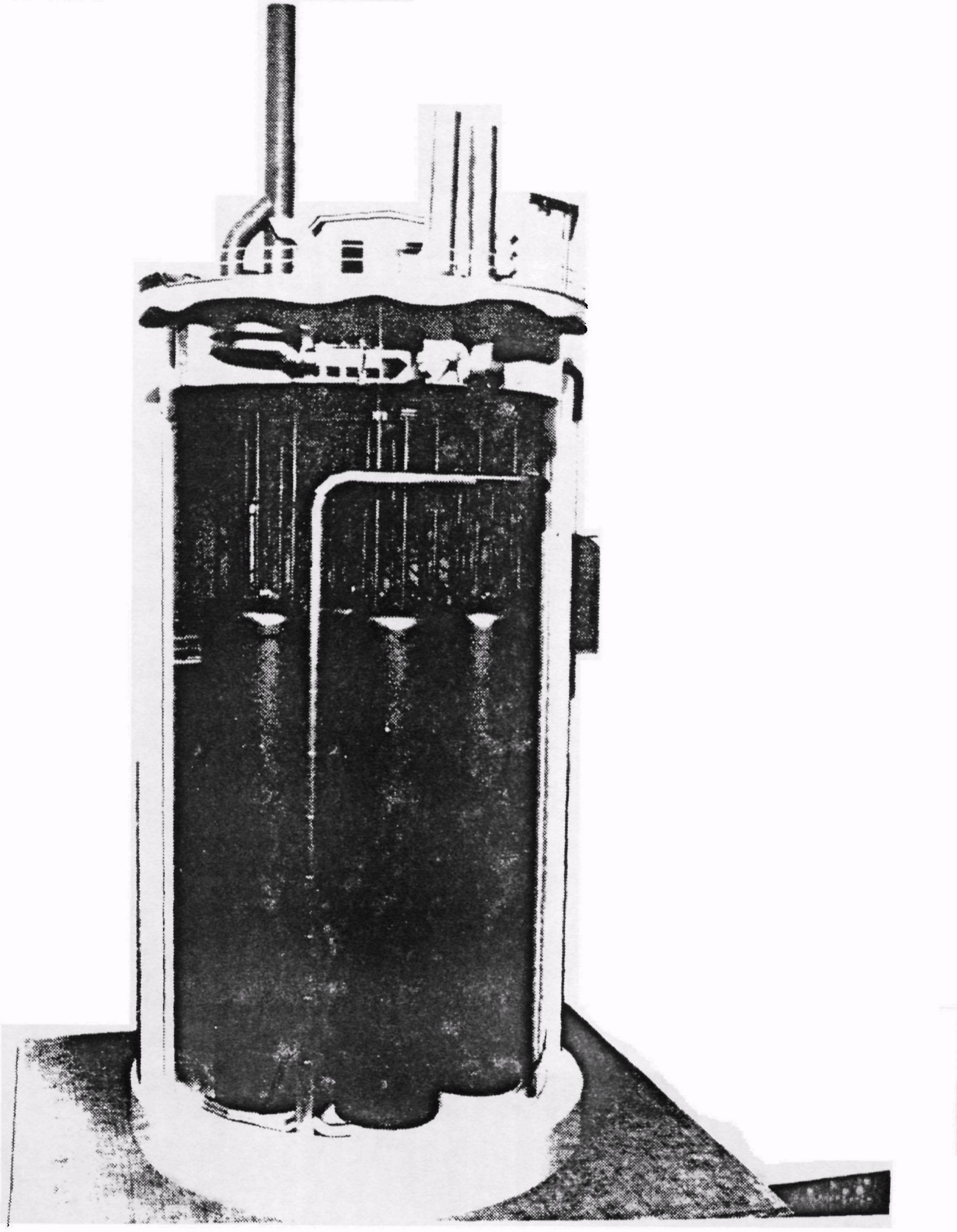


FIGURE 2-3
CALCINE BIN SET MODEL



Currently, several waste form storage options are under consideration at the INEL for use during interim storage including continuation of the calcine production, incorporation of the calcine into glass or ceramic logs, or discontinuing calcination and going directly to glass or ceramic logs.

Transforming calcined waste into glass logs could be accomplished by mixing the calcined wastes with small granules of glass (frit), heating the mixture, and then drawing it off into a stainless steel canister. The canisters would be handled remotely. Because of the heat generation, the canisters would be stored in such a way that air can be circulated around them. Provisions would be made for decades of such storage.

2.2 TRANSURANIC (TRU) WASTE

TRU waste is defined in DOE Order 5820.2 as waste contaminated with transuranium radionuclides that are alpha emitters with an atomic number greater than 92. The radionuclides have half-lives greater than 20 years and occur in concentrations greater than 100 nanocuries per gram (nCi/g). This definition would include various isotopes of plutonium (Pu), americium (Am), and curium (Cm).

Individual DOE facilities are also permitted to "designate" radionuclides with an atomic number of 92 or less as TRU waste as they determine to be appropriate. Under the authorization of this policy, an isotope uranium (U-233), which is unique for the thorium fuel cycle, and an isotype radium (Ra-226) have been designated as transuranics by the DOE Oak Ridge Operations office.

The majority of TRU waste contains plutonium which is a low-energy, alpha-particle emitter. Alpha particles are easily stopped by almost any barrier, and thus the radiation level at the surface of container (box or drum) with only Pu-239 in it is usually low. This type of waste is called "contact-handled" TRU waste (CH-TRU). Some TRU waste, however, also contains beta- and gamma-ray emitters. These wastes must be handled remotely if the radiation level at the surface of the container exceeds 200 milirem per hour (mrem/hr). This type of waste is called "remote-handled" waste (RH-TRU).

The various elements involved in the management of TRU waste include generation, packaging, on-site transfer and tank storage, treatment and certification, waste analysis, controls, post-treatment storage, transport, and disposal.

2.2.1 GENERATION

TRU waste results mostly from the processing, shaping and handling of plutonium-contaminated materials. Most TRU waste is solid (e.g., gloves, paper, rags, tools, and machine parts); however, some waste is liquid resulting from chemical processing for the recovery of plutonium. Some TRU waste contains listed RCRA hazardous waste, such as spent cutting oils, solvents, or lead. A small amount of TRU waste (<2%) is classified because of its shape or form; its isotopic, chemical, or alloy composition; or because the waste contains tools that may be classified.

The average annual generation rate of TRU waste for the period 1986 through 1995 is projected to be 6,057 cubic meters (m^3), of which 6,024 m^3 is CH-TRU and 32.8 m^3 is RH-TRU (Table 2-3). As can be seen from this table, Rocky Flats Plant (RFP) is by far the largest generator of CH-TRU, followed by Hanford and SRP. ORNL is the largest generator of RH-TRU.

2.2.2 PACKAGING

When it is determined that the amount of plutonium or other transuranic element is not worth recovering, the waste material is packaged for storage and ultimate disposal. This process generally involves placing the waste in an 11-mil PVC bag which is sealed with tape and placed in either (1) a 90-mil, rigid polyethylene drum liner which is sealed and placed inside a 55-gallon DOT 17-C metal drum, or (2) a 50-mil fiberboard liner which is wrapped in an 11-mil PVC wrapper, sealed, and placed in a 4ft. x 4ft. x 7ft, 14-gauge, corrugated metal, welded box. The drums and boxes are sealed with tamper-indicating mechanisms.

Some facilities -- ORNL, LANL and LLNL -- use a second 11-mil PVC bag inside the drum. While many of the facilities use a steel drum for the final container, LLNL and SRP use galvanized drums. ORNL does not use a 90-mil drum liner. ORNL has recently switched to stainless steel drums due to corrosion problems encountered with steel drums. As a result of switching, LANL coats its steel drums prior to storage with a corrosion inhibitor which will be steam-cleaned away before shipment.

TABLE 2-3
DOE-PROJECTED TRU WASTE GENERATION RATES (1986-1995)

SITE	VOLUME (M^3)	
	CH-TRU	RH-TRU
Hanford	658	6.1
INEL	3.3	3.6
LANL	320	1.4
LLNL	282	0
ORNL	44	15
RFP	4,158	0
SRP	348	0
WIPP	40	0
Other	171	6.7
TOTAL	6,024	32.8

Adapted from Table 3.5, "Integrated Data Base for 1986: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics", DOE/RW-0006, REV. 2, September 1986.

2.2.3 ON-SITE TRANSFER AND TANK STORAGE

Liquid TRU wastes are piped from the generation source to treatment, or to storage and then to treatment. All facilities visited use double-walled (pipe-in-pipe) pipe systems composed of polyethylene or stainless steel.

Liquid TRU waste is generally stored in above-ground tanks in buildings. If the tanks are not double-walled, they have curbing around them for secondary containment. In the case of ORNL, TRU wastes are stored as sludges in two types of underground tanks. ORNL's Melton Valley storage tanks are stainless steel tanks. They are contained in a stainless steel-lined concrete vault. Each vault has a sump system with an alarm. In addition, six single-walled gunite tanks are used. These lack ground-water monitoring but are equipped with sumps with alarms. Formerly, these tanks were used to store wastes prior to evaporation and disposal by underground injection. This practice, called hydrofracture, has been discontinued.

2.2.4 TREATMENT AND CERTIFICATION

Many different treatment systems for the processing of TRU waste are already in place or are in the planning stages. Some of these systems were installed for the purpose of recovering plutoninum (liquid waste treatment at RFP and LANL), some are for the purpose of reducing the volume of TRU waste (the planned incinerator for SRP, the incinerator at LANL, and the size reduction facility at LANL, and others are for the express purpose of complying with the WIPP waste criteria (e.g. Process Experimental Pilot Plant (PREPP) at INEL).

The LANL liquid waste treatment system, a physical-chemical plant, removes 99 percent of the uranium and plutonium. The treatment steps include influent analysis, flocculation/precipitation, filtration, ion exchange, treated liquid analysis, and discharge. The sludge resulting from treatment, which is TRU waste, is dried on a vacuum filter, mixed with cement, and placed in 55-gallon drums. Approximately 60 drums of cemented sludge are produced each year. The supernatant from the plant is directly discharged in accordance with a NPDES permit.

The TRU waste incinerator at LANL is utilized for the volume reduction of TRU combustible wastes. This incinerator consists of a ram feeder, a primary combustion tank and a secondary combustion chamber to burn particulates and volatiles, a feed preparation glove box, and an off-gas cleanup system. The off-gas cleanup system consists of a high energy scrubber, venturi scrubber, packed column, and three banks of high energy particulate air (HEPA) filters. The incinerator is presently permitted to incinerate PCB's and has interim status as a hazardous waste incinerator. During a recent trial burn it achieved a 99.99 percent reduction of carbon tetrachloride (CCl_4) and a 99.9999 percent reduction of trichloroethylene (TCE). The capacity of the incinerator is 100 pounds of solids per hour or one million BTU's per hour of liquids. LANL plans to incinerate all TRU wastes containing organics, solvents, and oil.

The size reduction facility at LANL is used to cut up large metallic TRU wastes, such as glove boxes. The entire facility is fully contained and remotely operated. It can handle wastes up to 15 x 15 x 30 feet. A plasma torch is used to cut up the large objects.

The PREPP at INEL includes shredding, rotary kiln incineration with secondary combustion with dry, off-gas handling, and particle-size separation with fine materials going to grout mix and coarse materials being added to the grout product in certifiable WIPP containers. The PREPP facility has been designed for full RCRA compliance, including waste analysis, performance standards, operating requirements, and monitoring and inspection. The expectation is that the facility will be used for both hazardous wastes and mixed wastes in the future.

Currently, there is no facility in the DOE organization for processing RH-TRU wastes. However, funding for a Waste Handling Pilot Plant (WHPP) at ORNL has been appropriated. The WHPP is a processing facility for repackaging and WIPP certification of RH-TRU wastes. The WHPP feasibility study was completed in 1984 with construction on the facility scheduled to begin in 1991. Existing plans call for construction to be completed and the plant operational by 1996. Since 94 percent of DOE's inventory of RH wastes is stored at ORNL, it is conceivable that the WHPP may serve as a central processing facility for RH-TRU wastes. Such wastes could be transported from INEL and Hanford, for example, for processing.

In addition to the waste treatment systems, the larger TRU waste generators and the retrievable storage facilities have installed or are in the process of installing facilities for examination and assay of containerized TRU waste. At ORNL, for example, each drum must pass an examination by three separate assay systems in order to obtain certification: (1) The ORNL real-time radiography (RTR) examination allows x-ray inspection of individual drums. Using this system, liquids, partially filled aerosol cans and other prohibited items can be detected. (2) Drums are also passed through a neutron assay system (NAS) which scans the container for fissile material. This is accomplished by using active and passive scanning modes. The active mode of the NAS detects thermal-neutron-induced fission reactions, while the passive mode detects neutrons emitted by spontaneous fission. Using these data, the total TRU activity per drum may be obtained by adding the results of the active and passive scans. The sensitivity of NAS ranges from 200 grams (g) to as low as 0.5g. Finally (3) the segmented gamma scanner (SGS) identifies minimum detectable quantities of gamma-emitting isotopes. Although the SGS qualitatively monitors for gamma-emitting isotopes at present, it will be upgraded to provide a quantitative assay of individual waste containers.

2.2.5 WASTE ANALYSIS

TRU waste analysis is routinely performed for radioactive material content. The hazardous constituents are routinely identified but not quantified. Lab experimenters and other glove-box generators of TRU wastes must label the contents of each package, specifically noting any hazardous waste contents. The individually wrapped packages are then doubly wrapped and containerized for disposal at the WIPP, minimizing the chance of contact among incompatible wastes and thus at least reducing the need for quantitative analyses.

Quantitative analyses will be performed more regularly in the future as automated, remote-handling laboratory capacity increases. As indicated in the next section, remote monitoring of liquid TRU is being enhanced at LANL. TRU waste is analyzed prior to incineration at LANL and in the newly constructed PREPP facility at INEL.

2.2.6 CONTROLS

Two types of controls -- process and administrative -- were observed in use for TRU waste management. Extensive process controls are utilized with regard to the transfer of liquid TRU waste as well as the treatment of this waste. This control generally consists of state-of-the-art, computerized control of such factors as valves, pumps, tank levels, and chemical addition. In addition, remote, routine monitoring of several parameters such as flow rate, pH, temperature, conductivity, and radioactivity is performed. Similar control and monitoring technology is used with respect to the treatment systems dealing with solid TRU wastes described in Section 2.2.4.

There are also extensive administrative controls for TRU waste. The majority of these controls are a part of the WIPP Waste Acceptance Criteria (WAC) and must be met if a facility is to ship its waste to the WIPP. Record keeping starts at many facilities with a detailed description of each bag of waste placed in a drum or box. This data package accompanies each drum certified for shipment to the WIPP. The data requirements include shipment/transportation data (e.g., shipment number, shipment date, carrier code, vehicle number, vehicle type, waste type, shipment certification, etc.), as well as waste package data (various code and identification numbers, closure date, weight, surface dose rate, neutron component, organic materials weight and percent volume, plutonium fissile gram equivalent, total alpha activity, presense of hazardous waste, waste package certification date, etc.). All waste examination and certification records are retained in duplicate.

Detailed and extensive record keeping for drum assay is also done and accompanies each shipment to storage. Operator training is documented and quality assurance programs serve to oversee the handling of TRU wastes at every facility.

A nonconformance report is issued for any newly generated TRU waste which cannot be certified. This report accompanies any noncertified TRU waste container returned to the generator for repacking. Appropriate signatures must be provided on the nonconformance report before the waste will be reaccepted for re-examination and certification. Drums which fail WIPP certification are color-coded and returned to the retrievable storage area until such time as a disposition can be determined.

2.2.7 POST-TREATMENT STORAGE

Since 1970, DOE has placed its TRU waste in what is referred to as "retrievable storage." As of the end of 1985, 90,555 m^3 of CH-TRU waste was stored at six facilities and 1,572 m^3 of RH-TRU waste was stored at four facilities (Table 2-4.) It should be noted that Table 2-4 does not account for the RH-TRU waste observed by the task force at SRP.

TABLE 2-4
INVENTORY OF DOE RETRIEVABLE TRU WASTE THROUGH 1985*

STORAGE SITE	VOLUME (M^3)
CONTACT HANDLED	
Hanford	16,301
INEL	65,725
LANL	4,723
NTS	536
ORNL	507
SRP	2,763
TOTAL	90,555
REMOTE HANDLED	
Hanford	22
INEL	45
LANL	29
ORNL	1,476
TOTAL	1,572

* Adapted from Table 3.3, "Integrated Data Base for 1986: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics", DOE/RW-0006, REV. 2, September 1986.

Storage of CH-TRU waste varies with the facility. However, the majority of TRU waste stored at Hanford, INEL, LANL, and SRP has been placed on pads (asphalt or plywood), at or below grade as shown in Figure 2-4. After the waste containers are stacked four or five high, they are covered with plywood, plastic and earth (Figure 2-5). Plastic standpipes are installed at some facilities to allow for escape of generated hydrogen gas. These standpipes can also be used to monitor the air for radionuclides. More recently, SRP has been placing certified CH-TRU wastes on concrete pads without covering and INEL is using an air support building as illustrated in Figure 2-6. At the WVDP, CH-TRU is stored in a metal hoop building, NTS stores the CH-TRU generated at LLNL in cargo containers outdoors and at ORNL, retrievable CH-TRU waste drums are stored below grade in concrete block storage cells. The cells are not completely dry and, occasionally, small quantities of water have been observed accumulating in the storage cell. Storage cells are equipped, however, with a monitoring sump which is checked monthly for the liquids.

RH-TRU is stored in several ways. At ORNL some retrievable RH-TRU wastes are stored in concrete casks placed in below-grade concrete vaults. The storage casks are lined with polyethylene and can accommodate 27 drums. Typically, ORNL RH-TRU waste must be stored five to 10 years in order to allow sufficient radioisotope decay to meet the WIPP-WAC.

Other retrievable RH-TRU wastes at ORNL are stored in single-shelled, stainless steel tubes (called wells) with a welded stainless steel bottom and anchored to a 6-inch concrete slab. The wastes are first placed in stainless steel primary containers which are lowered into the wells. Similar wells are utilized at INEL and LANL. At SRP, drums of RH-TRU waste are placed inside at concrete culvert sections which are placed on a concrete pad and covered with a concrete lid.

2.2.8 TRANSPORT

At the present time, TRU waste is generally shipped from generation facilities to retrievable-storage facilities via highway in specially designed TRUPACTs or by rail in specially constructed enclosed cars called "ATMX." The ATMX holds 140 drums or 24 boxes. LLNL currently uses a "Super Tiger" container to ship its wastes to NTS.

FIGURE 2-4
WIDE BOTTOM STORAGE TRENCH FOR TRU WASTE

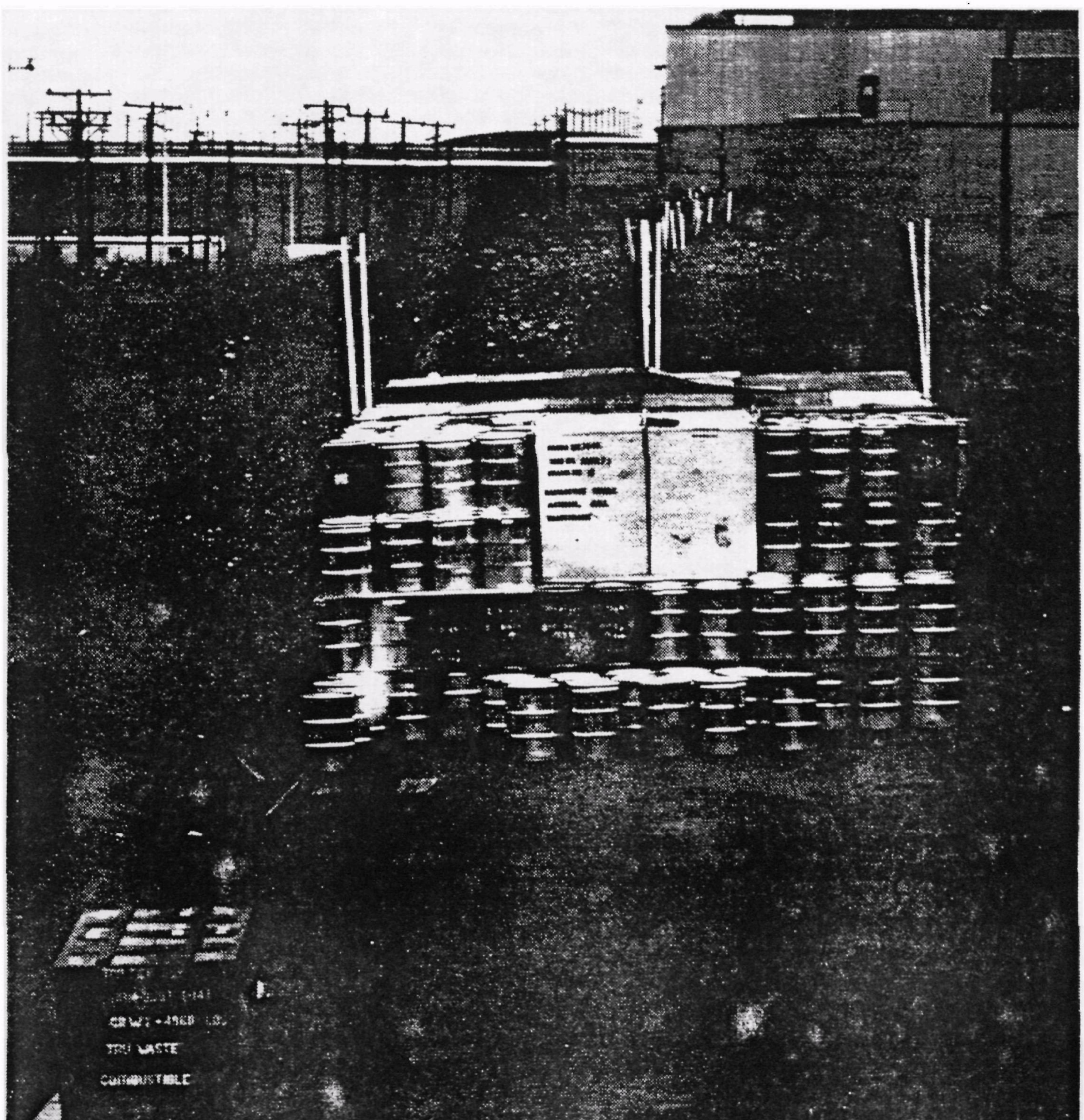


FIGURE 2-5
TRU WASTE STORAGE PADS COVERED WITH PLASTIC AND EARTH

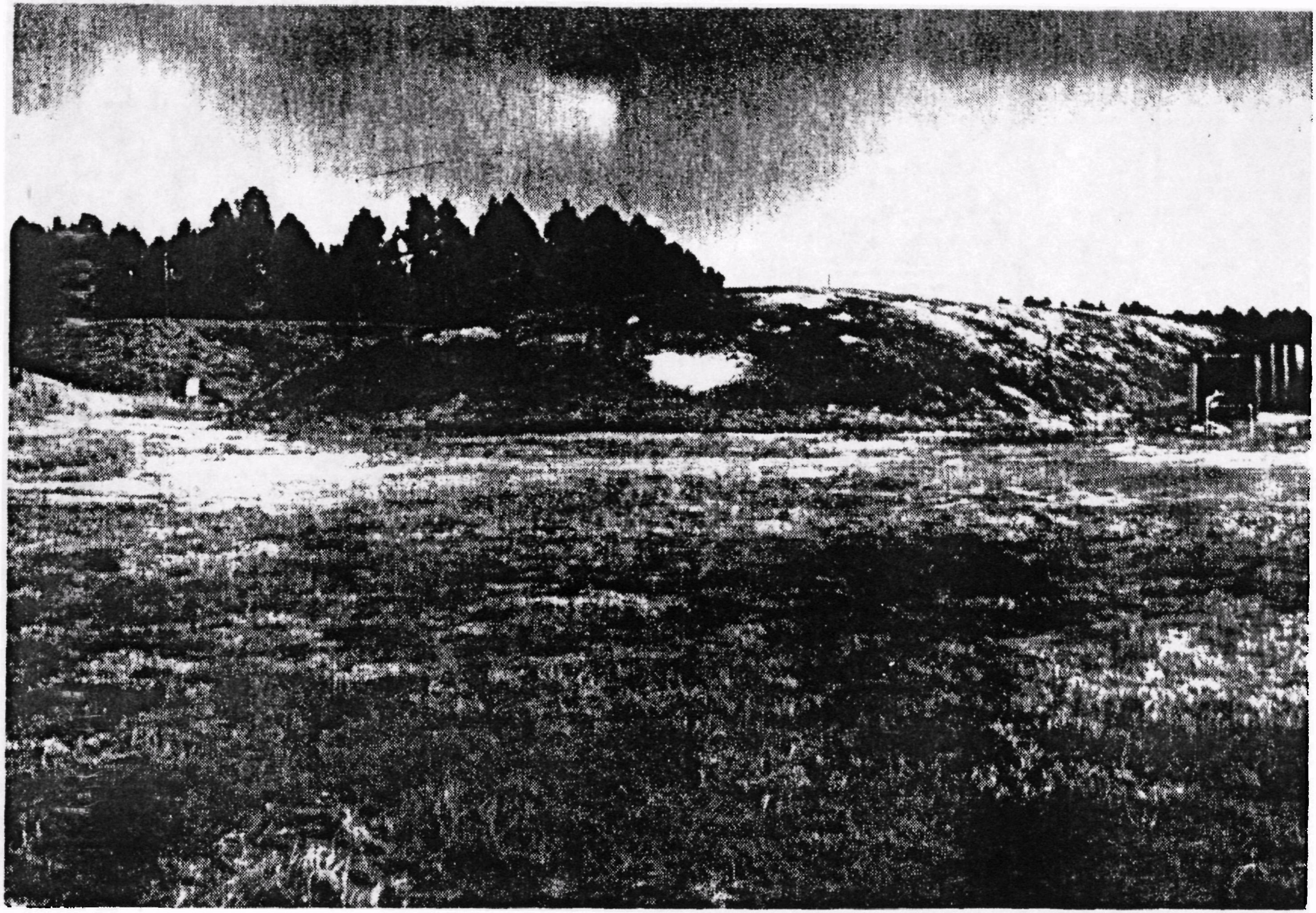
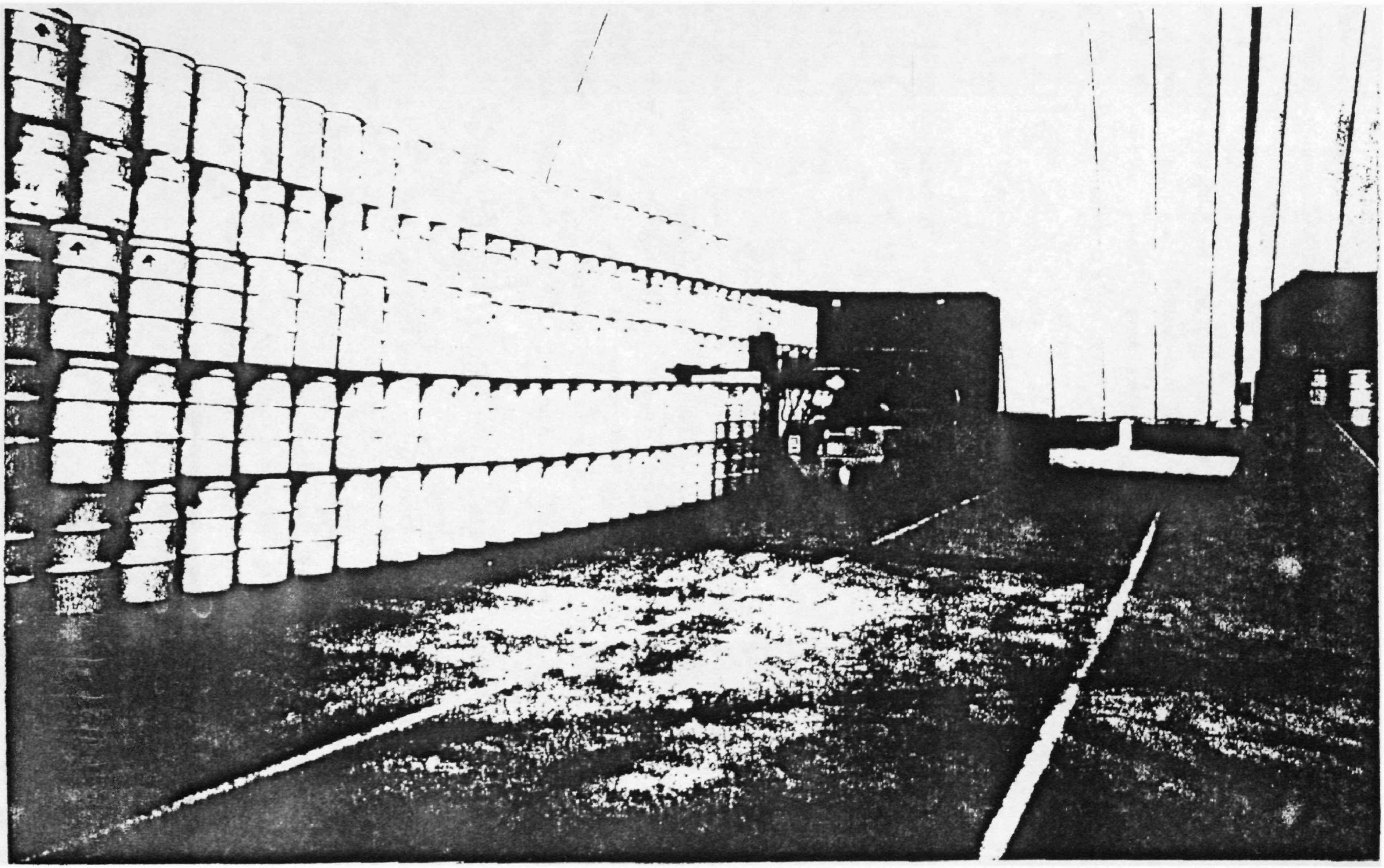


FIGURE 2-6
TRU WASTE STORAGE AREA
CONTACT-HANDLED WASTE RETRIEVABLY STORED



With the startup of WIPP in 1988, contact-handled TRU will be shipped to the WIPP site via highway or rail in TRUPACTs (Figure 2-7). These TRUPACTs will hold either 55-gallon metal drums banded together in "six-packs" or various-sized metal boxes.

The TRUPACTS have been designed to satisfy all federal regulatory requirements of the Department of Transportation and tested to withstand highway accident conditions. Only one TRUPACT will be transported per truck, two per railcar. Remote-handled TRU waste, by far the smaller amount anticipated at WIPP, will arrive in specially designed, shielded casks which will contain the actual waste container.

2.2.9 DISPOSAL

All certifiable TRU wastes, (except for those from the WVDP, because they are not defense related), will be sent to the WIPP starting October, 1988. The WIPP will handle both contact-handled and remote-handled TRU waste (Figure 2-8). TRU waste will be received first; RH-TRU waste will follow in 1989.

When a TRUPACT of CH-TRU waste arrives at WIPP, it will be inspected for damage and contamination. Then, after all shipment documents are verified, it will be taken to the contact-handling part of the Waste Handling Building, where it will go through an air lock. The TRUPACT will be opened and the waste packages inside removed and inspected prior to being transferred to the underground storage area. Once underground, a forklift will stack the waste packages ("six-packs" will be stored three high). This final location will then be entered into a computer, so that every package will be traceable.

When a shielded cask of RH-TRU waste arrives at WIPP, it will be carefully inspected and all of its shipping documents checked. The cask will then be transported into the remote-handling portion of the Waste Handling Building, an area separated from the contact-handled waste area. The cask is then isolated in a special room and opened to remove the waste container, which will be taken to the "hot cell" where it will be identified and inspected. The container will then be placed in a facility cask for transport to the underground storage room. Once in the storage room, the facility cask will be placed in a machine that removes the waste container and emplaces it into a pre-drilled hole in the storage room wall. After the container is emplaced, the hole will be plugged and the facility cask reused.

FIGURE 2-7
TRUPACT BEING TRANSPORTED

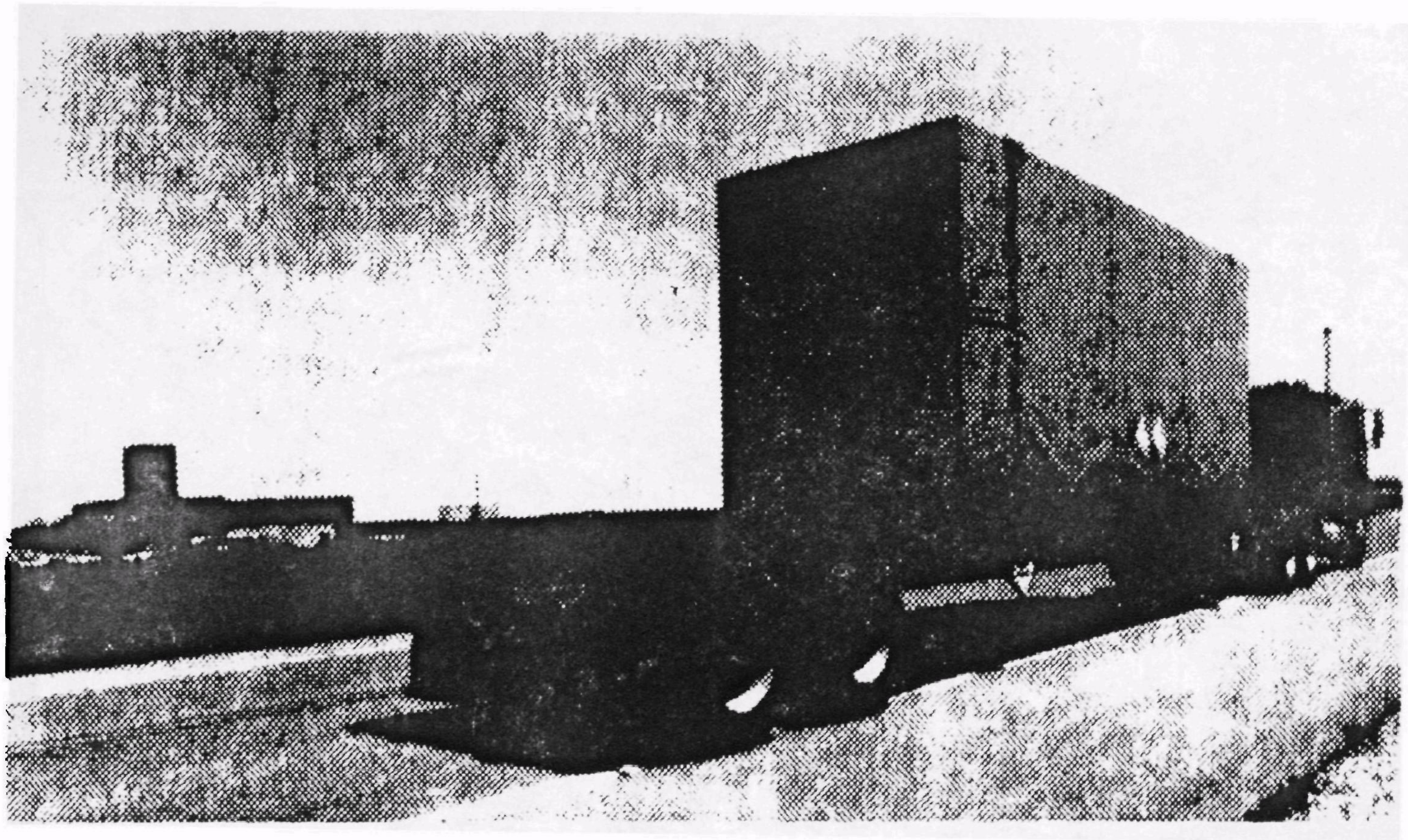
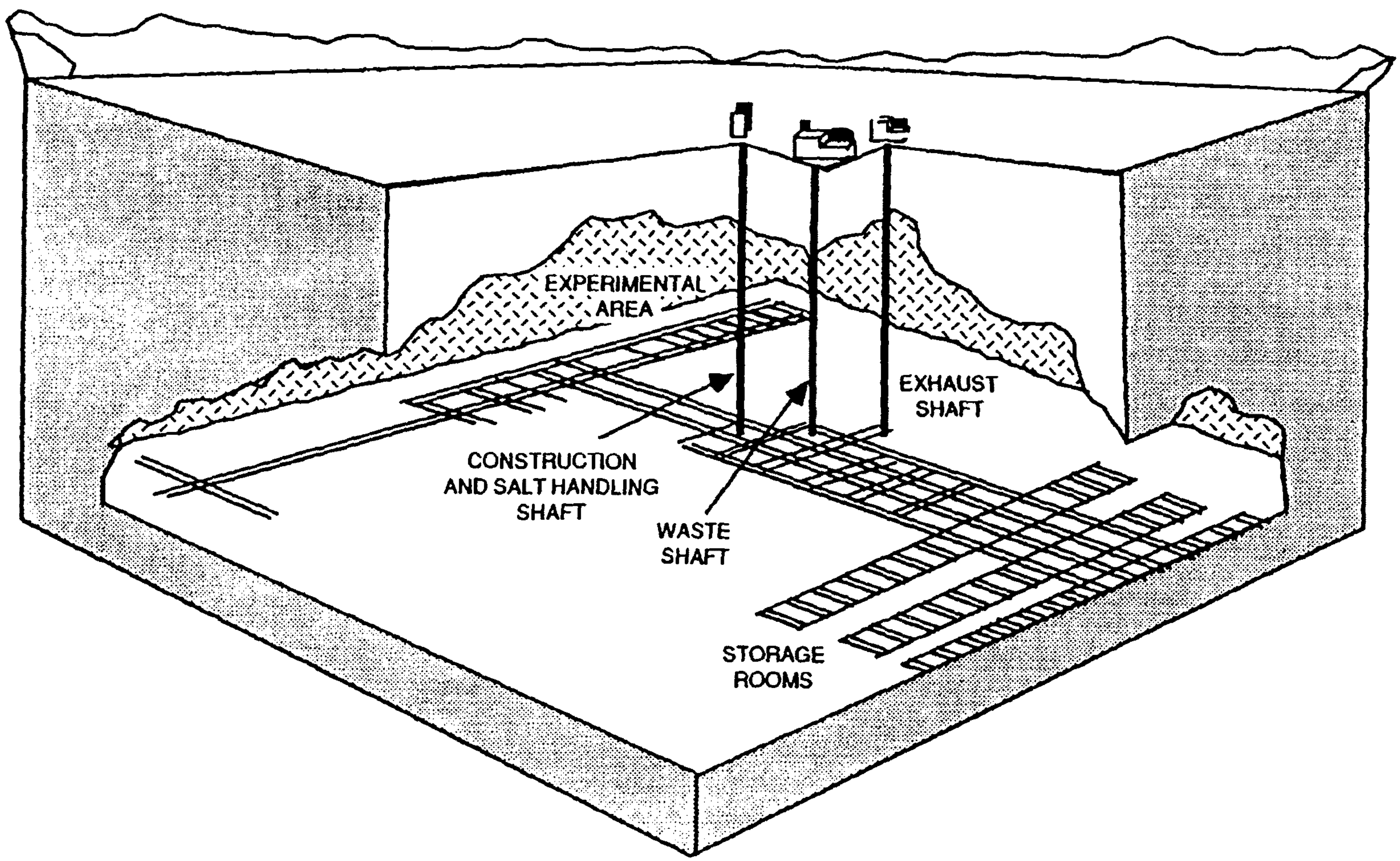


FIGURE 2-8
WASTE ISOLATION PILOT PLANT SCHEMATIC



The WIPP is currently limited by law to 25 years of operation. The amount of TRU waste that can be stored at WIPP is limited by the total authorized TRU storage area of approximately 6.4 million cubic feet. By the end of 1988, when the WIPP is scheduled to begin operation, there will be an estimated 3.8 million cubic feet of retrievably stored TRU waste. At the current rate of TRU waste generation -- about 0.23 million cubic feet per year -- the capacity of WIPP will be exceeded before the year 2000, assuming production continues at the current rate. At the expected emplacement rate, 0.3 million cubic feet per year (limited by transportation), capacity will be reached by the year 2009.

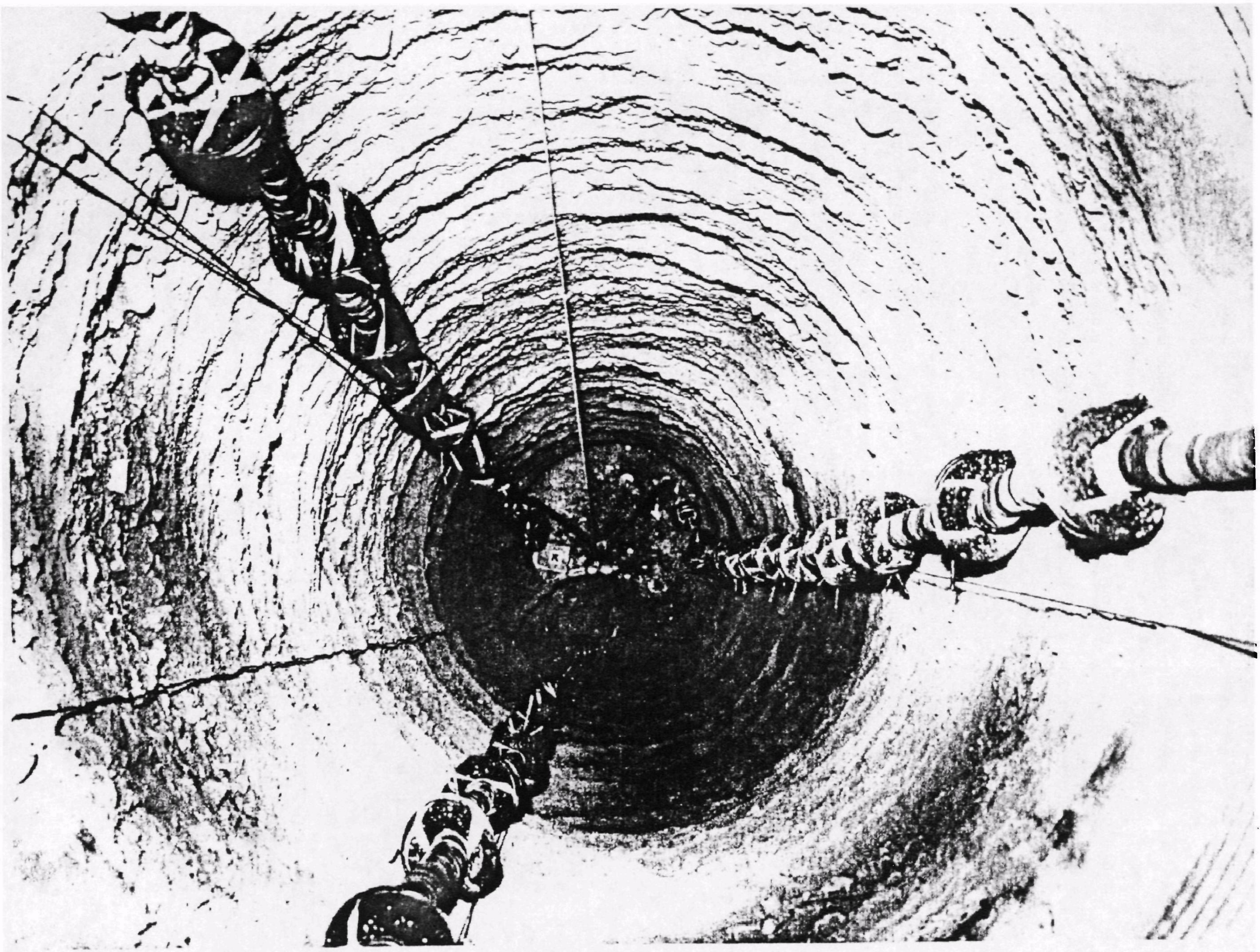
Wastes disposed of prior to 1970 at many facilities will be left in place. Some TRU waste which is uncertifiable and older TRU wastes at LANL were studied and a decision was made to leave them in place. This particular decision is presently being re-evaluated with a report due to DOE's Albuquerque Operations office in June 1987.

Classified TRU waste is disposed of at the NTS. All classified TRU waste is in solid form (such as graphite, steel, or plastic). Most of the waste is uncontaminated by known RCRA hazardous chemicals. Approximately 5,600 cubic feet of TRU waste has been disposed of at NTS since 1985 in a greater confinement disposal (GCD) facility. The GCD shafts are drilled 10 feet in diameter and 120 feet deep and are not lined (Figure 2-9). Waste is then emplaced in the shaft to fill about half the volume and the shaft is then backfilled.

The GCD project began in 1981 to demonstrate the disposal of defense LLW at a depth sufficient to minimize or eliminate natural intrusion processes -- for example, animal burrowing or plant rooting, -- and to substantially reduce the potential for inadvertent human intrusion. The two goals for the GCD test are to collect and analyze data on radionuclide migration (using nonradioactive gaseous and liquid tracers) at the 120-foot level and to develop handling procedures. Fiscal year 1987 is the final year of the GCD test. Data from this test will be used in the forthcoming 40 CFR 191 performance assessment (draft due September, 1987).

The GCD facility currently has a capacity (assuming 50% of the volume is waste) of about 40,000 cubic feet of waste. The GCD facility is being used for both high-specific-activity LLW and classified TRU waste. The classified TRU waste comes from weapons facilities around the country. There are no plans to retrieve this waste.

FIGURE 2-9
GREATER CONFINEMENT DISPOSAL (GCD) SHAFT



2.3 SPECIAL WASTES

Hanford has been chosen as the disposal site for decommissioned reactor compartments from nuclear submarines. These compartments are approximately 30 to 35 feet in diameter, 30 to 38 feet in length, and weigh approximately 1000 tons (Figure 2-10). The compartments contain no spent fuels or TRU waste but pose a potential low-level radiation hazard due to activation products, mainly cobalt (Co-60). The compartments also contain approximately 250 to 350 tons of lead.

The disposal site is located in the 200 east area and consists of an excavation approximately one acre in area which will accommodate about 12 compartments. At the present time, one unit has been placed at the site. When 12 compartments have been placed, the site will be backfilled. No ground-water monitoring is planned after burial of the units.

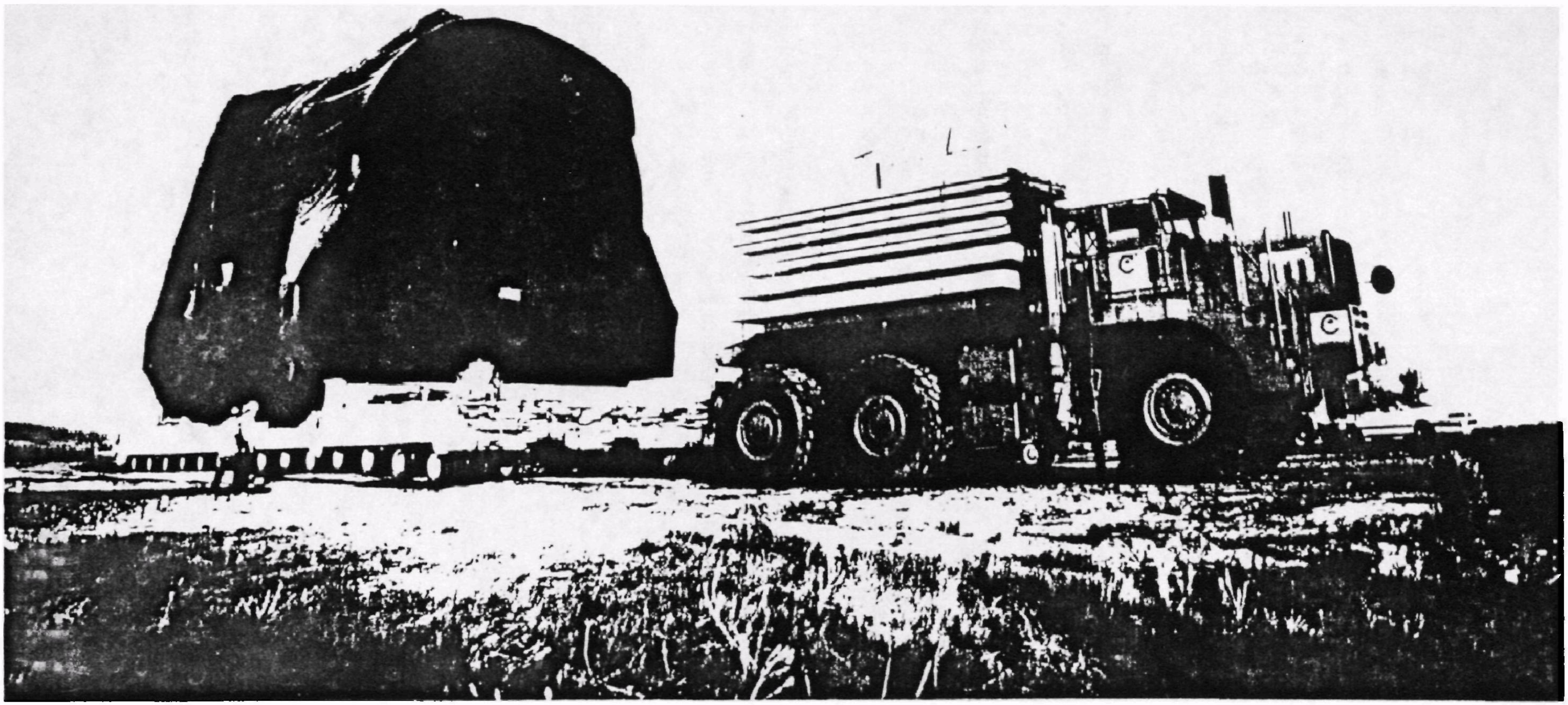
2.4 ENVIRONMENTAL MONITORING

Environmental monitoring by contractor-operators is carried out in some measure at every facility and usually includes air and surface water and ground-water monitoring for radionuclides. In some cases soil, sediment, biota, and foodstuffs are also collected and analyzed for radioactivity.

Typically, the ground-water monitoring has been useful for establishing area-wide trends but not for determining whether contaminants have entered the ground water from specific waste treatment and disposal units. Some facilities have recently begun analyzing ground water for hazardous constituents, although a majority of the installed wells do not meet RCRA criteria.

At SRP and Hanford, where tank leakage has been documented, some ground water monitoring wells have been installed to map the extent of radioactive material migration. The monitoring system, however, like other DOE facilities visisted, did not meet RCRA standards. In adequate analyses have also been performed for hazardous waste components designed to detect and quantify the impact on ground water by each source.

FIGURE 2-10
NAVY SUBMARINE REACTOR COMPARTMENT



Area-wide air monitoring is usually extensive both at the perimeters of the facilities and toward population centers. At INEL, constant air monitors in the milli curies per cubic centimeter operational areas provide detection sensitivity at about 10^{-6} (Ci/cc), roughly equivalent to 15 parts per billion (ppb) of plutonium oxide. Perimeter monitoring detection sensitivity is 10^{-17} Ci/cc, or 1.5×10^{-10} ppb. of plutonium oxide.

