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THE HAZARDOUS WASTE/MIXED WASTE DISPOSAL FACILITY (U)

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ABSTRACT

The Hazardous Waste/Mixed Waste Disposal Facility (HW/MWDF) is a two-phase, 1989 Congressional Line Item project. The HW/MWDF will provide permanent Resource Conservation and Recovery Act (RCRA) permitted storage, treatment, and disposal for hazardous and mixed waste generated at the Department of Energy's (DOE) Savannah River Site (SRS) that cannot be disposed of in existing or planned SRS facilities.

Final design is complete for Phase I of the project, the Disposal Vaults. The Vaults will provide RCRA permitted, above-grade disposal capacity for treated hazardous and mixed waste generated at the SRS. The RCRA Part B Permit application was submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) in September, 1990. Pending the approval of the Part B Permit application, the first Disposal Vault is scheduled to be operational in mid 1994.

The technical baseline has been established for Phase II, the Treatment Building, and preliminary design work has been performed. The Treatment Building will provide RCRA permitted treatment processes to handle a variety of hazardous and mixed waste generated at SRS in preparation for disposal. The processes will treat wastes for disposal in accordance with the Environmental Protection Agency's (EPA's) Land Disposal Restrictions (LDR). A RCRA Part B Permit application has not yet been submitted to SCDHEC for this phase of the project. The Treatment Building is currently scheduled to be operational in late 1996.

ASME MIXED WASTE SYMPOSIUM
THE HAZARDOUS WASTE/MIXED WASTE DISPOSAL FACILITY(U)

THE SAVANNAH RIVER SITE

The Savannah River Site (SRS) is a Department of Energy (DOE) installation operated by Westinghouse Savannah River Company (WSRC). The Site is located approximately 25 miles southeast of Augusta, Georgia; 18 miles south of Aiken, South Carolina; and 100 miles west of the Atlantic Coast. The Site consists of 18 major production, service, research, and development sections within an area of approximately 325 square miles. The SRS was established by the U.S. Atomic Energy Commission in 1950.

SRS OPERATIONS

The SRS's main function is to produce and recover nuclear materials (primarily tritium, plutonium-239, and highly enriched uranium fuel) for national defense purposes. The SRS produces and recovers nuclear materials for space use (primarily plutonium-238). The versatility of the Site's reactors has led to the production of many other nuclear materials, including californium-252, americium-243, uranium-233, curium-244, polonium-210, and cobalt-60, all used in medicine and industry.

WASTE MANAGEMENT

Through the SRS's primary and ancillary operations at its various facilities, a variety of solid, radioactive, non-radioactive hazardous, and mixed hazardous wastes are generated. Effective management of waste generated by operations at the SRS is an integral part of the continued success of the installation. The Waste Management departments within both the Department of Energy-Savannah River (DOE-SR) and WSRC are charged with overseeing waste management activities.

The SRS's overall objectives in the management of wastes are to eliminate effects of wastes on the environment, comply with applicable regulations and, to the extent possible, provide waste handling, treatment, storage, and disposal within the Site.

The strategy for achieving the waste management objectives includes steps to:

- ensure waste can be treated and properly disposed of before it is generated,
- minimize waste generation,
- recycle waste in processes as much as practical,
- segregate waste at the generating locations for temporary storage in permitted facilities,
- incinerate to destroy hazardous waste and reduce waste volume,
- treat waste to minimize mobility before final disposal,
- dispose of newly generated waste in monitored repositories,
- maintain integrity of existing disposal sites, and
- initiate new projects to ensure performance objectives are met.

THE HAZARDOUS WASTE/MIXED WASTE DISPOSAL FACILITY

The Hazardous Waste/Mixed Waste Disposal Facility (HW/MWDF) is one such "new project". This project is part of the integrated SRS plan to treat and dispose of regulated wastes and will play a key role in waste management activities at SRS. The HW/MWDF is a two-phase, 1989 Congressional Line Item project that will provide RCRA permitted storage, treatment, and disposal for hazardous and mixed waste generated at the SRS that cannot be disposed of in existing or planned SRS facilities.

Phase I - Disposal Vaults

The HW/MWDF project includes the design and construction of two (2) Disposal Vaults, preparation of a 10-vault site, and procurement of a mobile gantry crane for waste placement. The Disposal Vaults portion of the project will provide ultimate and permanent disposal of treated solid hazardous and mixed waste that has been processed into acceptable disposal forms. Eventually 10 Disposal Vault units will occupy the approximately 36-acre Disposal Vault site which is almost centrally located at the SRS.