Radiological baseline monitoring programs are conducted at new facilities such as WIPP. The goal is to measure background levels of radiation and radionuclides. This program includes sampling and analysis for atmospheric, terrestial, hydrologic biota, and ambient radiation. An Ecological Monitoring Program monitors and evaluates the impacts of the WIPP construction (and future operations) on the ecosystem. This program includes environmental photography, soil sampling and analysis, soil microbiotic studies, vegetation surveys, air and water quality monitoring, vertebrate censuses, and meteorological monitoring.

The hydrogeology at WIPP has been studied extensively. There is no significant amount of ground water in the vicinity of the underground site. There is a limited amount of ground water in the Rustler Formation, which is located within 1,000 feet of the surface, about 1,100 feet above the underground site. No RCRA ground-water monitoring wells are scheduled for installation prior to or after waste acceptance.

At NTS, the monitoring system for the waste management area centers on the detection of gamma radiation and airborne radionuclides. No ground-water monitoring is done because DOE believes that there is not enough water to drive the radionuclides to the ground water, that the long distance through the unsaturated zone will protect the aquifer, and that drilling monitoring wells would increase the spread of contamination.

ORLN has developed a remedial action program to control existing and future ground-water contamination and investigate potential sources of continuing releases. This program is based on a "Waste Area Groupings" (WAG) approach which uses information from U.S. Geological Survey (USGS) studies, an ORNL developed ground-water strategy; geology, hydrology, waste management reports and research results; and an inventory of solid-waste-management units (SWMU's) identified at ORNL and other available data and information.

To date, there are 830 ground water monitoring wells at ORNL. Of this number, 258 are newly constructed WAG Perimeter wells, 90 are new piezometer wells, and 27 are new hydrostatic head-measuring stations. The extent of wells required for the remedial investigation/feasibility study of the SWMU's has not been determined to date. The program is not yet in full operation, and no data or results were available for the task force. It is predominantly oriented towards older, low-level waste disposal practices where extensive contamination is suspected.

At all facilities determinations would need to be made for many HLW/TRU waste management units to determine whether Subpart F ground-water monitoring requirements apply and, if so, whether the units would qualify for waivers. The above-ground inspectable waste storage areas observed by the task force for example, probably would not require ground-water monitoring under RCRA. Similarly, the double-wall piping and tanks with interstitial monitoring would not need ground-water monitoring . On the other hand, the task force observed "retrievably stored" drum areas which looked very much like landfills or waste piles. These drums, buried under two to four feet of earth cover, were not inspectable. Leak detection systems in some piping and storage tanks were sparse (one to two thousand feet between sumps was not uncommon). Whether these systems qualified as bases for ground-water monitoring waivers could require considerable documentation.

2.5 AUDITS/ASSESSMENTS/OVERVIEW

All of the DOE facilities operate under the same management system, which is characterized by relatively high contractor autonomy, some operations or Area office oversight and little headquarters involvement. DOE headquarters issues orders which are interpreted to fit each operation by the appropriate operations office.

All facilities planning to ship TRU waste to the WIPP have been and will be subjected to audits by the WIPP-WAC committee. Other audits are performed by the contractors' staff, DOE Operations, DOE Headquarters, or outside consultants hired by DOE. However, there are no audits by any groups who do not report to DOE.

2.6 SECURITY

General security at most of the facilities is provided by 24-hour armed guards sometimes supplemented by tactical response teams. There are usually barriers such as fences and controlled access to TRU waste disposal or storage areas. At most sites, armed guards are required for non-pipeline, TRU waste shipments made within the plant. There are materials balance checks and satellite tracking for TRU waste shipments off site.

3.0 STATE PERSPECTIVES

The MEWS task force discussed the DOE option with personnel from the States of California, Colorado, Idaho, New Mexico, South Carolina, Tennessee, and Washington. The State of Nevada declined to meet with the task force because of a time conflict. New York State personnel who are actively involved in the project were present at the West Valley briefing and participated in the discussions. This selection corresponds closely with the DOE facilities visited by the MEWS task force. Each State is directly concerned with current and future oversight and regulation of DOE facilities within its borders. Some States are concerned with DOE operations outside their borders as well (e.g., New Mexico). Regional EPA representatives participated in all State discussions.

The State's response to the DOE option varied from strong opposition to mild reservations. The following is a synopsis of the discussions with the States. Many of the same issues were raised by each. Detailed State reports are provided in Appendix B.

A majority of the States felt that a "blanket RCRA exemption" would be unwise and would lead to litigation. Most States, however, were willing to consider applications for specific variances or limited exemptions. They did not agree that self-regulation of mixed wastes by DOE was appropriate. Some States also expressed doubt about DOE's "inconsistency by duplication" argument.

Most of the States expressed the desire to have EPA and DOE definition of HLW, low-level waste (LLW), and TRU waste. Universal definitions would provide a foundation for more detailed waste management studies and for classifying waste streams at facility. Fixed definitions would also simplify estimations of needed storage, treatment and disposal at facilities and the Waste Isolation Pilot Project (WIPP) capacity. One State recommended that EPA set specific activity levels to separate waste types. Several States were also concerned that any LLW generated by treatment of HLW remain under RCRA purview.

Some States were concerned about the hazardous wastes or hazardous constituents released from the wastes mixed with grout or vitrified for disposal. The leachability of these products in different environments has yet to be established. The State's were also concerned about the incompatibility of wastes while in containment. Better characterization and segregation of waste streams would resolve these issues, although it may be difficult to conduct chemical analyses for such wastes.

Some States emphasized the need for a broad definition of equivalency when comparing RCRA requirements with facility safeguards. They also pointed out that RCRA was written for different situations, and there is thus a need to compare intents and results rather than specific regulations and requirements.

Several States expressed concern with both the difficulty of monitoring underground pipelines to tanks and the general lack of RCRA-quality ground-water monitoring at the facilities. Most felt this situation was not acceptable.

Finally, each State, when queried about its desire and ability to regulate DOE facilities under RCRA, replied that it wanted some oversight in conjunction with EPA. Some are willing to prepare to meet the challenge.

In summation, the States were universally opposed to that portion of the DOE option which would remove them from providing regulatory oversight at DOE operations.

4.0 FINDINGS

The purpose of this section is to present the MEWS task force findings concerning DOE's current management of high-level waste (HLW) and (TRU) waste. These findings are based on short visits to 10 DOE facilities that generate and manage the nation's HLW and over 95 percent of the TRU waste in the DOE system. In-depth visits might uncover other details but most likely would not change the overall impressions of the task force. These findings do not apply to DOE's past management practices. More detailed visit reports for each facility and each State are provided in Appendices A and B respectively.

4.1 HLW/TRU WASTE MANAGEMENT IS COMPLEX

As noted in Section 2.0, the size of the DOE facilities varies, the operations are complex, and it would require considerable time to become familiar with them. Each facility generates products and wastes differently. The differences depend on the mission, the age of the facility, and the operating contractor. Similarly, once produced, the wastes are often managed differently at the various sites.

At large production plants, such as the Savannah River Plant (SRP) or Hanford, operations are more fixed and routine and produce waste streams that are more predictable than those of the smaller research laboratory facilities. The research performed and the waste generated at laboratories such as Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Oak Ridge National Laboratory (ORNL) vary from year to year. Consequently, waste managers at these sites must be involved in current and planned operations. They must also be able to deal with new situations. The large plants produce very large quantities of waste over long periods of time. The wastes are difficult to handle; they are mostly liquid, highly radioactive, and contain hazardous chemicals.

As facilities change over time, the ways in which they produce and handle their wastes change. Definitions of certain waste types have changed with time and also differ from facility to facility. DOE facilities are run by several different contractors; therefore, waste management attitudes and concepts vary. Requirements for disposing wastes at the

Waste Isolation Pilot Plant (WIPP) or in a future HLW repository have helped to standardize packaging and treatment, particularly for TRU waste. Even so, there are four different types of TRU waste [contact-handled (CH-), remote-handled (RH-), classified, and U-233] and each is managed in a different way.

Waste streams generated by different DOE facilities will continue to vary, requiring flexibility in applying national regulatory guidelines. Various methods such as incineration, glass vitrification, and grouting and cementing of the treated wastes continue to be refined and improved, producing changing waste handling requirements.

4.2 TRU WASTE IS OFTEN MANAGED WITH LLW AND RCRA HAZARDOUS WASTE

TRU wastes are often managed together with LLW and RCRA hazardous waste. For example, at LLNL, TRU waste is managed within the same staging area as LLW, RCRA non-radioactive hazardous waste, and PCB waste. In other words, TRU waste is usually not a separable waste management problem.

Many old HLW/TRU waste disposal sites are now designated as RCRA Solid Waste Management Units (SWMUs). Some of these sites will require cleanup under RCRA permits because of the hazardous waste component. The radioactive component will have to be dealt with at the same time.

4.3 THE HLW/TRU WASTE SYSTEM DEPENDS HEAVILY ON FUTURE ACTIONS

The handling and disposal system for HLW and TRU waste depends heavily on the construction of several new facilities, including the WIPP and a HLW repository.

Throughout the DOE system, TRU wastes are being packaged and stored pending delivery to the WIPP beginning in October, 1988. If the WIPP operations should be delayed or stopped, long-term storage of TRU waste will have to be implemented. Alternative disposal methods may also be necessary (e.g., on-site disposal at each generating site). The WIPP repository is limited in the amount of TRU waste it is designed to receive. Estimates of the present quantities of TRU waste slated for WIPP storage indicates that the WIPP must either be expanded or duplicated.

The high-level waste repository is projected to be built in basalt, tuff, or bedded salt and be operational by 1998. It is designed to dispose of both DOE and commercial wastes and should be able to accept projected HLW volumes for at least 50 years.

HLW will be processed and stored at DOE facilities with the specifications of such a repository in mind. If the repository is delayed or canceled, other disposal options must be considered and developed.

Vitrification plants are either being designed or are in various stages of construction at three facilities. The unit at West Valley is presently in the testing phase and should be operational in 1987. The Defense Waste Processing Facility (DWPF) at the SRP is 46 percent complete and will be operational vitrifying HLW by 1990. The Hanford facility is only in the planning stages and is projected to be completed in the mid-1990s.

Currently, there is no facility at ORNL for processing RH-TRU wastes. However, funding for a Waste Handling Pilot Plant (WHPP) has been appropriated. The WHPP is planned as a processing facility for repackaging and WIPP certification of RH-TRU wastes. The WHPP feasibility study was completed in 1984 with construction on the facility scheduled to begin in 1991. Existing plans call for construction to be completed and the plant operational by 1996. Since 94 percent of DOE's inventory of RH-TRU waste is stored at ORNL, it is conceivable that the WHPP may serve as a central processing facility for RH-TRU wastes. Such wastes could be transported from INEL and Hanford, for example, for processing.

4.4 THERE ARE SPECIAL CASES THAT DO NOT FIT THE "NORMAL" MANAGEMENT SCHEME

There are also special disposal cases. Dismantling and decommissioning of submarine reactor compartments would expose workers to high levels of radiation. Consequently, these compartments are disposed of intact at the Hanford site without subsequent monitoring.

Classified TRU waste will continue to be generated, even though DOE is trying to minimize the quantity of this waste. It must either be treated to destroy the classified nature of the material or be disposed of in such facilities as the Greater Confinement Disposal (GCD) at the Nevada Test Site (NTS).

Some TRU wastes are and will be uncertifiable and will not be accepted by the WIPP. A final disposal site for this material has not yet been decided upon.

4.5 MOST DOE PRACTICES FOR HLW/TRU WASTE SEEM COMPARABLE TO RCRA STANDARDS, AND SEVERAL PRACTICES SEEM SUPERIOR TO RCRA REQUIREMENTS

Assessment of the major operational features of each DOE facility leads to the general conclusion that most aspects of DOE's current management practices for HLW and TRU waste appear equivalent to RCRA requirements for hazardous waste. Moreover, DOE's practices for these wastes seem to exceed RCRA requirements.

Security is very tight and generally exceeds that required by RCRA. The quality of contingency planning and emergency response networks is also high. The controls for monitoring HLW tank storage and treatment systems are sophisticated and are staffed continuously. Waste tracking and documentation are strictly adhered to and often computerized. The planned disposal of HLW and TRU wastes in deep underground repositories appears to be superior to near-surface disposal in landfills allowable (after treatment) under RCRA.

4.6 SEVERAL ASPECTS OF DOE PRACTICES PROBABLY WOULD NOT MEET RCRA STANDARDS

There are other aspects of present DOE management practices for HLW/TRU waste which, because they depend heavily on radiation detection for their effectiveness, would probably not meet RCRA standards. The lack of detailed knowledge of the hazardous chemical components of radioactive waste raises concern about incompatibility or the production of toxic emissions when wastes are stored or treated together. Ground-water monitoring systems, if they exist, generally do not meet RCRA standards (e.g., for number and placement of wells, materials in well construction, etc.) Monitoring TRU waste contained in retrievable storage is often not performed, cannot be performed on the present system, or relies exclusively on sump monitoring or air sampling which frequently occurs at irregular intervals. RCRA regulations and guidance assume independent inspection and control of waste management sites. Self implemented and internally audited programs are not consistent with this principle.

4.7 RCRA VARIANCES OR PROPOSED SUBPART X COULD APPLY TO SOME ASPECTS, BUT CASE-BY-CASE EVALUATION IS NECESSARY

RCRA variances may be applicable to some aspects noted above, such as waste analysis or ground-water monitoring requirements. Each facility, however, must be evaluated on a case-by-case basis before variances can be granted. The new RCRA Subpart X regulation may provide a mechanism by which unusual management options could be evaluated separately for each facility, or for new facilities or treatment units. Examples of possible application of proposed Subpart X include the WIPP and the HLW vitrification plants.

4.8 THE CURRENT MANAGEMENT WOULD NOT CHANGE SIGNIFICANTLY HLW/TRU WASTE WERE CONTROLLED UNDER RCRA:

The general management of HLW/TRU waste at DOE facilities would not change significantly if the facilities were subject to RCRA Subtitle C hazardous waste controls. Areas that would need to be addressed through improved practices or case-by-case variances include chemical analyses of wastes, ground-water monitoring, and independent oversight.

5.0 ALTERNATIVE STRATEGIES

This section presents alternative strategies to the DOE option for EPA's consideration. The DOE operation is broad and permanent. It provides DOE with control over all current and future mixed HLW and TRU waste management with essentially no further EPA or State involvement. The MEWS task force has identified five alternatives to the DOE option. These were developed as a result of task force visits to DOE facilities and discussions with State and EPA Regional personnel. The alternatives presented do not include all possible strategies. They do however, provide a broad spectrum of possible EPA and State overviews ranging from full RCRA exemption with minimum oversight to full RCRA applicability with maximum oversight. This section presents a description of each alternative strategy followed by a general discussion of its implications, advantages, and disadvantages. Each strategy is described from an EPA perspective. A variation on each strategy would have RCRA-authorized States participate with EPA in oversight or control of DOE's HLW/TRU waste operations.

5.1 DESCRIPTION

Strategy 1 - Mixed HLW/TRU Waste Exempt, But Greater EPA Oversight

This alternative strategy is basically the DOE option but with a stronger, more visible and assertive EPA presence. This strategy would be implemented through EPA regulation and would be applicable to all facilities that manage HLW and TRU wastes.

Strategy 2 - Site-by-Site Exemption (e.g. WIPP)

This alternative strategy would provide exemptions on a site-by-site basis. It is based on the assumption that there is such a wide variety of waste management practices among the facilities that a nationwide exemption would be impractical. Under this alternative, an individual site would be exempt if all HLW and TRU mixed-waste management practices at that site were equivalent or superior to those required by RCRA. Potential candidates for such exemptions might include the WIPP, the future HLW repository, other future facilities designed with the exemption in mind, and any of the existing facilities meeting certain criteria that could be developed jointly by the two agencies.

Strategy 3 - Unit-by-Unit Exemption (e.g. Vitrification Plants)

This alternative strategy provides exemptions for all similar units nationwide. It is based on the assumption that the identified processes incorporate best waste management technology and could be exempt categorically. Possible examples include vitrification plants, vitrified waste storage facilities, deep geologic repositories, and TRU waste certification facilities.

Strategy 4 - Mixed HLW and RH-TRU Waste Exempt, But not CH-TRU (More RCRA-like)

This alternative strategy exempts HLW and RH-TRU waste as per the DOE option but regulates CH-TRU waste under RCRA. The exemption for HLW and RH-TRU waste is based on the high level of protection which is provided by controls for radiation hazards and on the risks to operation personnel involved in sampling and analyzing of those wastes. CH-TRU waste is regulated under RCRA because of its numerous similarities to low-level waste.

Strategy 5 - Mixed HLW/TRU Waste Controlled Under RCRA (With Variances)

In this alternative strategy, mixed HLW/TRU waste is regulated under RCRA. In those instances where current DOE waste management practices do not conform with RCRA requirements, EPA decides whether changes in those practices are necessary in order to achieve performance levels equivalent to RCRA, or whether case-by-case variances are appropriate.

5.2 DISCUSSION

In evaluating the alternative strategies, the MEWS task force examined the following issues identified through its site visits: definitional problems, conditional exemptions, resources required, burden of proof, administrative barriers, levels of oversight, and the role of RCRA-authorized States.

One of the findings (Section 3.0) of the MEWS task force is that there are definitional problems that require resolution before exemptions can be considered. These problems result in an unclear distinction between those units and processes which would be included or excluded in any exemption or variance. This lack of certainty would vary in degree depending on the extent of the exemption. For example, the total exemption of HLW and TRU wastes in Alternatives 1 and 2 would result in more definitional problems than in Alternative 3 where only HLW and RH-RU waste would be exempt. Additionally, the exemption of HLW and TRU wastes from RCRA regulation would not typically exempt entire DOE facilities from RCRA control, because all sites visited to date are subject to RCRA regulation for mixed low-level and/or hazardous waste.

The second issue is whether an exemption should be conditional. Under the DOE option, the exemption is irrevocable. Alternative 1, HLW/TRU waste exempt with greater oversight, could either be irrevocable, or it could be made contingent upon satisfactory performance by DOE with regard to mutually established nationwide criteria. Under Alternative 2, site-by-site exemptions, EPA could establish an exemption which would remain in effect as long as joint EPA/DOE reporting requirements and environmental performance criteria were met. If the criteria were not met at any site, procedures could be established to re-evaluate the criteria or revoke the exemption for that site. Exemptions under Alternatives 3 and 4 could be contingent upon nationwide performance criteria. Under Alternative 5, variances would normally extend only for the life of the RCRA permit.

The advantages of revocability are that EPA can respond more quickly to environmental problems and can ensure that the conditions of any exemption continue to be met. A large resource commitment may be needed in order to provide surveillance, and perhaps more importantly, the procedural requirements to rescind an exemption could become complex.

Each of the listed alternatives requires greater EPA resources than the DOE option. These resources would be needed by headquarters in the preparation of rulemaking packages necessary for exemptions, and by the various Regions for oversight permitting and variance processing. Given that each facility is already involved in the RCRA permitting process for mixed low-level and/or hazardous waste, the additional resources for any of the options will be less than would otherwise be required.

The burden-of-proof shifts from EPA to DOE under Alternative 5. In the granting of any exemption, the Agency must make the determination that such an exemption is warranted and justify that decision. Under Alternative 5, justification for a variance must be made by the permit applicant (DOE).

Many of the processes that the DOE proposes for the treatment, storage, and disposal of HLW and TRU waste are in the construction or planning stages. Subjectd TRU processing plants, for example).

There have been past problems regarding the handling of classified TRU waste information and unclassified controlled nuclear information. The exemption of HLW and TRU waste from RCRA would most likely circumvent these barriers. However, if all HLW and TRU waste management were subject to the RCRA permitting process, it would be highly desirable for EPA and DOE to jointly develop procedures protective of both national security and the environment.

The final issue is the role of RCRA-authorized states under the DOE option and the alternatives. The DOE option does not provide a role for RCRA-authorized state programs, and EPA, of course, has no control over whether States choose to regulate substances independent of RCRA. States may elect to implement a more stringent program. Any of the five alternative strategies discussed above could be implemented either by the authorized State or by EPA, as appropriate.

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- RCRA Compliance Strategy and Status at ORNL, January 21, 1987.

- Waste Examination and Certification, January 21, 1987.

- Independent Review and Oversight of Transuranic Waste Management Operations at ORNL, January 21, 1987.

- TRU Waste System Description, January 21, 1987.

- DOE Summary.

ROCKY FLATS PLANT (RFP)

- Agenda, Rocky Flats Plant, December 9, 1986. Information on the Plant provided by Rockwell.

- Briefing for EPA/DOE Technical Working Group on High Level and Transuranic Waste, Rocky Flats Plant, December 9, 1986 by John Whitsett.

- Monthly Environmental Monitoring Report, September, 1986.

- Colorado Department of Health Environmental Surveillance Report on the U.S. DOE Rocky Flats Plant, Monthly Information Exchange Meeting, September, 1986.

- City of Broomfield Radiometric Monitoring Report, Monthly Information Exchange Meeting, October 28, 1986.

- Agenda, DOE-State Exchange of Information Meeting, October 12, 1986.

- Audit of TRU Waste Certification Activities at Rocky Flats Plant, Golden, CO, September 29 - October 3, 1986 by J.F. Bresson.

- Rocky Flats TRU Waste Certification and Transportation Documents, in a 3-ring binder, dated December 17, 1986 with a cover memo from Allan Corson to Jack Lehman. Subject: Equivalency of DOE's Transportation System to RCRA's System.

SAVANNAH RIVER PLANT (SRP)

- Draft, MEWS Informational Needs at DOE's SRP Facility Visit, 11/86 and letter to Ray Berube, DOE from John Lehman.

- Agenda, EPA Tour, High Level-Waste and Transuranic Waste, 12/2-3/86, Orange Room.

- Underground Storage Tank Regulations & DOE Radioactive Material Tanks, April 22, 1986 by DOE. Outline - Inventory of Tanks; High Level Radioactive Waste Tanks; Application of API Type Regulations; Notification Plans.

- DOE Savannah River Defense Waste Processing Facility Project Status for the EPA, Presentation by Wm. Brumley, December 2, 1986.

- SRP TRU Waste Certification Program by Kim Wierzbicki, December 3, 1986.

- Determining the Composition of SRP Waste by P.D. d'Entremont, December 3, 1986.

- Tank Farm Operations, December 3, 1986 - High Level Radioactive Waste Management Program Mission.

- Interim Radioactive Waste Management - Receive and Store High Level Waste in Tanks; Reduce High Level Waste Volume by Evaporation; Remove Older Tanks from Service; Provide Feed for the Defense Waste Processing Facility.

- SRP Site Descriptions, Maps.

- Containment and Leak Detection by Neil Davis.

- SRP Waste Management Program by L.C. Goidell.

WEST VALLEY DEMONSTRATION PROJECT (WVDP)

- Agenda - EPA/DOE By-product Rule Task Force, January 8, 1987.

- An Introduction to the West Valley Demonstration project by DOE, July, 1981.

- West Valley Demonstration project. Project Overview, presented to the EPA/DOE Byproduct Rule Task Force, January 8, 1987, presented by Dr. W.W. Bixby.
- External Interface Control Diagram.
- WVDP Decontamination Activity.
- RTS Waste Stream Data Sheets, Rev. 4, dated March, 1986, From: LWTS Design.

WASTE ISOLATION PILOT PLANT (WIPP)

- Presentation Materials, December 8, 1987.
- Certification Criteria.
- Environmental Activities.
- Sandia Technology Report.

7.0 ACKNOWLEDGEMENTS

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APPENDIX A

FACILITY REPORTS

Mixed Energy Waste Study (MEWS) Visit
U. S. Department of Energy (DOE)

Hanford Site
Richland, Washington
December 11-12, 1986

PURPOSE:

On December 11-12, 1986, the MEWS task force and EPA Region X representatives met at Richland, Washington, with individuals frcm the Department of Energy's (DOE) Headquarters, DOE's Richland Operations Office, other DOE field offices and the Hanford contractors. A representative from the Washington State Department of Ecology attended the initial briefings in Richland. The purpose of the meeting was for task force members to gain a working knowledge about methods for treatment, storage and disposal of high level wastes (HLW) and transuranic (TRU) wastes at DOE's Hanford site (see Section J Appendices).

SUMMARY:

DOE's Richland Operations Office and its Hanford contractors provided an overview briefing of the site with the majority of emphasis on HLW and TRU waste management practices. Subject areas included environmental monitoring, double-shell tank construction, operation and control, TRU waste storage, event reporting, and the audit system. Also, at the task force's request, additional briefings related to the deep geologic repository and the grout system were provided. A bus tour of the 200-East and 200-West areas was provided with special tours of the control systems for the tank farms and the computer-automated surveillance system. The tour also included the nuclear submarine compartment disposal area. The briefings and tour provided the task force with a good understanding of the waste management systems.

In general, the current management systems at Hanford for HLW and TRU wastes from both an administrative and technical standpoint are advanced and comprehensive with many areas being apparently equal or superior to those required by RCRA. Specific weaknesses include the lack of detailed analyses of wastes for hazardous chemicals, the lack of ground-water monitoring, and the lack of an independent outside audit. While the ultimate disposal methods for HLW and TRU wastes appear excellent, they are not yet in place and, in the case of the HLW, are not yet a certainty.

REPORT:

A. FACILITY DESCRIPTION:

The Hanford site is a 570-square mile DOE reservation located in remote south-central Washington state on the Columbia River. The elevation of the Hanford site is about 600 feet above MSL and approximately 200 to 300 feet above the ground water. The average annual precipitation is less than seven inches. Hanford's primary missions include the production of plutonium for nuclear weapons and advanced reactor development which began in 1943. Figure 1 details the facility's history.

During the 1940's, Hanford originally consisted of three reactors and three related chemical separation facilities. Since that time, six additional reactors have been built including the dual-purpose N reactor which is currently the only operating production reactor on the reservation. Hanford has a current operating budget of one billion dollars and some 14,400 employees. Eight major contractors presently operate the facility. The ones pertaining to HLW/TRU wastes are listed below:

> Rockwell - Chemical Processing (PUREX Plant, B-Plant, PFP, etc.), Waste Management and Support Services
>
> United Nuclear - Operation of the N reactor
>
> Westinghouse - Operation of the fast flux test facility (FFTF)
>
> Battelle Pacific Northwest Laboratory - Research and Monitoring

On December 12, DOE announced that a new five year contract had been awarded to Westinghouse/Boeing which will incorporate all operations presently run by Rockwell, United Nuclear, Westinghouse, and Boeing.

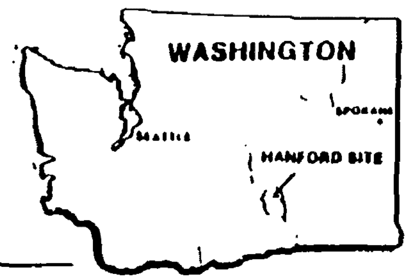
FIGURE 1
HANFORD HISTORY

1943 - 1945
The Beginning

- Acquisition of a 450,000 acre site
- Construction of 3 reactors and related production and waste management facilities
- Production of plutonium to help end World War II
- Pioneering work in nuclear technology

1947 - 1963
Hanford Expansion

- Construction of 5 additional once-through reactors and related production and waste management facilities
- Construction of dual-purpose N Reactor
- Expanded production of materials for national defense



1964 - 1972
Crisis and Recovery

- Declining onsite employment
- Adverse impact on the community
- Segmentation and diversification
- FFTF siting at Hanford
- Defense waste problems

1973 - Present
Recovery, Transitions, Improvements

- Restoration of defense mission
- Upgraded management of defense wastes
- Construction of the FFTF
- Changes in cognizant agency
- Public involvement
- Non-Federal activities on site (Supply System, US Ecology)

Two major non-Federal activities are located on the reservation. These include a low-level commercial waste disposal site run by U.S. Ecology and one commercial nuclear power plant plus an electric generation facility connected to the N reactor, both run by the Washington Public Power Supply System.

All waste management with respect to HLW and TRU waste is located in the 200-area which is subdivided into the 200-East and 200-West areas. The 200-area is located near the center of the Hanford site, approximately seven miles from the Columbia River (Figure 2).

B. HIGH LEVEL WASTE:

1. Generation

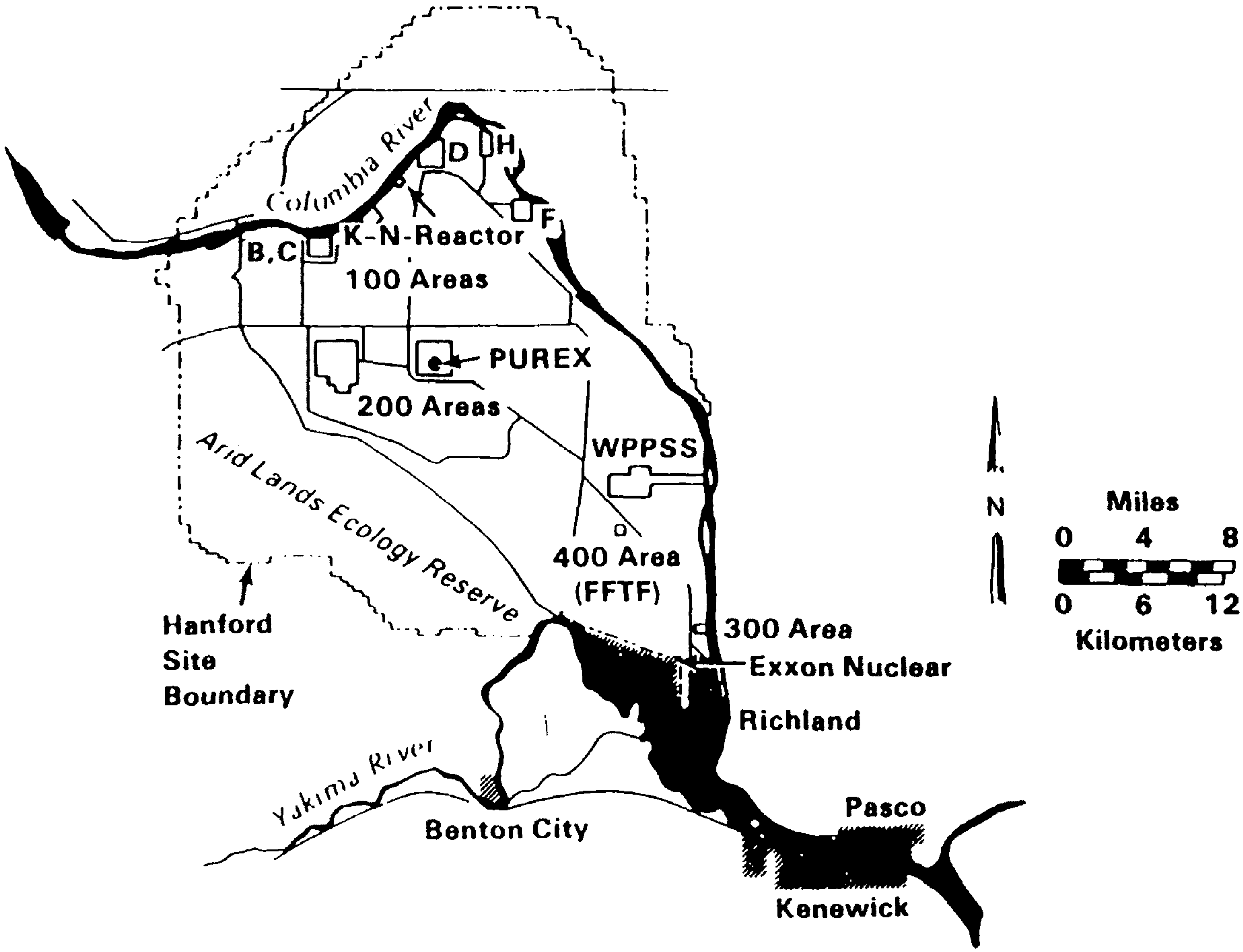
The majority of HLW at Hanford is presently generated in the PUREX (Plutonium Uranium Extraction) facility. In the PUREX facility, the irradiated fuel from the N reactor is declad and then dissolved with acid so that the plutonium can be separated out. The resultant waste acid stream contains the majority of the fission products. While the volume of the corrosive and radioactive components of the wastes are generally well known, few data exists regarding their hazardous chemical composition. Other liquid wastes, which are not dischargable to the environment, are also placed in the HLW tanks and managed as HLW.

2. Waste Management

HLW generated in the PUREX facility is treated with a caustic to a pH in excess of 12 and routed through a double-lined pipe system to underground double-shell tanks. The double-lined pipes consist mainly of pipe-in-pipe; however, some pipe-in-concrete encasements are utilized.

The piping system is laid out such that transfers can be made to and from any tank for treatment process. Any liquid escaping from the primary pipe flows by gravity to a collection tank or diversion box; from there it can be pumped back into the system. The waste is first sent to "aging tanks" where the short-lived fission products decay, wastes cool and sludge is allowed to settle. Such sludge contains the majority of the fission products. The HLW supernatant is reduced in volume through evaporation and the evaporator

FIGURE 2
DOEs HANFORD SITE IN WASHINGTON STATE



bottoms are returned to the double-shelled tanks. The condensate is presently being disposed of in cribs (leaching fields) as a low-level waste. Supernatant from the older single-shell tanks is sent to the B-plant where the cesium (Cs-137) and strontium (Sr-90) were removed through an ion exchange process. This process was initiated in the mid 1960's to remove the dominant heat and radiation source from the waste. The cesium and strontium were doubly encased in stainless steel and stored in a water bath at the B-plant or shipped off site for use. In the future, HLW will be processed in the B-plant to prepare the waste for immobilization in the planned vitrificiation facility.

3. Storage

Nationwide, Hanford has 62.3 percent of the volume of HLW in storage (2×10^5 cubic meters) which contains 35.1 percent of the radioactivity (474 megacuries; Figure 3). Prior to 1970, HLW was stored in single-shelled carbon steel tanks. Hanford has 149 of these tanks. Between 1960 and 1970, many of these tanks were leaking. As a result of double-shelled tanks were built and all pumpable liquid was removed from the single-shelled tanks leaving only sludge, salt, and some interstitial liquid. Since 1970, HLW has been stored in the double-shelled carbon steel tanks. There are presently 28 of these at Hanford. Each tank can hold one million gallons of waste (Figure 4). Eight additional tanks are presently in the planning stage. While all currently generated HLW at Hanford is stored in double-shelled tanks, not all of the wastes in the 28 double-shelled tanks are by definition HLW. The following is a list of stored wastes:

- Complexed concentrate from Cs-137 and Sr-90 removal systems
- Double-shell slurry (mixtures of all types of past waste streams)
- Cladding removal waste from PUREX plant
- Facility waste (solvents, caustics, bases, metals ....)
- PUREX first-cycle extraction waste
- Plutonium Finishing Plant Waste (TRU waste)

FIGURE 3
TOTAL HIGH LEVEL WASTE
(NOT SPENT FUEL)

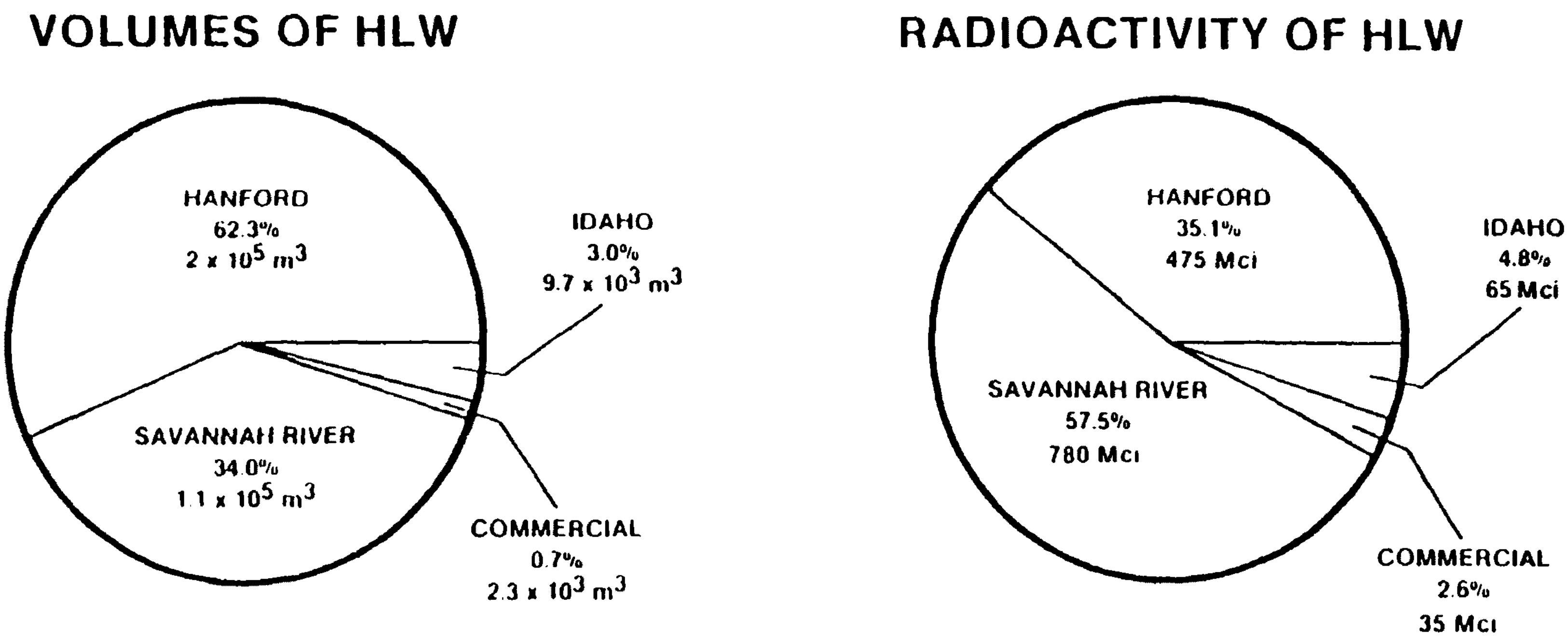
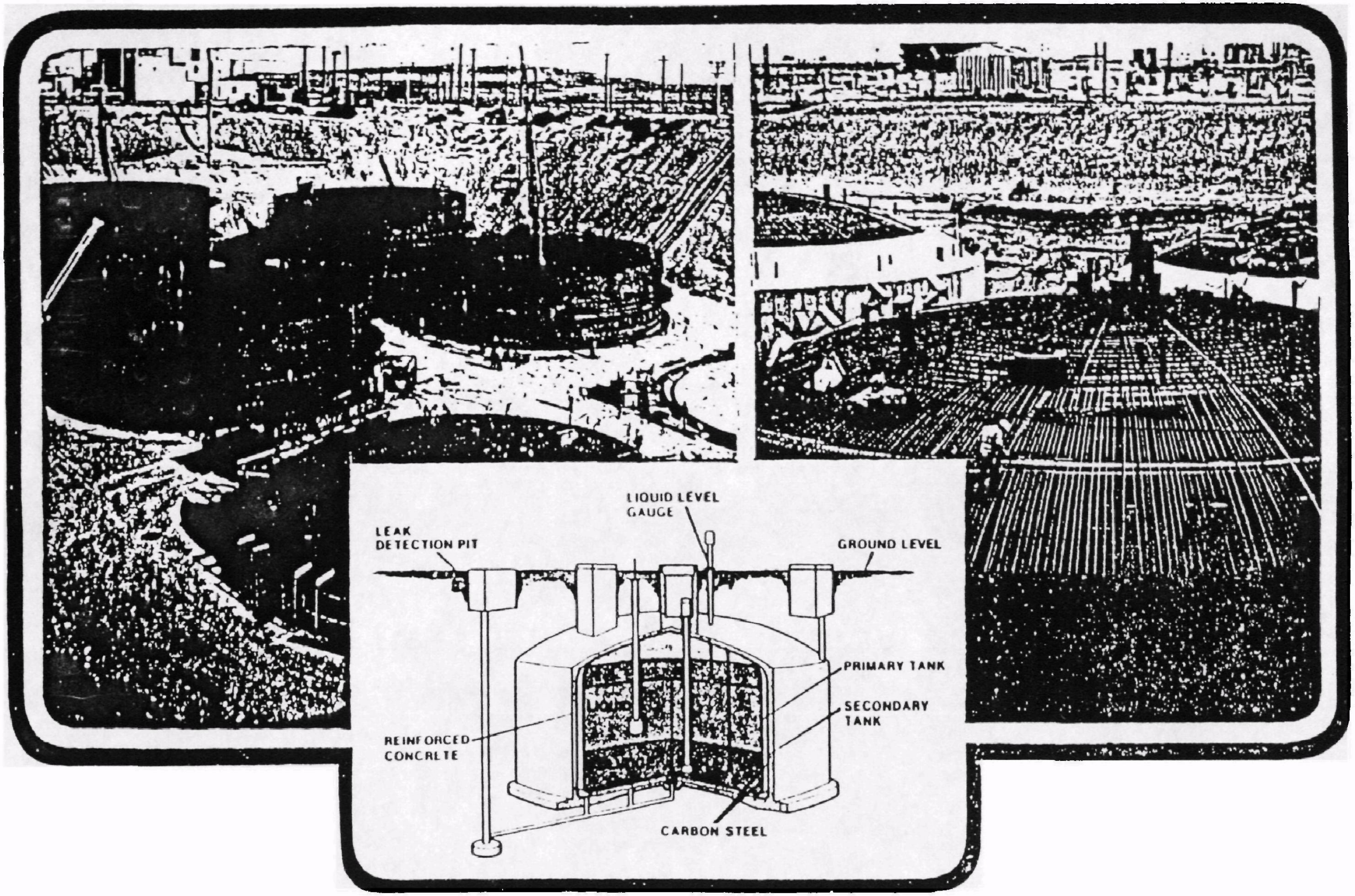


FIGURE 4
DOUBLE SHELL TANKS



DOE is proposing that all waste in the 28 double-shelled tanks be included in the proposed option since it will be managed as HLW.

4. Control

Both technical and administrative controls exist at Hanford with regard to HLW. All double-walled pipelines have leak detection systems consisting of encasement alarms, diversion box alarms, material balance discrepancies, radiation monitoring above grade, and periodic swabbing of encasements. Tanks are controlled or monitored through tank liquid levels, annulus air monitoring, annulus liquid level, and/or leak detection pit monitoring for liquids and air. Hanford employs a computer automated surveillance system (CASS) which makes 5,700 readings/day. All monitoring (other than liquid levels) is for radioactive components in air.

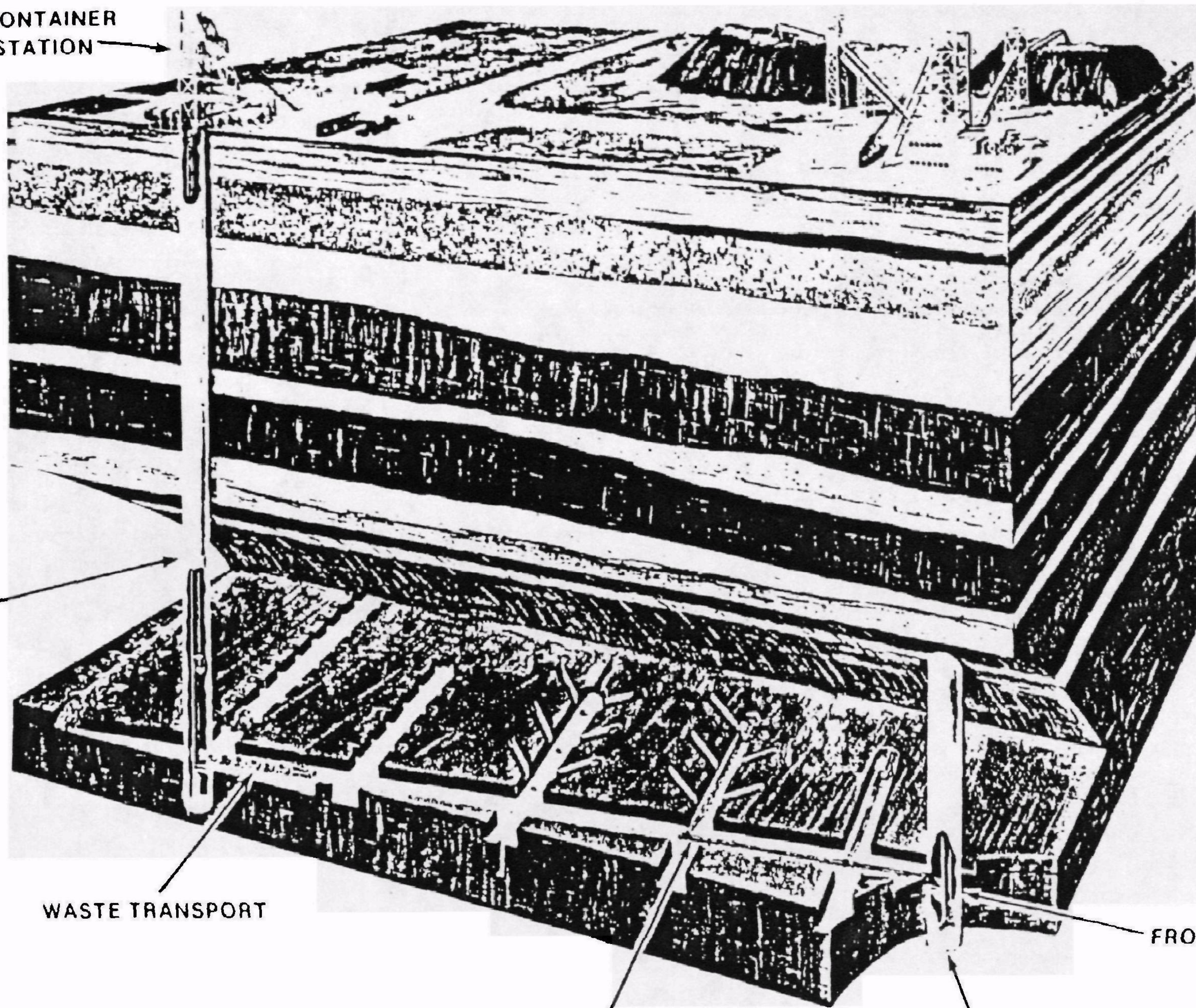
Hanford also has an elaborate process control system where valves, pumps, tank levels, and other items can be monitored from a central area. The system also employs interlocks and fail-safe systems (e.g., shutdown for power failure). Administrative controls involve extensive documentation on material balances, tank inventories, and treatment and tank transfers. Hanford officials indicated that the tank level monitors would provide a first indication of a loss, with readings to the nearest one-half inch amounting to a volume of approximately 1,350 gallons.

Unlike the Savannah River Plant (SRP), annulus monitoring with photography is not utilized at Hanford.

5. Disposal

Plans for the disposal of HLW at Hanford parallel those at the SRP. Sludges from the double-shelled tanks will be reslurried and sent to a vitrification facility where the waste would be mixed with a technically controlled boron silica frit, vitrified, poured into a steel cylinder which would be sealed, and then decontaminated before shipment and disposal in a deep geological repository (Figure 5). Unlike the SRP, the Hanford vitrification facility is only in the planning stages and is projected to be completed by the mid-1990's. The majority of the wastes (supernatant and salt cake) in the HLW tanks contain small quantities of carbon (C-14), iodine (I-129), and other residual

FIGURE 5
CONCEPTUAL DESIGN CUTAWAY
NUCLEAR WASTE GEOLOGIC REPOSITORY



radionuclides. These would be classified as low-level waste (LLW) and would be mixed with cement, clay, and fly ash to form a grout that will be disposed of near the surface on the Hanford site. Thus, the grout system will treat the LLW and the vitrification process will eventually treat the HLW. Present plans call for a portion of the N reactor plant's LLW to be treated in the grout system starting March 1988 and the double-shell slurry waste starting in December 1989.

C. TRU WASTES:

1. Generation

TRU wastes at Hanford are mainly generated at the PUREX plant, the plutonium finishing plant (PFP), the FFTF, and the Battelle Laboratory. To date, approximately 525,000 cubic feet of TRU waste, including 804 cubic feet of remote-handled TRU, has been placed at Hanford in retrievable storage. Hanford also has a small quantity of classified TRU waste in retrievable storage. The rate of generation of TRU waste at Hanford is approximately 12,000 cubic feet per year. Virtually no information is available about the quantity or characterization of stored TRU waste containing hazardous chemicals.

2. Waste Management

The waste management system for the handling of TRU waste at Hanford is similiar to that for other DOE facilities. To date, only the facilities run by Rockwell which generate the most TRU waste at Hanford have completed the steps necessary to certify TRU waste for the Waste Isolation Pilot Plant (WIPP). The remaining producers of TRU (Westinghouse and Battelle) are moving toward the same status.

Similar to the INEL processing experimental pilot plant (PREPP), Hanford is developing a plan for a WRAP (waste receiving and processing facility) which would process TRU waste as required for certification. After processing and certification, the TRU waste will be sent to the WIPP for disposal.

3. Storage

Prior to 1970, all TRU waste as well as LLW were disposed of in shallow land trenches at Hanford. Since 1970, TRU waste has been segregated and placed in retrievable storage. To date, none of the buried TRU waste has been certified for the WIPP. The retrievable storage at Hanford (euphemistically labeled "Hanford Burial Garden") consists of placing the waste in 55-gallon steel drums or steel boxes on an asphalt pad or plywood foundation below grade. Plywood and plastic are placed over the drums which are then covered with four feet of earth. Plastic standpipes are placed down into the storage modules to allow for gas sampling.

4. Disposal

Disposal of all certified TRU Waste will be at the WIPP, which is scheduled to start receiving waste in October 1988.

D. MONITORING:

All site monitoring at Hanford is performed by Battelle Pacific Northwest Laboratories. This includes air, surface and ground-water monitoring. A total of 339 ground-water monitoring wells are located on site; most monitor for radionuclides. Recently, some 90 wells have been used for hazardous chemical characterization, although these wells were not installed as per RCRA requirements (Figure 6).

Environmental monitoring in the separations area (200 area) is performed by Rockwell. This includes air, soil and biota, surface water and ground-water monitoring. A total of 131 ground-water monitoring wells are sampled (Figure 7). As with the site monitoring, analysis has been primarily for radionuclides. Water table measurements are also made for the purpose of ground-water mapping.

To date no specific program has been instituted at Hanford for the monitoring of ground water in the vicinity of the retrievable TRU waste storage.

FIGURE 6
LOCATIONS OF HAZARDOUS CHEMICAL CHARACTERIZATION WELLS

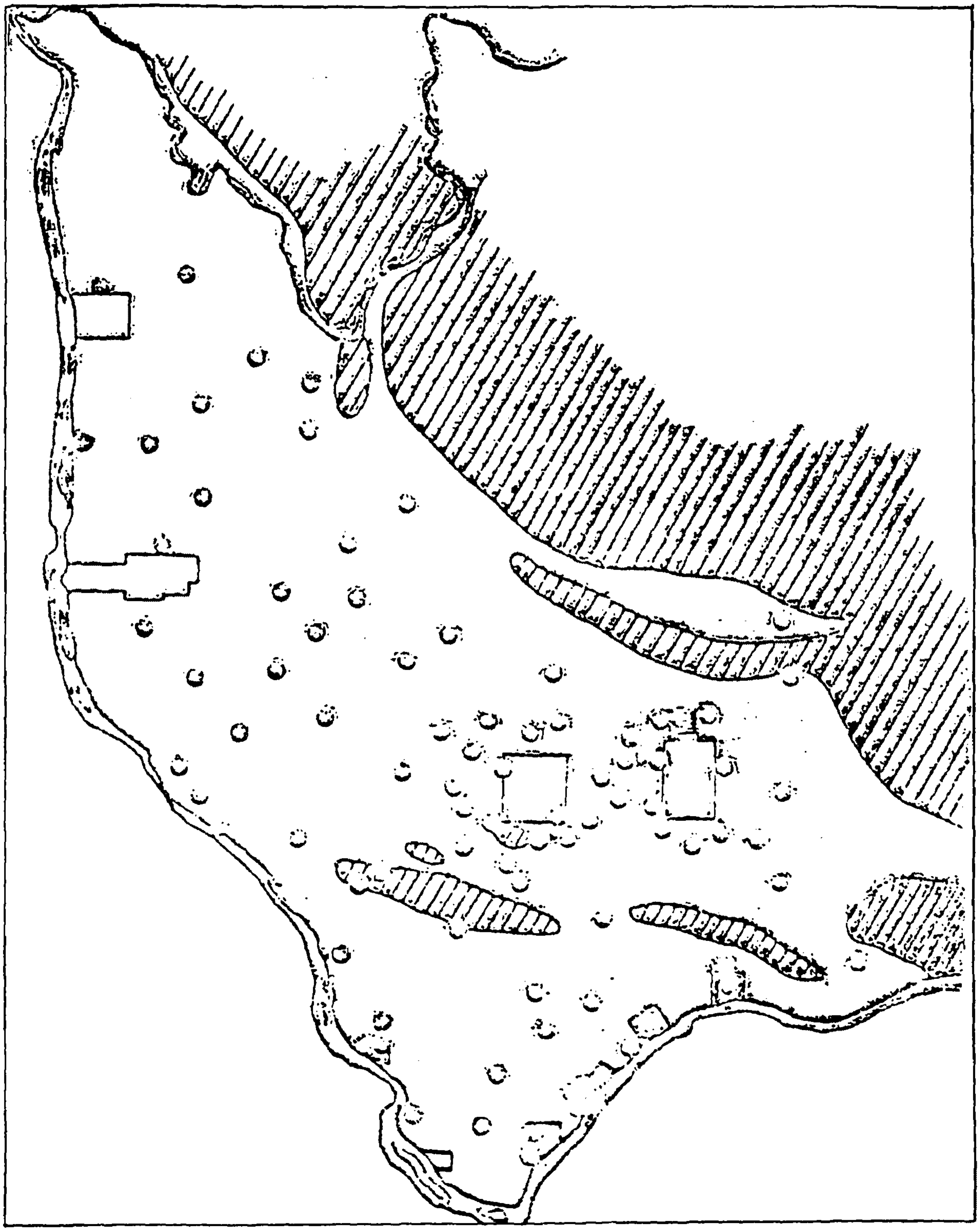
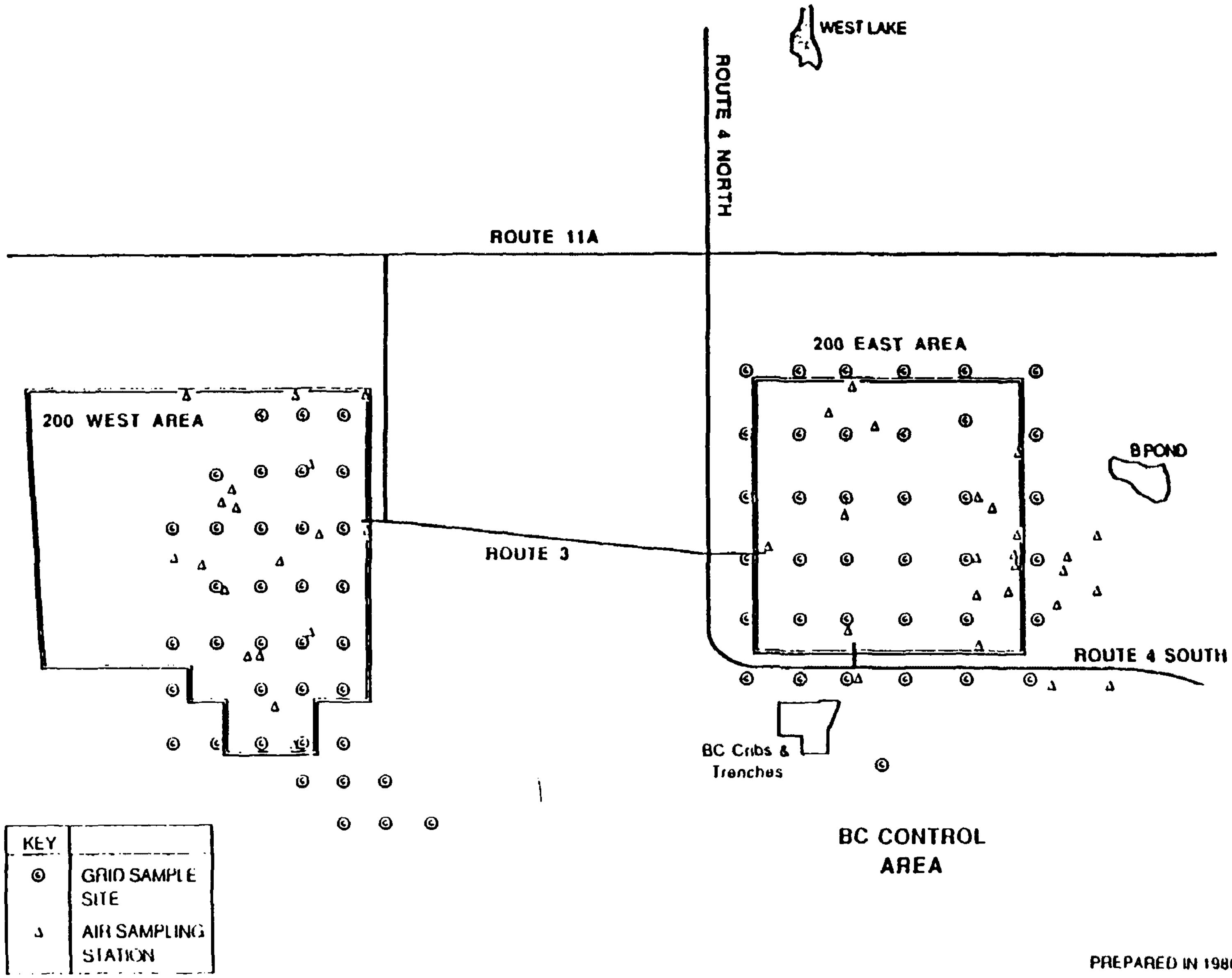


FIGURE 7
LOCATIONS OF GROUND WATER MONITORING WELLS SAMPLED



E. AUDITS/ASSESSMENTS/OVERVIEW:

Hanford operates under the standard DOE management system. DOE headquarters issues orders which are then interpreted and narrowed in scope by the Richland Operations Office to meet site-specific conditions. This process continues down to the procedures written by the contractor for the plant operators to follow. Audits are performed by all of the organizations under their jurisdiction. There are, however, no independent outside audits conducted.

F. SECURITY:

Security for the 200 area is maintained 24-hours per day by armed guards and tactical response teams. Security is especially heavy around the plutonium handling facilities.

G. SUBMARINE REACTOR COMPARTMENT DISPOSAL:

Hanford has been chosen as the disposal site for decommissioned reactor compartments from nuclear submarines. These compartments are approximately 30-35 feet in diameter, 30-38 feet in length and weigh approximately 1,000 tons. The compartments contain no spent fuels or TRU waste but pose a potential radiation hazard due to activation products, mainly cobalt (Co-60). The compartments also contain approximately 250-350 tons of lead. The disposal site is located in the 200 East area and consists of an excavation which is approximately one acre in area and will accommodate about 12 compartments. At the present time, one unit has been placed at the site. When all 12 compartments have been placed, the site will be backfilled. No ground-water monitoring is planned after burial of the units.

H. RCRA EQUIVALENCY:

While a point-by-point comparison of waste management practices at Hanford with those required by RCRA was not discussed, the areas where RCRA equivalency was provided include the following:

- Excellent process control with regard to the treatment, transfer, and storage of HLW. Includes computer-automated surveillance system.
- Extensive administrative controls for the tracking of waste from generation through disposal for both HLW and TRU wastes.

- Excellent conceptual plan for the final disposal of both TRU waste and HLW.

- Excellent security provided.

Areas where potential problems with RCRA equivalency include the following:

- Lack of or limited data on waste quantity and characterization with regard to hazardous components.

- Lack of RCRA ground-water monitoring around buried TRU waste in retrievable storage.

- Lack of RCRA ground-water monitoring around HLW piping and storage (double-walled tanks) systems.

- Lack of independent audits.

- Disposal facility for HLW is not yet and may never be a reality.

I. <u>ACTION ITEMS</u>:

The following information was requested from the DOE:

- *Analyses for heavy metals, pH and organics from all waste streams related to* high-level and TRU wastes.

- Percentage of pipe-in-pipe and pipe-in-concrete encasement.

- Comparison of procedures for various DOE operation offices.

- Diagram of burial sites delineating what is in each trench (classified waste, CH-TRU waste, etc.).

- Percentage of liquid in double-shelled tanks destined for grout and percentage for deep geologic repository.

- Criteria for what is contained in an unusual occurrence (UO) report.

- Location of ground-water monitoring wells in vicinity of tanks, processes, piping, etc. related to HLW and TRU waste.

- Map of site showing what tanks, pipes, treatment processes, etc. are related to HLW and TRU waste.

- Listing of the contents of the double-shell tanks (including color coded schedule).

J. <u>APPENDICES</u>:

1. Agenda: 12/10-12/12 Hanford Tour (Modified)

2. Welcome/Hanford Overview

3. Hanford HLW and TRU Waste Management Overview

4. Disposal of Hanford Defense Wastes - Draft EIS Summary

5. Environmental Monitoring (Hanford Site)

6. Environmental Monitoring (Separations Area)

7. Double-Shell Tank Waste With Emphasis on: Facilities Description and Waste Transfer Operations

8. Double-Shell Tank Waste With Emphasis on: Management Control

9. TRU Storage Operations

10. Double-Shell Tank Sampling

11. Event Management

12. Grout Disposal Program

13. Waste Minimization

14. Audit System - Rockwell Program

15. Audit System - DOE-RL/WMPO

16. Audit System - DOE-RL SQA

K. DISTRIBUTION:

MEWS Task Force Distribution List

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Idaho National Engineering Laboratory
Idaho Falls, Idaho
December 10, 1986

PURPOSE:

On December 10, 1986, the MEWS task force met with individuals from the Department of Energy's (DOE) headquarters, the Idaho National Engineering Laboratory (INEL), several employees of Westinghouse and EG&G, and contractors operating the facilities at INEL which were of interest to the task force. The purpose of the meeting was for task force members to understand INEL's methods for treatment, storage, and disposal of high level (HLW) and transuranic (TRU) mixed wastes.

SUMMARY:

DOE's Idaho Operations office provided a brief overview of the mission and the waste-handling operations at INEL. As described in the body of this report, the task force focused on two operations of this large, complex facility: (1) the HLW management associated with enriched uranium recovery from spent naval reactor fuel and (2) the TRU waste management services provided for many DOE facilities located around the country. Tours of the facilities and detailed presentations of the operations were provided by Westinghouse for HLW and by EG&G for TRU wastes.

While the HLW and TRU waste management areas differ, they do share several beneficial characteristics including:

- highly automated, fully computerized process-control capabilities.
- self-auditing for contractors and DOE's auditing procedures which provide a "paper trail", also available for audit.
- handling procedures for current waste streams provide some protection against release of hazardous constituents to the environment.
- greatly improved current operations compared with past practices.

In addition, they also share the following disadvantages:

- chemical characterization of waste streams is not well detailed.
- ground-water monitoring systems fail two important RCRA criteria in that they *do not assure detection of the first emission from any source and they will* not confirm the absence of RCRA hazardous constituents.

REPORT:

A. FACILITY DESCRIPTION:

The Idaho Operations office is responsible for a wide variety of operations at the Idaho National Engineering Laboratory near Idaho Falls. The facility, covering 890 square miles of sagebrush desert, was established in 1949 as a reactor testing station. INEL includes *thirteen* nuclear reactors and many research and production facilities; the site has nine program operating areas with a total operating budget of about $500 to $600 million per year.

Annual precipitation is very low (8.5 inches per year or less) and the temperature varies widely (between -47° and 103°). Highly porous and fractured basalt rock underlies relatively shallow soil. The regional ground-water system is the Snake River Plain aquifer. Its depth exceeds one billion acre feet of water and is among the fastest flowing ground water in the nation. It flows through fractured basalt with average velocities exceeding 100 to 200 feet per year. This aquifer lies beneath approximately 200 feet of intermittent beds of basalt and sandy silt/gravelly sand. This overburden contains intermittent areas of perched ground water; this is the "uppermost aquifers" of concern in the RCRA ground water monitorial regulations. The depth to this uppermost aquifer is typically 20 to 40 feet and it is clearly interconnected with the regional system.

Among the multiple facilities and contractors operating at INEL, the task force focused predominately on the waste management operations under EG&G-Idaho and the Idaho Chemical Processing Plant (ICPP) operated by the Westinghouse Idaho Company. The former has been set up to manage TRU wastes from several DOE facilities including Rocky Flats, Mound, Bettis, and others around the country. The facility is effectively a transfer station receiving, examining, processing as necessary, and repackaging TRU wastes for eventual shipment to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. The ICPP receives and processes spent fuel from the Navy for recovery of enriched uranium, generating HLW as a by-product.

B. OVERVIEW OF WASTE MANAGEMENT OPERATIONS:

1. High Level Wastes

The ICPP began reprocessing spent fuel in 1953, mostly from naval sources. The major objective of the plant is to recover highly enriched uranium and krypton. Plant capacity is 16 kilograms of uranium per day.

After incoming spent fuel is removed from its DOT approved packaging, it is stored under water. Six pools containing 3 million gallons of water have 2600 fuel positions for temporary storage and handling.

The major waste-generating step in the ICPP is fluorinel dissolution of the zirconium cladding from the spent fuel rods. A strong acid (hydrofluoric acid) is used in the decladding process. Since stainless steel would corrode in less than two weeks under these conditions, a special alloy (called Hastalloy) is used for process vessels and piping. This step complexes the hydrofluoric acid, ties up the free available fluorine, and produces a clear but highly acidic waste liquid which is then sent to tank farms.

The next step after decladding is fuel dissolution. Extraction of the uranium is accomplished through use of an organic solvent. It produces a highly acidic waste. The radioactivity of this waste is due mostly to fission products and trace amounts of transuranics. This waste and the still bottoms from the "intermediate level" evaporation facility are sent to the tank farm.

Interim liquid waste storage is provided in stainless steel tanks which are cased in concrete. There are 11 of these tanks, 10 of which are used for storage and the other held for emergency use. Each tank has a 300,000 gallon capacity.

There has never been a leak discovered in the HLW storage tanks, although there have been gasket failures in lines leading to and from tanks. In 1980, INEL began doubly encasing all lines. The lines to the tank farm and to the calciner are currently double-walled stainless steel, but there are still seven steel pipes which are encased in ceramic. Final plans are now in draft for replacing five of these; use of the other two has been discontinued.

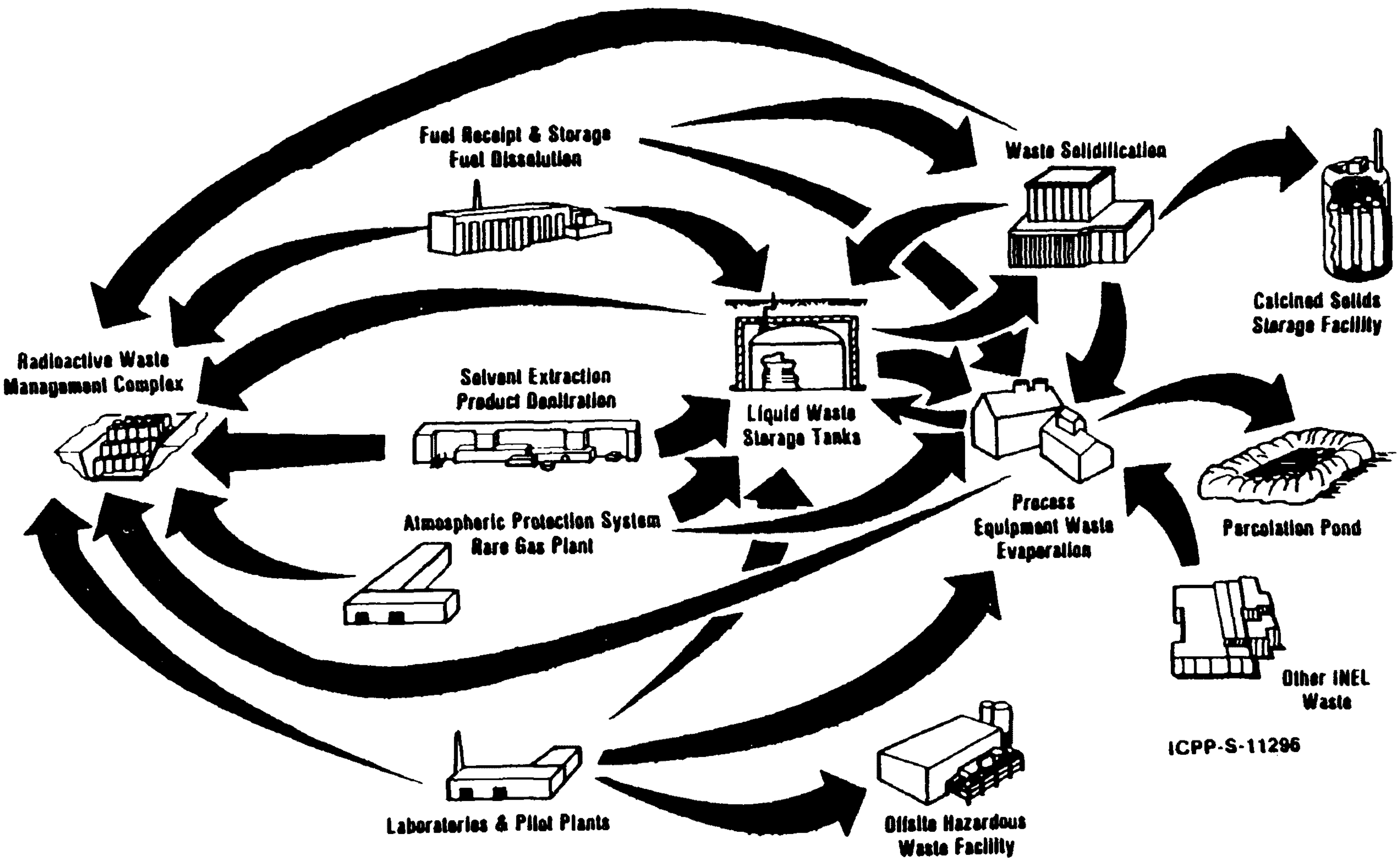
The attached flow diagrams (Figures 1 and 2) describe the six waste handling activities at ICPP:

1. fuel receipt and storage;
2. fuel dissolution, uranium recovery, and product de-nitration;
3. interim liquid waste storage;
4. waste solidification and decontamination;
5. off-gas treatment; and
6. liquid process waste calcination.

The liquid wastes from the fuel reprocessing and the intermediate level waste evaporation are solidified in the New Waste Calcining Facility (NWCF). This facility began hot (radioactive) operations in September, 1982. It has a 3,000 gallon per day capacity in a highly automated, remote-handled, fluidized bed calcination process. All dissolution wastes are sent from the liquid waste storage tanks to the fluidized beds. Some sodium liquid wastes are also generated; because of difficulties in calcining sodium, this waste is added in at a ratio of 1:4. This ratio is less with the fluoride wastes. Spent solvents are used as an auxiliary heat source in the calcine plant.

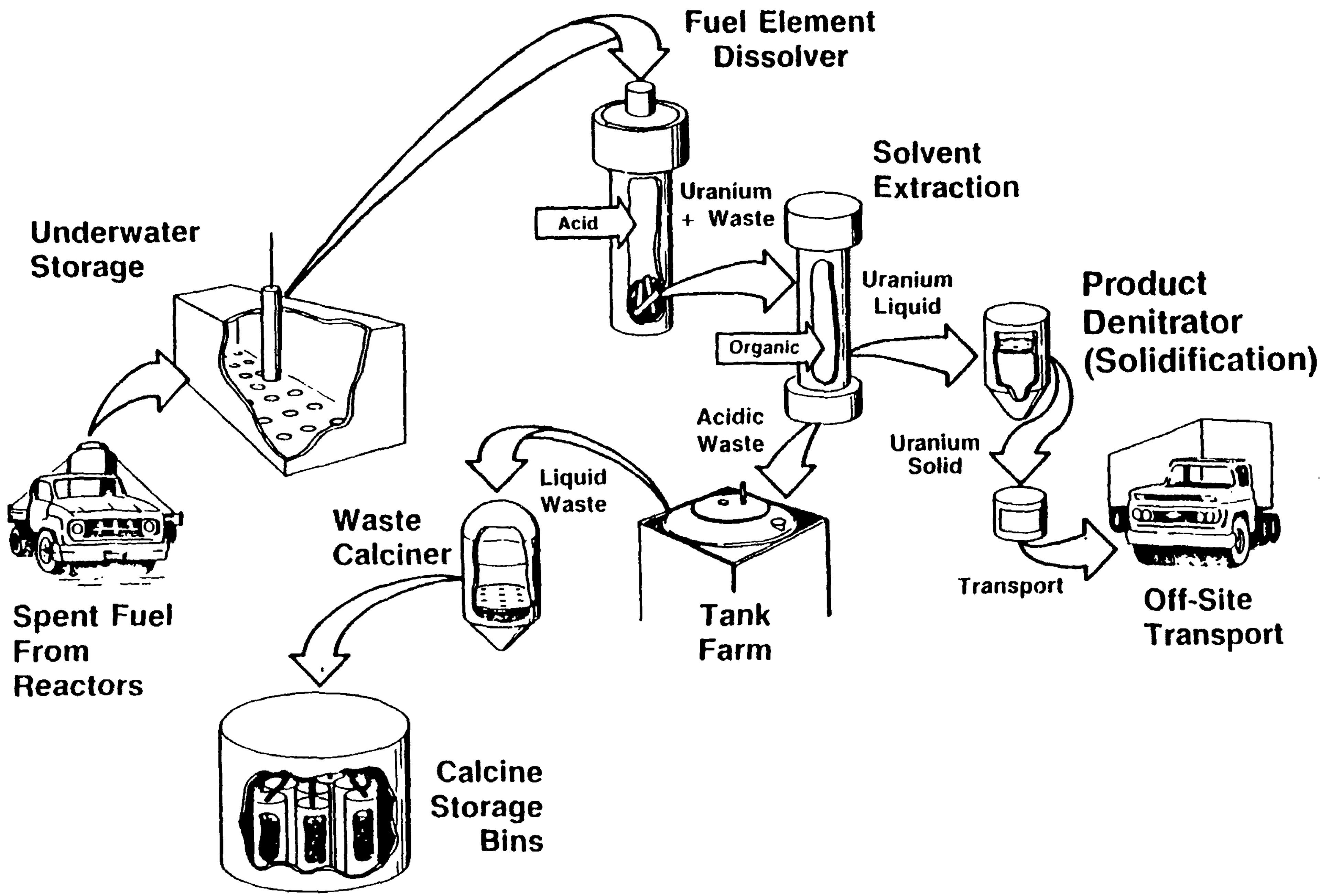
The calcined waste, which is in granular form, is pneumatically piped to cylindrical stainless steel storage bins set in a reinforced concrete silo. There are three to twelve bins per silo and there are six silos currently in use; a seventh is under construction. Each silo holds an average of 35,000 cubic feet of calcine. Several chemical parameters are monitored for process control. These quality-control analyses are performed daily, and all HLW is sampled for some chemical analyses prior to every transfer.

FIGURE 1
IDAHO CHEMICAL PROCESSING PLANT (ICPP)



ICPP-S-11296

FIGURE 2
IDAHO CHEMICAL PROCESSING PLANT (ICPP) PROCESS FLOW



Currently, several options are under consideration for the final waste form including continuation of the calcine production, incorporation of the calcine into glass or ceramic logs, or discontinuing calcination and going directly to glass or ceramic logs.

The ICPP is supported by a remote analytical laboratory (RAL) which began operations this year. Samples are shipped to the RAL via pneumatic messenger systems. The facility has a large (20 X 50 foot) hot cell served by 17 master/slave manipulators. Because this laboratory easily meets the radioactive exposure criteria for workers, many more chemical analyses can be routinely conducted on the radioactive wastes.

2. Transuranic Waste Management

Transuranic radioactive waste generated in DOE defense and research programs is stored or buried at the Radioactive Waste Management Complex (RWMC), a restricted area in the southwest corner of the INEL. The RWMC began in 1952 as a 13 acre shallow burial disposal site. Until 1970, TRU and low-level waste (LLW) were buried, without plans for retrieval, using practices which do not meet RCRA standards. Since 1970, over 2.1 million cubic feet of TRU wastes have been placed in above-ground retrievable storage. RWMC expanded to 144 acres in the 1970s and now separately manages both TRU and LLW.

The old, discontinued practices are not part of the DOE option and therefore were not subject to task force review. The mixed LLW will continue to be subject to RCRA regulations under DOE's option. Consequently, the LLW site was not included in the task force visit.

INEL defines TRU waste as waste which is contaminated with transuranic radionuclides, primarily alpha emitting elements, with an atomic number greater than 92, a half life greater than 20 years, and a surface concentration (specific radioactivity) greater than 100 nanocuries/gram (nCi/g).

Very little of the TRU waste handled at RWMC is generated at INEL (less than 1% by volume, mostly by the Argonne National Laboratory.) In fact, 95% of the TRU wastes at INEL comes from Rocky Flats. The mission of RWMC is to serve as a transfer, processing, and storage facility for other DOE locations until the WIPP begins operations and to continue as a transfer and processing center for the smaller generators thereafter.

The bulk of the TRU waste is received in specially designed railroad cars and tractor-trailers. Waste packages are tested against Department of Transportation (DOT) standards. Access control, barriers, and surveillance features at the RWMC provide excellent security. Incoming waste is inspected, assayed, evaluated against acceptance criteria, and stored on asphalt pads for subsequent retrieval. The current operating area of the storage pad is covered by an air support weather shield extending the life expectancy of containers and permitting year round operation and TV surveillance. Until recently, however, wastes were covered with earth on these pads. Buried wastes will eventually be retrieved, assayed, certified, and stored for transfer to the WIPP.

High efficiency particulate air (HEPA) filters are discarded at a rate of 300 per year. Two hundred of these currently fail TRU waste acceptance criteria for percent fines. It is anticipated that this will be corrected this calendar year.

RWMC currently contains a majority (68%) of all DOE-generated, retrievably stored TRU waste. Wastes currently being received are stored in above ground buildings but previously buried retrievable drums must be exhumed, evaluated, processed as necessary, and placed in the above ground storage. There is neither sufficient processing nor sufficient storage capacity to process these wastes now.

Approximately one percent of the TRU waste at INEL must be remotely handled because of high contact dose rates (greater than 200 millirems/hour (mr/h), but less than 4500 rem/hour (r/h)). These wastes are placed in steel pipe vaults with sand, cement, and grout protection; containerized wastes are placed in these vaults and covered with a plug and vault cap.

The WIPP has established waste acceptance criteria (WAC) which all generators and shippers of TRU waste must meet. All wastes currently received at the RWMC are tested against the WAC prior to storage. Previously stored but unclassified wastes are retrieved for evaluation and segregated storage. Waste evaluation determines whether a waste package is free of explosives, free liquids, pyrophorics, compressed gases, excessive radioactivity, excessive fines, and other undesirable constituents. These criteria are subject to revision; recently, for instance, the free liquids limit at INEL was raised from zero to one percent (about four cups per drum).

The Stored Waste Examination Pilot Plant (SWEPP) has been in operation since 1985. Wastes are currently being evaluated against the WIPP WAC at this facility. A second facility, the Process Experimental Pilot Plant (PREPP) is under construction. It is scheduled to begin processing wastes which fail WIPP WAC by 1991. At the SWEPP, containers are certified as meeting DOT Type A criteria and size and handling limits. They are weighed and measured against waste form requirements including particle size limits (less than one percent by weight of particulates smaller than 10 microns; and 15 percent by weight less than 200 microns) and liquid limits (one percent by volume, although 0.75 percent is the operating target). Rocky Flats, the major generator of wastes handled at INEL, has begun similar waste examination prior to shipment. Few discrepancies are found.

Wastes which fail the certification criteria are transferred from the SWEPP to the PREPP. The PREPP process flow (Figure 3) includes shredding, rotary kiln incineration with secondary combustion, particle size separation with fines going to grout mix, and coarse materials being added to the grout product in certifiable containers for transfer back to SWEPP.

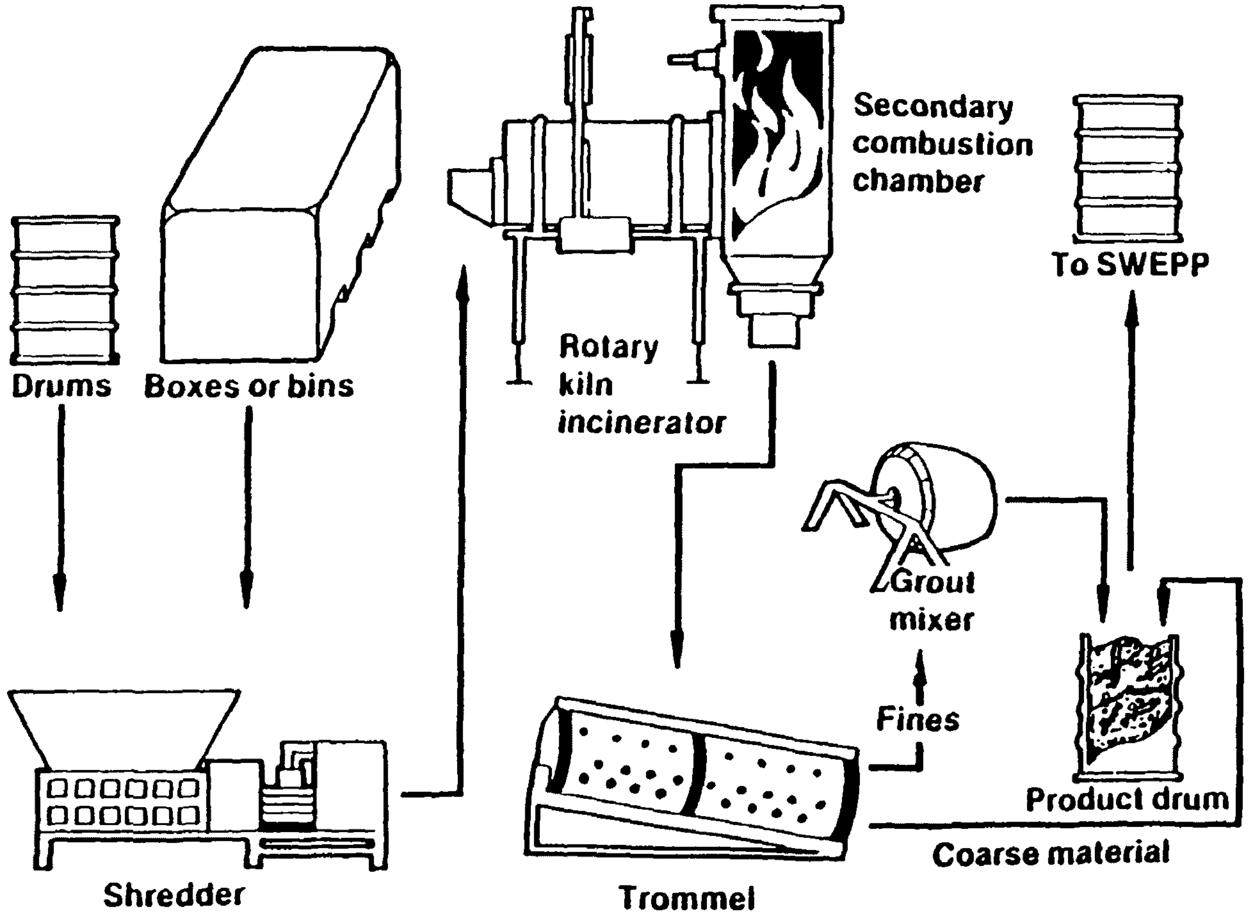
The PREPP facility design should be capable of meeting RCRA performance standards, operating requirements, and monitoring and inspection. The expectation is that the facility will be used for both hazardous wastes and mixed wastes in the future. Unlike the waste experimental reduction facility (WERF) which handles LLW, the PREPP incinerator has wet off-gas handling capabilities. Some LLW may be treated at PREPP in the future.

The record keeping system for transportation, storage, and waste certification activities appears to be substantially equivalent to RCRA. Internal review by DOE audits and quality assurance programs provides a "paper trail" which can be made available to the public.

C. ENVIRONMENTAL MONITORING:

INEL maintains a general level of environmental monitoring at the TRU waste facility. Area-wide air, biota, and radiation monitoring provide reasonable assurance against gross emissions of radioactive material. Surface and ground-water monitoring, to a lesser degree, establishes area-wide trends useful in gauging facility impact. Ground-water monitoring programs are being upgraded, particularly with regard to the RCRA controlled LLW disposal operations.

FIGURE 3
PREPP PROCESS FLOW



The ground-water monitoring program is conducted by a staff of five from the U.S. Geological Survey. The most intensely monitored area is around an infiltration pond or seepage pit for chromate wastes. This impoundment was closed in 1964 and replaced by an injection well which discharged directly into the regional aquifer for the next ten years. The monitoring program has delineated several miles of contaminant plume.

Historically, INEL officials assumed that the nature of the waste handling operation at the RWMC provided adequate assurance against ground-water contamination. Ground-water monitoring has not focused on either the HLW or the TRU waste facilities. The ground-water monitoring system for the site provides an overall indication of ground-water quality. It is comprised of 24 deep wells sampling the regional aquifer with dedicated pumps, and several dozen shallower wells with portable, submersible pumps. Ground-water monitoring protocols in use at the facility are not in agreement with the EPA guidance documents with regard to location, design, materials of construction, or other specifications. DOE is working with EPA Region X under a RCRA technical agreement and is submitting upgraded monitoring plans for the INEL.

Constant air monitors in the operational areas provide detection sensitivity at about 10^{-6} curies/cubic centimeters (Ci/cc), roughly equivalent to 15 parts/billion (ppb) of Pu-239 oxide. Perimeter monitoring detection sensitivity is 10^{-17} Ci/cc, or 1.5×10^{-10} ppb of Pu-239 oxide. The RWMC TRU waste storage area, as well as the "intermediate level" storage facility with TRU storage in vaults, is monitored for airborne plutonium contaminants.

The buried TRU wastes placed prior to 1970 were not subject to task force inspection. The current plans call for a 1995 removal/remediation date for these older SWMU/CERCLA wastes.

D. RCRA EQUIVALENCY:

1. Comparison of Existing Monitoring to RCRA Requirements

Current HLW and TRU waste management practices for newly generated wastes do not include land disposal; all tanks, piping, and storage is double contained, inspectable, or otherwise qualified for exemption from RCRA ground-water monitoring requirements. The older (pre-1970) disposal facilities will probably require monitoring under HSWA Section 3004(u). These requirements are unaffected by the DOE option since it does not address LLW.

The retrievably buried 55-gallon drum pads look very much like landfills which would require monitoring if TRU waste management were to be RCRA regulated. RWMC contends that soil-gas monitoring for radioactive emissions in the backfill material and between drums on the asphalt pads provides assurance of detection better than that possible by ground water monitoring.

2. Waste Characterization, Handling

Materials handling procedures for HLW and TRU wastes are heavily documented. Upon receiving TRU wastes and from the moment of generation of HLW, detailed operating procedures require signatures of managers, technicians, and inspectors each time the wastes are handled. These records are separately checked by DOE personnel and remain available as part of the public record. INEL officials contend that the operation of the RAL has greatly improved the waste analyses. The RAL will be capable of the abbreviated Appendix IX analysis and will routinely characterize the waste stream.

3. Oversight

The detailed operating procedures require sign-off at vital points throughout the waste handling system. Operators must sign their names, clearly indicating who did what and when. The load list duplicate gives blanks for health physics technicians to record notes. There are 140 check points throughout the waste receipt and storage area prior to the SWEPP and the PREPP. While there is no routine oversight by any independent agency, there are many internal levels of oversight and DOE officials contend that these data are part of the public record.

The Idaho State air quality office recently regained primacy; otherwise, Idaho is not authorized for either the Clean Water Act or for RCRA programs. INEL officials estimate that CERCLA remedial action (probably under Section 3004(u)) will be required at about 350 sites at the INEL reservation. The tank farms have dry wells for radiation detection.

although these were not shown to the task force. The calcine storage bins do not have wells, but since they are double-walled, they would probably not be subject to RCRA Subpart F. The task force did not see the organic solvent storage area although we understand that it does contain some transuranic wastes.

E. ACTION ITEMS:

INEL promised to deliver the following:

1. Examples of RWMC waste tracking forms.
2. Hazardous constituent analyses lists, with typical results, from the RAL.
3. Hard copy of the environmental monitoring presentation by Marcy Williamson.
4. Report on analysis of constituents and subsequent interpretive reports.

E. APPENDIX:

1. Waste Management Programs at EG&G, Idaho
2. Idaho National Engineering Laboratory, An Overview
3. Overview of INEL Waste Management Program

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Lawrence Livermore National Laboratories
Livermore, California
January 15, 1987

PURPOSE:

On January 15, 1987, the MEWS task force, accompanied by an EPA Region IX representative, met with individuals from the Department of Energy (DOE) headquarters, from the Lawrence Livermore National Laboratories (LLNL), from other DOE facilities and from the University of California (the DOE contractor operating LLNL). The purpose of the meeting was for task force members to observe llnl's methods for handling, treating, storing, and transporting transuranic (TRU) wastes.

SUMMARY:

University of California officials presented an overview of the objectives and management of the LLNL. There are no high-level wastes (HLW) generated or managed at LLNL. Areas potentially affected by the DOE option include the Plutonium Facility (Building 332), the Heavy Element Facility (Building 251), the HWM Decontamination Facility (Building 419), and the Hazardous Waste Storage Area (Area 612). LLNL generates approximately 265 cubic meters of TRU wastes annually in the forms of solidified liquids, boxed wastes, and barreled miscellaneous trash.

Like Los Alamos (LANL) and other research laboratories, LLNL's wastes vary depending upon what projects are currently underway. Unlike production facilities such as Idaho National Engineering Laboratory (INEL) and Savannah River Plant (SRP), the LLNL TRU waste generators are limited to a small number of personnel. This allows for individual attention to generator training and performance to assure conformance with waste form requirements, and eliminates the need for real-time-radiography (RTR) and the other certification procedures necessary at the larger TRU waste generating facilities.

Much of the presentation by LLNL officials was directed toward description of low-level waste (LLW) management and some of the more widely known environmental problems which have resulted from past practices. The LLNL officials claim that none of the past problems are TRU waste related. Prior to the 1970s, TRU waste was ocean disposed and has subsequently been shipped to the Nevada Test Site (NTS) or INEL. TRU waste generation and on-site movement is separate and distinct from LLW and hazardous waste until wastes are received at Building 419 and Area 612. However, at those facilities, waste containers are stored side-by-side with LLW, PCB's, waste oil, etc. These wastes are currently shipped to NTS. Future plans are to transport directly to the Waste Isolation Pilot Plant (WIPP).

In general, based on LLNL's hand-out materials and presentations, the level of protection afforded by current and proposed TRU waste management practices appear to equal or exceed RCRA requirements for hazardous waste. Waste characterization, similar to the Task Force findings at other facilities, is less than would be required under RCRA. Regardless of the chemical components, the Task Force learned that waste destined for the WIPP would not be handled differently. Since packaging and waste segregation are carefully managed, this may only be a factor for classified wastes going to NTS for greater confinement disposal (GCD).

REPORT:

A. FACILITY DESCRIPTION:

The LLNL was founded in 1952 by E.O. Lawrence and Edward Teller. It is one of two DOE nuclear weapons development laboratories, established as a separate and, to some extent, competing laboratory to Los Alamos (LANL). Their missions are similar, but they differ in methods and technological approach. Both facilities are operated by the University of California.

The LLNL mission is research and development on nuclear weapons, energy, and national security problems. The operating budget, $800 million per year, is over one-third weapons research. The next largest areas are isotope separation, laser, magnetic, and inertial fusion, and biomedical environmental and energy research. Waste management funding is typically carried as overhead rather than as a line item. Employment has intentionally been kept at about 7000-8000 people for the last ten years. When larger projects are assigned, such as recent Strategic Defense Initiative work, the increase has been handled by subcontracts rather than expansion.

The physical plant is located on two distinct properties. The main site at Livermore, an old Naval Air Station, occupies a one-mile by one-mile square. A buffer zone has been recently purchased, doubling the site size (and temporarily resolving a problem of ground-water contamination migrating off-site). A ten square-mile satellite facility, called Site 300, is located 15 miles east. It is a high explosives testing facility (non-nuclear only). There are multiple hazardous waste management units on the Main Site and Site 300 including more than 20 impoundments and 160 underground tanks.

Both the Main Site and Site 300 have extensive ground-water contamination, (mostly PCE, TCE, and tritium), from past practices; the Main Site is listed on the proposed N.P.L. They are located in two different counties (Alameda and San Joaquin, respectively), in two different California Water Board districts, and are regulated by several layers of Federal, State, and local agencies. Extensive ground-water assessments have begun on both sites. One hundred fifty RCRA wells have recently been installed and early results are showing excellent resolution and plume definition. Some interesting findings are emerging from this program (e.g., they have data indicating that aliphatic hydrocarbons will form the plume "front" in gasoline-contaminated ground-water). The monitoring program will be peer reviewed, and articles will be submitted to several professional journals and conferences.

Considerable remedial work will be required but so far Congress has eliminated each line item from the LLNL budget dealing with cleanup of environmental problems. Site managers interpreted this congressional message to suggest more detailed and better planned efforts, but there was some disagreement with and discussion of this interpretation.

B. OVERVIEW OF WASTE MANAGEMENT OPERATIONS:

The DOE option will have relatively little impact at LLNL. There is no HLW and the total amount of TRU wastes is equivalent to less than two weeks of waste produced by Rocky Flats, the largest generator. No radioactive wastes have been disposed on site. The facility is already actively involved with Federal, State, and local regulators for air and water discharges. It has a large and active public information program in response to citizen opposition to past practices. The ongoing RCRA and CERCLA investigations are large and visible. Generator and transporter liability and other RCRA paperwork will continue almost unaffected by the DOE option.

Altogether LLNL generates 5,500 cubic meters of LLW, hazardous wastes, waste oils, PCB's, and other "dangerous substances". About half of this volume is radioactive. Waste treatment includes an incinerator rated to burn at 375-575 pounds per hour solids and 300 gallons per hour liquids. It burns both hazardous (non-halogenated) wastes and mixed LLW. It has a 1800° combustion temperature and is capable of sufficient retention time to destroy pathogens. It is located in Area 614 with the drum storage and the TRU waste handling operation. Two RCRA interim status landfills are located on Site 300.

The operating budget for complying with environmental protection requirements is $11 million and involves a total staff of 100 people. They have requested $40 million for construction of a new waste management facility and $60 million for clean-up operations, but they are several months away from beginning the permit and public hearing process for these new facilities. Meanwhile, the waste management yard functions primarily as a drum staging area for a variety of waste forms. Wastes are stored in tanks, drums and boxes. Drums are lined up in rows according to category. Housekeeping is apparently good, but the task force noted some instances of labels being separated from containers. While there was some disarray among the non-hazardous liquid waste containers in the staging area for the incinerator feed, the TRU waste containers were segregated, permanently labeled, and well organized.

1. HLW Management

No HLW is generated, received, or otherwise handled at LLNL.

2. TRU Waste Management

The LLNL generates 265 cubic meters of TRU wastes annually, constituting about 5% of the total "dangerous substances". TRU wastes are typically low activity, low volume, but highly variable (38 isotopes). TRU waste originates from two buildings: Building 332 (americium, and plutonium) generates 95% and Building 251 (berkelium, curium, americium, neptunium, einsteinium, and others) generates 3% of the total TRU wastes. Liquids from each of these facilities are taken to Building 419 where they are solidified and the residue from this process constitutes the other 2% of the TRU waste total. These wastes are currently stored at the DWT Area. Liquid wastes are stored in 1500-gallon tanks, treated in a Dorr Oliver package plant providing neutralization, flocculation, oxidation/reduction, precipitation, separation, and filtration designed for copper, chromium, nickel, and zinc removal. Sludges with heavy metals and other RCRA characteristics are sent to USPCI in Nevada and radioactive residuals are sent to the NTS.

TRU waste management at LLNL is characterized by a small number of waste handlers and a relatively streamlined "matrix management" approach which delegates responsibility to a small number of key managers. The design objective of the matrix is to incorporate line management responsibility, not just relegating TRU waste management responsibility to "support services" or others peripheral to the main mission. During the briefing, LLNL officials promised to provide the task force with anecdotal examples showing how issues were raised, decided, and subsequent resolution implemented. At the time of this report, however, the examples had not been received.

The certification process at LLNL may also be characterized in terms of its manageable scale. The waste handlers are routinely visited by the laboratory manager. They are provided with standard packages of operating safety procedures. Floor supervisors perform double checks by visually verifying that the description of a drum's contents are accurate. Drums are selected randomly. Only a small proportion of drums have been returned due to problems. WIPP certification at LLNL was conditionally approved by the WIPP-WAC committee in June 1986, and all containers packaged after August 8, 1986 will be certified as acceptable.

Average activity of the 300 drums produced annually is four curies and the 25 (5'x 5'x 8') boxes typically have 30 curies. Only about eight to ten of the drums will contain hazardous wastes, usually lead shielding contaminated by TRU. The drums are WIPP approvable (Type A DOT) steel drums with 80 or 90 mil liners. They are currently placed in a "Super Tiger" container for highway transport via commercial haulers. Eventually, either TRUPACT or Super Tiger containers will be used for shipment to the WIPP. The Super Tiger is currently loaded weekly and shipped bi-monthly (six times per year).

In the future, the DWTF will house the entire waste management operation including TRU waste consolidation.

C. ENVIRONMENTAL MONITORING:

Environmental monitoring, particularly ground-water monitoring, is extensive. Response to mounting regulatory and public pressure has produced an extensive monitoring network for air and ground-water. Data analysis has just begun on the new systems, providing remarkable resolution of plume details. Annual soil sampling is done at one- and two-mile radii around the plant and at the edge of the facility buffer zone. Surface water samples are taken at ten locations on Site 300 and the Main Site. Drinking water samples are taken at the community water supply. Public meetings are held periodically to share data with the two counties, two water resource boards, the other regulatory agencies and an alliance of public interest groups.

At the Main site, there are currently five areas of known ground-water contamination which are under investigation. The release of the contaminants to the ground water was probably due to the past practices of the U.S. Navy and LLNL. West of the southwest corner of LLNL is a plume of VOCs (volatile organic compounds) which is 3600 feet long by 1700 feet wide by 200 feet deep and consists of two subplumes. The larger of the two subplumes is dominated by TCE (trichloroethylene) at concentrations up to 1100 ppb (parts per billion). The smaller subplume is dominated by TCE at concentrations up to 580 ppb. LLNL is currently evaluating remedial action alternatives for this area.

In the southeastern portion of the Main Site there are three main sources of VOCs. The extent of contamination in this area has been determined. The next phases of work for this area include long-term hydraulic testing and the evaluation of remedial action alternatives.

An estimated 65,000 liters of gasoline leaked from an underground storage tank located along LLNL's southern boundary prior to March, 1979. LLNL has determined the extent of gasoline constituents in soil and ground water and is currently evaluating remedial action alternatives.

At Site 300, LLNL is currently investigating the extent of high explosives, TCE, and tritium in soil and ground water. The investigations are being conducted to determine the extent and impact of process waste water lagoons and the "burn pit" area where small quantities of high explosives are destroyed by burning. The investigations have found concentrations of TCE exceeding 200 ppm in a shallow water-bearing zone under environmental test facilities where TCE has been used as a heat exchange fluid. Far lower amounts of TCE have been found in ground water near inactive landfills and in an area to the east and northeast which was used for testing explosives. With maximum velocities of a few tens of meters per year, this rate of flow and direction poses no immediate threat to any on- or off-site water supplies. The Site 300 investigations include evaluation of remedial action alternatives.

RCRA ground-water monitoring would probably not be required for TRU waste management at LLNL. There are no facilities or practices comparable to buried "retrievable" storage or remote handled vaults seen at other DOE facilities. All TRU management is indoors in well ventilated, easily inspectable areas.

D. AUDITS/ASSESSMENTS/OVERVIEW:

Waste management operations at LLNL are conducted under the Standard DOE Management System, with relatively high contractor autonomy, some District or Area office oversight (San Francisco Operations Office in LLNL's case) and little headquarters involvement. Orders from DOE headquarters are interpreted and narrowed in scope to fit site-specific situations by the San Francisco Operations Office.

The TRU Waste Certification Program has been authorized by the WIPP-WAC to certify drums dated after August 20, 1986 and boxes generated after January 15, 1987. (Drummed waste prior to August 20 will be certified at NTS and old boxed wastes will be certified at LANL). The WIPP-WAC committee listed only minor deficiencies in their audit of LLNL procedures. For example, WIPP-WAC found that LLNL's technical specifications for containers and the container vendor's data requirements were excessive, resulting in vendors not supplying necessary information. Other minor findings include absent entries on TRU Waste Package Control Records and Data Log Cards. Personnel training was recommended to remedy these.

TRU Waste Certification oversight is rigorous, but it is all internal to the contractor. DOE or local/regional regulatory oversight of drum content lists is not routine.

E. SECURITY:

Movement of all TRU materials and wastes on-site is controlled and documented. Material balance checks are made regularly and documented. Each waste container is bar coded and information on all shipments and the current status of each container is fully computerized.

F. RCRA EQUIVALENCY:

Most aspects of TRU waste management at LLNL appear to be equivalent to RCRA Hazardous Waste regulations. There is excellent process control with regard to treatment and packaging; this is facilitated by the small number of people involved. There are extensive administrative controls for the tracking of waste from generation to disposal and there is excellent security. There is a lack of waste characterization with regard to quantification of the hazardous chemical components, but otherwise the TRU management program would not need to be substantially different under RCRA.

G. ACTION ITEMS:

The following items were requested from LLNL:

- Examples of deliberations and decisions under the matrix management system.

H. APPENDIXES:

Set of briefing materials.

Mixed Energy Waste Study (MEWS) Visit
U. S. Department of Energy (DOE)
Los Alamos National Laboratory
Los Alamos, New Mexico
January 13, 1987

PURPOSE:

On January 13, 1987, the MEWS task force, and an EPA Region VI representative, met at the Los Alamos National Laboratory (LANL), with individuals from the Department of Energy's (DOE) headquarters, DOE's Albuquerque Operations Office, DOE's Los Alamos Area Office and the Los Alamos Contractor (University of California). The purpose of the meeting was for task force members to gain a working knowledge about methods for treatment, storage and disposal of high-level wastes (HLW) and transuranic (TRU) wastes at the LANL.