Design: Final design of the Disposal Vaults was completed in October, 1990. The Disposal Vaults will be above-grade, concrete structures, with a double-lined, leachate detection and collection system. These units will comply with applicable EPA and SCDHEC Regulations and Standards, DOE Orders, and will conform to the direction provided in the Joint Guidance Document issued by the EPA and the Nuclear Regulatory Commission (NRC) for mixed waste land disposal facilities. The approximate outside dimensions of each Disposal Vault are 200 ft. long x 50 ft. wide x 25 ft. deep.

All concrete for the Disposal Vaults shall be 4,000 psi 90-day strength in accordance with ACI 301-84. To minimize cracking, special concrete mixes will be used. The mix will include super plasticizer, 3/4" coarse aggregate, blast furnace slag, and fly ash. Concrete at placement will be nitrogen cooled to 60^{o}F at placement. Insulated wall forms will be required to be left in place for seven days and curing compound will be applied to wall surfaces to facilitate curing.

Each Disposal Vault is subdivided into four (4) cells. Each cell will be supplied with a removable steel raincover. The design of the raincovers will allow for stacking during operations.

Each cell will be independently lined. The liner system for the bottom and walls of each cell will be comprised of two (2) High Density Polyethylene (HDPE) membranes, sandwiching an HDPE drainage net. The primary liner will have a thickness of 80 mils and the secondary liner will have a thickness of 60 mils. Each cell will have an individual leachate collection and leak detection system, including HDPE pipes and sumps integral with the bottom slab liner system and extending to the top of the wall. Liquid indicators will be installed within each of the riser pipes. The indicator installed within the leak detection riser will have a single liquid level set point to alarm should liquid accumulate. The indicator for the leachate collection riser will have two liquid level set points; one to indicate the presence of liquid and the other to notify personnel that liquid removal is required. If leachate is determined to be present, a submersible pump will be lowered down the riser pipe to remove any accumulation. The removed leachate would be managed as hazardous waste. The leachate collection and detection system can be seen in Figure 1.

Permitting: Construction of the Disposal Vaults cannot begin without receipt of a RCRA Part B Permit. Receipt is anticipated in September, 1992. In addition, the project requires that an Erosion Control Plan be filed with the State of South Carolina and a permit for an SCDHEC Groundwater Monitoring program be obtained. The project must also comply with applicable SRS permitting requirements, including Site Use, Site Clearance, and Power Service Utilization.

Significant project schedule delays have been incurred by the Disposal Vault portion of the project as a result of RCRA permitting delays. Limited manpower within SCDHEC has affected the RCRA approval process and thus the project schedule.

Operation: A gantry crane will be used to remove the raincovers for access to the cells. The Vaults will be filled one cell at a time. Waste placement will be accomplished by use of the gantry crane. For the most part, the waste containers will be specially-designed concrete boxes or palletized drums. Lifting operations can be accomplished with precision through the employment of iso-twist locks, originally developed for containerized cargo applications. These self-locking devices allow for complete remote handling of the waste from within the cab of the crane. An operational sketch (not to scale) is shown in Figure 2.

Only solid hazardous and mixed waste, treated in accordance with applicable standards, shall be disposed of in these units. Treated wastes will be received from Phase II of the project (the Treatment Building) and from the SRS Consolidated Incineration Facility.

RCRA Closure: Partial closure will take place as each Disposal Vault is filled. The temporary raincover will be replaced by a permanent concrete cap, which will be constructed in two steps. First, precast concrete tees will be positioned to span the width of each waste cell. The tees will function to support the weight of the second step, the poured-in-place concrete cap that will be placed over each Disposal Vault. The concrete cap will also be sloped and the top will be covered with an Ethylene Propylene Diene Monomer (EPDM) roofing membrane to prevent the infiltration of precipitation. Metal flashing along the perimeter of the Disposal Vault will be installed to help exclude water from the waste cell. Joints resulting from the construction of the concrete cap will be sealed and flashed to minimize leakage.

Final closure of the Disposal Vaults will take place after the last unit is filled and closed. Final closure activities are projected to take about 13 months to complete. After the last Disposal Vault is sealed, the area surrounding the Vaults will be backfilled with well-graded sand or silty sand to the top of the roofs. Over the top of the backfill and vaults, a three-layered final cover will be constructed, meeting the requirements of South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.264.310(a). A sketch of the final cover is shown in Figure 3.

The final cover will consist of three layers:

1. The top layer will be at least two feet thick and will support a grass cover to minimize erosion. This layer will have a final slope between three and five percent.
2. The middle layer will consist of at least 12 inches of sand with a hydraulic conductivity of at least 1.0 x 10^{-3} cm/sec. This sand layer will be overlain with a geotextile fabric to prevent plugging. The bottom of this layer will have a slope of at least two percent.
3. The bottom layer will be a composite clay/synthetic liner. The clay will be at least 23 inches thick and have a hydraulic conductivity of not more than 1 x 10^{-7} cm/sec. The clay will have a minimum slope of three percent. On top of the clay layer, a 60 mil thick HDPE liner will be installed.