SUMMARY:

DOE's Los Alamos contractor (University of California) provided an overview briefings of the site with emphasis on TRU waste management practices (there are no HLW at LANL). Subject areas included administrative organization and funding, TRU waste management, environmental monitoring, environmental compliance and environmental assessment and response program. Following the briefings, a tour of the liquid waste treatment plant, the TRU incinerator, the size reduction facility and the TRU and low-level waste (LLW) management area was provided. The briefings and tour provided the task force with a thorough understanding of the waste management systems at LANL.

In general, the current management systems at LANL for TRU wastes, from both an administrative and technical standpoint, are advanced and comprehensive with many areas equal or superior to those required by RCRA. Specific weaknesses would include the lack of detailed chemical analysis of TRU wastes, the lack of ground-water monitoring around the TRU waste retrievable storage, the lack of an adequate disposal plan for uncertifiable TRU wastes and the lack of independent inspection.

REPORT:

A. FACILITY DESCRIPTION:

The LANL was established in 1943 as a part of the Manhattan Project to develop the world's first nuclear weapons. Today LANL's primary missions include nuclear weapon development, development of new concepts for defense against nuclear attack, advanced fission and fusion theories and development of fossil, renewable and geothermal energy.

The LANL site occupies 43 square miles on the Pajarito Plateau of the Jemez Mountains in north-central New Mexico (Figure 1). It is organized into 32 distinct technical areas. Precipitation averages 18 inches per year across the entire LANL site. At lower elevations, precipitation averages only 13 inches per year.

The facility is operated under contract by about 8,200 employees of the University of California. There are also about 2,000 contract maintenance people for a total of 10,200 employees. Approximately 430 persons work in the Health, Safety and Environment Division; 55 work in waste management. The LANL annual operating budget for FY 86 was $800 million.

B. HIGH-LEVEL WASTE:

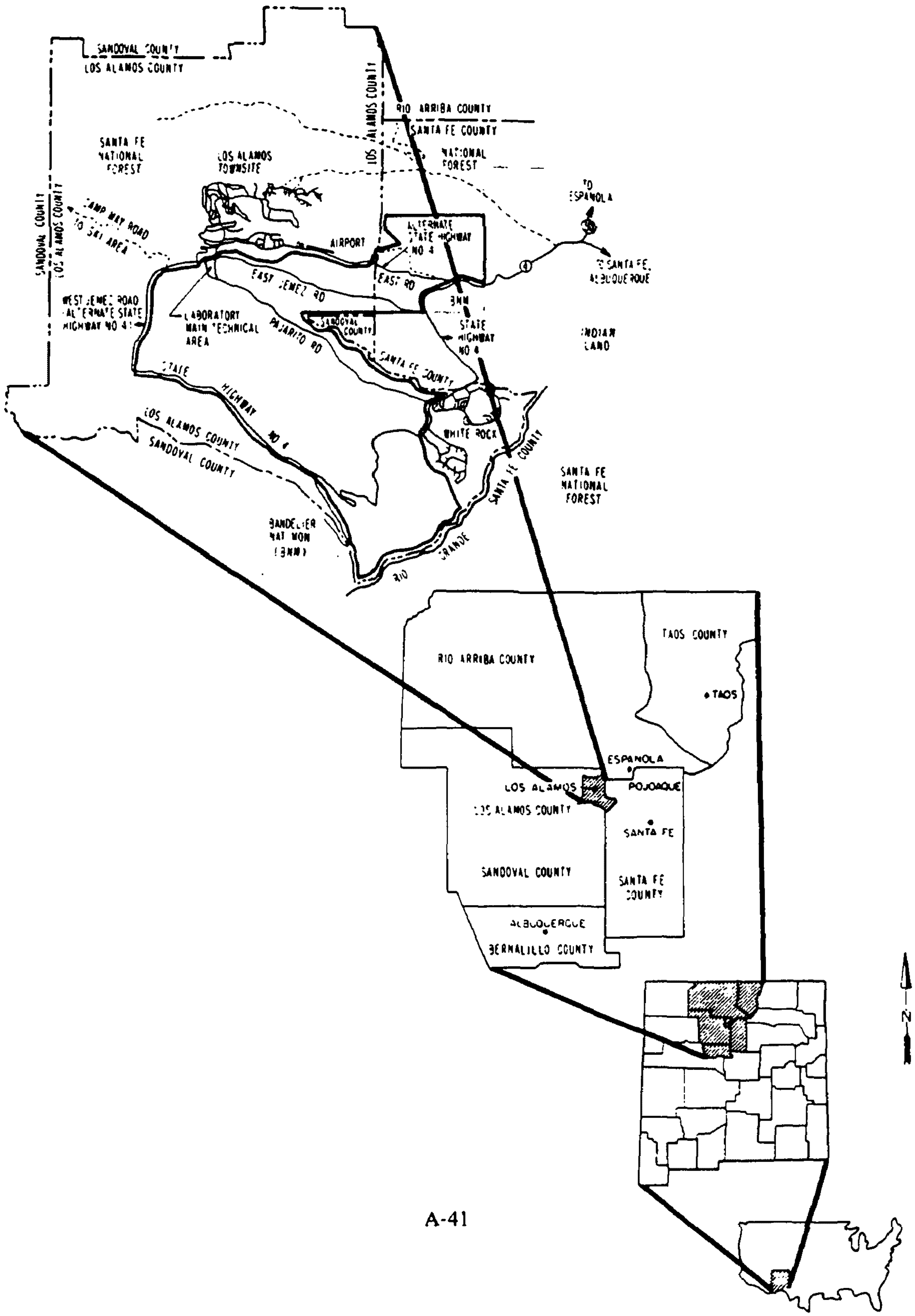
No HLW is generated, treated, stored or disposed of at the LANL.

C. TRU WASTES:

1. Generation

TRU waste generation rates for LANL are estimated to be 450 cubic meter per year (m^3/year) of which 317 m^3/year will be sent to the Waste Isolation Pilot Project (WIPP) beginning in 1989. The difference between these figures is due to the volume reduction accomplished in the size reduction facility. TRU waste represents approximately six to ten percent of the total radioactive waste generated at LANL.

FIGURE 1
LOS ALAMOS NATIONAL LABORATORY (LANL)



Of the 396.6 cubic meters (m^3) of TRU waste generated in 1986 at LANL, the origin of generation was as follows.

Plutonium Facility	76%
Analytical Chemistry	10%
Liquid Waste Treatment	8%
Other	6%

In addition, LANL receives approximately five drums of TRU waste (cemented) per year from the Lovelace Clinic and the Sandia Laboratory in Albuquerque, NM.

The composition of the currently stored retrievable TRU waste at LANL is as follows:

Large Metallic Wastes		32%	(e.g. glove boxes,)
Misc. Combustibles		19%	(e.g. paper, cloth,)
Dewatered Sludge		15%	
Misc. Noncombustibles		14%	
Cemented Wastes		10%	
Process Residues		6%	
Soil		2%	
Chemicals/Oils	0.1%		
Others	1.9%		

Aside from cemented waste and soil, much of this TRU waste may also be RCRA hazardous waste due to the presence of lead shielding or solvents.

Almost all of the TRU waste at LANL is contact-handled with only one-half of one percent being remotely-handled. LANL also generates some classified TRU waste, but this waste is treated by the generator so that it is not classified when turned over to the waste management group.

2. Management

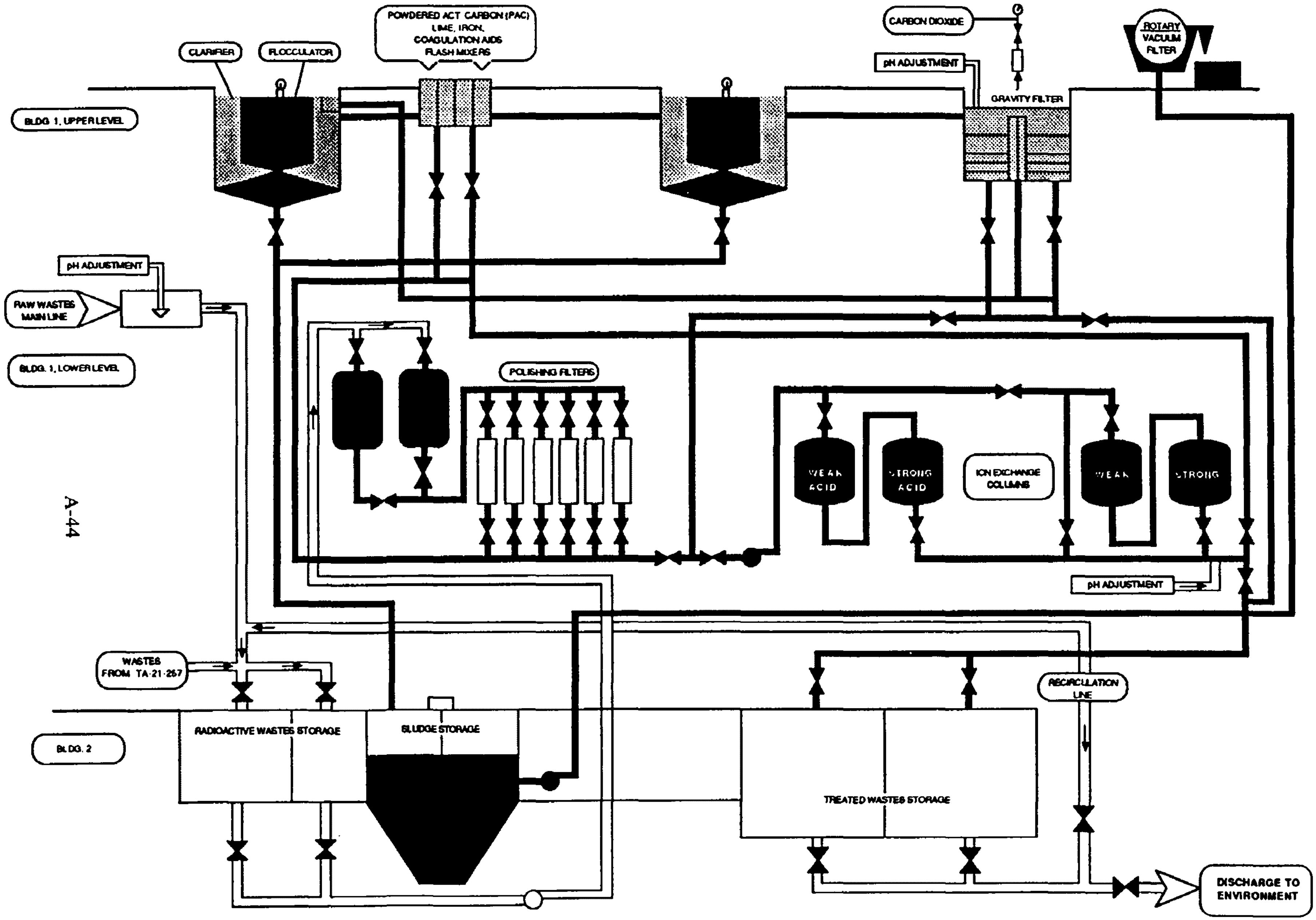
Management of TRU waste at LANL includes treatment of liquid wastes, incineration of combustible wastes, size reduction for large metallic wastes and certification for disposal at the WIPP.

There are three liquid waste treatment plants at LANL, one of which services the plutonium plant and other generators of liquid TRU wastes. This facility, a physical-chemical plant, removes 99 percent of the uranium and plutonium. The treatment steps include influent analysis, flocculation/precipitation, filtration, ion exchange, treated liquid analysis and discharge (Figure 2). The sludge resulting from treatment, which is TRU waste, is dried on a vacuum filter, cemented and placed in 55-gallon drums. The supernatant from the plant is directly discharged in accordance with a NPDES permit. The rated capacity of the plant is 250 gallons per minute (86,000 gallons per day); however, the plant is presently treating about 20,000 gallons per day of liquid waste resulting in the generation of approximately 60 drums of cemented sludge per year. The facility does not allow organics in the cemented sludges. In addition, LANL does not perform any leachability tests due to concerns about radiation exposure.

The treatment facility has an elaborate process control system. This system provides computerized monitoring of tank levels. Pumps and values are computer controlled; pH adjustment and chemical feeds are automated. There are about four and one-half miles of pipeline used in the conveyance of liquid TRU waste to the treatment facility. This pipeline was installed in FY 86 at a cost of two million dollars and consists of a six-inch polyethylene pipe inside a 10-inch polyethylene pipe. The interstitial space contains liquid sensors placed every 500 to 600 feet which are monitored to detect any leakage in the inner pipe. The Previous pipelines leaked for about 20 years prior to replacement. Contaminated soil resulting from those leaks was dug up and stored in 55-gallon drums.

An incinerator is utilized at LANL to reduce the volume of TRU combustible wastes. In 1975, this incinerator consisted of a ram feeder, a primary combustion tank and a secondary combustion chamber to burn particulates and volatiles. In 1979, a feed preparation glove box and off-gas clean-up system were added. The off-gas clean-up system consists of a high-energy scrubber, venturi scrubber, packed column and three banks of air filters. The present cost of the incinerator was given as five million dollars. The incinerator is presently permitted for incineration of PCB's and has interim status as a hazardous waste incinerator. During a recent trial burn, it achieved a 99.99% reduction of carbon tetrachloride (CCl_4) and a 99.9999% reduction of trichloro ethylene (TCE). The

FIGURE 2
LANL TREATMENT STEPS



solids capacity of the incinerator is one hundred pounds per hour; liquids must be limited to less than one million Btu's per hour. LANL plans to incinerate all TRU wastes containing organics, solvents, and oil.

The size reduction facility at LANL is used to cut up large metallic TRU wastes such as glove boxes. The entire facility is fully contained and remotely operated. It can handle wastes up to 15 x 15 x 30 feet and uses a plasma torch to cut up the large objects. The facility cost two million dollars.

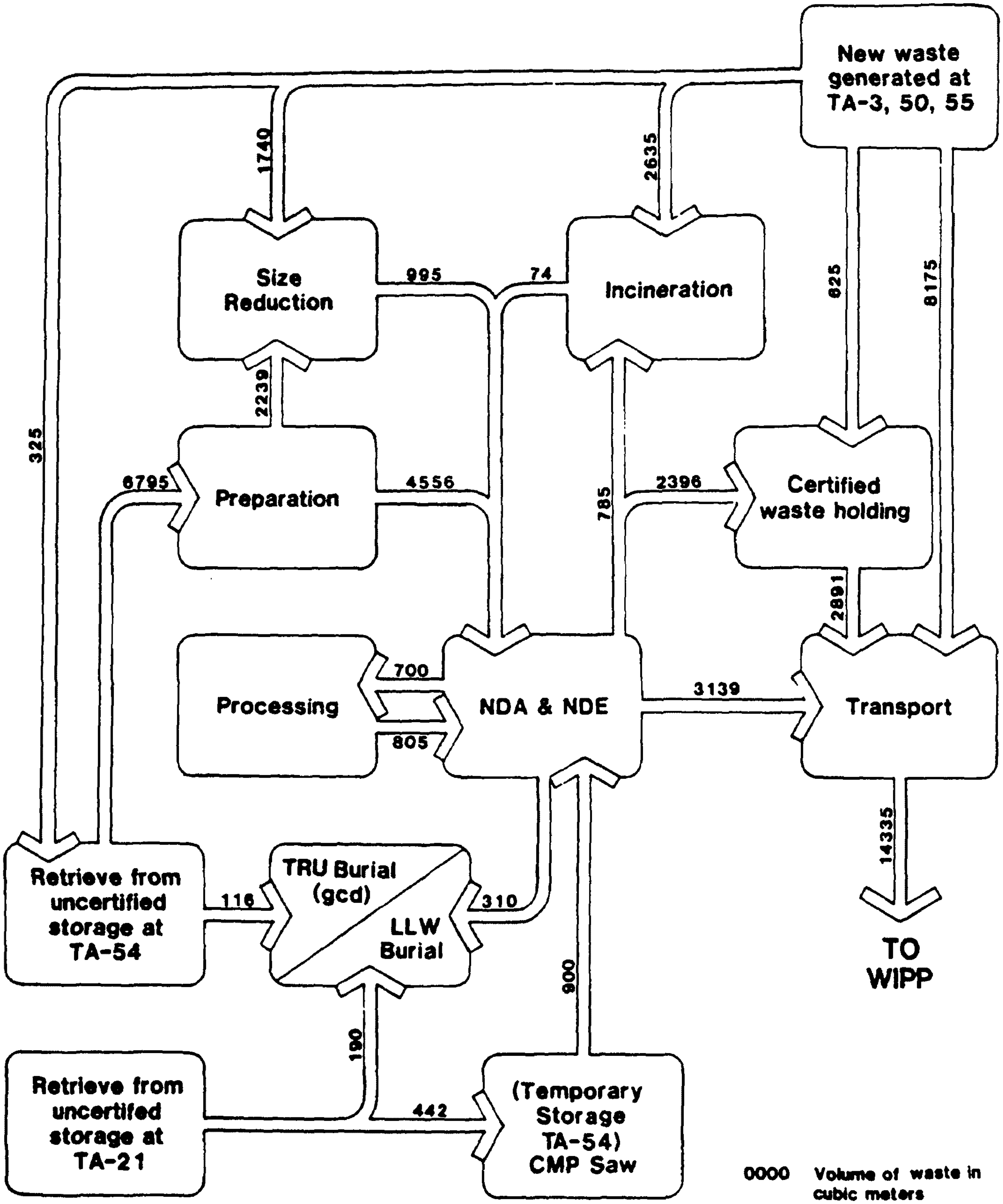
All generating units are responsible for certification of new TRU waste under the direction of a Waste Management Group. The Waste Management Group can reject any waste that does not comply with the WIPP criteria. Present plans call for the neutralization and cementing of all corrosives, and the incineration of all solvents, oils and the majority of all paper and cloth prior to certification. The WIPP certification team has not yet approved the LANL certification process. The final WIPP audit is scheduled for February, 1987. Until approval is received, newly generated TRU wastes are being labeled as certifiable. After approval, this label will be changed to "certified". A back-log plan has been developed for the TRU wastes in retrievable storage. It calls for all waste to be certified by 1997. As a part of this process, LANL is presently in the design phase for a neutron assay facility which is scheduled to be operational in late 1988. The entire certification flow sheet is shown in Figure 3.

3. Storage

Prior to 1970, all TRU waste was mixed with LLW and landfilled on site. Since 1970, TRU waste has been segregated and placed in retrievable storage. The volume of retrievable TRU waste is presently 7453 m^3 and LANL estimates that 14,000 m^3 of TRU waste will be shipped to the WIPP over the next 30 years.

The Los Alamos site is divided into many waste management areas (Figure 4). Pre-1970 TRU wastes are buried in areas B, C, G, T, AB and possibly area A. Areas K, E, D, U, V, W, X and Y contain only LLW. Area G is currently active as a LLW disposal area and has been receiving all TRU wastes since 1970. The TRU retrievable storage consists of asphalt pads similar to those at the Idaho National Engineering Laboratory (INEL). These pads are above ground and are on top of an older LLW disposal ground. TRU waste is stored in 55-gallon drums and boxes on the pads. The drums are coated with a yellow corrosion

FIGURE 3
LANL CERTIFICATION FLOW SHEET



inhibitor which will be steam cleaned away before shipment to the WIPP. As a pad is filled, the drums and boxes are covered with plywood, polyethylene sheets and a two-foot layer of earth. At one location on each pad, four columns of four drums are left out to allow for an inspection portal. Air monitoring can also be performed on the buried storage. Inspections to date have shown no drum leakage or need for routine air monitoring. Unlike other DOE facilities visited (Hanford, INEL, WVDP) where certified TRU waste goes to storage in buildings, LANL plans on continuing to cover and bury certified TRU wastes. At present, two pads have been filled with an estimated three years of storage capacity remaining on two additional pads.

Remote-handled TRU waste at LANL is stored in the G area in concrete culverts with two drums per culvert. Some of these have been opened for inspection and sampled for gas; however, gas was only found in the newer drums.

4. Disposal

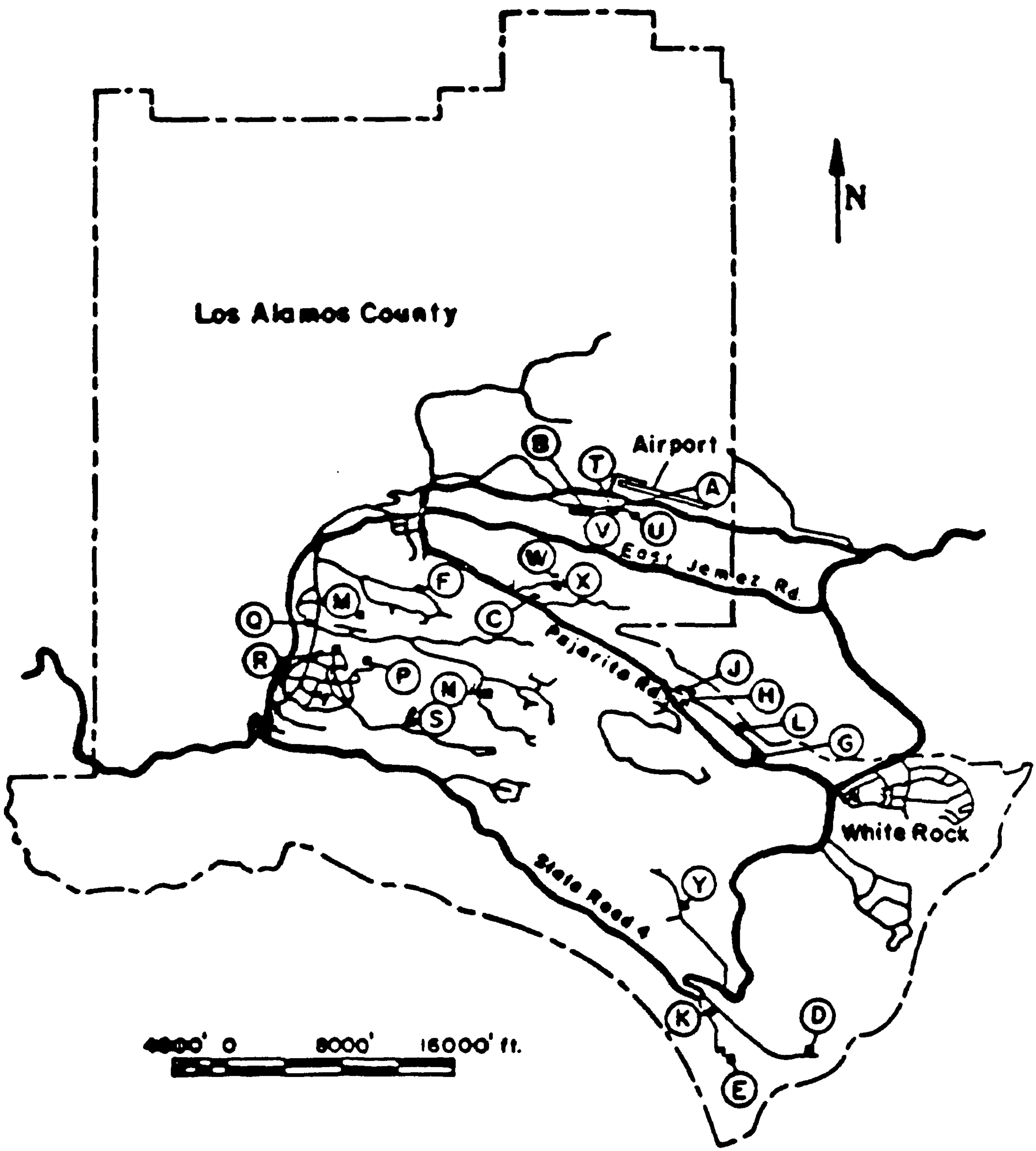
Disposal of all certified TRU waste will be at the WIPP which is scheduled to start receiving waste in October, 1988. About 125 m^3 of uncertifiable TRU waste may be disposed of on-site in greater confinement. This greater confinement will consist of cemented waste placed at a greater depth than LLW is presently being buried.

A 1979-80 study of old TRU burial sites resulted in a decision to leave that waste in place and to add earth, plant shallow rooted vegetation, add fencing, and establish a maintenance plan for the sites. This decision is being restudied with a report due to the Albuquerque Operations Office in June, 1987.

D. MONITORING:

A comprehensive monitoring program for transuranics is carried out at LANL. This includes routine sampling of the air, surface water, ground water, soil, sediments, and foodstuffs for radioactivity. In addition, the waste water discharge from the liquid TRU waste treatment plant is monitored weekly for pH, chemical oxygen demand (COD), ammonia, cadmium, chromium, copper, iron, lead, mercury and zinc as required by the NPDES permit.

FIGURE 4
LANL WASTE MANAGEMENT AREAS



Through the use of modeling, LANL has estimated the travel time from the waste management areas to the regional aquifer to be in excess of one million years. The average depth to ground water is 1,100 feet. Based on this effort, ground-water monitoring at waste management area G has only been for radioactivity. However, monitoring for hazardous chemicals has been performed, when possible, on perched water tables where they discharge at the surface into surrounding canyons.

In 1976, LANL did horizontal borings from the canyon to give side access to the area beneath one of the TRU waste disposal facilities where waste had been buried for 11 years. Borings came within one foot of the bottom of the trench. No TRU migration was found; however, analyses for hazardous waste were not performed.

E. AUDITS/ASSESSMENTS/OVERVIEW:

LANL operates under the standard DOE management system. DOE headquarters issues orders which are then interpreted and narrowed in scope to meet site specific conditions by the Albuquerque Operations Office. This process continues down to the procedures written by the contractor for the plant operators to follow. The DOE Headquarters' Health, Safety, and Environment Office has no direct power to require implementation or compliance. The LANL Environmental Compliance Office operates with borrowed staff and can only refer problems to the Laboratory Environmental Compliance Management Committee. Audits are performed by all of the organizations under their respective jurisdictions. However, independent, outside audits are not conducted.

F. SECURITY:

Security for the TRU waste treatment and storage areas is maintained 24-hours per day through controlled access and armed guards.

G. RCRA EQUIVALENCY:

Most aspects of TRU waste management at LANL appear to be equivalent to RCRA hazardous waste requirements. The areas where TRU waste management appears to exceed RCRA standards include the following:

- Excellent process control with regard to the treatment and transfer of TRU liquid waste. Includes a computer automated surveillance system.

- Extensive administrative controls for the tracking of waste from generation through disposal.

- Excellent conceptual plan for final disposal of certified TRU waste.

- Excellent security.

Areas where there seem to be potential problems with RCRA equivalency include the following:

- Lack of or limited data on waste quantity and characterization with regard to hazardous chemical components.

- Lack of RCRA ground-water monitoring around buried TRU retrievable storage (probably a waste pile or landfill under RCRA).

- Lack of adequate disposal plan for uncertifiable TRU waste.

- Lack of independent audit or inspection.

H. ACTION ITEMS:

The following information was requested from the DOE:

- Listing of all disposal sites with the type and amounts of wastes identified.

- Example of non-conformance report.

- Map of LANL showing which portions (tanks, pipelines, processes, storage sites, etc.) would be included in DOE option.

I. APPENDICES:

1. "Los Alamos National Laboratory, A Profile", LALP-84-35

2. "Organizational Profile; Health, Safety and Environment Division",LALP-83-36

3. "Welcome To Los Alamos", LALP-85-9

4. "Los Alamos 1943-1945; The Beginning of an Era", LASL-79-78 Reprint

5. Agenda, Department of Energy (DOE)/Environmental Protection Agency (EPA) Interagency Team Review, January 13, 1987.

6. Set of briefing materials to MEWS Task Force, January 13, 1987.

   a. Wayne Hansen Overhead Slides [Laboratory and Health, Safety and Environment Division Overviews].

   b. Doris Garvey Overhead Slides [Environmental Compliance Management Office - Organization and Funding]

c. John Warren Overhead Slides [Transuranic (TRU) Waste Management at Los Alamos].

d. "Comprehensive Environmental Assessment and Response Program", Gunderson, T.C., Vocke, R.W. & Stoker, A.K., Los Alamos National Laboratory, Los Alamos, New Mexico.

e. Bob Vocke Overhead Slides [Environmental Oversight Monitoring]

f. Tony Drypolcher Overhead Slides [Environmental Oversight: Compliance]

g. Liquid Waste Treatment Plant Overhead Slides

7. "Final TRU Waste Inventory Work-Off Plan", LA-UR-862932

8. "Environmental Surveillance at Los Alamos During 1985", LA-10721-ENV

9. Health and Safety Manual, Section 9 - Environmental Protection

10. Health and Safety Manual, Section 10 - Waste Management

11. "The Los Alamos Controlled Air Incinerator for Radioactive Waste", Volume I: Rationale, Process, Equipment, Performance and Recommendations, LA-9427, Vol. I

12. "The Los Alamos Controlled Air Incinerator for Radioactive Waste", Volume II: Engineering Design Reference Manual, LA-9427, Vol. II.

J. <u>DISTRIBUTION</u>:

MEWS task force Distribution List

Mark Sides, Region VI

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Nevada Test Site
Las Vegas, Nevada
January 14, 1987

PURPOSE:

On January 14, 1987, the MEWS task force visited the Nevada Test Site (NTS), meeting with representatives of the Department of Energy (DOE) headquarters, DOE Nevada Operations Office, Idaho National Engineering Laboratory, and Reynolds Electrical and Engineering Co., Inc. the (REECO), prime contractor-operator of NTS.

The purpose of the visit was for task force members to gain a working knowledge of the mission of the NTS and the operation of the transuranic (TRU) waste management system including disposal of classified wastes.

SUMMARY:

The major discussion subjects were:

- The NTS TRU waste program.
- The greater confinement disposal (GCD) facility.
- The geology and hydrology of NTS.
- The NTS low-level waste (LLW) program.
- The development of mixed-LLW disposal facility at NTS.

The major findings were:

- Neither high-level nor TRU waste is currently produced on-site; TRU waste may be produced if a proposed site clean-up is pursued.
- The only TRU waste now being disposed on-site is classified.
- All non-classified TRU waste in storage is from Lawrence Livermore National Laboratory.

- An intermediate-depth disposal technology (GCD) has been developed and is currently in use.
- The GCD facility is used for classified TRU waste and high specific activity LLW.
- The GCD wastes are about 850 feet above the aquifer.
- Approximately 1 millimeter per year of precipitation infiltrates 1000 feet below the surface.
- Ground water takes about 3,800 years to move off-site from the disposal area.
- Continuous security is present.
- Documentation on TRU waste packages is thorough.
- The NTS is used for disposal of DOE LLW.
- The NTS is planning to develop and operate a RCRA permitted mixed-LLW facility.

REPORT:

A. SITE DESCRIPTION:

The NTS is located about 60 miles northwest of Las Vegas, Nevada. The 1,300-square mile reserve encompasses both mountain and desert environs, with the waste areas being located in the desert.

The rock underlying the waste management area is tuff, a volcanic rock, which is overlain by fine alluvial soil. There is about five inches of precipitation per year, most of which (97%) evaporates; it is estimated that less than 1% infiltrates to the 800-foot depth of the ground water. A DOE contractor, Desert Research Institute of the University of Nevada, reported that there is no gravity drainage without continuous (about two years) ponding and that the estimated travel time for ground water from the disposal area to off-site (Ash Meadows outflow) is 3,800 years.

The NTS began operations in 1950 as the continental nuclear weapons proving ground. Its primary mission is still to provide a remote, secure facility for the safe conduct of underground nuclear weapons testing. One other important but subordinate function is waste management and disposal of defense-related radioactive waste, including classified TRU waste. The fiscal year 1986 budget was about one billion dollars overall, with $1.2 million designated for waste management.

B. HIGH-LEVEL WASTE:

No high-level waste is generated, treated, stored or disposal of on-site.
A potential site for the first national high-level waste repository (Yucca Mountain) is located within the NTS reserve. If Yucca Mountain is chosen, the high-level waste situation on-site would obviously change; however, that decision is at least several years away.

C. TRU WASTE MANAGEMENT:

1. Management and Storage

TRU waste is not produced on-site; the NTS has been used only as a waste storage and disposal facility. Prior to 1970, TRU waste was disposed of on-site. The only wastes currently being disposed of are defense related low-level and classified TRU wastes. All other TRU waste is in retrievable storage in above ground shipping overpacks.

All the nonclassified TRU waste on-site is from Lawrence Livermore National Laboratory (California). From 1974 through 1985, NTS received about 21,000 cubic feet of TRU waste containing about 3,300 curies. In July 1985, NTS stopped receiving TRU waste packages which were not certified for disposal in the Waste Isolation Pilot Plant (WIPP). For TRU waste received before July 1985, NTS has begun a certification program. Using portable equipment, almost 1,500 drums and 32 of the 64 total steel boxes have been neutron assayed. Of those drums, 1,349 were found to contain TRU wastes and were sent through real-time radiography (RTR); all but 229 passed. Those drums that passed are now awaiting sonic testing, bar coding, weighing and banding. The drums found to contain non-TRU waste have been disposed as LLW; the 229 drums not passing the RTR test (mostly because of liquid content) have been placed in storage awaiting a decision on how to process them. The NTS is expecting to build an RTR facility and sampling station in about two years. While this is mainly for LLW, it could be used for TRU waste packages also.

Incoming waste shipments are inspected by the organizational element known as RADSAFE for both physical and administrative requirements. If shipments are not accepted, they are returned to the generator unless leakage is found. Leaking packages are overpacked and held pending a decision to dispose, store, or return them. Outgoing shipments to the WIPP will be in conformance with the WIPP Waste Acceptance Criteria labeling, packaging, and documentation requirements.

2. Disposal

Approximately 5,600 cubic feet of classified TRU waste have been disposed on-site since 1985 using a technique called greater confinement disposal (GCD). The GCD test project began in 1981 to demonstrate the disposal of defense LLW at a depth sufficient to minimize or eliminate natural intrusion processes, e.g., animal burrowing or plant rooting, and to substantially reduce the potential for inadvertent human intrusion. A test shaft was drilled 10 feet in diameter and 120 feet deep, the same dimensions as the operational shafts now being used. The shafts are not lined. Waste is emplaced to fill about half the volume, then the shaft is backfilled. Fiscal year 1987 is the final year of the GCD test. Data from this test will be used in the 40 CFR 191 performance assessment (EPA's Environmental Standards for the management and disposal of spent nuclear fuel, high-level and radioactive wastes; draft due September, 1987). The two goals for the GCD test are to collect and analyze data on radionuclide migration (using nonradioactive gaseous and liquid tracers) at the 120-foot level and to develop handling procedures. The GCD facility currently has capacity (assuming 50% of the volume is waste) for about 40,000 cubic feet of waste.

The NTS is a major defense disposal site for LLW produced both on-site and off-site. This is a much larger operation than the TRU waste operation; for fiscal years 1982 through 1986, approximately 5.8 million cubic feet of LLW were disposed in shallow land burial. The GCD is being used for both high-specific activity LLW and classified TRU waste. The classified TRU waste comes from weapons facilities around the country. The high-specific activity LLW includes about 2.5 megacuries of tritium. There is an effort to concentrate LLW radionuclides for GCD and reduce the concentration in shallow-land LLW disposal areas.

Following the visit, it was learned that GCD of TRU waste has been suspended pending demonstration of compliance with 40 CFR 191.

A problem which is becoming more pressing for the DOE defense facilities is the disposal of mixed-LLW waste. At the moment, there are no active, interim status, or permitted DOE disposal sites for mixed radioactive waste. In an effort to relieve this problem, the NTS is planning to develop and operate a mixed-LLW facility adjacent to the current GCD facility. Assuming the timetable can be followed, this facility would be operational in late 1988. The RTR and sampling station mentioned earlier would be built to support this facility and could be used in the TRU waste management system as well.

E. ENVIRONMENTAL MONITORING:

The monitoring system for the waste management area centers on the detection of gamma radiation and airborne radionuclides with monitoring stations located around the perimeter of the waste management site. There is no dedicated monitoring for either the GCD facility or the TRU storage overpacks or area.

When packages are moved they are monitored and to date, no leakage has been found. No ground-water monitoring has been completed; there is very little water to drive the radionuclides to the ground water or the long distance through the unsaturated zone to the aquifers. Drilling monitoring wells may increase the spread of contamination. NTS has requested a variance from Region IX for the ground-water monitoring requirements.

There is a large water monitoring program both on and off-site for NTS. The nearest such well to the waste management site is about 3/4 mile away in Frenchman Flat. The monitoring detects radionuclide migration from the nuclear test sites; there are no RCRA-quality wells.

Soil sampling has been conducted sporadically. Sampling of surface soil was initially done in 1980 and again in 1986. Current plans call for annual sampling. The focus will be on alpha, beta, and gamma scans, and plutonium, tritium, and fission products.

F. AUDITS/ASSESSMENTS OVERVIEW:

The NTS operates under the standard DOE management system. DOE headquarters issues orders which are then interpreted and narrowed in scope by the Nevada Operations Office to meet site-specific conditions. The contractor, REECO, then writes procedures for the operators to follow. Audits are performed by all of the organizations under their jurisdiction as well as by the WIPP Waste Acceptance Criteria Certification Committee. No independent, outside audits are conducted.

G. SECURITY:

There is no dedicated security force for the waste management area. However, security for the overall NTS is maintained 24-hours per day by armed guards.

H. RCRA EQUIVALENCY:

The areas where TRU waste management appears to exceed RCRA requirements include:

- Extensive administrative controls for the trading of waste from acceptance to storage through disposal for shipment off-site.
- Excellent conceptual plan for disposal of WIPP-certified TRU waste.
- Continuous overall site security.

Areas where there may be potential problems with RCRA equivalency include:

- Lack of classification for any RCRA-hazardous waste contained in classified TRU waste.
- Lack of adequate disposal plan for WIPP-uncertifiable TRU waste.
- Lack of independent audit or inspection.
- Public access to RCRA permit application information due to the classified TRU waste.

I. ACTION ITEMS:

None

J. APPENDICES:

1. Bound copy of briefings entitled "HQ, U.S. Department of Energy and Environmental Protection Agency Visit to Nevada Test Site, January 14, 1987".

2. Booklet entitled, "Greater Confinement Disposal Test at the Nevada Test Site".

K, <u>DISTRIBUTION</u>:

MEWS task force Distribution List
Lou Johnson, Region VIII

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Oak Ridge National Laboratory
Oak Ridge, Tennessee
January 21, 1987

PURPOSE:

On January 21, 1987, the Mixed Energy Waste Study (MEWS) task force, accompanied representatives from EPA Region IV and the Department of Energy (DOE) Headquarters and visited the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. The purpose of the visit was to review transuranic (TRU) waste management operations at the facility. A list of attendees is provided in Attachment 1.

SUMMARY:

Once a major producer of plutonium for use in weapons production, ORNL operations now focus primarily on research and development of heavy elements for use in medical applications. No HLW is generated at ORNL as a result of these or other operations at the laboratory. ORNL is not a major contact-handled TRU (CH-TRU) waste generator. However, the facility is a major generator of RH-TRU wastes and 94% of DOE's inventory of retrievably stored remote-handled TRU (RH-TRU) waste and are housed at ORNL. Funding has been appropriated for a Waste Handling Pilot Plant (WHPP) which will allow processing, repackaging and certification of these wastes for final disposition at the Waste Isolation Pilot Plant (WIPP).

Newly generated and stored CH-TRU wastes are being certified for disposal at the WIPP in preparation for initial waste acceptance in 1988. However, thirty percent of stored TRU wastes fail the certification process. At this time, ORNL does not have a facility available to process drums failing certification; however, a repacking facility for stored CH-TRU wastes is being planned.

Additionally, some TRU wastes are stored in tanks. These tanks are both single-walled and double-walled although wastes are no longer being added to the single-walled tanks. DOE plans to send these wastes to the WIPP. However, technology for retrieval and solidification of these wastes has yet to be developed by ORNL.

ORNL has initiated a remedial action program based on detecting contamination, migration of contaminants and delineation of the source of contaminants from groupings of ground-water monitoring wells. These wells typically do not conform with RCRA requirements but their use, as outlined, may satisfy that requirement.

Lastly, ORNL operates under the standard DOE management/audit system. However, unlike other DOE operations, ORNL has solicited independent audits for their operations.

NOTES:

It should be noted that the discussion which follows addresses TRU waste management operations at ORNL. Use of ORNL for the purpose of this report is considered to be synonymous with X-10 operations. No classified TRU wastes are either stored or generated at ORNL. ORNL contends there is no high-level waste at the facility although dissolution and processing of fuel rods yield wastes characterized as high-level by other DOE operations. At this time, the task force is not challenging ORNL's waste classification.

REPORT:

A. FACILITY OVERVIEW:

Although DOE-owned, ORNL is contractor-operated by Martin-Marietta Energy Systems, Incorporated. The 2,900-acre Laboratory (X-10) is located approximately 10 miles from downtown Oak Ridge, Tennessee and is one of three major DOE production and research facilities located in Oak Ridge. The other facilites are 1) the Y-12 plant which is involved in non-plutonium weapons components manufacture and services, and 2) the Gaseous Diffusion Plant (K-25) which is currently in stand-by mode.

The first reactor was started at Oak Ridge in 1942 as a pilot plant for the production of plutonium from irradiated reactor fuel. Currently, ORNL activities include production of heavy elements such as uranium, americium, einsteinium, californium, and curium for medical, industrial, and research applications while weaponry applications are a secondary consideration at this time.

B. HIGH LEVEL WASTE:

None at ORNL, notwithstanding the previously noted exception.

C. TRANSURANIC (TRU) WASTE:

1. Characteristics

TRU wastes are defined in DOE Order 5820.2 as waste contaminated with transuranium radionuclides (that have atomic numbers greater than 92) that are alpha-emitters having half-lives greater than 20 years and in concentrations greater than 100 nanocuries per gram (nCi/g). This definition would include various isotopes of neptunium, plutonium, americium, curium, californium and berkelium (i.e., elements that are heavier than uranium).

TRU wastes at ORNL are categorized as either contact-handled which is primarily low penentrating, alpha emitting particles, or remote-handled, containing sizable quantities of more penetrating beta- and gamma-emitting radionuclides. CH-TRU wastes exhibit less than 200 millirems/hour (mrem/hr) hour at the container surface. Conversely, RH-TRU wastes exhibit greater than 200 mrem/hr at the container surface.

ORNL also indicated individual DOE operations offices are permitted to "designate" certain isotopes as TRU, when appropriate. In accordance with this policy, U-233, an alpha emitter which is unique to the thorium fuel cycle and R-226 are being considered as transuranics by ORNL for waste management purposes.

2. Generation

ORNL does not generate large quantities of TRU waste when compared to other DOE operations and projects where annual generation rates are cubic meters/year 28 (m^3/yr) and 10 m^3/yr for CH- and RH-TRU wastes, respectively. This inventory is generated from five major operations at ORNL. They are:

1. the radiochemical processing plant operations which generate U-233 CH wastes:
2. the transuranium heavy elements reprocessing plant operations whichs generates CH- and RH-TRU wastes;

3. the isotopes area where some plutonium and heavy elements are handled, generating CH-TRU wastes;

4. the High Radiation Level Analytical Laboratory generates CH wastes; and

5. the Transuranium Research Laboratory which generates approximately 1 drum of heavy-element-TRU wastes biannually.

Currently, no classified TRU wastes are generated or stored at ORNL.

3. TRU WASTE MANAGEMENT:

1. Overview

All newly generated and retrievably stored TRU wastes which can be "certified" to meet the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC) will ultimately be shipped to the WIPP for permanent disposal. The WIPP, which is located 26 miles east of Carlsbad, New Mexico was conceived as a research and development facility to demonstrate a technology for permanent disposal of defense-generated TRU wastes. This is to be accomplished by entombment of the waste in a 225 million-year-old bed of salt at a depth of approximately 2,150 feet. The WIPP and its waste acceptance criteria are the subject of a separate report. Interested persons are referred to that report for further details.

The WIPP-WAC not only specifies waste container requirements which include type of container, package size, and radionuclide handling limits but also specifies waste form. That is, liquids (not more than 1.0% at some DOE facilities but 0% at ORNL), pyrophoric materials, explosives and compressed gases are prohibited. Additionally, waste package requirements such as package weight, nuclear criticality, plutonium equivalent activity, surface dose rate and contamination, thermal power, gas generation, labeling, and accompanying data package/certification are specified by the WIPP-WAC. Waste may be packaged in metal drums or corrugated metal boxes for shipment to WIPP. ORNL, unlike other DOE facilities, uses stainless steel drums (without plastic liners) to package TRU wastes because of concerns that high humidity in the Oak Ridge area might corrode carbon steel drums thus compromising their integrity. In fact, some of the black iron drums have corroded and leaked.

2. Certification

Sealed drums containing CH-TRU wastes are certified at the Waste Examination Assay Facility (WEAF). Each drum must pass an examination by three separate assay systems in order to obtain certification. One, the ORNL real-time radiography unit (RTR) examination, allows x-ray inspection of individual drums. Using this system, liquids, partially filled aerosol cans and other prohibited items can be detected. Two, drums are passed through a neutron assay system (NAS) which scans the container for fissile material. This is accomplished by using active and passive scanning modes. The active mode of the NAS detects thermal-neutron-induced fission reactions while the passive mode detects neutrons emitted by spontaneous fission. Using these data, the total TRU activity per drum may be obtained by adding the results of the active and passive scans. The sensitivity of NAS ranges from 200 grams (g) to as low as 0.5 g. Three, the segmented gamma scanner (SGS) identifies minimum detectable quantities of gamma-emitting isotopes. Although the SGS currently qualitatively monitors for gamma-emitting isotopes, it will be upgraded to provide a quantitative assay of individual waste containers.

Drums from retrievable storage as well as newly generated TRU wastes are examined at the WEAF. A total of 565 CH-TRU drums have been inspected at the WEAF since October, 1985. As of January, 1987, 354 drums (63%) passed inspection, 173 (30%) failed inspection, and 38 (7%) were undetermined primarily because of the suspected presence of high-efficiency particulate air (HEPA) filters or other problems encountered during examination. HEPA filters pose a special problem because the WIPP-WAC limits fines smaller than 10 microns to less than 1% by weight and fines smaller than 15 microns to less than 2% by weight. Unlike other DOE facilities, delineation of the size of fines cannot be standardized at ORNL due to the diversity and variations of its operations.

A nonconformance report is issued for "newly" generated TRU waste packages which cannot be certified at the WEAF. This report accompanies any noncertified TRU waste drum returned to the generator for repacking. Appropriate signatures must be provided on the nonconformance report before the waste will be reaccepted at the WEAF for re-examination and certification.

Drums formerly housed in retrievable storage and failing WIPP certification are color-coded and returned to the retrievable storage area until a repackaging facility becomes available. TRU waste drums found to contain less than 100 nCi/g of transuranics are managed as low-level wastes.

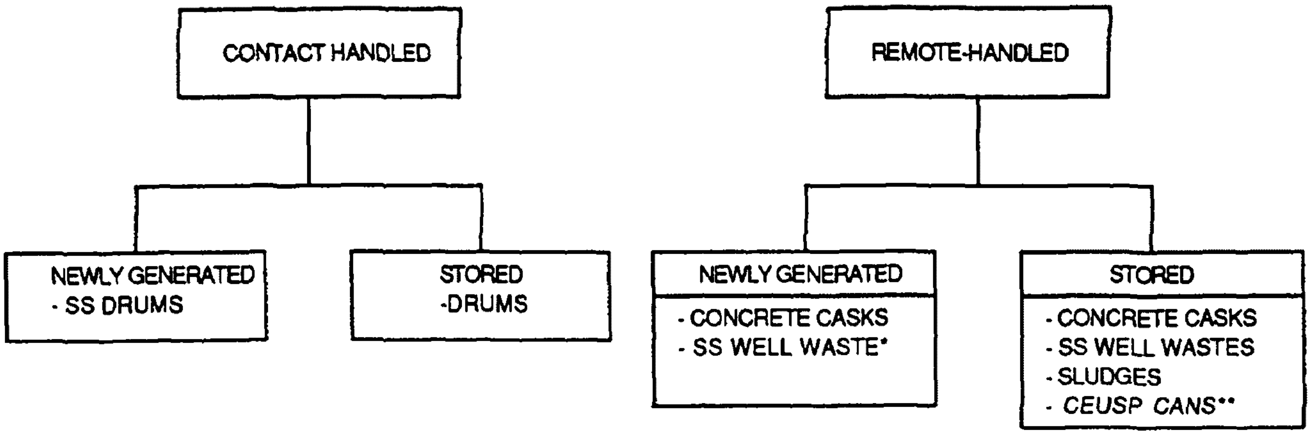
A data package accompanies each drum certified for shipment to the WIPP. These data requirements include shipment/transportation data (i.e., shipment number, shipment date, carrier code, vehicle number, vehicle type, waste type, shipment certification, etc.), as well as waste package data which includes various codes and identification numbers, closure date, weight, surface dose rate, neutron component, organic materials weight and percent volume, plutonium fissile gram equivalent, total alpha activity, hazardous waste, waste package certification date, etc. All waste examination and certification records are retained in duplicate.

The ORNL TRU waste certification program has not received final approval from the WIPP-WAC Certification Committee. The committee is, however, scheduled to review ORNL operations in May 1987 and it is anticipated that the certification program will receive final approval at that time.

3. Storage - Present and Past Practices

ORNL currently has 1750 cubic meters (m^3) of TRU waste in retrievable storage; of this quantity, CH-TRU waste accounts for 486 m^3 and RH-TRU wastes for 1264 m^3. Ninety-four percent of the total DOE inventory of RH-TRU waste is stored at ORNL in comparison to 0.7% of CH waste and 3.6% of buried TRU. Newly generated CH-TRU wastes are packaged in stainless steel drums and certified for shipment to the WIPP as generated. Formerly, however, several retrievable storage technologies have been applied to TRU wastes including storage in drums, concrete casks, stainless steel wells and as sludges in tanks under varying amounts of supernatant. The range of storage practices used at ORNL are summarized below in Figure 1.

FIGURE1
ORNL WASTE TYPES



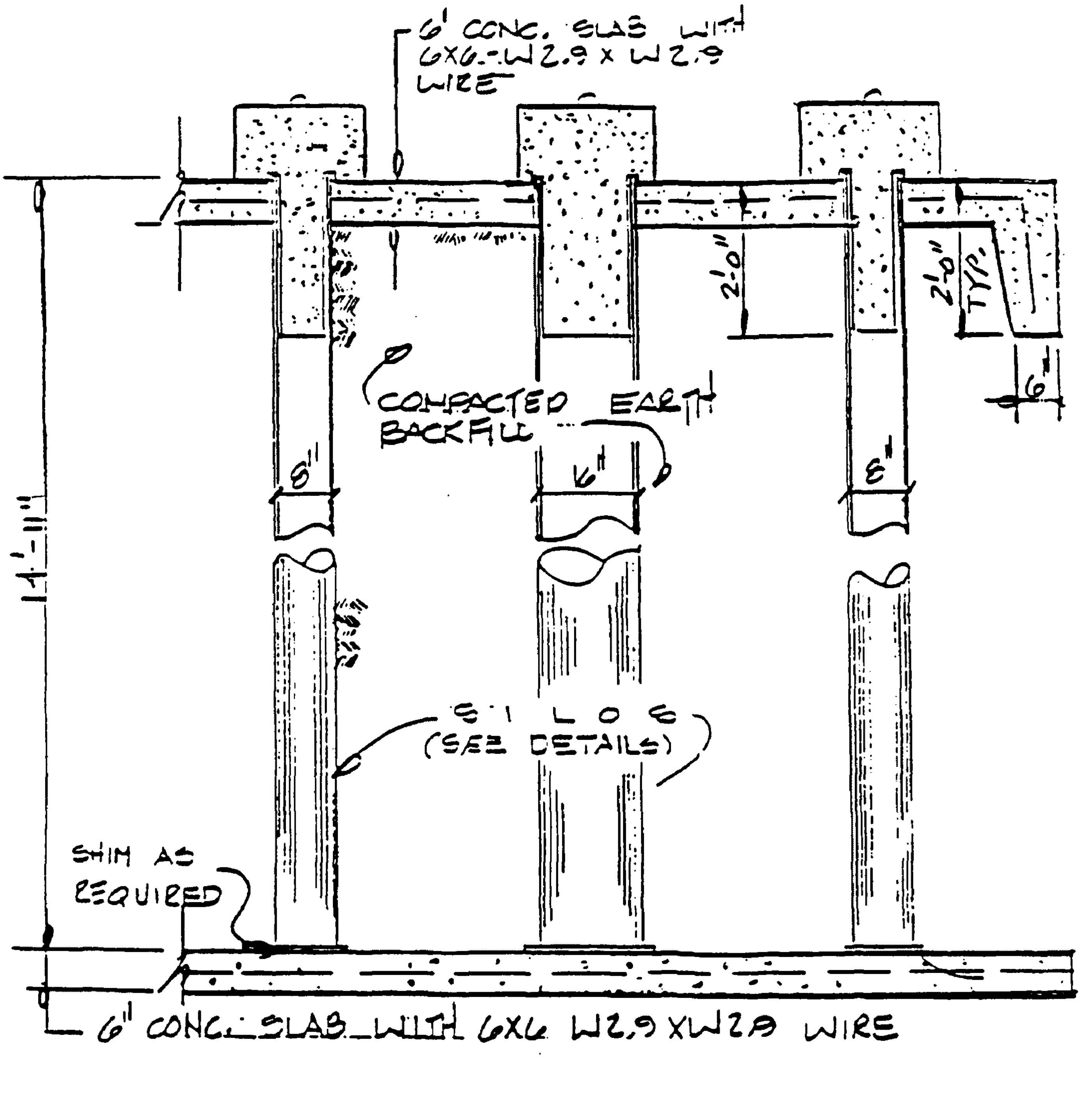
** SS - Stainless Steel
* CEUSP - Consolidated Edison Uranium Solidification Process, under consideration for designation as RH-TRU.

Retrievable CH-TRU waste drums are stored below grade in 10 x 10 ft concrete block storage cells on concrete block bottoms while the newer storage cells have a poured concrete bottom. Access to the cells can be gained through a square-shaped port in the top of the cell. Drums are stacked four high in older cells and five high in the newer storage cells. The cells are not completely dry and, occasionally, small quantities of water have been seen to accumulate in the storage cell. Storage cells are, however, equipped with a monitoring sump which is checked monthly for liquids.

Some RH-TRU wastes are stored in concrete casks. The wall thicknesses of the newer casks are either 6 or 12 inches with some older casks having four-inch thick walls; however, these older four-inch walled casks are no longer used. Storage casks are lined with polyethylene and can accommodate 27 drums. Typically, ORNL RH-TRU waste must be stored five to ten years in order to allow sufficient radioisotope decay to meet the WIPP-WAC. Storage is below grade in storage cells equipped with a monitoring sump which is checked monthly.

Other RH-TRU wastes are stored in single-shelled stainless steel wells with a welded stainless steel bottom and anchored to a six-inch concrete slab (Figure 2). These wells vary in diameter anywhere from 20 to 76 centimeters and vary in depth from 3.1 to 4.6 meters. Each well is capped with a removable concrete plug. ORNL has a total of 54

FIGURE 2
DESIGN FEATURES OF STAINLESS STEEL WELL FACILITIES



stainless steel wells which are used to store segmented fuel rod elements as well as some high-specific activity, low-level waste. The fuel rod elements are first placed in stainless steel primary containers which are lowered into the wells. ORNL has classified this waste, which weighs approximately 6000 kg, has a volume of 4 m^3, and exhibits more than 65,000 curies of activity of which 300 curies is plutonium, as "special case" waste. It is anticipated that the special case waste may be difficult to certify for disposal at the WIPP because of the potential concentration of fissile material. Additionally, there is no leak detection system dedicated to this well system.

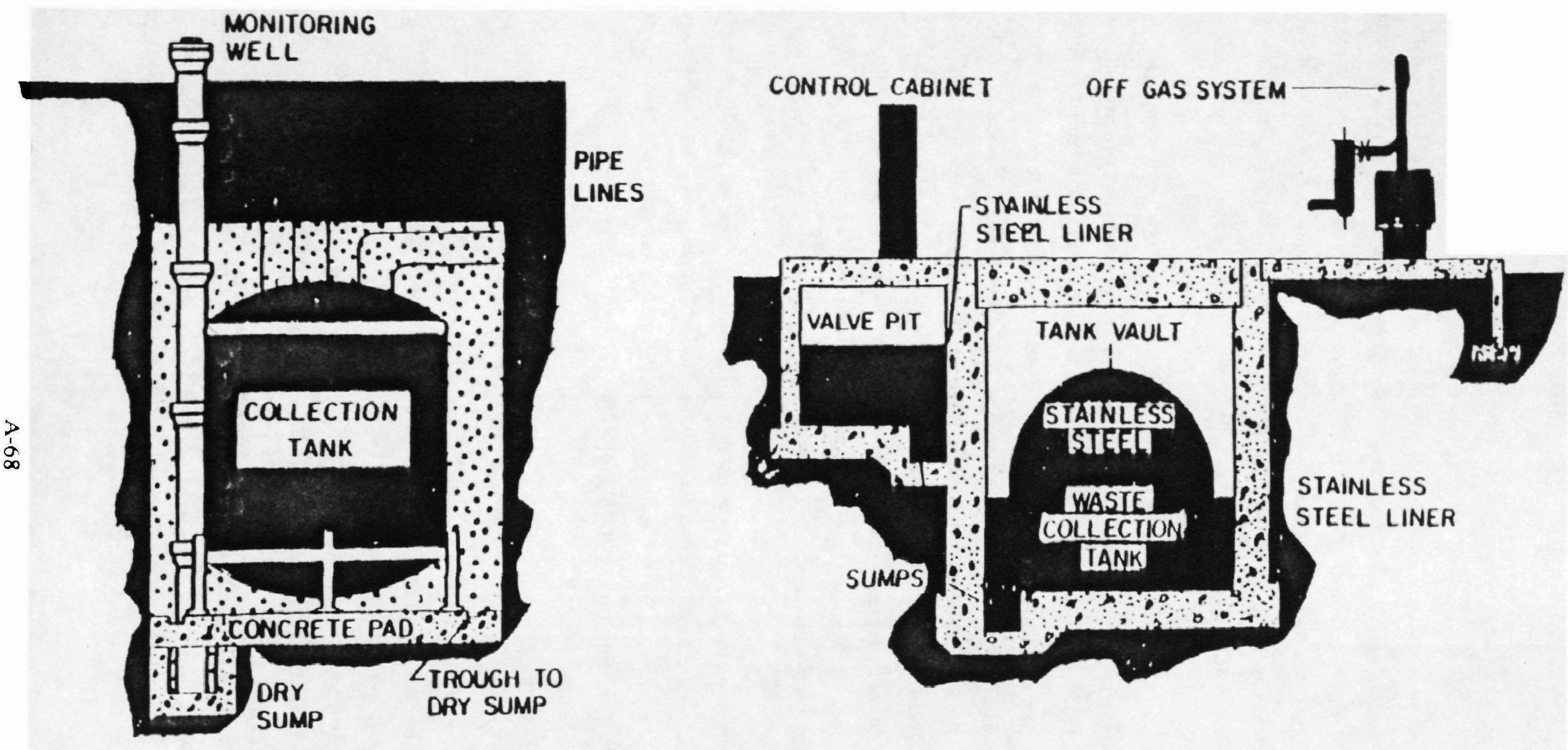
Lastly, wastes characterized as TRU by ORNL resulting from heavy element reprocessing and a multitude of other operations are stored as sludges in two types of tanks at ORNL. The Melton Valley Storage Tanks (MVST) are stainless steel tanks contained in a stainless steel-lined concrete vault (Figure 3). Each vault is equipped with a sump system that has an alarm. There are a total of 8 MVST's containing a total of 51,300 gallons of sludge. Sludges totaling 65,000 gallons are also stored in six Gunite tanks with approximately 60% of the total volume being contained in Gunite tank W-10. The Gunite tanks are single-walled tanks that lack ground-water monitoring but are equipped with sumps with alarms (Figure 4). Formerly, these tanks were used to store wastes prior to evaporation and disposal by hydrofracture, a practice which has been discontinued.

At this time, the Gunite tanks are inactive and ORNL has yet to identify a removal, handling and solidification process for the residual sludges they contain. Conversely, liquid TRU wastes are currently added to the second-generation MVST tanks as evaporation/concentration operations permit.

4. Treatment

Currently, there is no facility at ORNL for processing RH-TRU wastes. However, funding for a Waste Handling Pilot Plant (WHPP) has been appropriated. The WHPP is planned as a minimal processing facility for repackaging and WIPP certification of RH-TRU wastes. The WHPP feasibility study was completed in 1984 with construction on the facility scheduled to begin in 1991. Existing plans call for construction to be completed and the plant operational by 1996. Since 94% of DOE's inventory of RH-TRU wastes are stored at ORNL, it is conceivable that the WHPP may serve as a central processing facility for RH-TRU wastes. Such wastes could be transported from INEL and Hanford, for example, for processing at ORNL once the WHPP is on line.

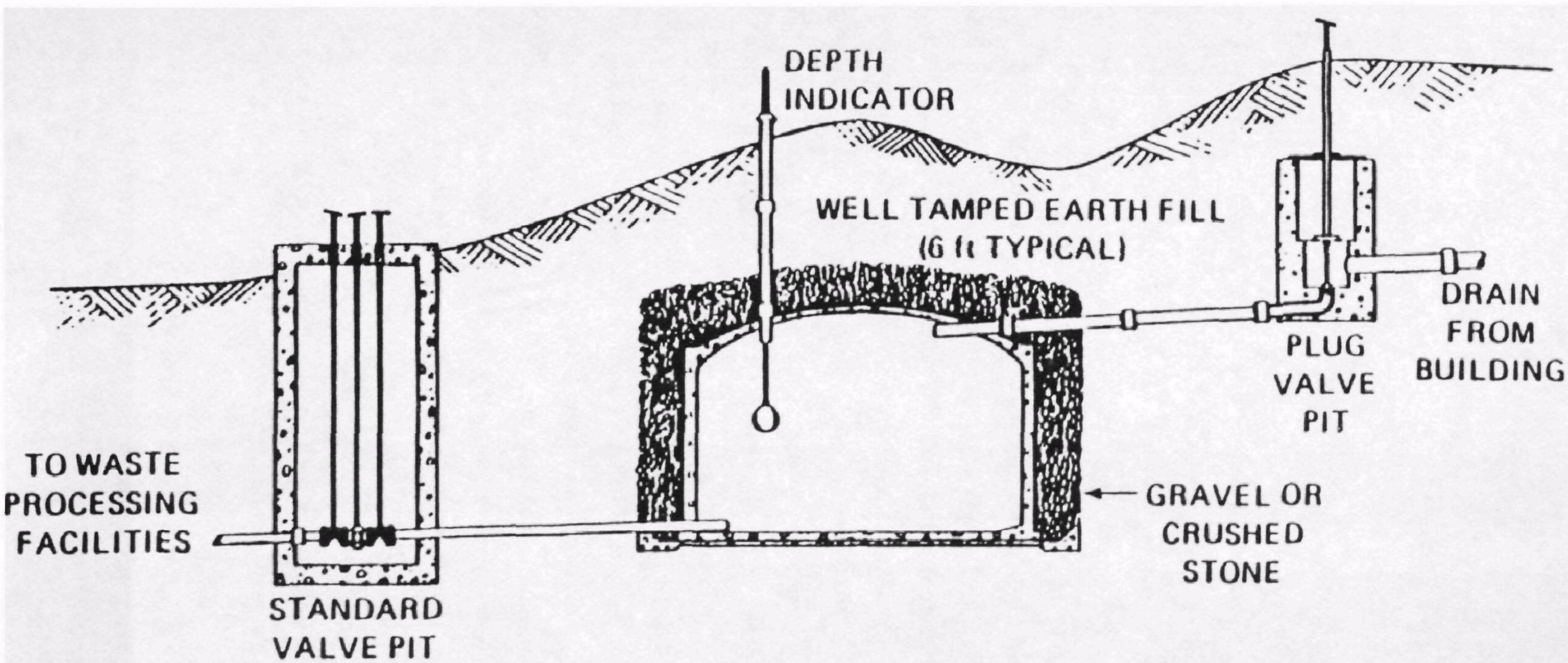
FIGURE 3
COMPARISON OF EARTHEN PIT VERSUS VAULT-TYPE TANKS



EARTHEN PIT

VAULT

FIGURE 4
TYPICAL CONCRETE (GUNITE) WASTE TANK INSTALLATION



5. Disposal

Disposal of all certified TRU waste will be at the WIPP which is scheduled to start receiving waste in October, 1988.

D. MONITORING:

ORNL has developed a remedial action program to control existing and future ground-water contamination and investigate potential sources of continuing releases. Because of the complexity of the hydrogeology and the extent of contamination, the ground-water monitoring program was based on a "Waste Area Groupings" (WAG) approach rather than the traditional RCRA array of wells up- and down-gradient of each unit. The program uses information from US Geological Survey (USGS) studies, an ORNL-developed ground-water strategy; geology, hydrology, waste management reports and research results; an inventory of solid waste management units (SWMUs) identified at ORNL; and other available data and information. This approach is based on grouping 250 formerly identified SWMUs, which have been grouped into 20 WAGs. Each WAG undergoes hydrogeologic review and characterization. The review includes installation of piezometer wells which permit delineation of flow patterns and some preliminary characterization of the uppermost aquifer.

Secondly, additional wells which are installed on WAG perimeters for water quality determinations are used to establish priorities. A Remedial Investigation/Feasibility Study (RI/FS) constitutes the third phase of the program and is intended to confirm ground-water contamination including delineation of SWMU's within WAGs which include TRU sites. The ground-water flow system and vertical gradients are ascertained using data obtained from hydro-static head measuring stations. These stations are three well clusters set at distances of 200, 300, and 400 feet connecting the WAGs. Because ground-water monitoring is on the perimeter of the WAG, the nature of the contaminants found in the ground water, flow paths etc. is used to identify the facility contributing to contamination. Typical ground-water wells are depicted in Figures 5 and 6.

To date, there are 830 ground-water monitoring wells at ORNL. Of this number, 258 are newly constructed WAG perimeter wells, 90 are new piezometer wells, and 27 are new hydrostatic-head measuring stations. The extent of wells required for the RI/FS for the SWMUs have not been determined to date.

FIGURE 5
MONITORING WELL SPECIFICATIONS

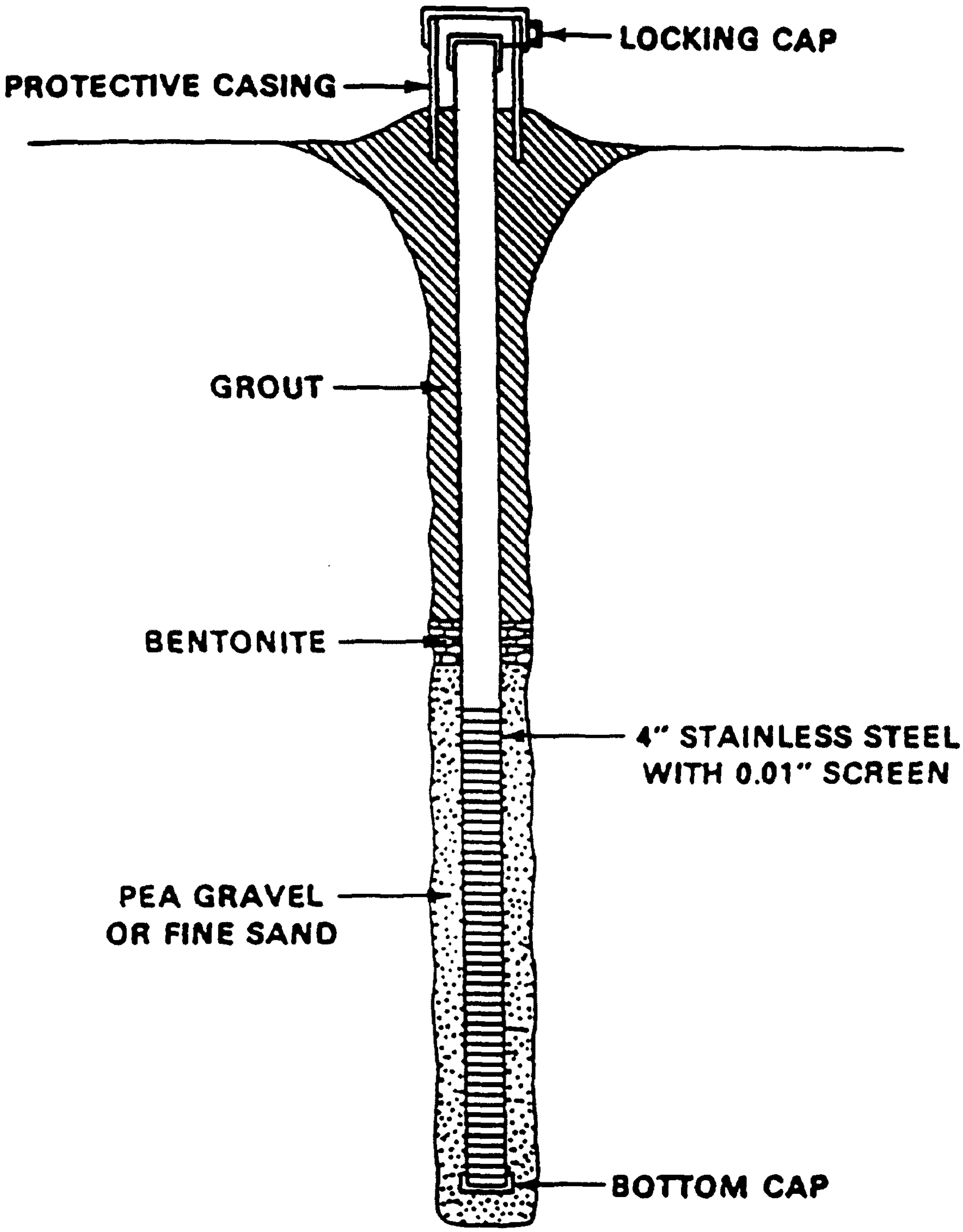
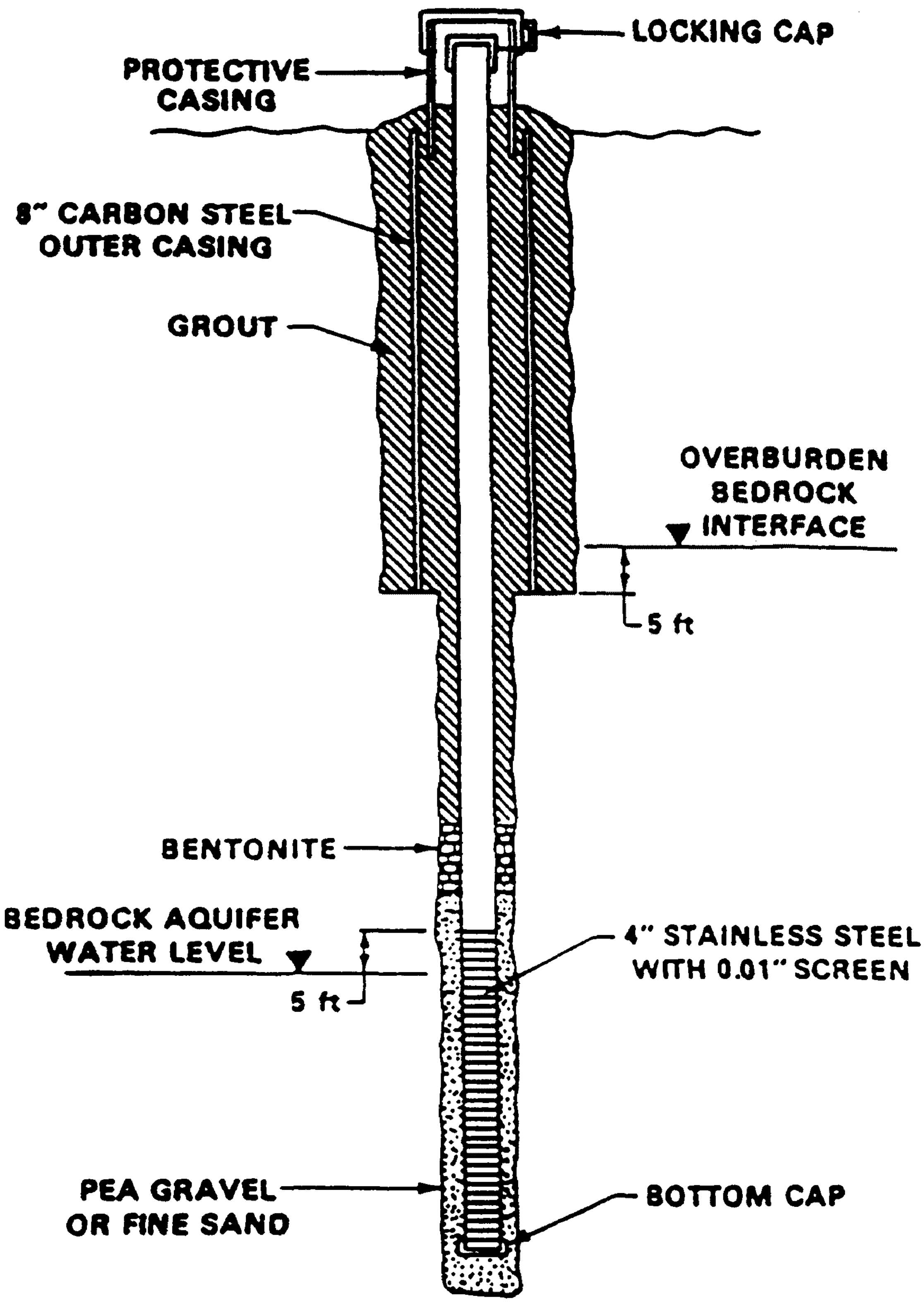


FIGURE 6
MONITORING WELL SPECIFICATIONS



Ground-water flow rates in the area can vary from one to 100 feet per year with typical conductivity of 10^{-5} centimeters/second (cm/sec) detected in ground water and at the burial sites. To date, limited chemical contamination has been observed in ORNL ground water. It should be noted that although it appears that a comprehensive ground-water monitoring program has recently been developed, study results were not made available to the task force. ORNL personnel did, however, indicate that data from the current monitoring system could not be used to meet RCRA requirements.

E. AUDITS/ASSESSMENTS:

ORNL operates under the standard DOE management system. DOE headquarters issues Orders which are then interpreted and narrowed in scope by DOE Oak Ridge Operations as appropriate. Typically, audits of waste management, compliance and environmental reviews are performed by ORNL's Department of Environmental Management, Energy Systems' Environmental and Safety Activities Office, DOE/Oak Ridge Operations Headquarters Lead Programs and an independent consultant to Energy Systems. Additionally, both EPA Region IV and the State of Tennessee tour the facility biannually although no formal inspection has been performed by either Agency to date. The State of Tennessee has EPA-delegated authority for all programs with the exception of mixed waste and the Hazardous and Solid Waste Amendments, 1984.

F. SECURITY:

Security at ORNL is maintained 24 hours a day by armed guards. This practice is consistent with that observed at other DOE operations.

G. RCRA EQUIVALENCY:

Insofar as ORNL has identified TRU waste management operations for newly generated and retrievably stored wastes, those practices appear to be comparable to RCRA requirements. However, there are areas where deficiencies can be identified because ultimate disposal parameters have not been determined such as:

- disposal of RH-TRU wastes is contingent on construction of the WHPP facility.

- the absence of a disposal plan for sludges stored in the single-walled Gunite tanks and the Melton Valley tanks; no disposal plan for wastes stored in stainless steel wells.
- absence of "RCRA" ground-water monitoring wells.
- no chemical analyses of wastes.
- the possession of a fair amount of potentially "non-certifiable" TRU wastes.

H. ACTION ITEMS:

None identified.

I. APPENDICES:

Briefing packages on:

1. Overview of Site Organization and Mission
2. ORNL RCRA Compliance Strategy and Status
3. TRU Waste System Description
4. Waste Examination and Certification
5. ORNL Hydrology and Ground-Water Monitoring
6. Independent Review and Oversight

J. DISTRIBUTION:

MEWS task force Distribution List

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Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
The Rocky Flats Plant
Golden, Colorado
December 9, 1987

PURPOSE:

On December 9, 1986, the Mixed Energy Waste Study (MEWS) task force visited the Rocky Flats Plant (RFP) near Golden, Colorado. Those present were members of the MEWS task force, Lou Johnson from EPA Region VIII, representatives of Department of Energy (DOE) Headquarters, DOE Albuquerque Operations Office, DOE Rocky Flats Area Office, DOE Rocky Flats Plant, Rockwell International (contract-operator of RFP), and personnel from DOE's Idaho National Engineering Laboratory (INEL), Savannah River Plant (SRP), and Hanford. No attendance list was compiled.

The objectives of the visit were to be briefed on the operations of RFP, the waste management system, and to review the transuranic (TRU) waste management facilities and practices.

SUMMARY:

Since there is no high-level waste (HLW) at RFP, the briefings were all related to TRU waste production and management. There were descriptions of the processes and facilities in which wastes are produced, how those wastes are collected and treated (if necessary), packaged, and transported. Discussions also covered administrative controls such as radiation safety, document control, reviews of facility construction and operational safety, environmental monitoring, quality assurance, CERCLA activities, security, audits, and operator training.

The major findings were:

- RFP generates no HLW.
- RFP generates more TRU waste than any other DOE facility;

- Almost all TRU waste streams at RFP have RCRA-hazardous chemical components which are not known quantitatively. They are known only qualitatively from by their use in the processes that generate these streams;

- Both liquid and solid TRU waste streams exist;

- There are no buried TRU waste tanks;

- All TRU waste packages leaving the site are certified for disposal at the Waste Isolation Pilot Plant (WIPP);

- Approximately ninety-nine percent of the TRU wastes are sent to INEL for storage. One to two percent is classified for security reasons and sent to the Nevada Test Site (NTS) for disposal;

- Documentation and security appear to exceed RCRA requirements; and

- DOE stated that mixed TRU waste is exempt from RCRA compliance under an agreement among RFP, the Colorado Department of Health, and EPA Region VIII.

REPORT:

A. FACILITY DESCRIPTION:

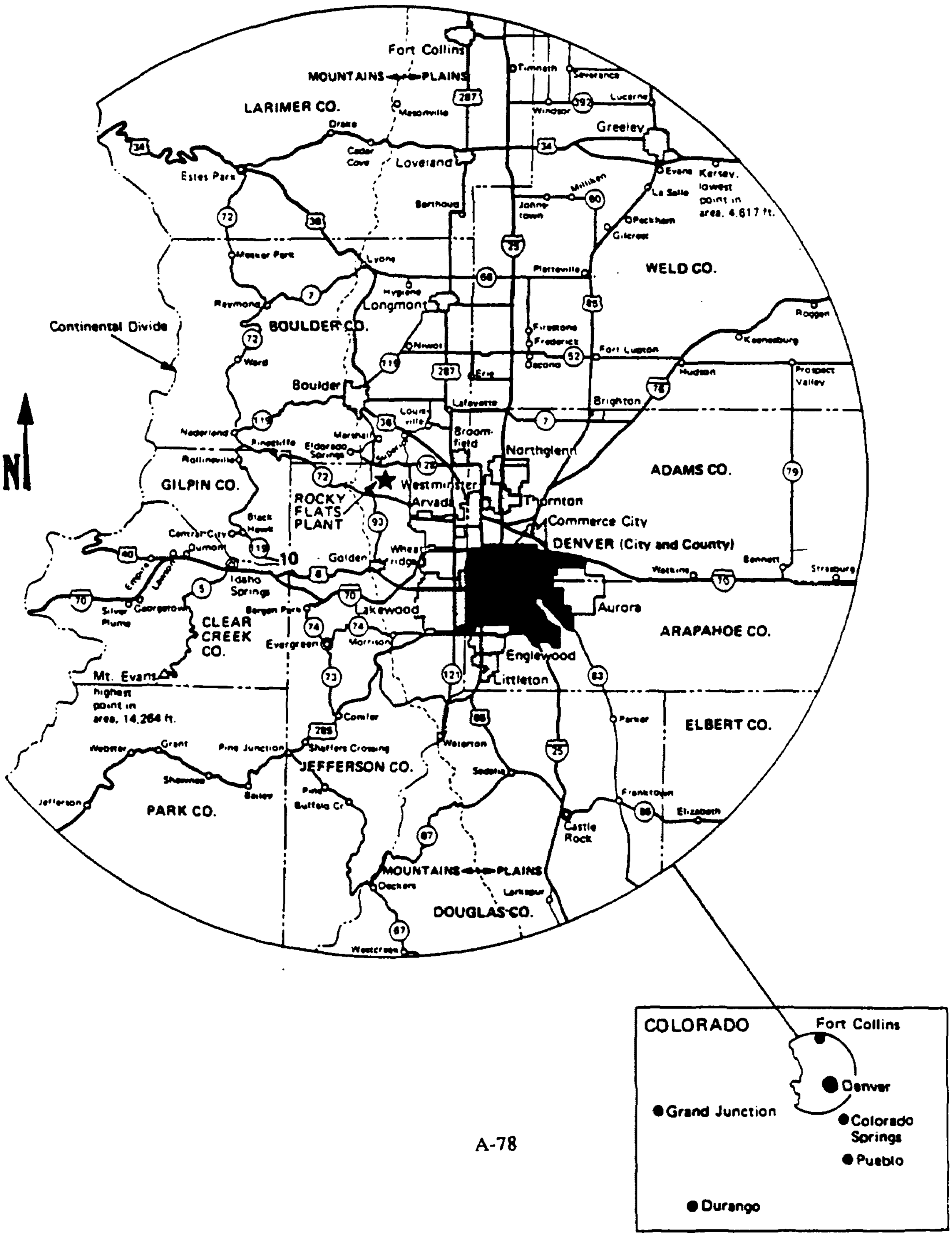
The RFP is located about 20 miles northwest of downtown Denver, Colorado and just east of the Front Range of the Rocky Mountains (Figure 1). The 6,500-acre reserve is on a generally grassy plain with a thin, gravely topsoil underlain by 20 to 50 feet of thick, coarser, clayey gravel. The plant is located on 350 acres near the center of the reserve.

Operations began in 1953 and have been continuous since. The RFP has an annual budget of $400 million and employs about 5,500 people. The main mission for RFP is the development and production of nuclear weapons components from plutonium, beryllium, depleted uranium, and stainless steel.

B. HIGH-LEVEL WASTE:

No HLW is generated, stored, or disposed of on the site.

FIGURE 1
GENERAL LOCATION OF THE ROCKY FLATS PLANT



C. <u>TRU WASTES</u>:

There are three sources of plutonium for the operations at RFP: (1) the DOE production facilities at SRP and Hanford supply fresh plutonium; (2) fission assemblies from old weapons are sent from Pantex and recycled; and (3) recovery of plutonium from liquid and solid production wastes. Once solidified, the plutonium metal is cast, machined, or otherwise formed into the necessary shapes.

1. Generation

TRU wastes are generated primarily from the chemical processes for recovery and the machining of plutonium; these sources determine the major separation between liquid and solid wastes, respectively. There were about 100,000 cubic feet of TRU waste generated in FY 1986.

2. Management

Solid TRU wastes are typically items contaminated during the processing of plutonium metal, e.g. gloves, paper, tools, or machine parts. The wastes are assayed to determine whether the amount of plutonium in them makes it economically reasonable to recover the plutonium. If recovery is found to be uneconomical, the waste may be cut, compacted, or washed, depending on the nature of the material. The wastes are then placed in an 11-mil PVC bag which is sealed with tape and placed in either (1) a 90-mil, rigid polyethylene drum liner which is sealed and placed inside a 55-gallon DOT 17-C metal drum; or (2) a 50-mil fiberboard liner which is wrapped in an 11-mil PVC wrapper, sealed, and placed in a 4'x 4'x7' 14-gauge corrugated metal welded box. The drums and boxes are sealed with tamper-indicating mechanisms. These containers are then stored in buildings to await certification processing (discussed later).

Liquid wastes, mainly from the plutonium recovery processes, are sent to above ground, in-building storage tanks. The wastes are held for up to one year while waiting for treatment. Examples of chemicals in the mixed wastes are hydrofluoric acid, nitric acid, potassium hydroxide, sodium hydroxide, carbon tetrachloride, and various reagents. If the tanks are not double-walled, they have berms around them for secondary containment; all piping is double-walled. Depending on the nature of the waste, it may be treated with any or all of the following: neutralization, precipitation, flocculation, clarification, filtration, and drying (Figure 2). There is also processing for organic and miscellaneous liquid TRU wastes. E ventually, all of the liquid TRU wastes are mixed with cement, placed in the previously described 55-gallon dru ms, and stored until the certification process begins.

All movements of materials on the site are controlled and documented. Armed guards are required for non-pipeline shipments made within the plant. Materials balance checks are made regularly and documented. Each waste container is given a unique number and will be tracked through to disposal. All shipments are accompanied by a hard-copy load list and the load list is electronically sent to the destination prior to the shipment leaving the site. In addition, off-site shipments will eventually be monitored by satellite. Following the site visit, it was learned that a system is in place at NTS and has been initiated for INEL to acknowledge receipt of the TRU shipments and waste containers.

3. *Storage and Disposal*

Prior to shipment off-site, each TRU waste container is tested for compliance with the WIPP Waste Acceptance Criteria (WIPP/WAC; Figure 3). Those drums containing compactible wastes are emptied. The waste is compacted and placed in boxes. Each container is then radioassayed before being sent to the real-time radiography (RTR) facility. If the package meets the WIPP/WAC, it is marked, labeled, and signed off as certified for disposal in the WIPP. If it does not meet the criteria, it is returned to the facility in which it was originally packaged to be repackaged in accordance with the criteria; it is then retested. This procedure is repeated, as necessary, until the package is in conformance. The containers are then placed inside storage buildings until they are shipped to INEL for storage.

The shipments are made in specially constructed enclosed railcars called "ATMX." These cars hold up to 140 drums or 24 boxes. Beginning in October, 1988 these shipments will go directly to WIPP and will use the new TRUPACT overpack on railcars and trucks. The TRUPACT-I is designed to hold 36 drums; there will be two TRUPACTS per railcar and one per truck.

FIGURE 2
BUILDING 374 - LIQUID WASTE TREATMENT FLOW DIAGRAM

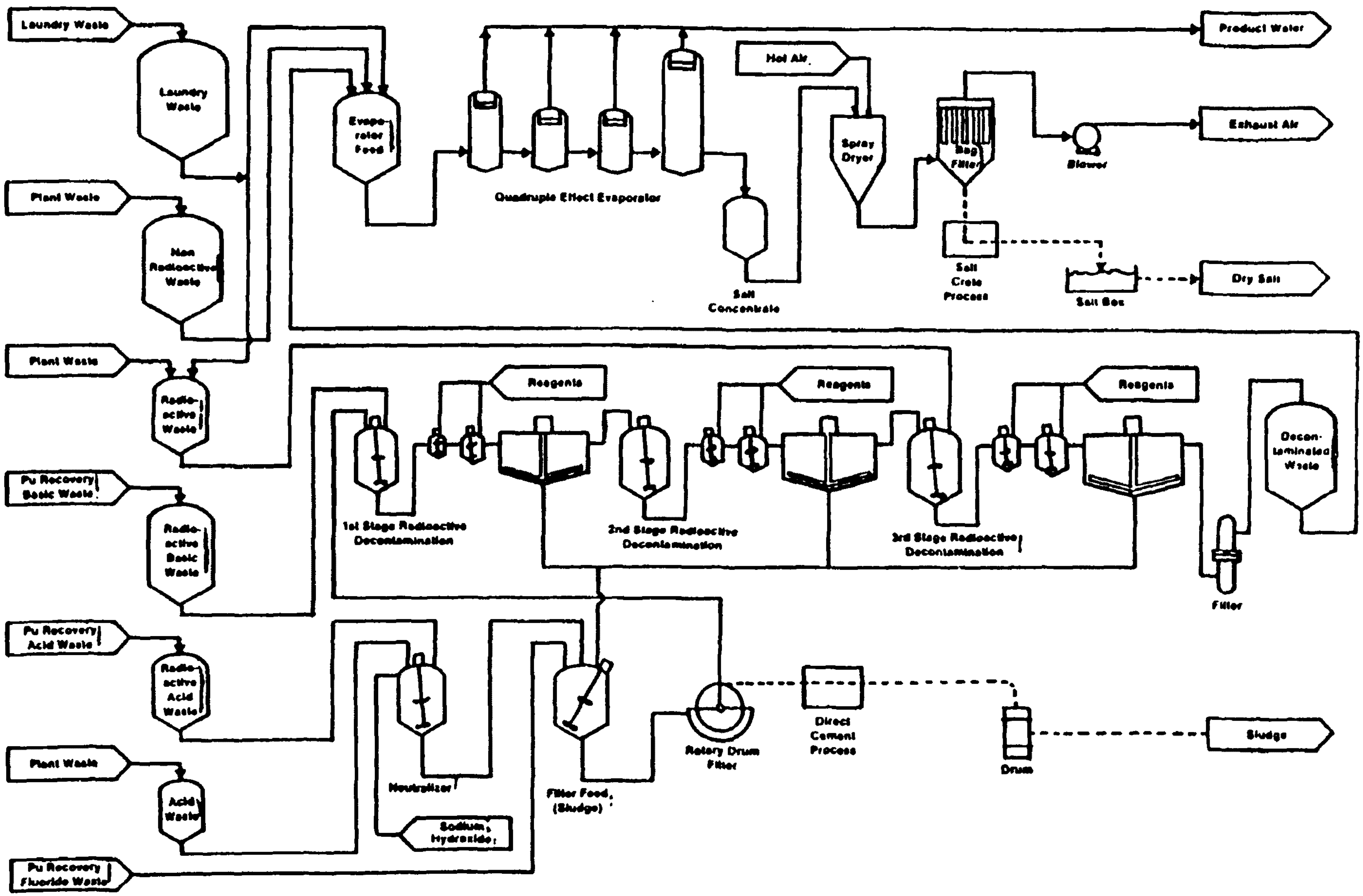
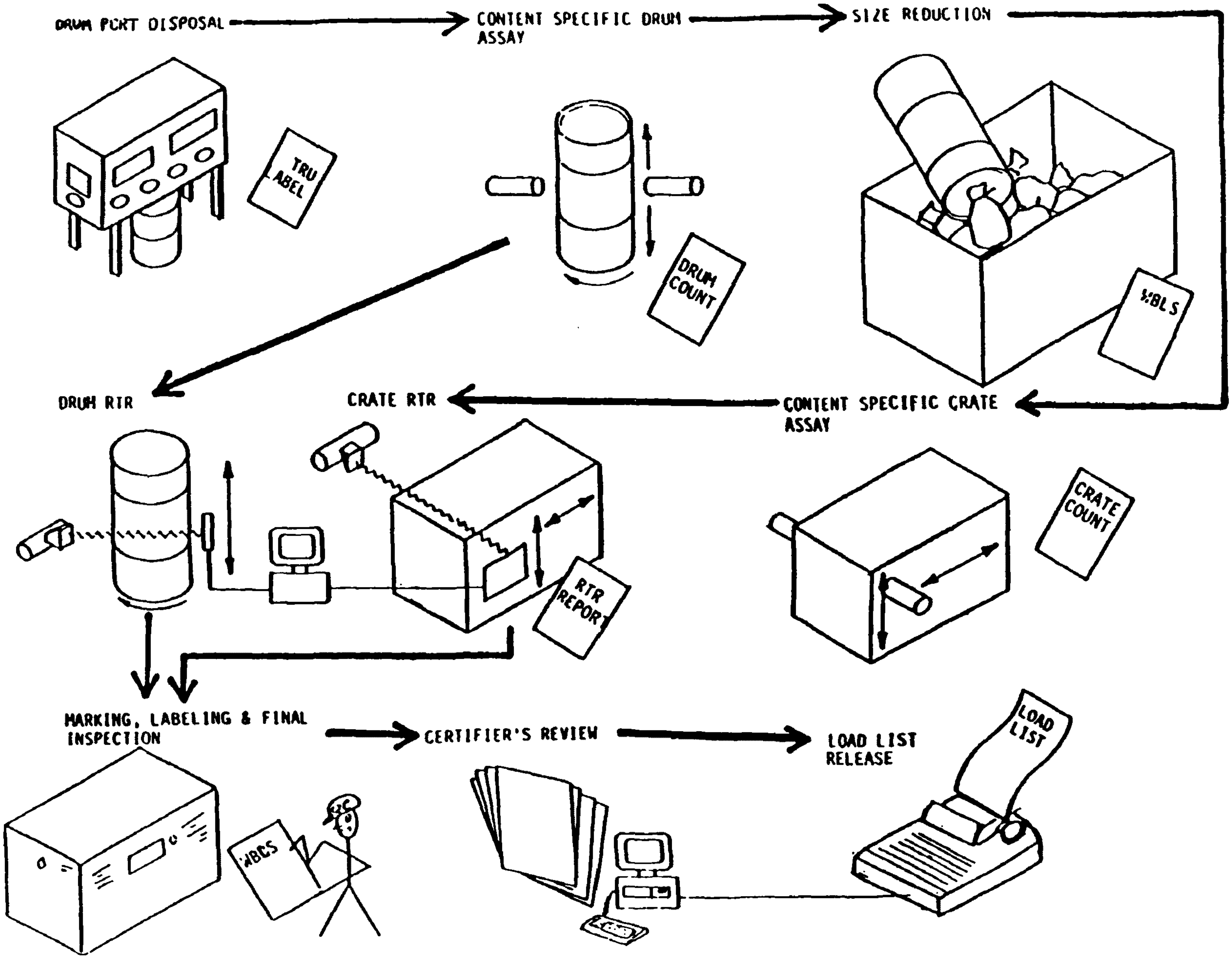


FIGURE 3
WIPP WASTE ACCEPTANCE CRITERIA FLOW DIAGRAM



D. ENVIRONMENTAL MONITORING:

The environmental program centers on the detection of radiation in air, soil, and water. Air monitoring is continuous at all 50 RFP air exhaust systems as well as 51 sites away from the plant. Annual soil sampling is done at one- and two-mile radii around the plant to determine the distribution and migration of plutonium. Surface water samples are taken at six locations and drinking water is taken from nine community water systems. Ground-water monitoring began in the early 1960s for radionuclides.

The RFP is beginning to install RCRA-quality ground-water monitoring wells. In 1986, 70 RCRA-quality wells were installed and more are scheduled. Data from these wells are unavailable.

Public meetings are held monthly to share the data from all monitoring programs.

E. OVERSIGHT:

The DOE stated that mixed TRU waste management at RFP is exempt under a recent RCRA compliance agreement with EPA and the State of Colorado. The State monitors air, soil, and water independently from the DOE; EPA participates in the air monitoring.

The RFP operates under the standard DOE management system. The DOE headquarters issues orders which are then interpreted and narrowed in scope by the Albuquerque Operations Office to fit site-specific conditions. This process continues down through the DOE Rocky Flats Area Office to the procedures written by Rockwell for the plant operators to follow. Audits are performed by all of the organizations under their jurisdiction as well as the WIPP/WAC Certification Committee. No independent outside audits are conducted.

F. SECURITY:

Security for the site is maintained 24-hours per day by armed guards and S.W.A.T. teams. Security is especially heavy around plutonium handling facilities.

G. RCRA EQUIVALENCY:

Most aspects of TRU waste management appear to be equivalent to RCRA hazardous waste requirements. The areas where TRU waste management appears to exceed RCRA standards include:

- Excellent process control with regard to the collection, treatment and transfer of TRU waste.
- Extensive administrative controls for the tracking of waste from generation through disposal.
- Excellent conceptual plan for final disposal of WIPP-certified TRU waste.
- Excellent security, including armed escorts for on-site solid TRU waste movements.

Areas where there seem to be potential problems with RCRA equivalency include the following:

- Lack of quantitative data on RCRA hazardous chemical components in the mixed waste; presence of such chemicals is usually known from their use during processing.
- Lack of RCRA-quality ground-water monitoring data; 70 RCRA-type wells have been installed and more are scheduled but no data is yet available.
- Lack of independent audit or inspection.

H. ACTION ITEMS:

The MEWS task force requested the risk level acceptability for equipment design and example copies of shipping documentation. (The examples of shipping documentation were received shortly after the visit).

I. DOCUMENTS OBTAINED:

To all member of the MEWS task force:

The Rocky Flats Plant (orientation booklet)
Briefing for EPA/DOE Technical Working Group on High-Level and Transuranic Waste

One copy of the following:

WO-4500-E, "TRU Waste Compliance Program for WIPP/WAC" (a representative Rocky Flats procedure)

"Rocky Flats Waste Streams" (Appendix C-3 from Part B permit application)

"Waste Management Units" (Appendix 1 from Part B application)
Typical report of environmental data from the monthly exchange meeting between Rocky Flats and the Colorado Department of Health

Latest WIPP/WAC audit report and the Rocky Flats response

"Transuranic Waste Certification and Transportation Documents," dated December 17, 1986.

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Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Savannah River Plant (SRP)
Aiken, South Carolina
December 2 - 3, 1986

SUMMARY:

Officials from the Savannah River Plant (SRP) provided an overview briefing of the facility's current hazardous, high-level waste (HLW) and transuranic (TRU) waste management practices. Subject areas included the Defense Waste Processing Facility (DWPF), the DWPF research and development program, tank farm operations, and TRU waste certification and storage operations. Tours of the above areas were also provided. The briefings and the tours were quite comprehensive, and provided the task force with a general understanding of the facility and methods for the treatment, storage and disposal of HLW and TRU waste. Both past and current methods were discussed.

Early in the briefings, attendees discussed definitions to clarify exactly what was meant by hazardous, HLW, TRU waste and mixed waste. SRP's definition of mixed waste included waste with both RCRA hazardous waste and radioactive waste, but did not encompass mixed HLW waste and TRU waste. Concern was also raised about to the period of time required for institutional controls in the definition of TRU waste. The group agreed to resolve the definitional differences at the next DOE facility.

Audits were also discussed and SRP highlighted their methods for appraisals, audits, and inspections. MEWS task force officials emphasized the importance of documenting independent oversight.

In general, SRP's methods for handling HLW appeared to equal or exceed RCRA requirements for hazardous waste tank design and construction, surveillance, inspection, and monitoring. However, the management program specifically focuses on the migration of radioactive rather than hazardous components. More information is needed to make a preliminary determination about TRU waste (i.e., specific types and amounts of hazardous chemicals commonly associated with TRU waste). Additional documentation will be necessary to demonstrate the capability of the existing ground-water monitoring system and the system planned for the future.

REPORT:

A. FACILITY DESCRIPTION:

The SRP is a 300 square mile DOE reservation located in South Carolina on the Savannah River. The SRP is engaged in the production of nuclear materials for defense purposes and research. DOE owns and administers the SRP; the facility is operated by Du Pont.

The SRP was constructed during the 1950's and is the nation's sole producer of tritium and plutonium-238 and is a major producer of plutonium-239. These isotopes are produced by absorption of neutrons in lithium (Li 6), neptunium-237 and uranium-238, respectively. The SRP has a budget of $1.2 billion/year for the operation of three nuclear production reactors, two nuclear production reactors on standby, one small reactor shutdown, two separations areas for processing irradiated materials, a fuel and target fabrication facility and the Savannah River Laboratory. Operations of the SRP include several hazardous waste and low level mixed waste facilities which are operated under interim status authorization from the South Carolina Department of Health and Environmental Control (DHEC).

Mixed liquid radioactive and hazardous waste are produced at SRP primarily for nuclear fuel reprocessing operations. Two facilities are equipped to chemically separate and purify the products from fuel and target assemblies irradiated in the reactors.

The major HLW storage areas for radioactive liquids, sludges, and crystallized salts (Figure 1) included in DOE's proposed option are adjacent to the F and H separations area (Figures 2 and 3). The HLW storage areas are linked to the separations area and to each other by pipelines with secondary containment. High level waste will be vitrified in the S-area (Figure 4) and the salt stone will be stored in the z-area. Three burial grounds totaling 195 acres between the F and H areas are used for controlled storage of solid radioactive wastes and interim storage at TRU waste. The reactors, separations area, and waste management areas are at least 4 miles from the nearest plant boundary.

FIGURE 1
SAVANNAH RIVER PLANT SITE OVERVIEW

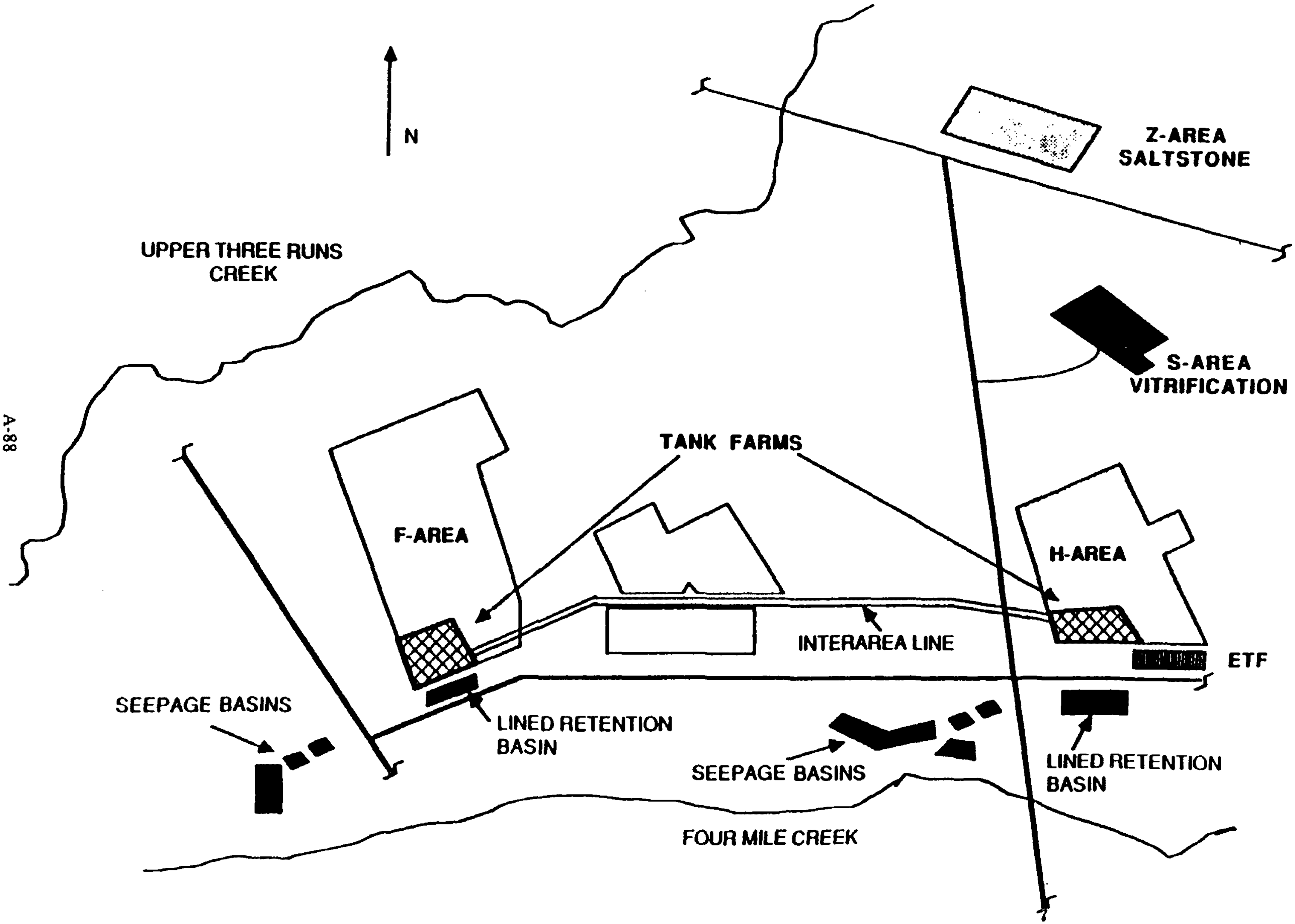


FIGURE 2
F-AREA TANK FARM

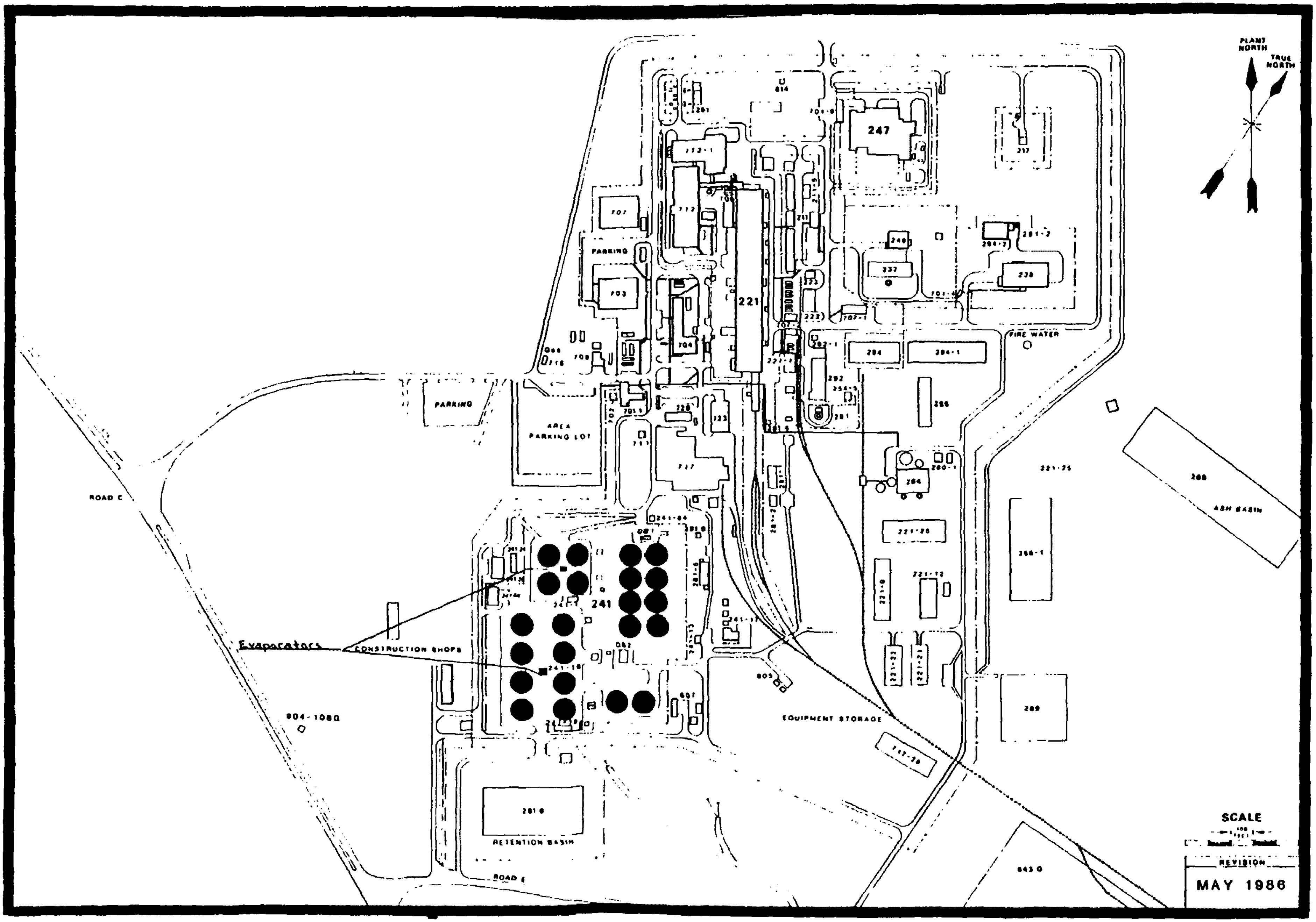


FIGURE 3
H-AREA TANK FARM

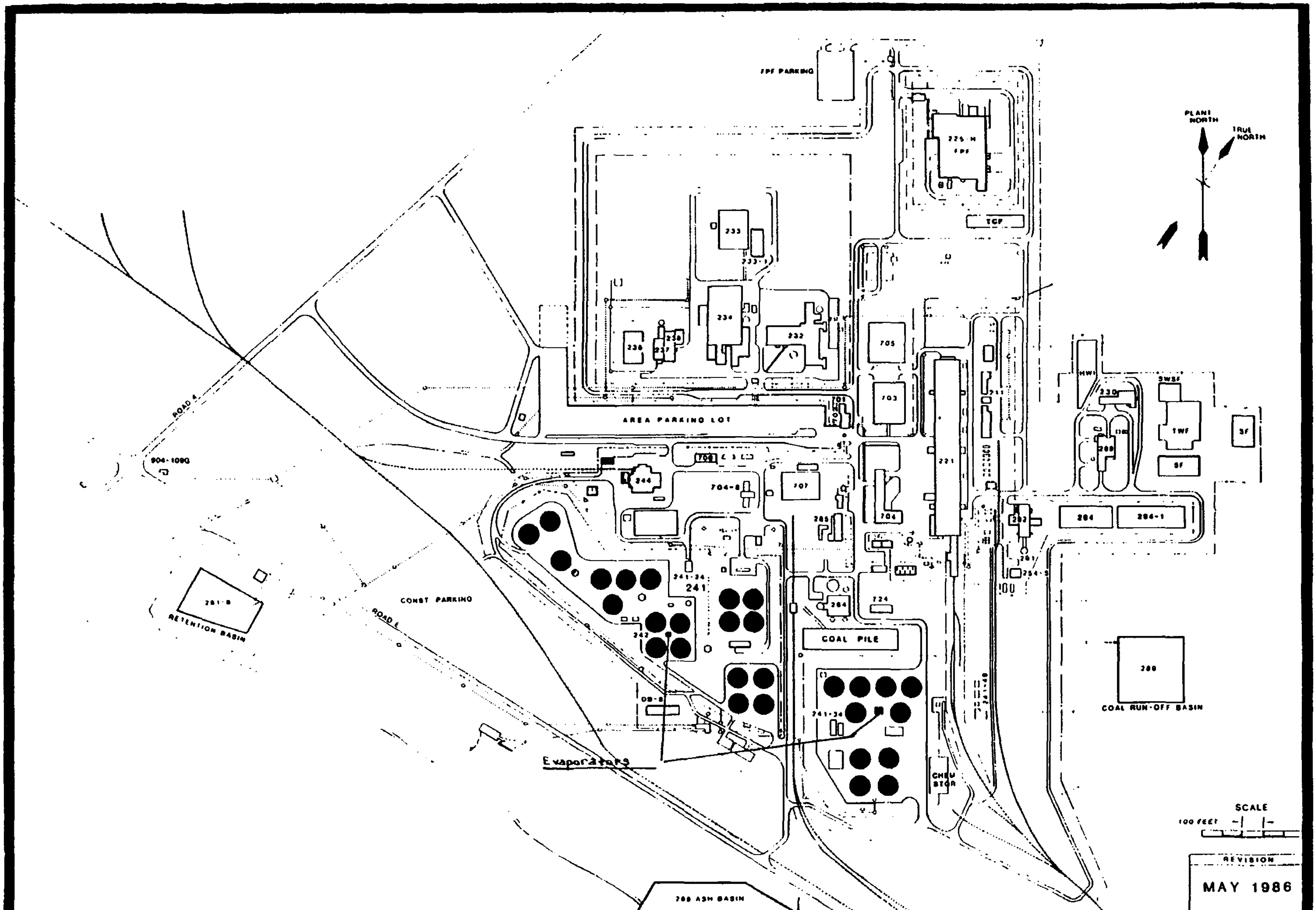
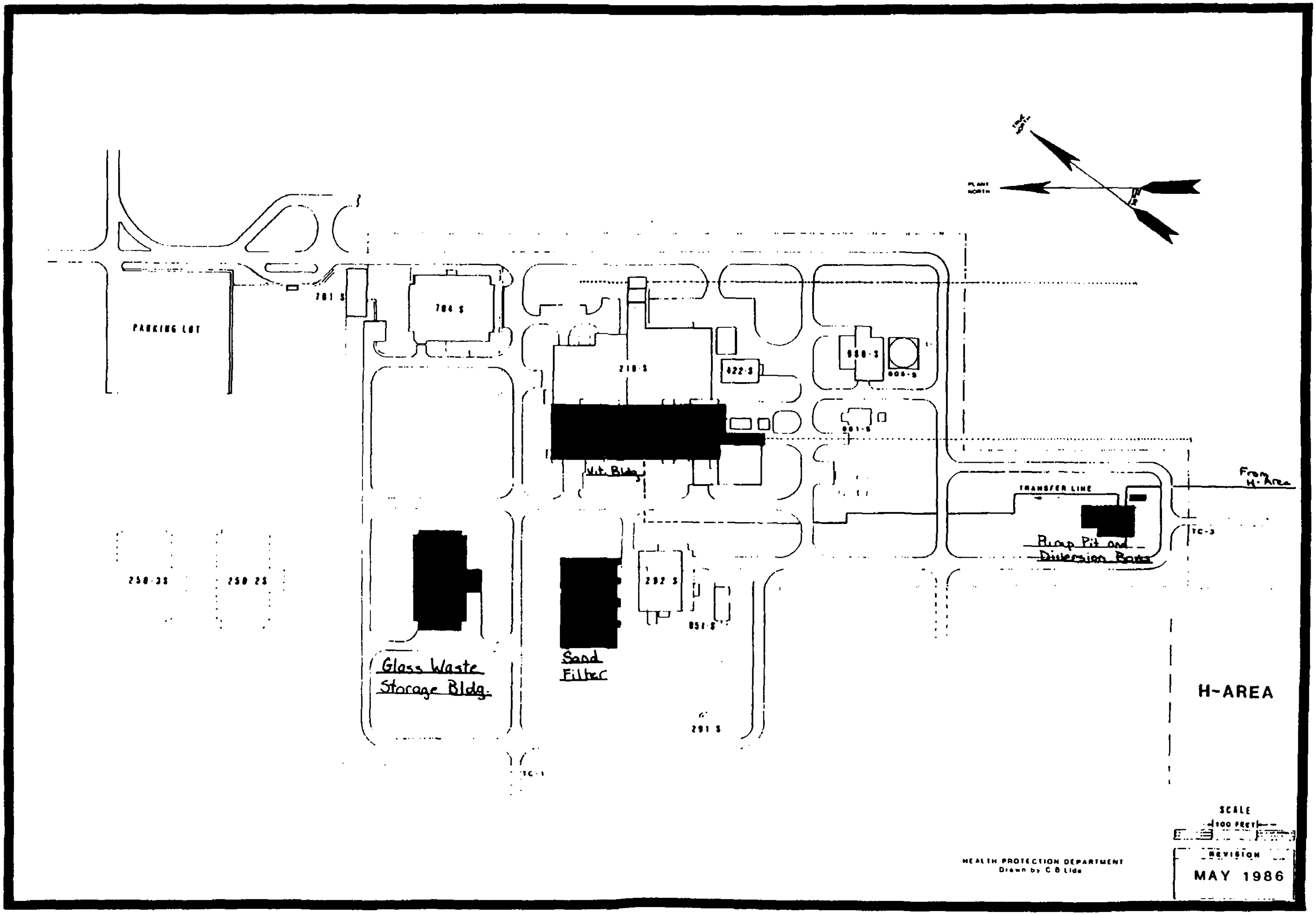


FIGURE 4
S-AREA VITRIFICATION FACILITY



B. OVERVIEW OF WASTE MANAGEMENT OPERATIONS:

An environmental impact statement on waste management activities for ground-water protection is being prepared to address waste management in particular. The EIS will not address sanitary landfills, HLW or TRU waste. However, it will address the publication of the draft EIS which is planned for April, 1987, and the final EIS which is scheduled for October, 1987. The SRP also plans to construct and operate an incinerator by November, 1991, for hazardous waste, low-level waste (LLW) and mixed wastes.

The SRP has a contingency plan and emergency procedures. Emergency and evacuation plans exist and drills occur regularly. The site also has an emergency operating center which is staffed 24 hours/day with direct access notification to key personnel by radio alert.

The HLW is stored in tank farms which are within controlled, limited-access areas and are fenced and guarded by patrols. The HLW is contained in underground tanks which are not easily accessible and 24 hour surveillance is maintained by operations personnel. Contractor employees and subcontractors are subject to a drug testing program. TRU waste storage areas are similarly fenced and controlled.

C. HIGH LEVEL WASTE (HLW):

1. Generation

The SRP produces approximately 3 million gallons of HLW annually (Hanford has approximately two-thirds of the total; Idaho only approximately 3%). SRP's HLW consists of supernate (61%), salt cake (28%) and sludge (11%). Thirty-three million gallons of HLW is currently stored at SRP. While this is approximately 34% of DOE's total stored HLW, it contains 62% of the radionuclide acivity. Stored waste is blended with that which is currently produced. Options are under consideration regarding the final closure of the HLW tanks.

The supernate portion of the liquid waste, after aging, contains dissolved salts and radioactive cesium. This supernate is transferred to an evaporator for dewatering, and the concentrate from the evaporator is transferred to a cooled waste tank where the suspended salts settle. Cooling causes additional salt to crystallize. The supernate is returned to the evaporator for further concentration. This process is repeated until this portion of the waste has been converted to damp salt cake. The salt produced by evaporation of the aged supernate consists of $NaN0_3$, NAOH, Na_2C0_3, $NaN0_2$, Na_2S0_4, and NaAl(OH). The radionuclide concentration in the salt is approximately three times that of the supernate. This process continues until the liquid has been converted to a crystallized salt cake. The evaporator condensate from all HLW tanks is a mixed waste.

The sludge is composed primarily of oxides and hydroxides of manganese, iron, and to a lesser degree, aluminum. It contains essentially all of the fission products originally in the irradiated fuel except cesium, and essentially all of the actinides. The sludge also contains mercury. Trace elements and a wide variety of other hazardous constituents are present.

2. Treatment and Storage of High Level Waste

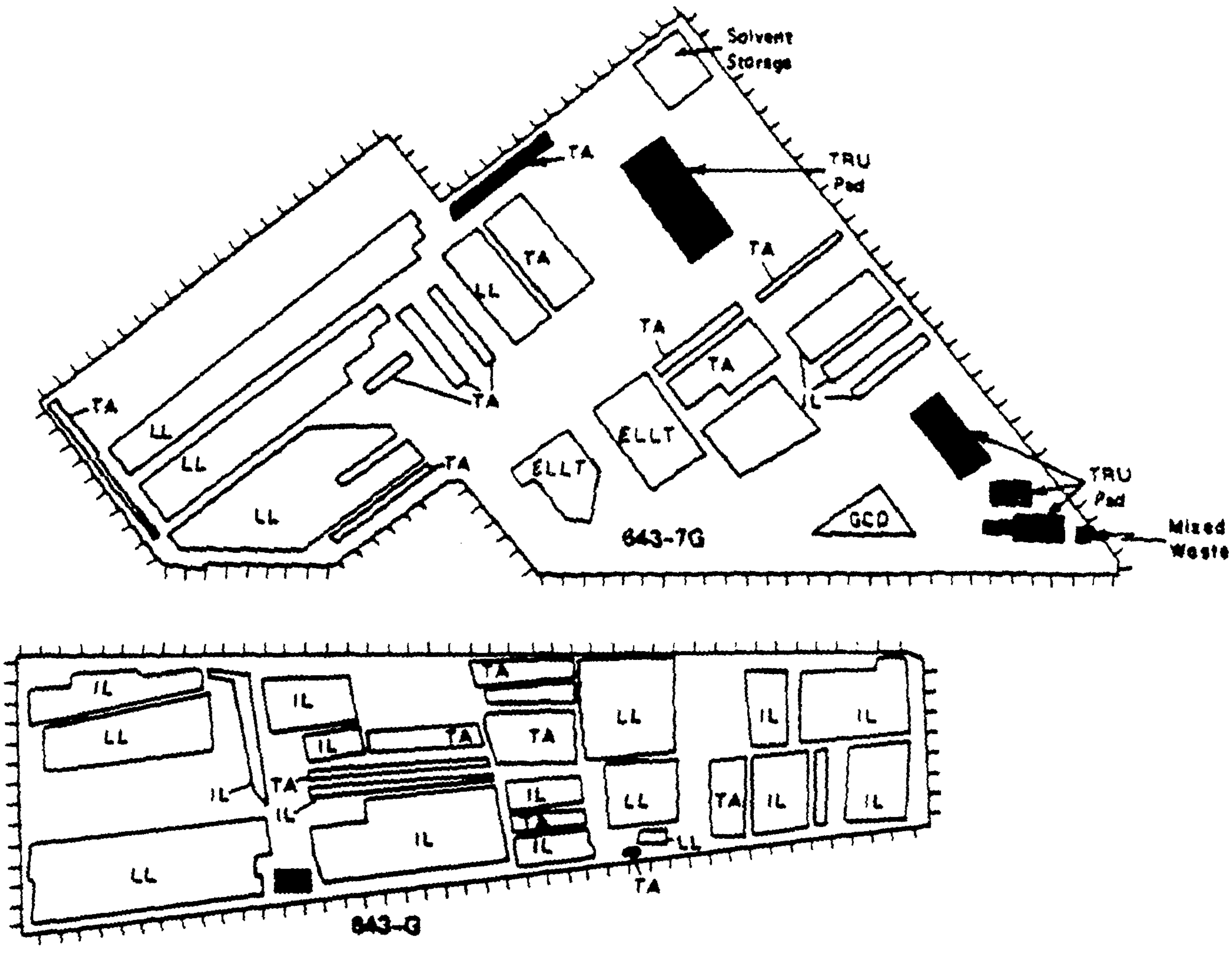
The Defense Waste Processing Facility (DWPF), currently under construction (46% complete), will vitrify HLW. The facility should be operational by 1990. *Vitrified waste will be* stored on-site until a repository becomes available (Figure 5). Decontaminated salt solution produced at modified facilities will be transfered to the DWPF. At the DWPF, the solution will be mixed with solidifying materials in an enclosed treatment facility (TETH) to form salt stone. The State of South Carolina DHEC has granted a TETF exemption; salt stone will be poured into above ground vaults which are permitted as an industrial waste landfill by the State. Ground-water monitoring is required.

Concern was raised about the TETF exemption because waste material may be stored for up to fifteen years before being processed. In addition, the exemption would impact HLW storage tanks further back in the process stream.

Areas F and H each have a large shielded "canyon" building for processing irradiated materials (fuel and/or targets), a waste concentration and storage system, and seepage basins. Recovery processes in the canyons generate liquid waste streams that contain most of the fission products. The wastes are made alkaline and flow through under-ground pipes by gravity from the processing buildings to the waste storage tank farm. The underground pipes are enclosed in a secondary concrete conduit for double containment or are double-walled with leak detection.

FIGURE 5
TRU WASTE STORAGE

NOTE: Blackened areas indicate areas which will be affected by DOEs proposed option.



LL — Low Beta-Gamma Waste
IL — Intermediate Beta-Gamma Waste
TA — Trench Alpha Waste
GCD — Greater Confinement Disposal
ELLT — Engineered Low Level Trench

Burial Grounds Showing Zones of Trench Alpha, Intermediate and Low-Level Beta-Gamma Waste, and Solvent Storage

Some concern was raised about the distance between leak detection devices in the pipes (approximately 1 mile). This distance could potentially impair the detection systems overall effectivness. A shorter distance between leak detection devices may indicate leaks faster and reduce the potential for external contamination.

The HLW waste is stored in large underground tanks in these areas. The method of storage does not eliminate options for long-range waste management. Fresh (high heat) waste is aged for one to two years to permit settling and the decay of short-lived fission products. During this period, insoluble materials settle to form a layer of sludge at the bottom of the tank. The sludge is a mixture of oxides and hydroxides of manganese, iron and aluminum; small amounts of uranium, plutonium, mercury and essentially all of the fission products orginally in the irradiated fuel except cesium. After aging, the supernate containing dissolved salts, primarily sodium nitrate and radioactive cesium, is transferred to a continuous evaporator. Fresh low heat waste may be transferred directly to this evaporation for volume reduction.

The separations process began operating in F-Area in 1954 and in H-Area in 1955, and waste storage began immediately (Figures 6 and 7). Since that time, 51 waste tanks have been used to contain the 33 million gallons of high-level liquid waste at the SRP.

Nine tanks have leaked radioactive waste from the primary tank into the annulus between the primary and secondary tanks. These are Tanks 1, 9, 10, 11, 12, 13, 14, 15, and 16. Of the nine primary tanks that have leaked into the annulus, only one (Tank 16) has leaked any waste into the surrounding ground, as verified by radiological analyses of ground-water samples drawn from wells in the vicinity of the tanks. No samples were taken to assess chemical migration. Tanks 9, 14 and 16 have leaked large volumes of wastes into the annulus. One single-wall tank (Tank 20) has possible leaks, but these are well above the level of contained wastes. No waste was detected outside the tank. The tank has since been emptied.

All of the waste tanks are below ground, and are built of carbon steel and reinforced concrete, with four different designs (Figure 8). Three designs have double steel walls and bottoms, forced water cooling systems and are used primarily for high-heat waste and waste concentrate; the fourth design has a single steel wall directly supported by the reinforced concrete, has no orced cooling, and is used primarily for low-heat waste and concentrate.

FIGURE 6
F-AREA HIGH LEVEL WASTE TANKS BY NUMBER

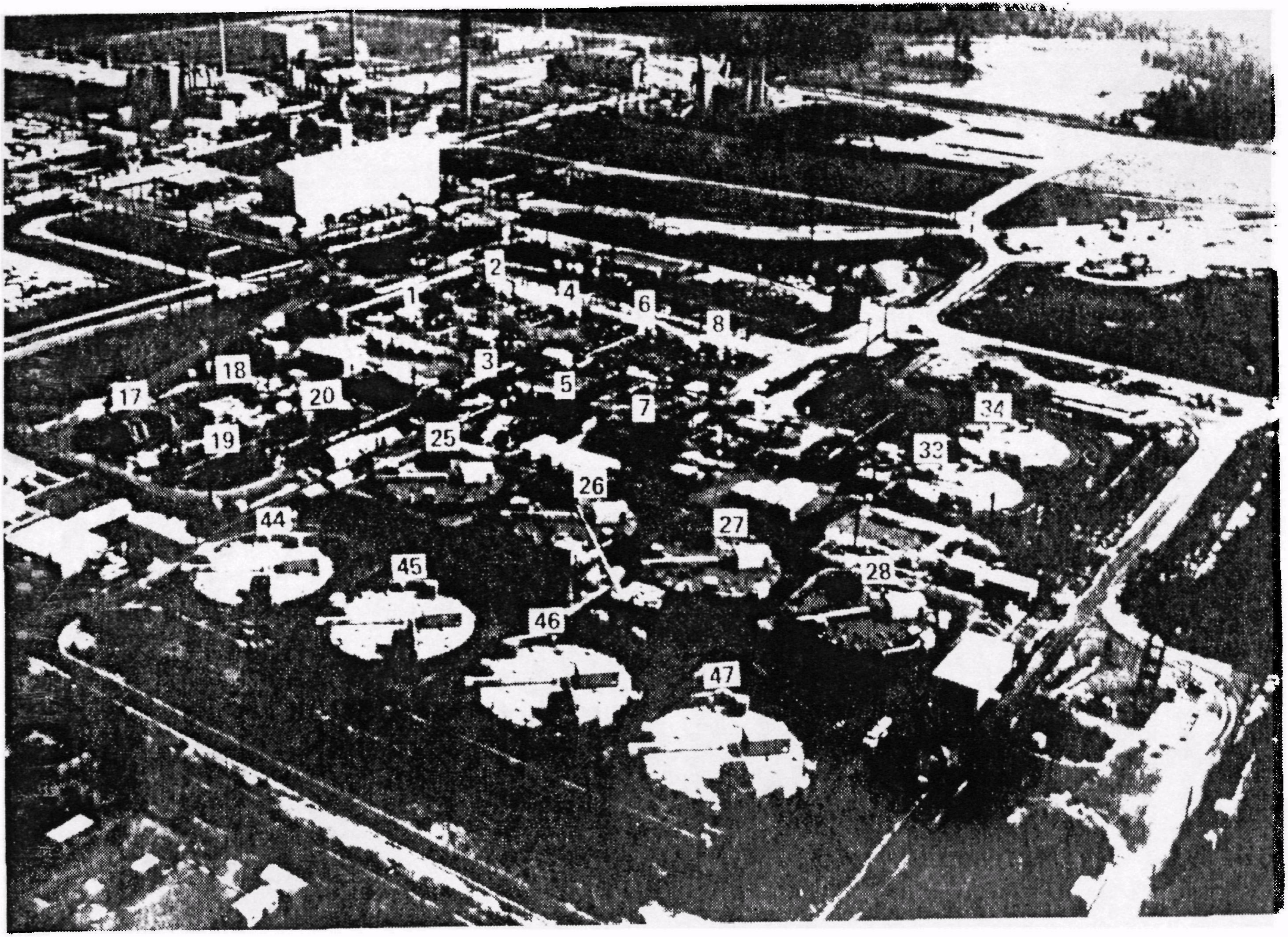


FIGURE 7
H-AREA HIGH LEVEL WASTE TANKS BY NUMBER

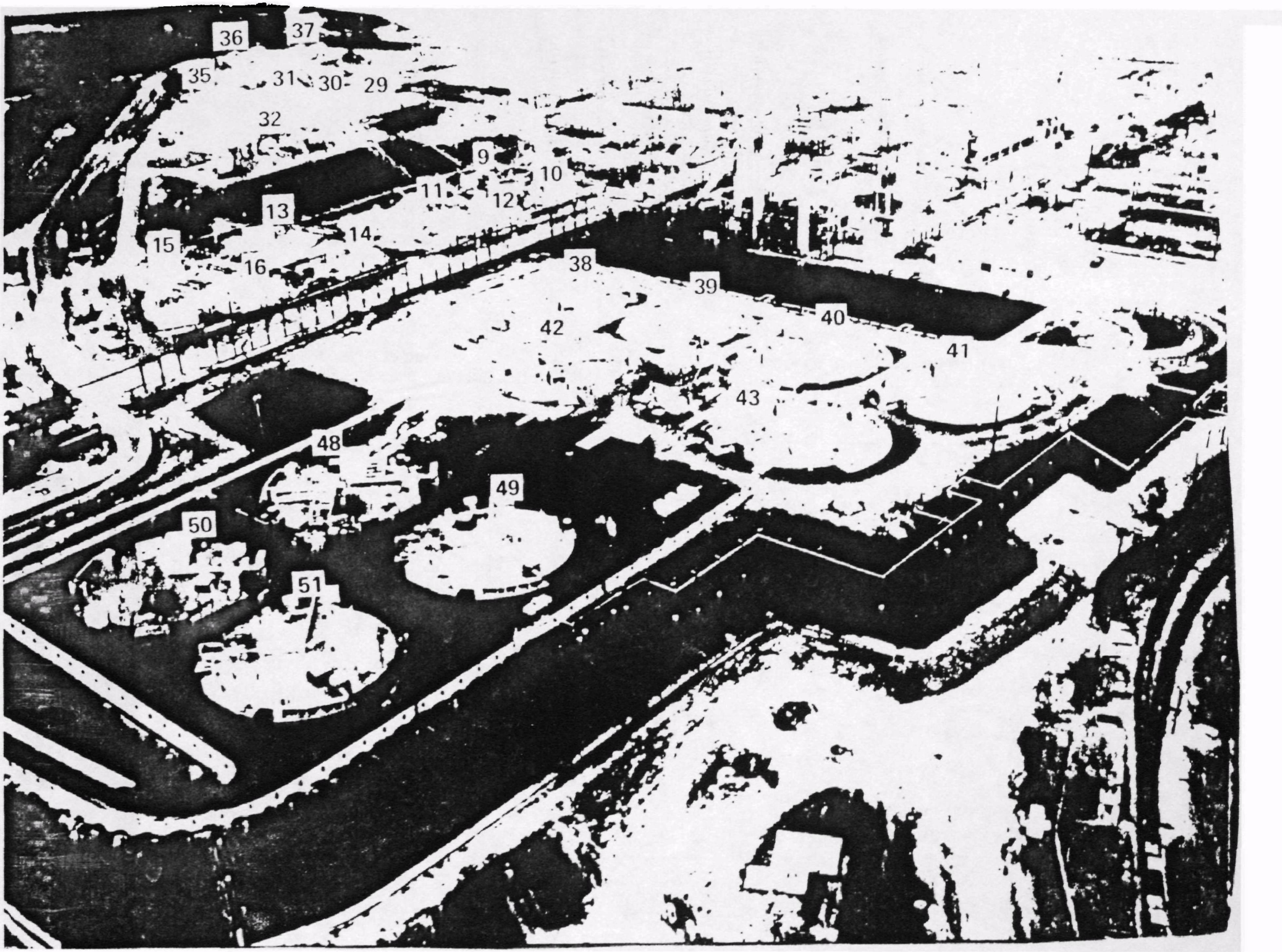
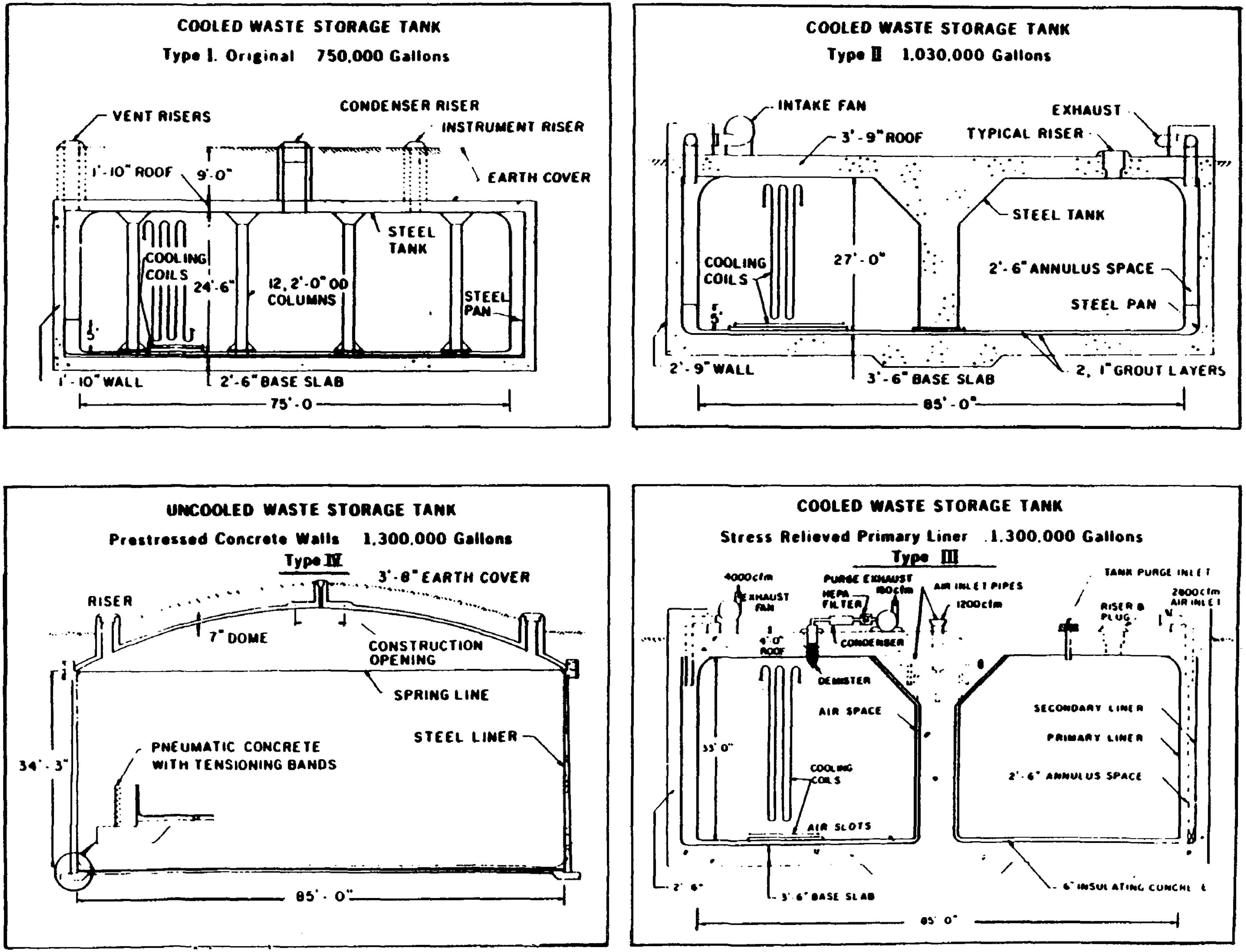


FIGURE 8
STORAGE TANKS - TYPES I-IV



- Type I

  The original 12 storage tanks constructed during 1951-1953 are designated as Type I tanks. Tanks 1 through 8 were placed in F Area and Tanks 9 through 12 in H Area. Each primary tank holds 720,000 gallons, is 75 feet in diameter, and is 24 1/2 feet high. The essential features of Type I tanks, include the primary tank, the secondary pan, and the concrete support structure. Five Type I tanks have leaked.

- Type II

  Tanks 13 through 16, constructed in H Area in 1955-1956, are designated Type II tanks. Each primary tank holds 1,070,000 gallons, is 85 feet in diameter, and 27 feet high.

  The primary container for Type II tanks consists of two concentric steel cylinders assembled with a flat bottom and a flat top to form a doughnut like structure. Four Type II tanks have leaked.

- Type III

  The tanks constructed most recently are designated as Type III. The Type III tank design was developed after an investigation into the causes for leaks from Type I and Type II primary tanks.

  For the Type III tanks, each finished tank was heated to relieve the stresses generated during fabrication. In addition, some stress patterns were avoided, or minimized, by mounting the roof supporting column on the foundation pad rather than on the bottom of the primary tank (as in Type I and II). Each primary tank holds 1,300,000 gallons, is 85 feet in diameter, and 33 feet high. None of the tanks have developed cracks or have leaked.

- Type IV

  Tanks 17 through 24 are of different design than those constructed previously and are called single-wall, uncooled, or Type IV tanks. They were designed for storage of waste that does not require auxiliary cooling. Tanks 17 through 20 were built in F Area in 1958, and Tank 21 through 24 were built in H Area in 1958-61. Each tank holds 1,300,000 gallons, is 85 feet in diameter, and is 34 feet high. One Type IV tank has leaked.

3. Controls

Primary leak detection methods rely on automatic surveillance in areas where waste that has leaked is most likely to migrate. Inventory surveillance is performed to ensure the integrity of the tanks.

The annulus of each of the doubled-wall tanks is equipped with at least two single-point conductivity probes located at the bottom of the annulus on opposite sides of the tank. When a conductivity probe detects liquid, it activates audio-visual alarms in the waste management control room. Each alarm is investigated, including visual inspection of the annulus, and a formal investigation report is issued to operating and technical supervision to describe each incident and the corrective action. All annuli are visually inspected and conductivity probes (designed to be fail-safe) are tested on a monthly basis.

The existing single-walled tanks are located on a concentrate slab with a network of leak collection channels which drain to a common sump. The liquid level in each sump, as measured by differential pressure transmitters, is recorded continuously, and an alarm is automatically activated if the level reaches a preset value. These sumps frequently contain ground water and rainwater and are sampled and pumped out as required.

For inventory control and as a backup to the leak detection system, liquid levels inside the tanks are measured and recorded. Each waste tank is equipped with a reel tape for measuring liquid level in the tank. The reel tape is checked manually once a month.

The liquid level in every tank is read once every eight-hour shift, recorded, and compared with previous readings. Additionally, tank levels are recorded every two hours on both the evaporator feed tank and concentrate receipt tank. This occurs while an evaporator is operating hourly on both sending and receiving tanks. The evaporator helps provide the information needed to compare the quantity received in each tank to the quantity sent.

The waste management employee on shift reviews and signs the data sheets used to record all sump, annulus, and tank level measurements indicated above, and any required corrective actions. These data sheets are reviewed by operating and technical supervisors. Daily reports on waste management activities are provided for operating and technical management. These reports describe any significant incident shortly after it has happened, how the problem developed, and follow-up action.

4. Monitoring

In the past, mixed waste could leave areas in several ways: in exhaust, ventilation air from building, off-gases from operations, and radioactive liquid that migrates from seepage basins through the soil to a natural waterway. The MEWS task force was assured that this effluent would not be included in the proposed option. However, the F and H seepage basis will be closed by November, 1988.

Nitrates, sodium, mercury and tritium have been identified as ground-water contaminants beneath the H-Area Seepage Basins. The F-Area Seepage basins show nitrate, sodium and tritium contamination in the ground water. The SRP has installed monitoring systems to detect the presence of contamination. Concern was raised that these systems were inadequate to fully characterize the rate and extent of migration of either the radioactive or hazardous waste consituents. The SRP agreed to submit further documentation in support of monitoring systems. Region IV is assessing all ground-water monitoring wells to ensure that they meet RCRA specifications.

5. Inspection

The inspection of equipment used for handling and storing radioactive wastes is difficult due to worker exposure to radiation and contamination problems. However, the SRP has developed techniques for remote inspection and evaluation of the condition of waste tanks. These include visual inspection by means of a periscope, photography, ultrasonic measurement of wall thickness, and corrosion specimens.

Recurrent waste tank inspections have consisted of visual surveys in the annular spaces, and to a lesser extent, inside the primary tanks. For closer, more comprehensive inspections, a portable optical periscope, composed of up to four ten-foot sections, is extended from grade into the annulus or tank with the objective lens relatively close to the location of interest.

Double-walled tanks with a history of leakage are inspected through a selected annulus-top opening at least once a year. All other double-wall tanks are inspected every two and four years, respectively.

Single-wall tanks are inspected internally above the waste level through a selected access riser at least once a year. Six of the eight single walled tanks were emptied by the end of 1986. The seventh should be emptied by mid 1987. The remaining tank is used for LLW storage. Two of the decomissioned single wall tanks will store DWPF wash-water.

D. TRANSURANIC (TRU) WASTE:

1. Generation

Approximately 5% of DOE's total volume of TRU waste is located at the SRP; however, this waste contains 62% of the radioactivity. TRU waste is contaminated with transuranic nuclides, mostly plutonium, with half-lives greater than 20 years and in concentrations greater than 100 nanocuries per gram of material.

2. Storage

Up until 1965, alph-emitting waste was buried unencapsulated in alpha trenches. At Savannah River, beginning in 1965, TRU waste was segregated according to two categories. Waste containing less than 0.1 Ci of the TRU materials was buried. In 1974, procedures were modified to reflect new criteria governing retrievable storage of solid TRU waste. TRU waste contaminated with more than 100 nCi/g is now stored on above ground concrete pads (Figure 9). Polyethylene galvanized drums are used as the primary containers. These drums are no longer buried. Waste packages containing more than 0.1 Ci are additionally protected by placement in concrete cylinders. Containers are stored on a concrete pad and covered with 4 feet of earth (Figure 10). These concrete culverts were 6 feet in diameter by 6.5 feet high. Waste that did not fit into the prefabricated concrete culverts were encapsulated in concrete. Transuranium waste from Savannah River Laboratory was buried in cubical concrete containers. Waste containing less that 0.1 Ci per package was buried in retrievable concrete culverts.

3. Monitoring

Ground-water monitoring wells help survey the buried wastes. The SRP has installed three types of non-RCRA monitor well systems to determine the extent of radioactive migration into the surrounding environment: perimeter wells, boreholes and trench wells. RCRA

FIGURE 9
TRU WASTE STORAGE PADS
WITH
GALVANIZED 55-GALLON DRUMS AND CONCRETE CULVERT

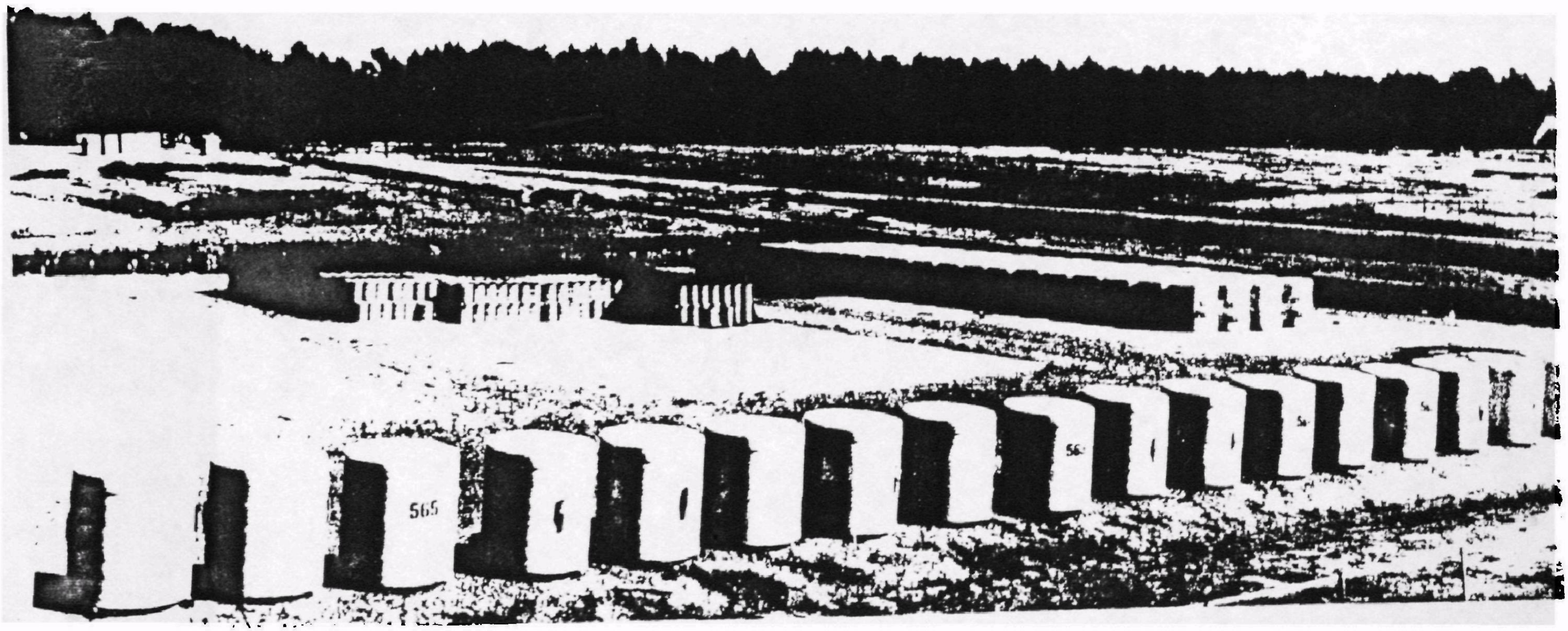
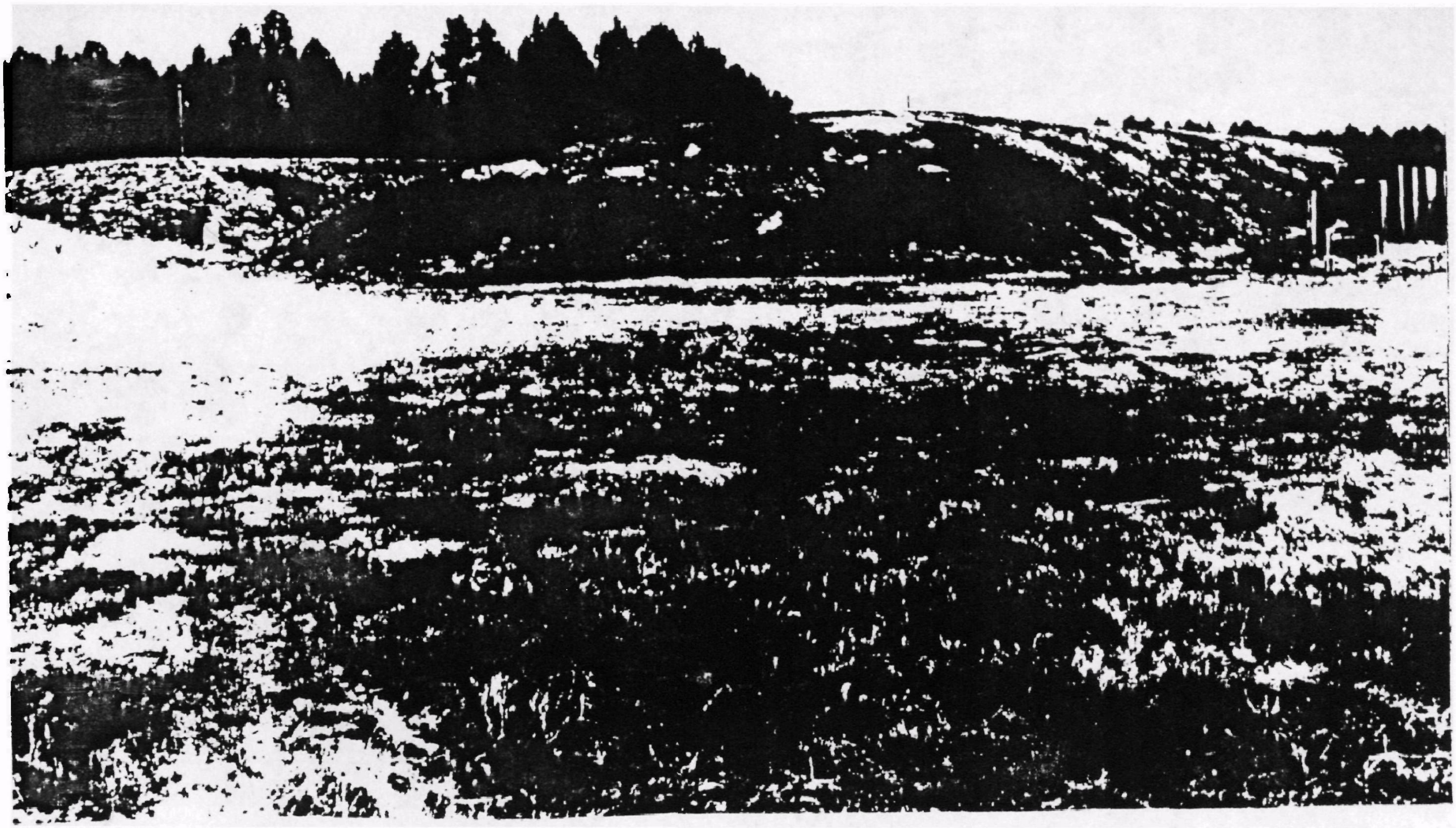


FIGURE 10
TRU WASTE STORAGE PADS COVERED WITH PLASTIC AND EARTH



monitor wells will also be installed in the future to monitor hazardous components. To date, the radioactive component of mixed waste has taken precedence in the monitoring program.

4. Controls

The SRP plans to minimize waste generation and contamination by segregation and identification at the point of origin. All TRU wastes are currently packaged to meet WIPP requirements which will enable direct waste transfer starting in late 1988, according to the schedule. Some TRU waste will require further processing to meet WIPP criteria.

Waste Isolation Pilot Plan/Waste Acceptance Criteria (WIPP/WAC) considers 1) Waste Container Requirements including DOT Type A packages, size and handling limits, and a twenty year design life; 2) Waste Forum Requirements - which include particulate size limits, no free liquids (i.e. no more than 1%); no explosives or compressed gas, no pyrophorics, and all hazardous waste constituents must be identified (but not quantified as would be required under RCRA); and 3) Waste Packaging Requirements - including weight and criticality limits, radiation dose limits/surface contamination limits, labeling, data packages and documentation (Figure 11).

The certification program ensures that waste is packaged according to TRU waste certification operating procedures. TRU waste certification data and records ensure that each drum containing TRU waste has been assayed and X-rayed. Operator training is documented. A quality assurance program acts to oversee the handling of TRU waste at the facility. Audits are conducted internally and by external groups. The SRP operations office and WIPP also conduct audits. A diagram of the SRP's TRU Waste Management Plan is show in Figure 12.

5. Audits and Assessments

At DOE Headquarters, the Assistant Secretary of Environmental Safety and Health (ES&H) oversees an annual environmental audit of the SRP's field operations. At SRP, the Assistant Manager for Operations is responsible for waste management operations and audits or appraisals of the contractor. The Assistant Manager for ES&H conducts independent audits. The SRP emphasizes that responsibilities for audits and assessments were not specifically outlined.

FIGURE 11
TRU WASTE PACKAGING FORM

OSR 7 872

TRU WASTE DATA PACKAGE

WASTE PACKAGING (TO BE COMPLETED BY WASTE GENERATOR)

PACKAGE ID NO(FSN NO) S R 1 2 3 4 5 6 | CONTAINER CODE 7 8 9 | GENERATED BY BLDG/AREA 10 11 12 13 14 15 16 17 18 | DATE DRUM CLOSED 19 20 21 22 23 24 | PACKAGED BY(PRINT) LAST NAME, FIRST INITIAL

CONTENT CODE 25 26 27 28 | WASTE DESCRIPTION 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 | VOL % ORGANIC 49 50 51 | WT % ORGANIC 52 53 54 | FREE LIQUIDS N 55 Y 56 | EXPLOSIVES/COMPRESSED GASES N 57 Y 58

MIXED WASTE N 59 Y 60 | HAZ MATL CODE 61 62 63 64 65 | HAZ MATL QUANT 66 67 68 69 70 71 | UNITS 72 | PARTICLES <10μ N 73 Y 74 | QUANTITY(lb) 75 76 77 | PARTICLES <200μ N 78 Y 79 | QUANTITY(lb) 80 81 82 | PYROPHORICS N 83 Y 84 | QUANTITY, lb 85 86 87

QUALITY ASSURANCE: This waste is packaged in accordance with the WIPP-Waste Acceptance Criteria and is: ___ 88 CERTIFIABLE ___ 89 NON-CERTIFIABLE

REASON IF NON-CERTIFIABLE: 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104

AUTHORIZED SIGNATURE ______ DATE ______

HEALTH PROTECTION SURVEY DATA

SURFACE DOSE RATE (mrem/hr) 1 2 3 4 5 | NEUTRON DOSE RATE (mrem/hr) 6 7 8 9 10 | SURFACE CONTAMINATION (d/m/ft2) 11 12 13 14 | SURFACE CONTAMINATION (c/m/ft2) 15 16 17 18 | READINGS TAKEN BY(PRINT) LAST NAME,FIRST INITIAL

WASTE PROCESSING (TO BE COMPLETED BY WASTE MANAGEMENT)

DATE X-RAYED 1 2 3 4 5 6 | TAPE NO. 7 8 9 10 11 | PASS 12 FAIL 13 | REASON IF FAILED 14 15 16 17 18 19 20 21 22 23 24 25 26 27 | X-RAYED BY(PRINT) LAST NAME, FIRST INITIAL | DRUM GROSS WT(kg) 28 29 30 31 | DRUM NET WT(kg) 32 33 34 35

DATE ASSAYED 36 37 38 39 40 41 | DISKETTE NO. 42 43 44 45 46 | PU-239 FISSILE GRAM EQUIVALENT(g) 47 48 49 50 | TOTAL TRU ALPHA ACTIVITY(Ci) 51 52 53 54 | THERMAL POWER (watts/ft2) 55 56 57 58 | PE Ci(Ci) 59 60 61 62 | nCi/g 63 64 65 66 | ASSAYED BY(PRINT) LAST NAME, FIRST INITIAL | WT ORGANIC 67 68 69

QUALITY ASSURANCE: This waste was processed in accordance with the WIPP-Waste Acceptance Criteria and is: ___ 70 PRECERTIFIED ___ 71 NON-CERTIFIABLE

REASON IF NON-CERTIFIABLE: 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86

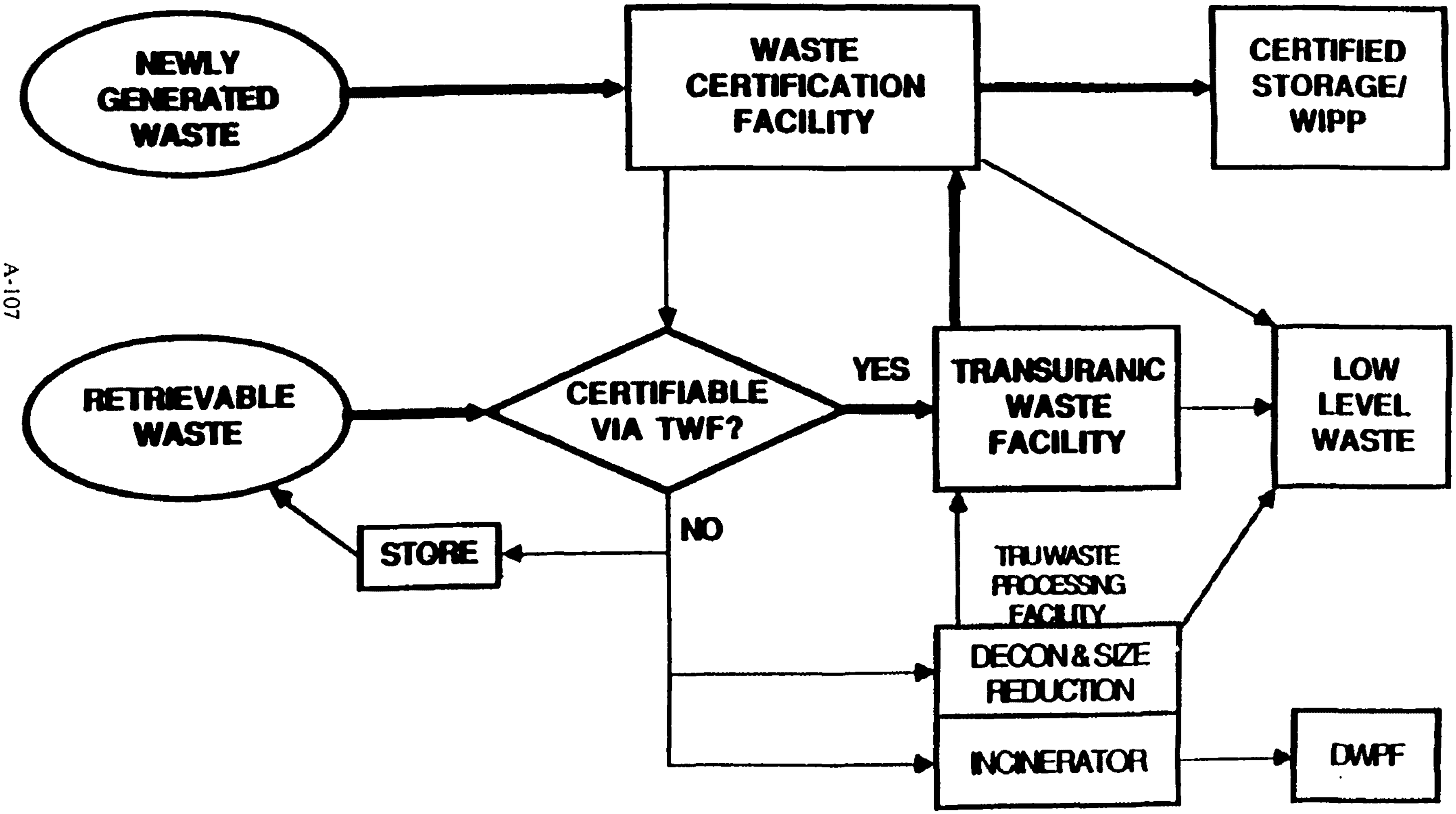
AUTHORIZED SIGNATURE ______ DATE 87 88 89 90 91 92

SHIPPING (TO BE COMPLETED BY WASTE MANAGEMENT)

SURFACE CONTAMINATION (d/m/ft2) 1 2 3 4 | SURFACE CONTAMINATION (c/m/ft2) 5 6 7 8 | SHIPMENT NO. 9 10 11 12 13 14 15 | SHIPMENT DATE 16 17 18 19 20 21 | DATE TYPE 22 | VEHICLE NO. 23 24 25 26 27 28 29 30 | VEHICLE TYPE 31 | CARRIER CODE 32

TRUPACT NO 33 34 35 | SIX PACK ID NO. 36 37 38 39 40 41 42 43 | BALANCE 44 | DATE CERTIFIED FOR SHIPMENT 45 46 47 48 49 50

FIGURE 12
SRP TRU WASTE MANAGEMENT PLAN



The SRP orders govern these audits. Appraisals are conducted to evaluate general compliance with orders; audits are more specific in nature and inspections ensure specific compliance with specific requirements. Management and functional appraisals are media specific and are conducted in three-year cycles.

The SRP has an unwritten open site policy with the State of South Carolina. State and EPA inspections are conducted regularly on water, air, and waste. The State reviews the location and design of all ground-water monitoring wells. An annual monitoring report is available to the public.

The WIPP Certification team also conducts appraisals. Field-oriented appraisals are conducted in addition to office/record-keeping audits. Examples of FY-86 audits include the Burial Ground Survey (8/86) and WIPP Certification Survey (9/86). Several audits are planned in FY-87.

All audits and reports are sent to the Manager of the Savannah River Plant Operations office and the Manager of Dupont Operations. Audit reports are not sent to the State. Audit information is also available through FOIA unless classified. Most material, however, is unclassified. An example of a Defense Programs Waste Transfer audit is shown in Figure 13.

E. ENVIRONMENTAL PROTECTION/EQUIVALENCY TO RCRA REQUIREMENTS:

1. High-Level Waste

Based on the materials presented by the SRP, the current level of protection for handling HLW appeared to equal or exceed RCRA requirements for hazardous waste on several accounts: tank construction, surveillance and inspection. Secondary containment was provided in the form of carbon steel pipe, stainless steel pipe, or concrete encasement. All connections in transfer lines were provided with secondary containment such as diversion boxes, waste tank inlet risers, or evaporator enclosures. All tanks, piping and storage, are inspected and otherwise qualified for exemption from Subpart F requirements.

DO NOT REMOVE From SRP
Without Approval

A...

g) Senior Supervisor must verify that up-to-date transfer procedure is available.

h) Refer to DPSOL 241-F/H-55 and 241-F/H-56 for leak detection and containment for waste transfers. If this transfer is not covered, special handwritten and approved sections must be provided. (Check one below.)

Covered in DPSOL 241-F/H-55 and 56 ________
Leak detection and containment sections special procedure provided ______

i) Indicate whether this transfer has potential for starting a siphon. Refer to applicable transfer procedure specified in step A,1),g). (Check one.)

Siphon present: Yes ___ No ___ If yes, provide section for stopping a siphon.
Siphoning breaking section provided: Yes ___ No ___

j) Record the transfer tank jet suction elevation and the latest sludge elevation. If these elevation are within 1.5 ft. of each other, the jet should be raised to insure that sludge is not transferred.

Transfer Tank ____________ Sludge ____________

Jet suction elevation __________ Elevation ______________
(NOTE: This is to ensure that sludge is not being processed in the evaporators, thereby releasing ^{90}Sr.)

k) Record the following data for use by Waste Management Technology in calculating supernate temperature and chemical composition resulting from the transfer.

Maximum supernate temperature (highest value of recorded supernate points).

Transfer tank ________°C Receiver tank ________°C

l) Sample analyses (to be filled in by Waste Management Technology).

	Transfer Tank ______		Receiver Tank ______	
	Last Sample Date ______	Calculated[a] Date ______	Last Sample Date ______	Calculated[a] Date ______
NO_2^-	______	______	______	______
NO_3^-	______	______	______	______
OH^-	______	______	______	______
pH	______	______	______	______

[a]Step A,2),b).

DO NOT REMOVE From SRP
Without Approval

		Technical Standard Limits[a]	Calculated Composition in Receipt Tank[b]	Composition Within Limits (Yes)	Composition Within Limits (No)
*	NO_3^- (Max)	8.5 M	______	___	___
	OH^-	______	______	___	___
	$OH^- + NO_2^-$	______	______	___	___

*When NO_3^- = 5.5 - 8.5M, Limits are: OH^- = 0.6 / OH^- + NO_2^- = 1.1

* [a] When NO_3^- = 2.75–5.5M, limits are: OH^- = 0.3M (min)

$OH^- + NO_2^-$ = 1.1M (min)

* When NO_3^- = 1-2.75M, limits are: OH^- = 0.1 x NO_3^-(min)

$OH^- + NO_2^-$ = 0.4 x NO_3^- (min)

* When NO_3^- 1M, limits are OH^- = 0.01M (min)

(pH = 12)

[b] If calculated composition is not within technical standard limits, transfer should not be made.

DO NOT REMOVE From SRP
Without Approval

B. RECEIVER TANK AIR PURGE REQUIREMENTS

1. Upon request from the Waste Management Technology Area Supervisor, measure and adjust receiver tank purge air flow per OPSOL 241-FH-121.

2. Record adjusted purge air flow in the receiver tank.

Completed by ________________

Date ________ Time ________ a.m./p.m.

C . SERVICE GROUP NOTIFICATION

1. Operating Senior Supervisor (or designate) must inform applicable service group(s) of pending transfer. This applies to transfer routes with exposed transfer piping or excavations near transfer piping. Signature (and date) of service group Area Supervisor is required, and implies that he will inform his personnel.

Service Group	Signature of Area Supervisor or Engineer	Date

Operating Senior Supervisor ________________

Date ________

This approval can be obtained by phone by the Senior Supervisor. If contacted by phone, indicate here: ______ (initials)

2. Have HP establish exposure rates in areas of exposed transfer piping or excavations near transfer piping.

3. Barricade exposed transfer piping or excavations near transfer piping using yellow and magenta rope, set up portable sign to indicate transfer in progress, and have HP affix radiation tag(s).

Radiation tag(s) attached: Yes ___ No ___

HP signature ________________

Date ________

2. TRU Waste

Current practices including retrievable TRU waste buried in concrete cylinders or concrete pads closely resemble land filling activities and may therefore be subject to RCRA.

Ground-water monitoring is conducted although RCRA specified monitoring wells are not used. The task force will further assess if hazardous constituents can adequately be detected through the ground-water monitoring system currently in place. Further information may be needed to make a final determination about the equivalency of TRU waste handling to RCRA requirements. The SRP, however, has submitted a RCRA ground-water monitoring program to South Carolina.

ACTION ITEMS:

The following documents have been requested from John Tseng (DOE).

- Hydrogeological studies.
- Monitoring Results.
- Plume Information.
- Diagram of the SRP -- defining mixed HL and TRU waste areas, process streams; treatment and storage units that would be exempt under the proposal.
- Ground Water Report.
- Index of Standard Operating Procedures.
- Audits and Reports:
  - Examples of paper train for accountability
- SRP Orders Governing Waste.
- Waste-type definitions.

DOCUMENTATION:

Appendices:

1. Attendance Sheet
2. Agenda 12/2-12/3 SRP Tour
3. Principal Constituents of HLW

4. Defense Programs Waste Transfer Audit
5. TRU Waste Data Briefing Package
6. Savannah River Hazardous Waste Management Program Briefing Package
7. Defense Waste Processing Facility Project Starters Briefing Package
8. Interim Radioactive Waste Management Briefing Package
9. Tank Farm Operations Briefing Package
10. Determining the Composition of SRP Waste Briefing Package
11. Containment and Leak Detection Briefing Package
12. SRP TRU Waste Certification Program Briefing Package
13. Waste Management Operations - SRP September 1977

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy
West Valley Demonstration Project
West Valley, New York
January 8, 1987

PURPOSE:

On January 8, 1987, the MEWS task force, accompanied by EPA Region II representatives, met at the West Valley Demonstration Project (WVDP) site near West Valley, New York with individuals from the Department of Energy's (DOE) Headquarters, DOE's WVDP Office and DOE's contractor at WVDP, Westinghouse, and the New York State Department of Environmental Conservation.

The purpose of the visit was for task members to gain a working knowledge of the WVDP.

SUMMARY:

Members of the DOE's West Valley Demonstration Project Office and the WVDP contractor provided an overview briefing of the site with the majority of emphasis on high-level waste (HLW), low-level waste (LLW), and transuranic (TRU) waste management practices. Subject areas included HLW storage, characterization, vitrification, and treatment; LLW storage, cement solidification, and disposal; TRU waste collection, assay, and storage; environmental monitoring; general operation and control; and the audit system. A van tour included stops at the environmental lab, the supernatant treatment system, the lag storage building where TRU waste assaying is performed, and the chemical process cell. The tour also included the cement solidification system, the liquid waste treatment system, and the U.S. Nuclear Regulatory Commission (NRC) licensed disposal area.

In general, the current waste management systems at WVDP for HLW and TRU wastes from both an administrative and technical standpoint are advanced and comprehensive with many areas being apparently equal or superior to those required by RCRA. Specific weaknesses include the lack of detailed RCRA chemical analyses of wastes (although WVDP had more chemical information about their HLW than other DOE facilities visited) and the lack of RCRA ground-water monitoring or waiver documentation. By the public law establishing the WVDP, NRC has an independent audit role. Other organizations (e.g., USGS, NYSDEC, NYSDOH, EPA and OSHA) are involved in both cooperative and regulatory capacities. While the ultimate disposal methods for HLW and TRU wastes appear excellent, they are not yet in place and, in the case of HLW, are not yet a certainty.

REPORT:

A. FACILITY DESCRIPTION:

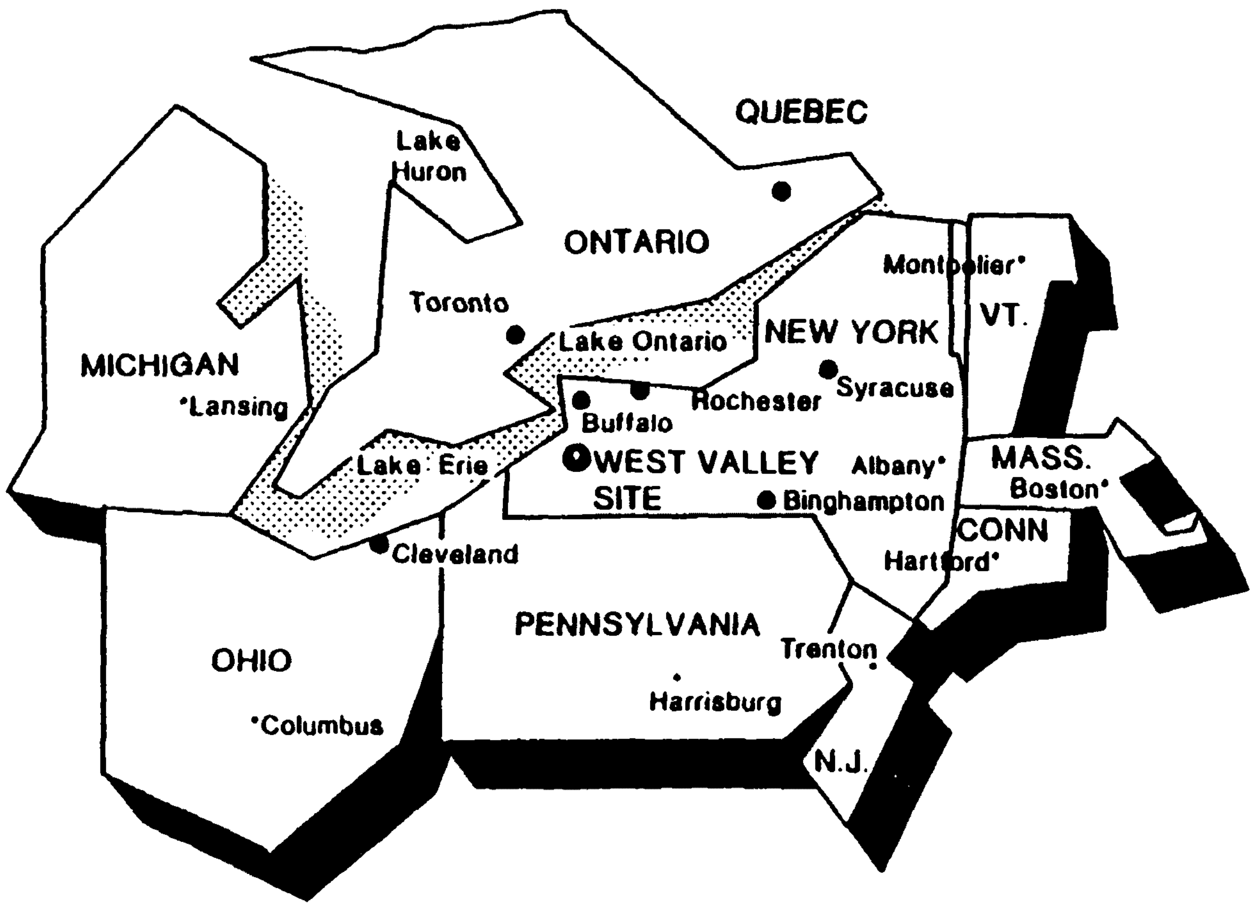
WVDP is located on 3,300 acres in a rural area about 30 miles southeast of Buffalo, New York (Figure 1); the communities of West Valley, Riceville, Asford Hollow, and Springville are located within 5 miles of the project (New York State owns the property). WVDP is operated and maintained for DOE by its contractor, Westinghouse.

The WVDP site comprises three basic operational entities: a former nuclear fuel reprocessing plant now a DOE HLW vitrification demonstration project, an NRC-licensed shallow-land LLW disposal area, and a former New York State licensed LLW burial ground (now closed).

Between 1962-1966, a nuclear fuel reprocessing plant was licensed and built on the site by a group of private companies operating as Nuclear Fuel Services, Inc. (NFS). The facility was designed with an 80,000 square foot main process building which is 90-feet high and has a ventilation stack which exhausts 200-feet above grade. It is composed of a number of process areas and shielded cells in which remotely operated mechanical and chemical operations were performed. The building also contains the fuel receiving and storage facilities (spent fuel pool), which were used later to store spent fuel from other commercial reactors, analytical laboratories, and a control room. Smaller structures include an office building, a warehouse, maintenance shops, and a liquid LLW treatment facility. The liquid LLW treatment facility consists of a building containing waste treatment equipment and a peripheral system of lagoons and concrete lined interceptor basins for effluent accumulation and batch pH adjustment and discharge.

In 1972, the plant was shut down to expand its capabilities and make modifications to reduce radioactive effluents and radiation exposure to personnel. By 1976, the modification cost estimates had increased from $15 million to over $600 million, and NFS exercised its right under its development agreement with the State of New York to

FIGURE 1
WVDP LOCATION



surrender the responsibility for the site, including all wastes, to New York State. This was done pursuant to Public Law No. 96-368 (enacted in 1980) which mandated the demonstration of technology for solidification of roughly 560,000 gallons of liquid HLW that was produced by NFS and stored on site.

Two types of liquid HLW are stored in waste storage tanks at West Valley. There are two large carbon-steel tanks (8D1 and 8D2) housed in separate concrete vaults. Tank 8D2 contains about 550,000 gallons of HLW from the Purex processing of uranium-based fuels and Tank 8D1 is a spare. There are also two smaller, stainless steel tanks (8D3 and 8D4) which are housed in a common concrete vault. Tank 8D4 contains about 12,000 gallons of acidic HLW from the Thorex processing of thorium-based fuels and Tank 8D3 is a spare.

The scope of the WVDP, as laid out in Public Law 96-368, is to:

1. Solidify liquid HLW in a form suitable for transportation and disposal;
2. Develop containers suitable for permanent disposal;
3. Transport solidified waste to the federal repository for permanent disposal;
4. Disposal of LLW and TRU waste produced; and
5. Decontaminate and decommission tanks, facilities, material, and hardware used.

B. HIGH-LEVEL WASTES:

The majority of the HLW at West Valley resulted from the Purex extraction process used to reprocess the fuel. This process utilized nitric acid to dissolve the spent fuel followed by a solvent extraction process where the extractant was a 30% solution of tributyl phosphate in a hydrocarbon solvent. This produced an acidic liquid HLW which was pH-adjusted to reduce corrosion prior to storage in the carbon steel tank. This neutralization process resulted in both settling and precipitation of the waste in this tank into two layers: 1) an upper liquid portion, containing most of the radioactive cesium, and 2) a dense solid (usually referred to as sludge) containing most of the radioactive strontium, other fission products, and long-lived radionuclides that constitute less than one-tenth of one percent of the total curies of radioactivity in the tank.

The Purex HLW is stored in Tank 8D-2 which sits in a steel saucer and is located in its own concrete vault. The concrete vault surrounding Tank 8D-2 provides complete secondary containment (Figure 2). Tank 8D-4, holding the Thorex waste, is co-located in a vault with its spare tank, 8D-3. The inside bottom of the carbon steel tank has a grid work of I-beams and girders which will make it difficult to remove the denser solid portion of the waste (see Figure 3).

As part of the decontamination activities at the reprocessing plant, additional LLW and possibly TRU waste is being added to these tanks. Figures 4 and 5 indicate WVDP progress on the decontamination activities. Roughly 33% of the total square footage remains to be decontaminated.

The radioactivity of the HLW owned by the State of New York at WVPD represents 2.5% of the total DOE HLW inventory at Hanford, Idaho, Savannah River, and WVDP (Figure 6). The estimated radioactivity at WVDP is 3.24×10^7 curies.

The overall plan calls for treatment of the supernatant, the upper liquid layer, followed by treatment of the bottom sludges and the spent resins resulting from the supernatant treatment. The supernatant treatment will involve the use of extensive liquid waste treatment systems. There will be cement solidification for disposal of the LLW generated during supernatant treatment. The sludge and resin treatment will involve vitrification using a melter and will result in the production of 300 glass logs (2' x 10') suitable for HLW repository disposal.

1. Vitrification System

Thorex waste in 8D-4 and spent zeolites from 8D-1 will be pumped into 8D-2 and mixed with the washed sludge. The mixture will then be pumped to the vitrification system. The feed delivery system routes the feed from the concentrator Feed Makeup Tank FMT) to the melter. Glass is poured directly from the melter into a canister. Off-gases will be sent to a submerged sand bed scrubber as well as remaining off-gas treatment systems. The filled canisters will be cooled and stored. At a later date, the canisters will be welded and decontaminated just prior to shipment. The canisters will remain in storage until a NRC-licensed HLW repository has been opened.

FIGURE 2
HIGH LEVEL LIQUID WASTE TANK

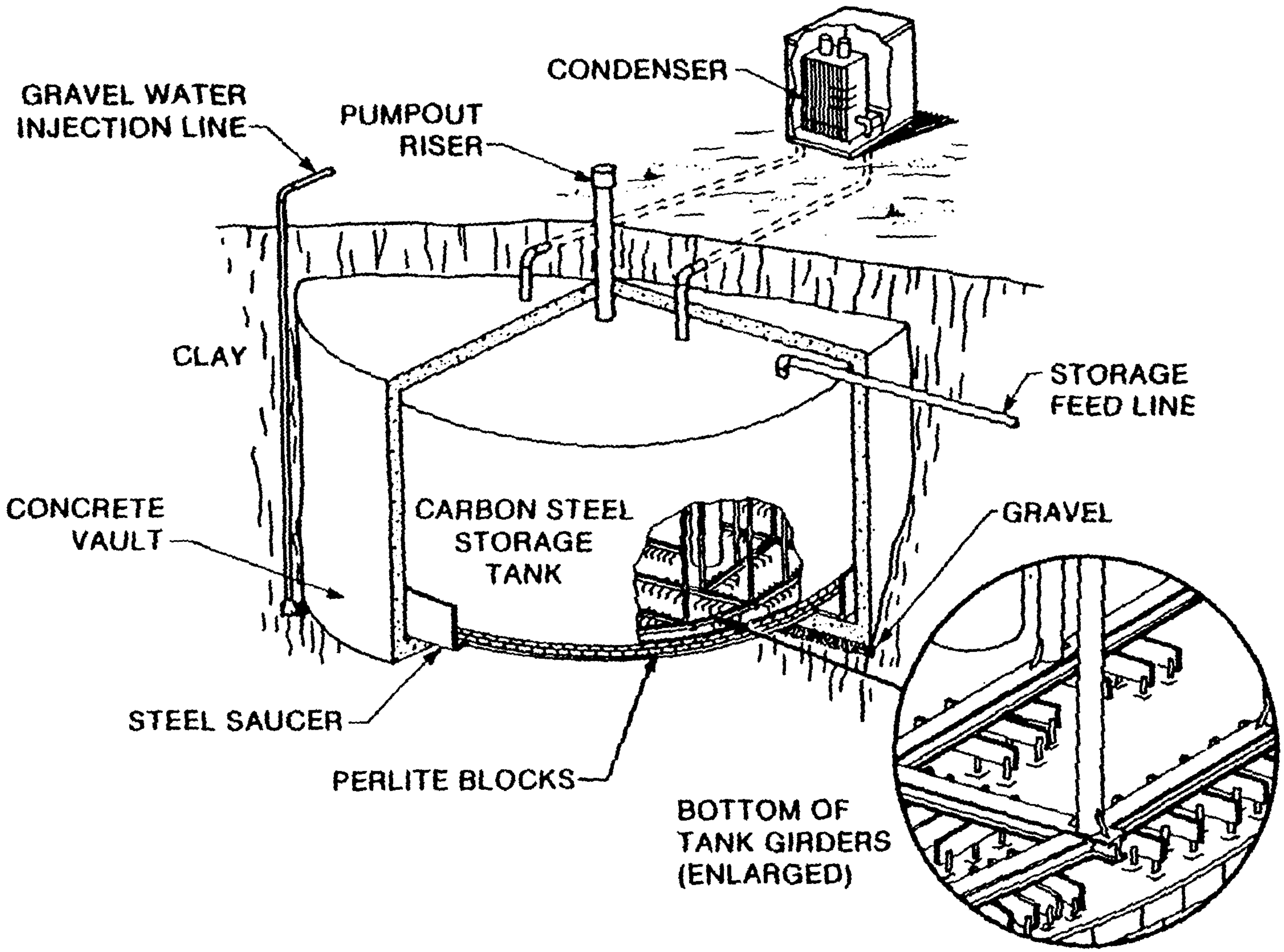


FIGURE 3
TANK 8D-2 SLUDGE LAYERING - SECTIONAL VIEW

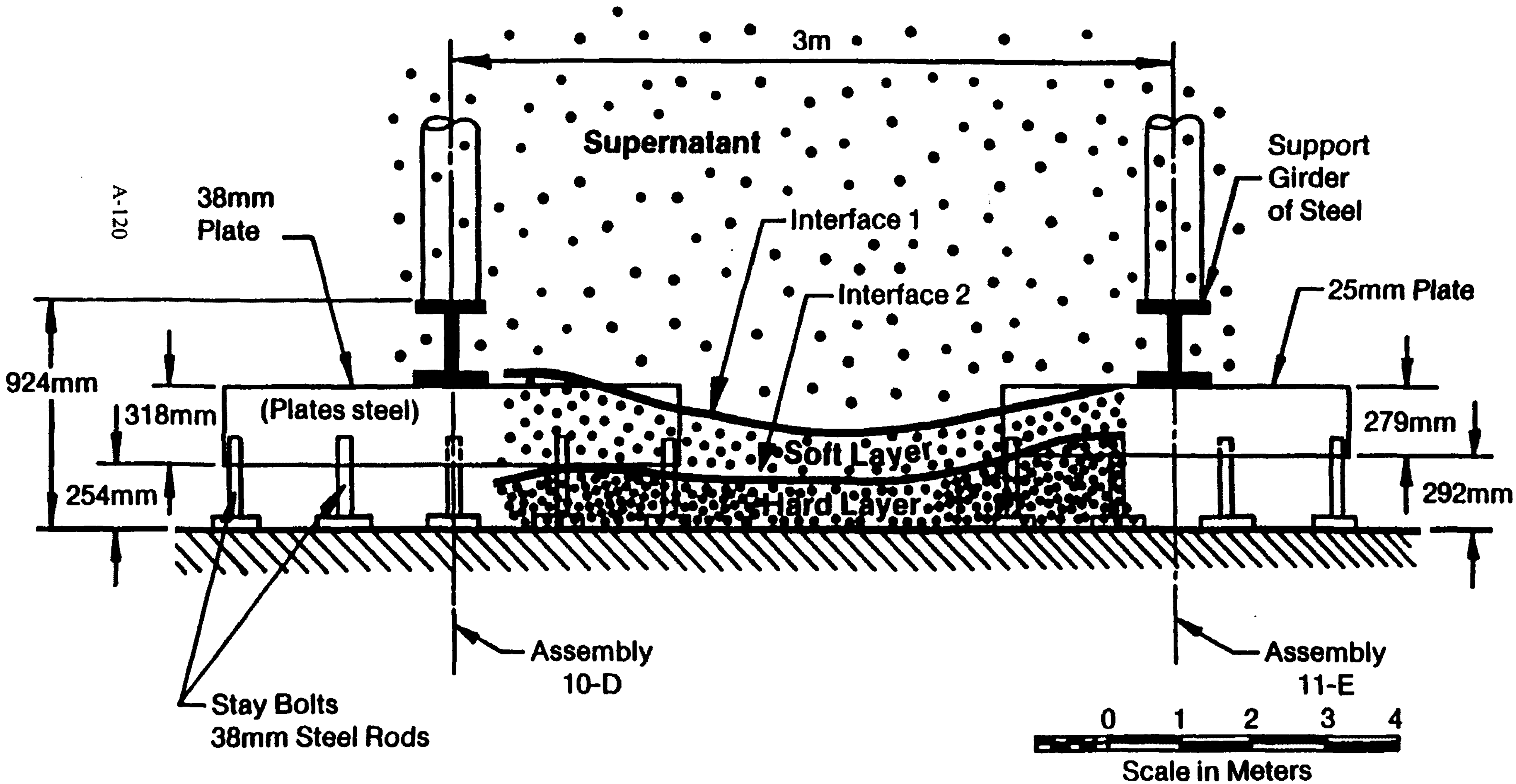


FIGURE 4
TOTAL FACILITY DECONTAMINATION STATUS

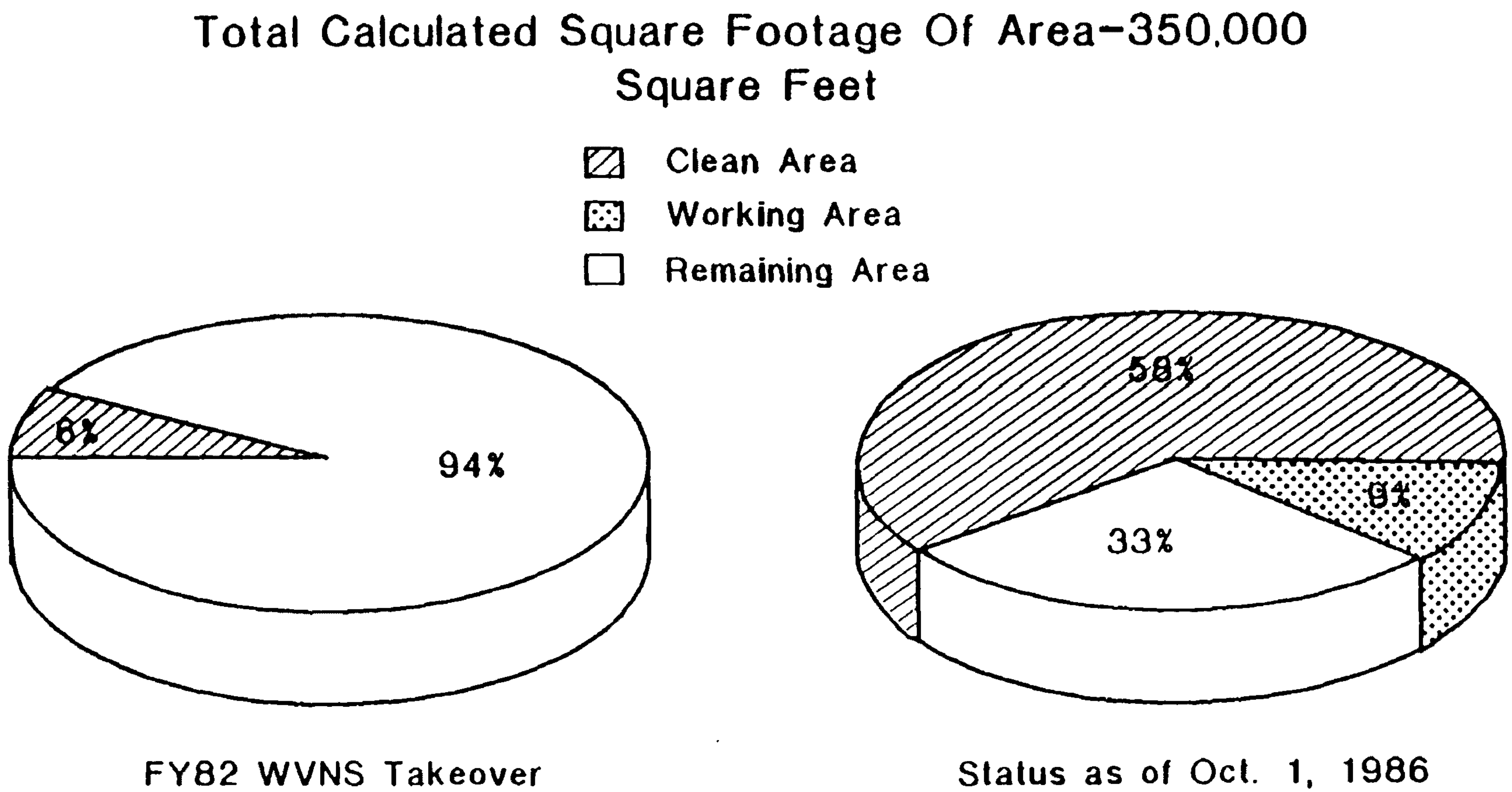


FIGURE 5
WVDP DECONTAMINATION ACTIVITY

Area	Status
MSM Shop	Complete
Extraction Cell Room	Complete
XC-1	Future
XC-2	Future
XC-3	Complete
Product Purification Cell	Complete
Analytical Lab	Complete
Radioachemistry Lab	Complete
Counting Lab	Complete
Component Test Stand Lab	Complete
Sample Storage Cell	Complete
Plutonium Product Handling	In Progress
Equipment Decontamination Room	Complete
Chemical Crane Room	Complete
Chemical Process Cell	In Progress
Extraction Sample Aisle	Complete
RAM Equipment Room	Complete
Alpha Lab	Complete
Uranium Lab	Complete
Upper Warm Aisle	Complete
Lower Warm Aisle	Complete
Uranium Loadout	Complete
Uranium Product Cell	Complete
Process Mechanical Cell	In Progress
General Purpose Cell	In Progress
Scrap Removal Room	In Progress
Process Chemical Room	Complete
Hot Acid Cell	Future

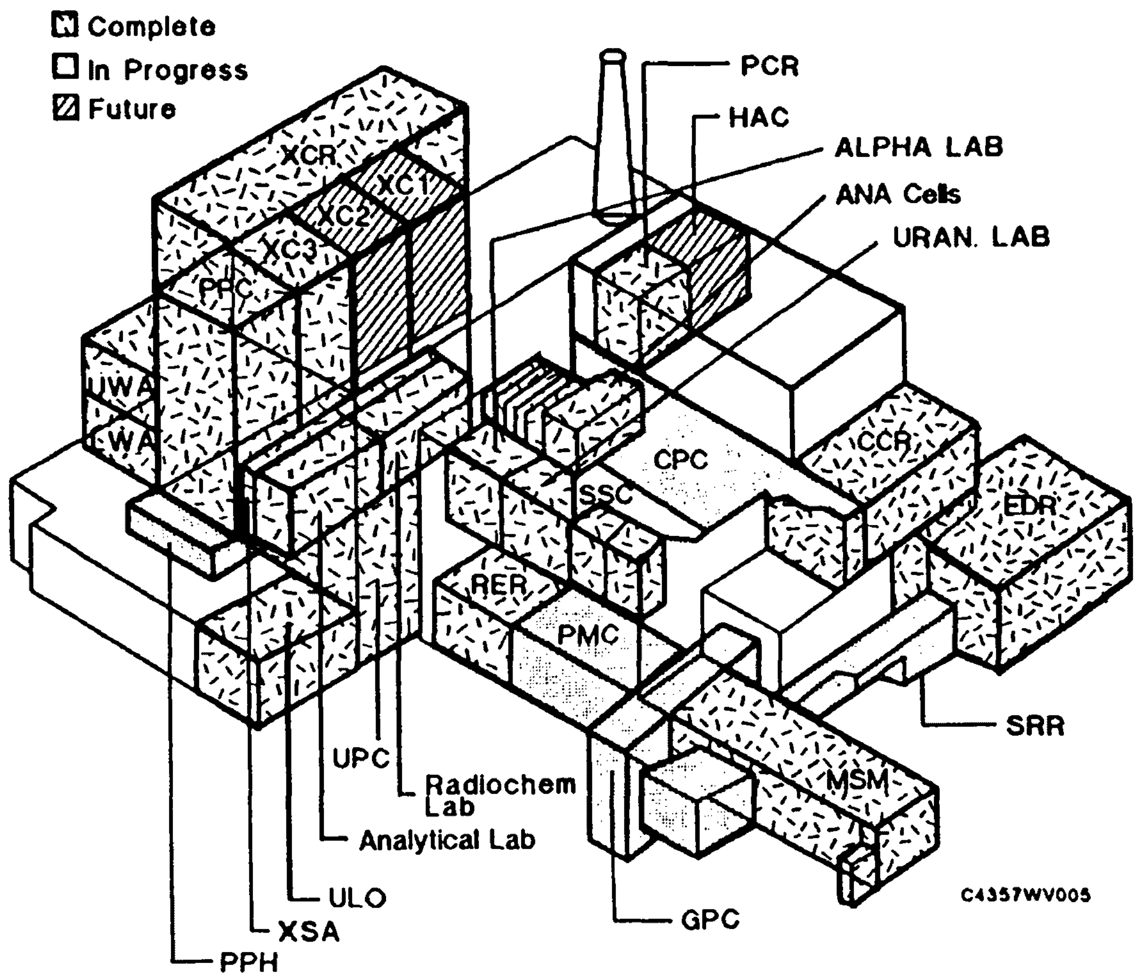
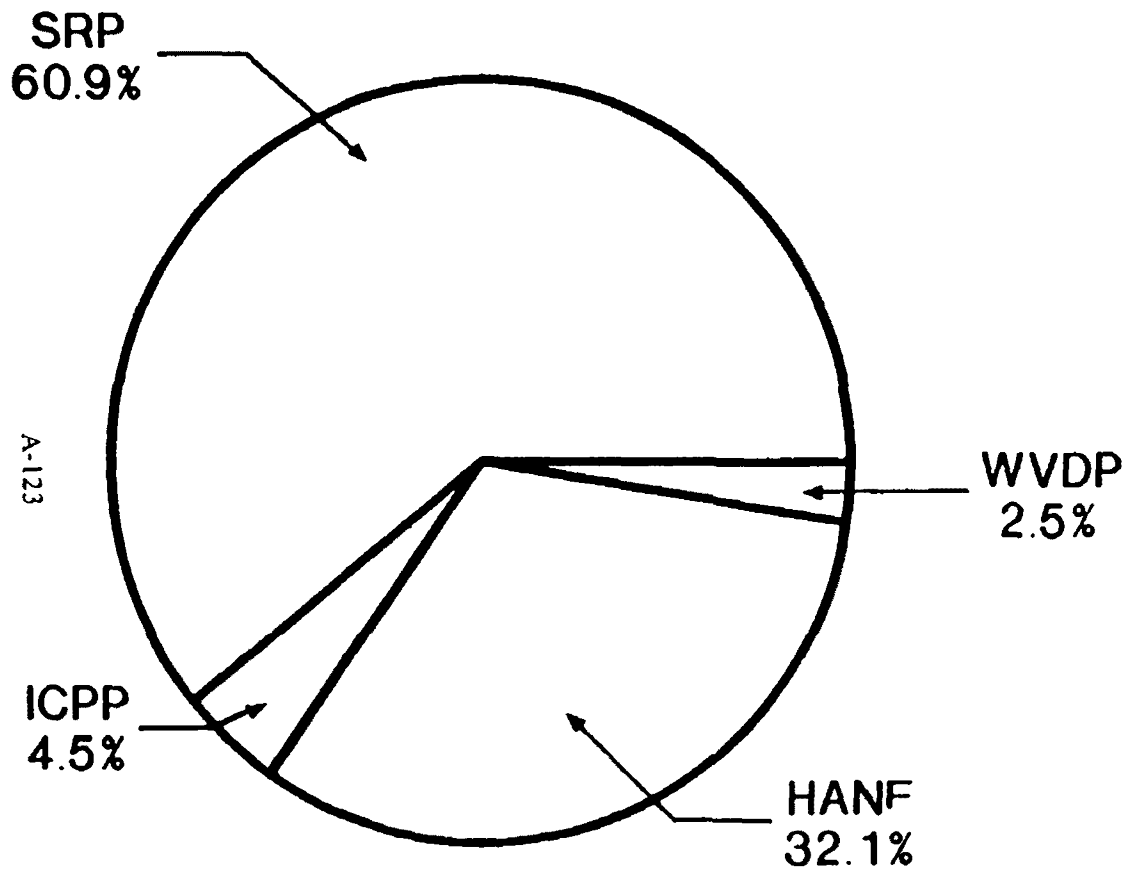


FIGURE 6
RADIOACTIVITY OF HLW THROUGH 1984



Site	Curies
SRP	7.96×10^{8}
ICPP	5.90×10^{7}
HANF	4.20×10^{8}
WVDP	3.24×10^{7}
Total	1.31×10^{9}

The HLW vitrification system planned at WVDP draws upon the same vitrification technology as that developed by DOE for Savannah River's Defense Waste Processing Facility. WVDP's vitrification system will be operational by late 1989.

2. Supernatant Treatment System (STS)

HLW supernatant from 8D2 and 8D4 will be pumped through a chiller and then through a zeolite ion exchanger system to remove cesium. Some is returned to 8D1 where it will be intermixed with HLW sludge and run through the vitrification system. The remainder will be routed to the liquid waste treatment system (LWTS). The Thorex waste in 8D-4 will be blended with the washed sludge in 8D-2 and processed through the LWTS. Cesium-loaded zeolite will be stored in Tank 8D-1 until it is transferred to 8D-2 and then to the vitrification system.

C. TRU WASTE:

DOE uses more stringent criteria for TRU waste at WVDP than at other DOE facilities. The WVDP definition for TRU waste is:

- Radioactive waste containing alpha-emitting transuranic radionuclides with half-lives greater than 5 years and concentrations greater than 100 nanocuries per gram.

TRU waste is currently being stored on-site until shipment off-site for disposal. Although WVDP TRU waste cannot be disposed of at WIPP because it is a commercial TRU waste. WVDP is using the WIPP Waste Acceptance Criteria for TRU waste packaging. The original estimate of TRU waste expected at WVDP is only about 3% of the total waste present. More specifically:

TRU Waste in Storage	23 cubic meters
Suspected TRU in Storage	135 cubic meters
Projected TRU Generation	300 cubic meters

Most of this TRU waste will be contact-handled TRU, with only a small percentage being remote-handled. Two methods of TRU waste assaying will be used: 1) a segmented gamma scanner which uses a lithium-drifted germanium (GeLi) detector and 2) a 4Pi Passive Neutron System using 78 BF_3 probes and a polyethelene moderator. The final disposal destination of this commercial TRU waste has not yet been determined.

D. MONITORING:

The ground-water monitoring program was expanded in 1986 to provide coverage of the following waste management units:

- HLW tank complex
- LLW lagoon system
- NRC-licensed disposal area.

The monitoring network consists of five old wells (installed by USGS in 1982), nine new wells, one seep well and a french drain outlet. All the wells are 80 to 90 feet in depth and screened only once. These wells do not meet RCRA ground-water monitoring requirements. These wells, the seep, and french drain will be sampled quarterly the first year beginning December, 1986, and semi-annually thereafter. The monitoring parameters include:

- Ground-water quality parameters: Cl, Mn, Na, SO_4^- , Fe, phenols
- pH
- Specific conductance
- Total organic carbon
- NO_3^-
- Gross alpha
- Gross beta
- Specific gamma emitters, and
- the eight metals in the EPA drinking water criteria.

A radiological monitoring program also exists at WVDP. Thirty-two wells, in addition to those previously mentioned, are sampled semi-annually for gross alpha, beta, tritium and pH.

E. AUDITS/ASSESSMENTS/OVERVIEW:

WVDP operates under the standard DOE management system. DOE headquarters issues orders which are then interpreted and narrowed in scope to fit their particular situations by the Idaho Operations Office. This process continues down to the procedures written by the contractor for the plant operators to follow. By the public law establishing the WVDP, NRC has an independent audit role. Other State and Federal agencies are involved in both a cooperative and regulatory capacity.

F. SECURITY:

Security for the WVDP is maintained 24-hours a day by armed guards and chain-link fences.

G. RCRA EQUIVALENCY:

The areas where RCRA equivalency appears to be provided include the following:

- Excellent process control with regard to the treatment, transfer and storage of HLW. This includes a computer-automated surveillance system.
- Extensive administrative controls for the tracking of waste from the waste tanks through disposal for both HLW and TRU wastes.
- Excellent conceptual plan for qualifying HLW for disposal.
- Good security provided.

Areas where potential problems with RCRA equivalency include the following:

- Lack of or limited data on HLW & TRU waste quantity and characterization with regard to hazardous components.
- Lack of RCRA ground water monitoring around HLW piping and storage (HLW tanks) systems.
- Lack of sufficient independent audits.

H. ACTION ITEMS:

None.

I. APPENDICES:

1. Agenda for EPA/DOE By-product Rule Task Force Meeting, January 8, 1987.

2. West Valley Demonstration Project - Project Overview presented to the EPA/DOE By-product Rule Task Force, January 8, 1987.

3. External Interface Control Diagram.

4. An Introduction for the West Valley Demonstration Project, July 1981, DOE.

5. Thorex Waste Chemical Composition.

6. Acronyms used at West Valley.

7. High-Level Waste Characterization at West Valley, Report of Work performed 1982-1985, by Larry E. Rykken Under Contract No. DE-AC07-81NE 44139.

8. West Valley Demonstration Project Candidate Mixed Hazardous Waste Streams, prepared by DOE, Idaho Operations Office, October, 1986.

9. Letter to EPA from W.W. Bixby, Acting Director of WVDP on Tumulus Location for Disposal of Project Low-Level Waste.

10. DOE's Finding of No Significant Impact - Disposal of Project Low-Level Waste, West Valley Demonstration Project, West Valley, New York.

11. RTS Waste Streams Data Sheets, Rev. 4, Dated March 27, 1986.

Mixed Energy Waste Study (MEWS) Visit
U.S. Department of Energy (DOE)
Waste Isolation Pilot Plant
Carlsbad, New Mexico
December 8, 1986

PURPOSE:

On December 8, 1986, the MEWS task force, accompanied by EPA Region VI *representatives*, met with individuals from the Department of Energy's (DOE) Headquarters, Albuquerque Operations Office, Waste Isolation Pilot Plant (WIPP) Project Office, and Westinghouse, the WIPP site contractor. The purpose of the meeting was for task force members to gain a working knowledge of the WIPP's mission, WIPP's transuranic (TRU) waste acceptance criteria, and how TRU waste will be managed once the WIPP is operational.

SUMMARY:

The WIPP's mission is to demonstrate the safe shipment, emplacement, retrieval, and disposal of TRU waste as well as to perform some experiments with high-level wastes. The WIPP has developed a waste acceptance program which is designed to assure that only TRU waste meeting certain waste form and packaging requirements are sent to WIPP.

The WIPP is located in a 3000-foot thick salt formation in southeastern New Mexico. There is no known significant amount of ground water in the vicinity of the underground facility. Nearby ground water is high in total dissolved solids, making it unusable for humans, livestock, or irrigation.

Specific procedures have been developed on how TRU waste will be packaged for WIPP, handled, and emplaced once received at WIPP. The procedures are specific to whether the waste is contact-handled TRU (CH-TRU) or remote-handled TRU (RH-TRU).

In the areas of ground-water monitoring and oversight, RCRA equivalency has not been met by the WIPP facility.

By the time the WIPP begins waste operations, retrievably stored waste at the Idaho National Engineering Laboratory (INEL) and other generating sites will account for 56% of the total disposal capacity available at WIPP (6.4 million cubic feet). At the rate TRU waste is currently produced (at about 0.23 million cubic feet per year), WIPP is only a partial solution for TRU waste disposal.

REPORT:

A. FACILITY DESCRIPTION:

Authorized by Public Law 96-164 in 1977, WIPP's mission is to provide a research and development facility to demonstrate the safe shipment, emplacement, retrieval, and disposal of TRU wastes resulting from the production phases of DOE's nuclear defense program. Experiments with defense high-level waste (HLW) will also be conducted for developing and testing designs for future bedded-salt repositories. The HLW will be retrieved at the end of the experiments which are scheduled for completion by the time decommissioning is authorized. The WIPP was exempt from NRC regulation by Public Law 96-164. DOE is currently completing construction of the WIPP. WIPP is scheduled to begin receiving wastes in October 1988.

The WIPP site is located approximately 26 miles southeast of Carlsbad, New Mexico over the Permian Salt Basin. This 3000-foot thick salt formation, which starts about 850 feet beneath the surface, extends laterally for many miles in all directions from the site. The main storage area is near the vertical center of the salt formation (approximately 2150 feet beneath the surface).

Geological exploration and facility design began in 1975. After public hearings and receipt of written comments, the final environmental impact statement was released in October, 1980. In January, 1981, DOE issued the record of decision allowing the project to proceed. Actual construction began by mid-1981, after the Bureau of Land Management and DOE signed an agreement allowing use of the federally owned land. A preliminary demonstration period which will involve non-radioactive (mock) waste will run from April, 1987 through September, 1988. A five-year demonstration period with actual TRU waste will begin October, 1988. Because the WIPP will be the first bedded-salt, waste research and development facility, the waste will be emplaced in such a manner that it can be retrieved from its place of burial if removal becomes necessary. After tests and analyses are performed, a decision will be made on whether to leave the TRU waste emplaced permanently. The WIPP was designed with the expectation that permanent emplacement will be implemented near the end of the five-year demonstration period. Retrieval could take up to 10 years if the decision for retrieval is made.

Currently, the WIPP facility is composed of surface buildings, three shafts penetrating into the earth's subsurface, and a series of underground storage rooms and tunnels. The shafts connect the surface facilities to the underground areas and make it possible to transport workers, equipment, mined salt, and fresh air. The underground facility provides both a storage area for isolating wastes as well as a separate area for conducting experiments.

Continuous mining equipment is used to excavate the bedded salt. This excavation carves out a series of rooms for storing the waste. The rooms will be mined on an as-needed basis during the operation of the facility. Prior to the receipt of any waste, the first storage panel (a series of rooms) will be completely mined. While waste is being stored in the first panel, the second panel will be mined. This process will continue as storage panels are needed. Eight storage panels are planned with seven storage rooms each.

B. OVERVIEW OF FUTURE WASTE MANAGEMENT OPERATIONS:

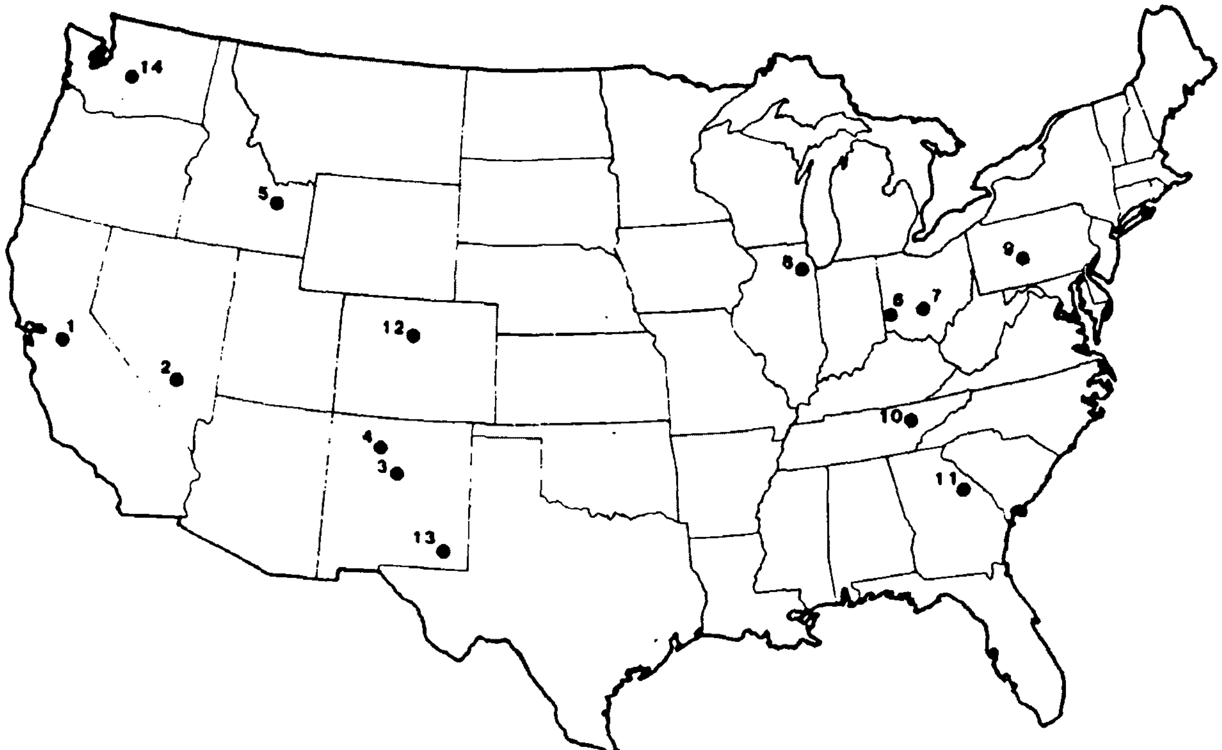
The WIPP will handle both CH- and RH-TRU waste.

CH-TRU waste is defined as transuranic waste materials which have a dose rate at the surface of the waste package not greater than 200 millirem per hour (mrem/hr).

RH-TRU waste is defined as transuranic waste materials which have a dose rate at the surface of the waste package greater than 200 mrem/hr. The normal upper limit for WIPP disposal will be 100 rem/hr. WIPP will accept waste with a dose rate in the range of 100 rem/hr up to 1000 rem/hr as long as the quantity of waste within this range does not exceed 5% of the total volume of the RH-TRU waste at WIPP.

Currently, numerous DOE facilities generate TRU waste (Figure 1). The largest TRU waste generator is DOE's Rocky Flats Plant (RFP). Currently, RFP packages CH-TRU waste in 55-gallon drums or corrugated metal boxes and then ships it to the Idaho National Energy Laboratory (INEL) by rail. Although INEL is not the only facility to store TRU waste

FIGURE 1
DOE FACILITIES GENERATING TRU WASTE



1. LLNL, Lawrence Livermore National Laboratories, CA
2. NTS, Nevada Test Site, NV
3. SNLA, Sandia National Laboratories, Albuquerque, NM
4. LANL, Los Alamos National Laboratories, NM
5. INEL, Idaho
6. Mound Plant, Miamisburg, Ohio
7. Battelle Memorial Institute, Columbus, Ohio
8. Argonne National Laboratories, Chicago, IL
9. Bettis Atomic Power Lab, Pennsylvania
10. OR Nat Lab, Oak Ridge National Laboratory, TN
11. Savannah River Plant, GA
12. Rocky Flats Plant, Colorado
13. WIPP, Waste Isolation Pilot Plant, Carlsbad, NM
14. Hanford Site, Richland, WA

(e.g., Hanford and Savannah River Plant (SRP) also do), INEL has the largest inventory of stored TRU wastes. In the past, INEL would store these shipments of TRU waste on asphalt pads, cover the containers with plastic once the waste containers were stacked to a desired height, then cover the plastic with a "removable" layer of earth. Currently, INEL stacks the containers on concrete/asphalt pads with curbing under roofs. Almost all of the retrievably stored TRU waste is destined for disposal at the WIPP (Figure 2).

The WIPP will start actual waste handling activities in October, 1988. All waste, prior to shipment to WIPP, must be certified by the generator or storage facility as meeting certain pre-established criteria called the Waste Acceptance Criteria (or WIPP/WAC). Specific certification criteria have been established for CH- and RH-TRU waste. The general elements of the criteria include:

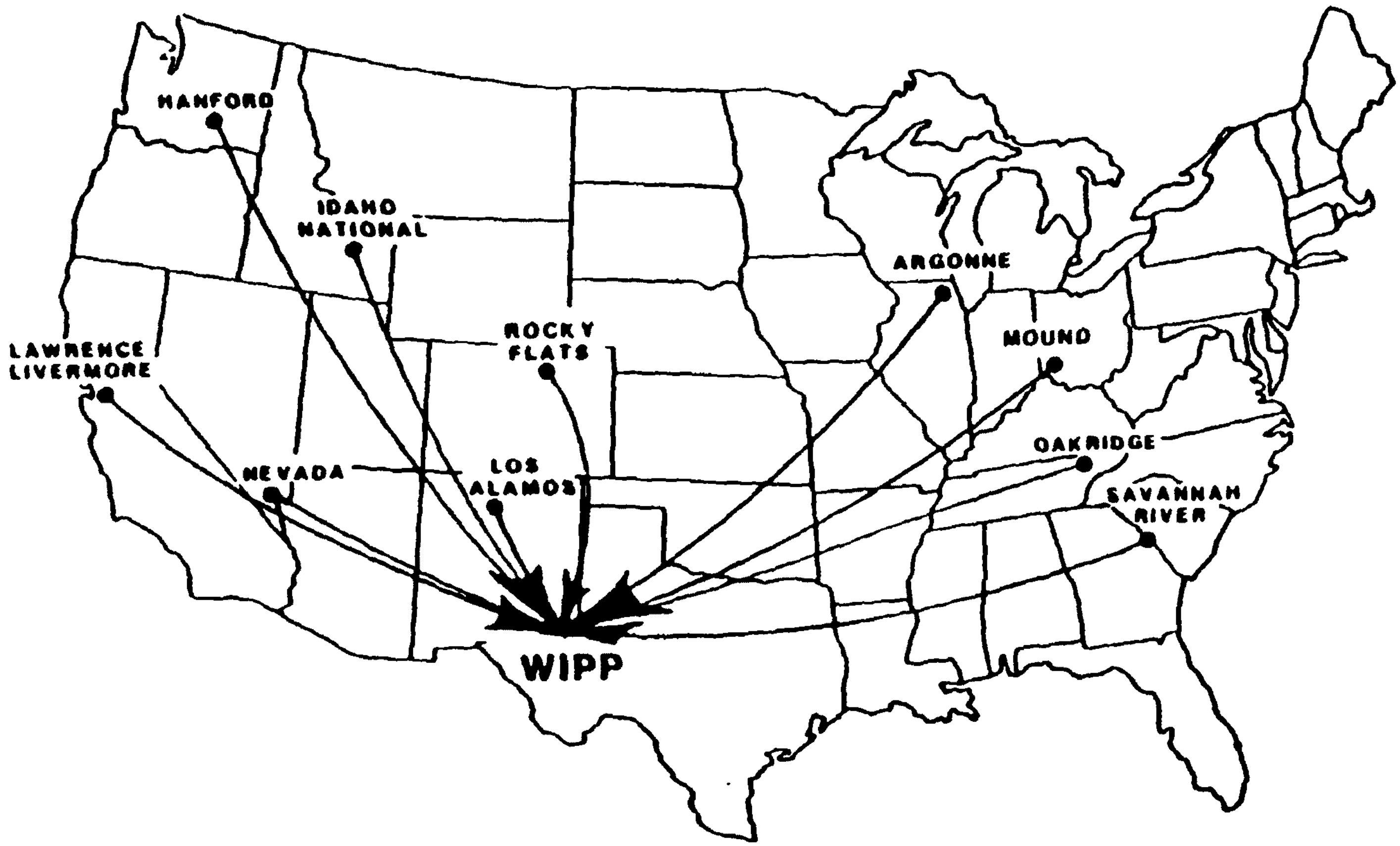
Waste Form Requirements

IMMOBILIZATION	-	powders, ashes, and similar waste materials shall be immobilized if more than 1% of waste matrix is smaller than 10 microns in diameter or if more than 15% is below 200 microns in diameter
LIQUID WASTES	-	no more than 1% free liquid
PYROPHORIC MATERIALS	-	no more than 1%
EXPLOSIVES OR COMPRESSED GASES	-	none
NUCLEAR CRITICALITY ACTIVITY	-	the fissile radionuclide content shall not exceed certain values
PU-239 EQUIVALENT ACTIVITY	-	waste package shall not exceed 1000 Pu-239 equivalent activity
HAZARDOUS WASTE	-	none are allowed in the waste package, unless they exist as co-contaminants with TRU waste

Waste Package Requirement

WASTE CONTAINERS	-	non-combustible, 20-year design life, meet the structural and design requirements for Type A packaging, see 49 CFR 173.412(b)
WASTE PACKAGE WEIGHT*	-	CH-TRU package assemblies shall not exceed 25,000 lbs
	-	RH-TRU packages shall not exceed 8,000 lbs

FIGURE 2
FUTURE TRU WASTE MANAGEMENT



WASTE PACKAGE SIZE*	-	CH-TRU package assemblies shall not exceed 12'x 8'x 8.5'
	-	RH-TRU packages shall not exceed 26" in diameter with a maximum length of 10'
WASTE PACKAGE HANDLING		both CH- and RH-TRU packages shall be equipped with special devices to facilitate handling
LABELING	-	shall be labeled with a standardized form to include the package I.D. number, weight information, and radionuclide content
THERMAL POWER	-	RH-TRU packages are limited to a maximum of 300 watts. The thermal power for an RH-TRU package shall be listed on the data package
SURFACE DOSE RATE	-	CH-TRU no greater than 200 mrem/hr RH-TRU no greater than 100 mrem/hr
SURFACE CONTAMINATION	-	no greater than 50 picocuries/100 cm^2 for alpha-emitting radionuclides and 450 picocuries/100 cm^2 for beta-gamma-emitting radionuclides
RELIEF FOR GAS GENERATION	-	for short term, during transportation and emplacement, all waste packages shall provide appropriate gas relief
DATA PACKAGE/ CERTIFICATION	-	shall be transmitted in advance of shipment

* These criteria are related to the design limitations at the WIPP facility.

Each facility which will be shipping TRU waste to the WIPP must have an approved waste certification plan before any of its waste will be accepted at the WIPP. The waste certification plan must be approved by DOE's Waste Acceptance Criteria Certification Committee (WACCC). Once approved, there will be periodic audits at each generator facility to ensure that the approved waste certification plan is being followed. Any problems noted during this audit must be resolved before any future waste from the facility will be accepted at the WIPP. Facilities with approved certification plans are currently certifying their waste and storing it until the WIPP begins accepting waste.

CH-TRU waste will be received first; RH-TRU waste will follow in 1989. The CH-TRU wastes, packaged in 55-gallon metal drums and/or other sturdy containers meeting specific structural requirements, design conditions, and dimensions, will be transported either by trucks or railcars to the WIPP. Remote-handled TRU waste, by far the smaller amount due at the WIPP, will arrive in shielded casks which will contain the waste container. When the shielded cask arrives at the WIPP, it will be carefully inspected and all of its shipping documents checked. The cask will then be transported into the remote-handling portion of the Waste Handling Building, an area separated from the contact-handled waste area. The cask is then isolated in a special room and opened to remove the waste container, which will be taken to the "hot cell" where it will be identified and inspected. The container will then be placed in a facility cask for transport to the underground storage room.

Once in the storage room, the facility cask will be placed in a machine that removes the waste container and emplaces it into a pre-drilled hole in the storage room wall. After the container is emplaced, a shield plug will be emplaced and the facility cask reused.

The storage process for contact-handled waste is quite different. The waste packages will arrive at the WIPP site in the specially designed transuranic package transporters called TRUPACTS. These TRUPACTS will hold either 55-gallon metal drums banded together in "six-packs" or various-sized metal boxes. The TRUPACTS have been designed to satisfy all federal regulatory Type B package requirements of the Department of Transportation and, therefore, tested to withstand transportation accident conditions. One TRUPACT will be transported per truck and two per railcar.

When the TRUPACT arrives at the WIPP, it will be inspected for damage and contamination. It will then be taken to the contact-handling part of the Waste Handling Building where it will go through the air lock. The TRUPACT will be opened and the waste packages inside removed and inspected again, prior to being transferred to the underground storage area. Once underground, a forklift will stack the waste packages ("six-packs" will be stored three high). This final location will then be entered into a computer so that every package will be traceable.

The WIPP storage areas have been planned and designed to accomodate 6.4 million cubic feet of TRU waste. By the end of 1988, there will be an estimated 3.5 million cubic feet of retrievably stored TRU waste at INEL and other DOE waste management sites. At the current TRU waste production rate, about 0.23 million cubic feet per year, and the expected emplacement rate at WIPP of 0.3 million cubic feet per year (limited by transportation), there will quickly be a capacity problem at WIPP.

An integrated work-off plan is being developed to methodically accommodate newly generated waste and the retrievably stored waste during the projected 25-year operating life of the WIPP.

C. MONITORING/OVERSIGHT/EQUIVALENCY TO RCRA REQUIREMENTS:

1. Monitoring

A Radiological Baseline Program is currently underway at the WIPP. Its goal is to measure background levels of radiation and radionuclides around the WIPP prior to acceptance of waste. This program includes sampling and analysis to obtain a baseline for the atmospheric, terrestrial, hydrologic, biota, and ambient radiation. An Ecological Monitoring Program monitors and evaluates the impacts of the WIPP construction (and future operations) on the ecosystem. This program includes environmental photography, soil sampling and analysis, soil microbiotic studies, vegetation surveys, air and water quality monitoring, vertebrate censuses, and meteorological monitoring.

The hydrology around WIPP has been extensively studied and is still undergoing characterization. Results indicate that while there are several water-bearing zones within the rocks (Rustler Formation) that overlie the salt deposits, none of these produce large quantities of usable ground water. The Rustler Formation is located about 1000 feet from the surface, about 1100 feet above the underground site. Studies have further shown that there are no natural communication paths in the 1100 feet between these water-bearing zones and the horizon in which wastes will be emplaced. Since the nearest ground water to the waste horizon is 1000 feet above, no ground-water monitoring within the waste horizon is planned. DOE considers ground-water monitoring unnecessary and argues that this would compromise the integrity of the facility. Although the site may qualify for a waiver from ground-water monitoring, no such application has been made by DOE.

Near-surface ground waters will be monitored through the life of the facility in order to evaluate operational impacts and to characterize long-term ground-water trends.

2. Oversight/Audit/Inspection Procedures

The WIPP/WAC Program will conduct periodic audits of DOE facilities generating TRU waste for disposal at the WIPP. These audits will ensure that the waste generators are maintaining a high level of quality in the waste certification program. The expected result is that all wastes that are shipped to WIPP will be within the restrictions of the waste acceptance criteria.

At DOE Headquarters, the Assistant Secretary of Environment, Safety and Health oversees an environmental audit of the WIPP Field Operations annually. At the WIPP, the Albuquerque Operations Office conducts audits and appraises the contractor (Westinghouse). The Headquarter's audits are independent of the Operations Office audits. The audits and appraisals are conducted to evaluate compliance with DOE orders. All audits and reports are sent to the Project Manager's Office and the Westinghouse Project Manager.

The audits performed by DOE do not monitor for compliance with all applicable RCRA requirements. These are not independent audits. On both these counts, DOE's audits cannot be considered equivalent to RCRA inspections.

3. Equivalency to RCRA Requirements

Containers of TRU wastes will be certified to be in compliance with the WIPP/WAC prior to shipment to WIPP. This certification will be verified by audits and spot checks at the shipper's facility. The certification and data package for every container will be checked at the WIPP prior to emplacement. No physical sampling or inspection which requires opening containers will be performed at the WIPP.

This approach is inconsistent with RCRA because the owner or operator who treats, stores, or disposes of off-site waste must inspect and, if necessary, analyze each hazardous waste shipment received at the facility to determine whether it matches the identity of the waste specified on the accompanying manifest and shipping paper. Lack of waste analysis and waste identification raises the question of whether or not the DOE will be able to properly segregate potentially incompatable reactive wastes within the salt rooms. DOE argues that sampling the waste, as required by RCRA, violates the "as low as reasonably achievable" principle of radiation protection, commonly referred to us ALARA.

DOE also indicated that the Waste Acceptance Plan had recently been amended to allow "some" free liquids in waste containers if the generator could demonstrate there was a sufficient amount of absorbents added to completely absorb all of the liquid waste. The RCRA requirements for no free liquids does not make allowances for the use of absorbents.

ACTION ITEMS:

Handouts from Ed Hess' discussion on transportation were requested.

DOCUMENTATION:

1) Waste Isolation Pilot Plant Handout

2) WIPP Certification Criteria

3) TRU Waste Acceptance Criteria for the WIPP - September 1985

4) Environmental Activities at WIPP

5) Sandia Technology Handout

APPENDIX B

STATE REPORTS

MEWS TASK FORCE

Meeting with State of California
Department of Health Services
Sacramento, California

January 16, 1987

PURPOSE:

On January 16, 1987, members of the MEWS task force met with Laura Yoshii and other personnel from the Toxic Substances Control Division of the California Department of Health Services (DHS) in Sacramento, California (Appendix I lists attendees). The purpose of the meeting was to get the State's perspective on the Department of Energy's (DOE) proposed option to exempt high-level (HLW) and transuranic (TRU) mixed waste management at DOE facilities from the RCRA hazardous waste program.

SUMMARY:

The Lawrence Livermore National Laboratory (LLNL), operated for DOE by the University of California, is the main TRU waste generator in the State. RCRA hazardous waste management oversight for LLNL is conducted out of the Emeryville District Office of the Department of Health Services. The State also issues air quality and water discharge permits at LLNL via regional air and water control boards. Some RCRA violations (mainly administrative) have been noted by the State at LLNL. Enforcement at LLNL is somewhat sensitive since the University of California is also an arm of the State government. The State declined to provide information on RCRA violations at LLNL because negotiations are in progress.

Personnel at the DHS headquarters in Sacramento were not familiar with TRU waste management activities at LLNL, but thought the Emeryville office would be. Much of the meeting time was taken up by MEWS personnel giving DHS personnel a description of TRU waste, low-level waste (LLW), and hazardous waste management at LLNL, as observed during the MEWS visit there the previous day.

Laura Yoshii stated that while no decision has been made, DHS would probably seek mixed waste authorization. The Radiation Health Office, also a part of DHS, has expressed an interest in taking the lead for mixed waste authorization. She did, however, question the State's capabilities for overseeing TRU waste management at LLNL, and any other DOE facilities in California (Rockwell International has a fuel de-cladding operation in Conoga Park that may also generate TRU).

Ms. Yoshii expressed conditional support for the DOE Option but wanted to learn more about the Option's implications before offering complete support. In any event, the State of California wants some oversight role at DOE facilities. It is not yet clear which State government unit would conduct such oversight.

ACTION ITEMS:

None

DOCUMENTATION:

Appendix I - List of attendees at meeting with California DHS January 16, 1987.

DISTRIBUTION:

MEWS Distribution List
Jeff Zelikson - Region 9

APPENDIX I

LIST OF ATTENDEES

EPA/Project MEWS

John Lehman

Dan Bodien

Ray Clark

Burnell Vincent

State of California

Laura Yoshii

Caroline Cabilas

Jan Smith

Florentino Castillon

MEWS TASK FORCE

Teleconference with State of Colorado

January 19, 1987

PURPOSE:

On January 19, 1987, members of the MEWS task force, along with a representative from EPA Region VIII, spoke with officials from the State of Colorado (Appendix I lists attendees). The purpose of the meeting was to get the State's perspective on the Department of Energy's (DOE) proposed option to exempt high-level (HLW) and transuranic (TRU) mixed waste management at DOE facilities from the RCRA hazardous waste program.

SUMMARY:

State officials are doubtful about the workability of the DOE Option at Rocky Flats Plant (RFP), primarily because the history of the contractors' performance is not encouraging. The waste streams merge and split in a complex fashion, impeding the identification of wastes to be covered by the option and complicating the determination that RFP is abiding by terms of the agreement. The State has invested considerable resources in understanding the waste management practices and problems at RFP; the incremental resources to be "saved" by the DOE option are not consequential. They have the expertise and can obtain lab services as needed to adequately regulate TRU waste management at RFP.

REPORT:

After briefly describing the DOE option and MEWS task force objectives, the task force chairman asked if the State was aware of facilities, other than RFP, which might be affected. Although there are several low-level mixed waste handlers in the State, no one other than RFP would be affected by the DOE Option.

The State, referring to the agenda originally proposed by DOE for Project MEWS, asked about the current estimated date for the promulgation of an EPA rule. They were gratified to hear that no decision had been made to propose a rule; the State has many reservations regarding DOE self-regulation. They asked whether DOE was attempting to demonstrate validity of the option or simply providing EPA with the information needed to make the case. The task force responded that it was the latter.

The State also expressed concern that DOE's approach to monitoring solely for radioactive indicators does not assure the absence of hazardous constituents. The State does not believe that solidification of solvent-containing wastes will effectively bind all hazardous constituents against subsequent release.

Resources to monitor HLW/TRU waste may be a near-term issue for the State. DOE spent $2 million on preparation of the RCRA Part B for hazardous waste, and reviewing it will be a major effort. In the long run, however, the State is confident that they will have enough personnel and enough resources in the chemistry lab to provide proper oversight for TRU waste management at RFP. If State labs cannot handle radioactive samples, the Department will contract for the service. Health physicists are available now, on loan, from the divisions and could be hired if full-time need was justified.

The State also expressed concern about the complexity of identifying which waste streams at RFP would be included in the exemption. The State's understanding of the hazardous waste management practices at RF has grown considerably over the last few years. Considering that the known inventory of prior and existing waste streams has grown from 14 in 1985 to 2200 at present, they are unsure how a RCRA inspector will know which waste streams are not exempt after the DOE option is implemented. Recycling and burning and blending practices have been particularly tricky to monitor.

The facility has not withheld information from the state; information contained in the facility's RCRA Part B form and any technical data from RFP has been designated as Unclassified Controlled Nuclear Information by the DOE. The designation does not require formal clearance for access because UCNI data is fully available to public agencies. It is not, however, available for release to the general public.

This was the first time the task force had encountered this classification. The State was instructed not to forward any UCNI or otherwise restricted information for task force use since all task force background materials would be publicly disclosed.

The State was aware that the Nevada Test Site (NTS) was no longer receiving TRU wastes from RFP. They were also aware that the waste shipments were stopped because NTS lacked RCRA "status", but denied that the State (or Region VIII) had ever suggested the shipments be curtailed. It is possible that Nevada requested the termination, but Region VIII and Colorado agreed that shipment of TRU waste to the NTS was environmentally safer and should not be curtailed because of NTS's confusion over RCRA procedures.

The State was not aware that classified TRU wastes were separately handled in "Greater Confinement Disposal" at NTS.

ACTION ITEMS:

State expressed desire to be kept informed of results of MEWS briefings and reports.

DOCUMENTATION: No documents were exchanged.

DISTRIBUTION:

J. Solenski

P. Bierbaum

N. Mueller

APPENDIX I

LIST OF ATTENDEES

EPA/OSW

John Lehman
Betty Shackleford
Burnell Vincent

EPA/OWPE

Tony Baney

EPA/REGION X

Dan Bodien

EPA/REGION VIII

Nat Mueller

State of Colorado

Charlie Brinkman
Joan Solinski
Phil Bierbaum

MEWS TASK FORCE

Meeting and Teleconference with
State of Idaho, Division of Environment
Boise, Idaho

December 4, 1986
January 22, 1987

PURPOSE:

On December 4, 1986, a member of the MEWS task force met with personnel from the Division of Environment, Department of Health & Welfare of the State of Idaho and on January 22, 1987, additional discussions were held by telephone (Appendix I lists attendees). The purpose of the discussions was to get the State's perspective on the Department of Energy's (DOE) proposed option to exempt high-level waste (HLW) and transuranic (TRU) mixed waste management of DOE facilities from the RCRA hazardous waste program.

SUMMARY:

The State of Idaho currently does not have RCRA authorization but is working on its application which should be ready in early 1987. The State does not anticipate authorization until the end of 1987, at the earliest.

The State has little information with respect to HLW or TRU waste generated or stored at the INEL site. The State meets with the DOE twice yearly (May and October) to discuss environmental problems.

With regard to problems at the site, Bob Funderburg stated that the State is notified of all press releases made available to the public. Bob said that over the past five years, he can only remember two minor incidents with respect to environmental problems.

Mark Torf estimated that INEL employs 10,000 workers, making DOE the largest employer in the State. He added that the main emphasis of the newly elected administration will be in relation to jobs and that any action taken by EPA or DOE resulting in loss of employment at INEL would cause problems.

The State emphasized the need for oversight on either the State or Federal level. They expressed their concern about DOE's current self-regulatory program.

Mark and Bob were interested in how the task force worked and wanted to be informed about MEWS's progress. However, they wanted to reserve any comment they may have about the DOE option for a later date.

The State is interested in obtaining information from INEL about the following issues:

- How are HLW and TRU waste generated?
- What hazardous wastes are mixed with the HLW and TRU waste?
- What is the potential for spills and how are spills handled?

With the assumption that the RCRA mixed waste program would be authorized, Mark Torf stated that he did not believe that the inclusion or exclusion of HLW and TRU waste would change the amount of resources of required for INEL. If the State encounters problems with resources such as technical assistance or laboratory support, Mark indicated that the State would find a way to get the job done. Mark also stated that the State wants to oversee HLW and TRU waste management at INEL.

<u>ACTION ITEMS</u>:

Keep State informed about direction of task force and provide information about INEL obtained from DOE.

DOCUMENTATION:

Appendix I - List of participants in discussions with Idaho Department of Health and Welfare, Division of Environment, December 4, 1986 and January 22, 1987.

DISTRIBUTION:

MEWS Distribution List

APPENDIX I

LIST OF ATTENDEES

EPA/Project MEWS

Danforth G. Bodien

State of Idaho

Steve Provant
Mark Torf
Bob Funderburg

MEWS TASK FORCE

Meeting with New Mexico State
Environmental Improvement Division
Sante Fe, New Mexico

January 12, 1987

PURPOSE:

Members of the MEWS task force and a representative from Region VI met with officials from the State of New Mexico in Santa Fe to explain the overall mission of the task force and to solicit the State's views on the issues surrounding mixed waste management by the Department of Energy (DOE).

SUMMARY:

The MEWS Task Force presented a brief history of the issues including: LEAF v Hodel, the by-product rulemaking, the reorganization of DOE to form a new Office of Assistant Secretary to deal with health, safety and environmental issues, and the November, 1986, advancement of new proposals by DOE to exempt the management of high-level waste (HLW) and Transuranic (TRU) waste by DOE from RCRA waste management standards.

In the state of New Mexico, DOE owns three facilities [Waste Isolation Pilot Plant (WIPP), Sandia and Los Alamos] where radioactive wastes are managed. Although Sandia and Los Alamos both have research reactors, HLW spent fuel rods are shipped out-of-state for processing. TRU wastes are currently being processed and stored at Los Alamos prior to shipment to the WIPP. TRU wastes may also be generated at the White Sands Proving Grounds as a result of certain Strategic Defense Initiative (SDI) experiments.

The State's relations with DOE were characterized as "strained" due to: (1) the State's view that DOE's radioactive waste management practices are less stringent than those imposed by the Nuclear Regulatory Commission on commercial facilities, (2) DOE's propensity to miss agreed-on deadlines for completion of environmental projects, (3) DOE's practice of not always following its own internal orders, and (4) DOE's secretive nature. The State did express its general concurrence with the Waste Acceptance Criteria for WIPP. However, the State indicated that comprehensive decisions could not be made until more information about waste volumes, characteristics, and management practices was made available.

REPORT:

To date, the State of New Mexico has not been involved in the regulation of radioactive or radioactive mixed waste management at Sandia or Los Alamos. The State believes that it has the legal authority to regulate these wastes under current state statutes. The State also expressed reluctance at this time to take on any additional regulatory burdens. This is due to a temporary employee shortage brought about by reduced revenues from the production of oil and natural gas (EPA has grouped the radioactive mixed waste program in Cluster Three of state authorization and states are required to apply for this Cluster by July, 1988).

In New Mexico, DOE owns three facilities which could be impacted by any decision on HL and TRU waste management. Sandia National Laboratory generates a small amount (three to five drums per year) of TRU wastes which are sent to Los Alamos for processing and storage. Los Alamos generates and manages TRU and radioactive mixed wastes. The TRU wastes are being processed to the acceptance criteria for the WIPP. Some radioactive wastes are sent to other DOE facilities for processing and disposal while low level wastes will continue to be disposed of on-site.

The WIPP is an underground disposal facility located in a salt formation which is designed to receive currently generated and backlogged inventories of TRU and mixed TRU wastes. The State has limited veto power over WIPP development and operation but it has the right, acquired in a civil proceeding, to inspect out of state DOE generators of TRU waste destined for the WIPP. This insures compliance with the acceptance criteria. The WIPP is scheduled to receive waste beginning in October of 1988.

In 1983, DOE agreed to complete hydrogeologic studies on the WIPP by 1986. This has been delayed until 1989. DOE is required to comply with 40 CFR Section 191 regulations concerning high-level and TRU wastes but has told New Mexico that it does not have to comply until disposal (backfilling) occurs. DOE argues that until disposal takes place, the WIPPP is a storage project and is not subject to Subpart B. Both of these delays are distressing to State officials and, in their view, are examples of a disturbing pattern.

The State did not have an opinion on the MEWS project objectives or DOE's HL or TRU waste management practices. The newly elected State governor and his staff have not had the opportunity to review the issues. Nonetheless, Mike Burkhart, the new EID Director, said the State would be concerned about the loss of State options if the DOE option were adopted.

The State's waste management professionals indicated that they had too little information on the volumes and types of wastes generated and DOE's waste management practices to express any opinions. This lack of information was blamed on the DOE's secretive nature and use of executive privilege to block information flow. DOE releases decision documents which cite other "draft" reports as the basis for a decision. However, those draft reports are not releasable. Therefore, the validity of the decision cannot be judged or challenged. The State could not provide many specifics about the management of HLW and TRU wastes at the DOE facilities outside of the WIPP. The State was concerned about past on-site disposal practices for a variety of RCRA, PCB, TRU wastes and other wastes at Los Alamos.

ACTION ITEMS: None.

DOCUMENTATION: No memoranda or documents were exchanged.

DISTRIBUTION:

Michael Brown
Jim Channell

APPENDIX I

LIST OF ATTENDEES

EPA/ PROJECT MEWS

Jack Lehman
Ray Clark
Tony Baney

EPA REGION VI

Marc Sides

STATE OF NEW MEXICO

Jim Channel
Kirk Jones
Mike Burkhart
Mike Brown
Richard Mitzelfelt
Jack Ellringer
Boyd Hamilton

MEWS TASK FORCE

Meeting with the State of South Carolina
Department of Health
and Environmental Control
Columbia, South Carolina

December 4, 1986

PURPOSE:

On December 4, 1986, MEWS task force representatives and EPA Region IV representatives met with the State of South Carolina's Department of Health and Environmental Control (DHEC) Commissioner Bob King and staff (Appendix I lists attendees). The purpose of the meeting was to discuss the Department of Energy's (DOE) option to assess methods of handling high-level (HLW) and transuranic (TRU) mixed waste in the context of affording an equivalent or superior level of protection than RCRA requirements prescribe.

SUMMARY:

The State of South Carolina's DHEC stated that they preferred to have as much control over the Savannah River Plant (SRP) as possible. Upon consideration of DOE's proposed option, DHEC stated that oversight or regulatory control should be mandatory at SRP. They stated that they preferred State and EPA oversight, with DHEC taking the lead.

In general, DHEC expressed confidence in the adequacy of SRP's management of HLW and TRU mixed waste that is intended to be sent off-site. DHEC stated that they currently do not have jurisdiction over the radiological components of HLW or TRU waste at SRP. Also, DHEC expressed concern about their limited capability and expertise to handle these wastes. DHEC stated that it may take some time to build their capability. In conclusion, DHEC urged that HLW, TRU wastes and by-product definitional differences be resolved so that the program could move forward.

REPORT:

The State of South Carolina's Department of Health and Environmental Control (DHEC) provided background information concerning formal agreements that may affect DOE's proposed option. Several documents currently exist. In April 1985, DHEC signed a memorandum with SRP which stated that SRP would be treated in the same manner as a private facility. In addition, DHEC described a letter from the Department of the Navy which stated that no submarine hull disposal is proposed at SRP. Through a Memorandum of Understanding (MOU) with SRP, the State does provide oversight of low-level radioactive waste that is mixed with hazardous waste.

DHEC's reading of the July 3, 1986, Federal Register notice concerning mixed waste did not include HLW and TRU waste. They stated that their interpretation of the Federal Register notice was that it addressed only low-level radioactive mixed waste.

Currently, DHEC does not exercise control over mixed HLW or TRU waste. However, it does exercise jurisdiction over air, water and Resource Conservation and Recovery Act (RCRA) permits at SRP. DHEC understood that without the by-product definition, HLW and TRU mixed waste would be encompassed by the Federal Register notice.

As a matter of policy, DHEC's Deputy Commissioner expressed preference in having as much control over SRP as possible. In consideration of DOE's proposed option, DHEC stated that independent oversight and/or regulatory control should be required at SRP. They emphasized the need for State and EPA oversight, with their preference for DHEC taking the lead.

DHEC stated that jurisdiction over radionuclides has typically been handled by the federal government, as is mandated by the Atomic Energy Act (AEA) and South Carolina State law. Representatives from DHEC's Radiation Health (RH) Division stated that SRP has done an acceptable job of off-site radiological control.

When DHEC's RH Division was asked about their ability to manage the HLW and TRU mixed waste program at SRP, they responded that they currently did not have the personnel, procedures, or expertise to handle the program. They stated that it would take time to build that capability. DHEC-RH expressed concern that if HLW and TRU mixed waste was regulated by their division, they would require an account of all processes involved in generation of the waste streams and that there may be some concern over those processes that are classified. DHEC stated that if the program fell under RCRA's jurisdiction, only the hazardous waste component would be regulated.

DHEC also raised concern that some mixing of low-level waste with HLW and TRU waste may have occurred in the past. They expressed concern that DOE may not have adequately controlled substances that were mixed with HLW and TRU mixed waste.

The meeting concluded with a discussion of the definition of HLW, TRU, and by product material. DHEC urged that definitional differences be resolved so that the mixed waste program could move forward.

DHEC referred to Dan Reicher from the National Resource Defense Council (NRDC) as a knowledgeable contact on this subject, stating that he had recently been involved in legal proceedings on this issue.

ACTION ITEMS:

Region IV will obtain a copy of the documents listed below.

DOCUMENTATIONS:

April 5, 1985, Memorandum of Understanding between DHEC and SRP concerning treatment as a private facility.

Letter from Department of the Navy concerning the disposal of spent submarine hulls.

Memorandum of Understanding between DHEC and SRP concerning low-level radioactive waste.

APPENDIX I

LIST ATTENDEES

EPA/PROJECT MEWS

Jack Lehman
Lynn Pirozzoli

EPA/REGION IV

Richard Campbell
John Dickenson

SC/DHEC-RA

Heyward G. Shealy

SC/DHEC-RAD. HEALTH

Virgil R. Autry
Pearce O'Kelley

SC/DHEC-SOLID & HAZ. WASTE

Hartsill Truesdale
Lewis R. Beckenbaugh
Robert W. King, Jr.
David Wilson
Eric Gleason

SC/DHEC-INDUSTRIAL WW

Alan Coffey
Burt Ruiter

MEWS TASK FORCE

Meeting with State of Tennessee
Tennessee Department of Health and Environment
Nashville, Tennessee

December 4, 1986

PURPOSE:

Members of the MEWS task force met with Tom Tiesler, director of the State Solid Waste Management Division and other personnel from the Solid Waste Radiological, Health, and general counsel offices of the States Department of Health and Environment (TDHE), General Counsel of the State's Department of Health and Environment (TDHE), and with representatives from EPA's Region IV. The purpose of the meeting was to discuss the DOE option, to understand the State perspective on high-level waste (HLW) and transuranic (TRU) waste management oversight and to discuss State perception of those operations at Oak Ridge National Laboratory (ORNL).

SUMMARY:

The task force presented a brief description of EPA's Mixed Energy Waste Study (MEWS) objectives and progress and requested the State's general reaction to DOE's suggested option to the proposed by-product definition. State attendees were all basically familiar with DOE's November 1985 proposal on the definition of by-product material, and offered suggestions and cautions regarding conduct of Project MEWS. The task force raised the issues listed in Appendix II.

While there were several misgivings and caveats expressed at the meeting, there were no strong "stopper" issues identified. The following general reactions were presented by the State:

- DOE's track record does not fully support a blanket exemption of either mixed high-level waste (HLW) or mixed transuranic (TRU) waste management from RCRA requirements.

- There are philosophical objections to self-regulation by any agency.

- There could be a problem with establishing the precedent that federal agencies can use Section 1006 to find "inconsistency by duplication".

- Limited exemptions are preferable to broad-based exemptions.

REPORT:

State personnel identified several concerns regarding the DOE option. They urged EPA to focus on the workability and clarity of the delineations between HLW and low-level wastes (LLW) and between TRU and other mixed wastes. The definitions should be tested on actual waste streams encountered at DOE facilities during the site visits. They suggested that it is not sufficient that a theoretically correct definition be in place, but that it must be practical as well. EPA and DOE should resolve the confusion because current definitions are partially based on the waste's origin and characteristics. The State suggested that specific activity levels should be used in distinguishing mixed wastes. Low-level, high-activity waste (sometimes called intermediate waste) is different from other LLW; the distinction could be useful as various exemption scenarios are considered.

State personnel indicated that ORNL revised their interpretation of the definition of LLW to include disposal practices called hydrofracture. As a result, state personnel suggested that the wording of any final agreement should specify that future changes in interpretation of waste classification or definitions be reviewed for their impact on the agreement. The agreement should be worded so as to enhance and assure the autonomy of the environmental organization at DOE, and to assure that production-oriented entities at DOE cannot edit environmental findings before the EPA, State, and public have access.

HLW treatment residues which are no longer HLW should not be part of the exemption. EPA should make sure that any exemptions agreed to under the DOE option do not apply to the non-HLW residues or effluents and that a tracking system is instituted to ensure that any resulting mixed wastes or hazardous wastes will be picked up by the RCRA system.

The State suggested that in presenting the findings, the task force should keep in mind the kinds of sanctions that an EPA authorized State could invoke. After discovering a problem, would the DOE self-regulating system move quickly and effectively to a remedy? Furthermore, it should be pointed out that the existing RCRA rules were drafted for different conditions and as a result, MEWS's analyses should include more than a single comparison between DOE procedures and existing RCRA rules. Comparisons should also envision a future "Subpart Z, Mixed Waste Management", if and where it would be appropriate. As a final step, the task force should consider applying two or three hypothetical scenarios of full RCRA (including Subpart "Z"), existing RCRA, and partially exempt programs to one or two of the DOE facilities as a demonstration or illustration of equivalency.

At each facility and for each waste stream, DOE should demonstrate the inseparability of the radioactive and chemical components (e.g. could toluene ever be released from a mixed-waste stream and not contain radionuclides?) Hydrofracture fixation at ORNL has released ground-water contaminants due to dissociation of hazardous constituents. In general, EPA should assure that DOE's ground-water monitoring objectives include tracking these discharges after they enter the environment.

EPA should provide a "safety net" for any cases where the DOE option would result in exemptions from Sec. 3004 (u). For instance, if a facility were only subject to RCRA-permitting requirements for HLW or TRU waste management units, an exemption could result in old solid waste management units (SWMU's) escaping requirements of Sec. 3004 (u); such a facility should still be required to clean up the SWMU's as if the permit were required.

The status of past practices should be carefully delineated in the agreement with DOE. Some TRU wastes are retrievably stored at ORNL; other TRU waste will probably remain in place. The exemption should allow case-by-case determinations of individual waste management areas. The State asked about the Underground Injection Control requirements and whether plugging, monitoring, and other considerations would be subject to a separate task force.

Delays in obtaining "Q-clearances" were a problem, but only at the annoyance level; a cleared inspector could be hampered by inability to report the specifics of a finding which was based on classified information.

The State also discussed ongoing DOE/TDHE interactions and the existing, potentially affected facilities in the State. The DOE/TDHE relationship has been positive (i.e., ORNL is much less inclined to use the by-product rule than SRP has). State concerns are primarily limited to generator/transport/storage issues; disposal in Tennessee is not anticipated. There are three activities/facilities in the state which could be affected by the DOE option: TRU waste storage, molten salt reactors, and a biodenitrification tank farm (eight 500,000 gallon tanks, five more on order). Some of these may be source-material related and therefore not affected. DOE identification of all waste streams and facilities which could be affected by the option would be appreciated.

Existing DOE facilities have recently begun to comply with Subpart F. Not one facility has completed their second quarter of background determinations; comparison sampling is more than a year away. Traditional pump-and-treat remedial measures for corrective action could be affected by considerations of worker exposure to radiation.

ACTION ITEMS:

The State will provide the following additional information:

1. Reference material regarding the change in DOE's definition of LLW.

2. Ground-water data at the hydrofracture site and evidence of the release of organic constituents.

DISTRIBUTION:

Attendees
Mews Distribution List

APPENDIX I

LIST OF ATTENDEES

EPA/REGION IV

Doug McCurry
Suzie Riddle

EPA/STATE PROGRAMS

Betty Shackleford

EPA/RADIATION PROGRAMS

Ray Clark

EPA/OFFICE OF SOLID WASTE

Burnell Vincent

TDHE/RADIOLOGICAL HEALTH

Michael H. Mobley
Lisa Stetar
Debra Shults

TDHE/SWM

Elizabeth Phillips

TDHE/OGC-E

Mary Johnston

TDHE/SOLID WASTE

Tom Tiesler
April Ingram
Wayne Gregory

TDHE/DOE PROJECT COORDINATOR

Earl Leming

TDHE/SOLID WASTE MGMT. DIV

John Leonard

TDHE/SWM

Larry Leford

APPENDIX II

Questions for States Regarding High-Level
Mixed Wasted Management

1. Query the State about their view on the approach currently under consideration by the Agency (i.e. exemption of transuranic (TRU) and high-level mixed wastes, and other wastes such as low-level nuclear submarine reactor compartments from RCRA regulation if management of the radioactive component is determined to adequately safeguard the hazardous waste component or if compliance with RCRA is found to be inconsistent as defined by Section 1006).

NOTE: Colorado is the only State authorized to regulate the hazardous component of radioactive mixed wastes.

2. Does the State have specific concerns regarding DOE management of high-level mixed waste with EPA oversight? If yes, what are the concerns?

3. When does the State intend to seek mixed waste authorization?

4. To date, have there been any documented incidents associated with DOE waste management practices? If yes, obtain appropriate documentation.

5. What, if any, information does the State have concerning DOE facilities?

6. Does the State anticipate that the regulation of high-level mixed wastes will pose problems significantly contrasting with those associated with low-level mixed waste management? If yes, what are the problems?

7. How many DOE facilities are located in the State? Are there any commercial facilities within the State that generate TRU or high-level mixed wastes? If yes, how many?

8. How many facilities within the State could potentially be affected by the approach under consideration by EPA? Obtain a listing if possible.

9. Other permits - air, water, RCRA.

MEWS TASK FORCE

Meeting with State of Washington
Department of Ecology
Olympia, Washington

November 25, 1986

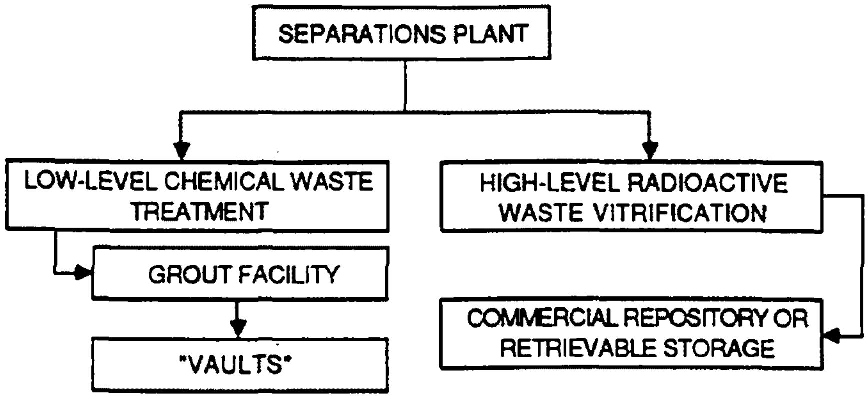
PURPOSE:

On November 25, 1986, members of the MEWS task force met with Roger Stanley of the Washington Department of Ecology (WDOE) in Olympia, WA from approximately 2:00 to 4:30 (Appendix I lists attendees). The purpose of the meeting was to get the State's perspective on the Department of Energy's (DOE) proposed option to exempt high-level waste (HLW) and transuranic (TRU) mixed waste management at DOE facilities from the RCRA hazardous waste program. A summary of the issues raised/discussed including the State's reaction to the DOE option follow:

SUMMARY:

- The State has a problem with DOE's definition of high-level waste; double-shell tanks do not contain only high-level waste. Hanford has told the State that low-level mixed wastes are also contained in the double-shell tanks. Roger used this example to illustrate the point that the double-walled tanks contain wastes other than high-level wastes; the information is from a presentation made by Hanford on a hazardous waste treatment facility it is preparing to construct.

Purex plant and double-walled tank waste will go to:



- Roger stated that "the State won't buy up-front exemptions to RCRA - these would lead to litigation." He feels the DOE proposal would exempt the wastes with greatest environmental hazard (liquid, concentrated) from the oversight that is necessary to protect the environment.

- He stated that the report "Liquid Waste Disposal Units" of October 1986 shows how waste going to tanks has been mismanaged in the past. The State does not take the word of DOE that wastes will be managed properly in the future.

- Roger expressed a concern that the double-shell tanks are all piped underground. "We do not know whether they are leaking." Hanford lacks ground-water monitoring data to verify there is no contamination - "this is a major problem."

- Roger would expect to see waste analyses for TRU waste. Not all TRU wastes are gloves and booties - Hanford has stated that it also includes process sludges. Waste analyses must show what the chemical (hazards) components are. DOE must show how it handles the chemical aspects, show whether liquids are present, how concentrated, etc.

- Roger feels that the State is not "gaining ground fast enough" on the by-product issue. Instead, DOE goes from issue-to-issue and does not make progress in managing its most hazardous wastes. State does not want a "gentleman's agreement trading off some wastes for others," which is what DOE's proposal does, in his opinion.

- There is a precedent in Washington State concerning the issue of inconsistency between Sections 1006 and 6001: the commercial low-level waste disposal site (U.S. Ecology) claimed it was not subject to RCRA even though it handled chemical and radiological waste, and US Ecology said 1006 and 6001 were inconsistent. However, US Ecology could not come up with an example of the inconsistency, and neither could the State. Jim Michaels, Bruce Weddles, and several NRC people were involved. The result, apparently, was that EPA and NRC said dual regulation would continue.

ACTION ITEMS:

The task force may wish to interview a member of the Office of High-level Nuclear Waste Management in addition to Roger Stanley. It is located within the WDOE and it deals primarily (but not solely) with issues concerning the siting of the geologic repository. It interfaces with the Governor's High-level Nuclear Waste Board, which consists mainly of legislators.

DOCUMENTATION:

Tank Waste Data supplied in response to Roger Stanley's questions of July 14, 1986.

DISTRIBUTION:

MEWS Distribution List

APPENDIX I

LIST OF ATTENDEES

EPA/Project MEWS

Danforth Bodien
Janet O'Hara

State of Washington

Roger Stanley