Prior to backfilling and installing the final cover, the leachate collection and leak detection riser pipes will be extended beyond the elevation of the final cover surface. The liquid level sensors will be modified accordingly. The riser pipes will be large enough in diameter to allow a pump to be lowered into the sump. A minimum of 30 years of post-closure care will be provided.

Phase II - Treatment Building

The HW/MWDF project also includes the design and construction of a waste Treatment Building and associated processes to handle and treat hazardous and mixed wastes generated at the SRS. This portion of the project will provide a controlled environment and required processes for the treatment of waste in preparation for final disposal.

Design: The design of the Treatment Building has not yet progressed past the preliminary stages. In 1988, when the technical baseline of the project was being established, it was known that EPA's LDR would lead to a disposal dilemma for the SRS when the Third Third Land Disposal Restrictions were promulgated (scheduled for May, 1990). In 1988, EPA had not yet proposed treatment standards for most SRS hazardous wastes. In order to proceed it was assumed that waste encapsulation/stabilization would most likely be the prescribed treatment for facility wastes. Preliminary design proceeded based on this assumption.

Land Disposal Restrictions: When the LDRs were promulgated in May, 1990, it was realized that much interpretation would be required for application to the unique characteristics of the hazardous and mixed waste generated at SRS. In addition, SRS has initiated programs to ensure all waste streams are characterized for final treatment and disposal.

Rationale for Process Selection: A task team comprised of representation from WSRC Waste Management, Savannah River Laboratory, Systems Engineering, and the Environmental Protection Department took on the challenge. This combination provided project, operational, technical, and regulatory input into the task. A matrix was developed starting with all known SRS waste streams, their current stored inventory and anticipated future generation rates. Next, attention was applied to the regulated waste streams. EPA's Best Demonstrated Available Technologies (BDATs) and/or Treatment Standards were applied to each waste stream, if available. A preliminary evaluation was made as to the best way to handle the greatest number of waste streams (and potential waste streams) with a minimal number of treatment processes. An example of the matrix process is shown in Table 1.

Some of the waste streams that had to be contended with in process selection include:

- **Lead** (used in shielding, gloves and aprons, bricks, tiles, and sheets)
- **Contaminated Process Equipment**, and
- **Contaminated Soils**

Process Selection: The task team ultimately recommended an expansion of the Treatment Building scope from the original encapsulation/stabilization scope to the following:

- **Tritiated Waste Handling**
- **Mercury Treatments**
  - Mercury Amalgamation (for radioactively-contaminated elemental mercury)
  - Acid Leaching and Chemical Oxidation (for low mercury wastes - less than 260 ppm Hg)
  - Retorting (for high mercury wastes - greater than or equal to 260 ppm Hg)
- **Macroencapsulation** (ideal for waste lead not suitable for decontamination)
- **Stabilization/Solidification** (for soils and sludges)

In depth details of these treatment processes are covered in A Perspective of Hazardous Waste and Mixed Waste Treatment Technologies at Savannah River Site (U), presented by J.L. England at the ASME First International Mixed Waste Symposium. Following is a brief discussion of each process.

Tritiated Waste Handling: Tritium mixed waste is a large volume driver for the Treatment Building scope. The handling of this waste stream will require special considerations for personnel safety, overall hazards, and engineered release prevention requirements. The main consideration in handling tritiated mixed waste is the constant offgassing of tritium. The tritiated waste handling area will be equipped with an off-gas system. The off-gas system will have the capability to monitor and recover tritium. The process design must minimize the amount of area within the Treatment Building contaminated with tritium.

Mercury Treatments: Mercury treatments will be included within the tritiated waste handling segment of the Treatment Building since the largest volume of mercury waste is tritium-contaminated.

Macroencapsulation: Macroencapsulation is the specified technology for radioactive lead solids, and is the process of surface coating a waste with a material such as polymeric organics or a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. SRS is looking into a readily available macroencapsulation process that uses a thermoplastic polymer. SRS may seek the necessary variance to macroencapsulate other waste streams.

Stabilization/Solidification: Stabilization/solidification is the process of transforming wastes into a more manageable, less toxic, or non-leachable form. It involves the use of cementitious or other binders for the immobilization of characteristic and listed metal constituents and radioactive contaminants. The leaching potential of the treated constituent is mitigated by isolating the contaminants from environmental influences through microencapsulation of the waste particles. Solidification adds material to a liquid or semi-liquid waste to produce a solid monolith.

Support of the listed treatment processes will also require:

- initial waste monitoring
- sorting

- size reduction where applicable
- packaging and/or repackaging
- final waste monitoring, and
- wastewater handling

Treatment Variances: Variance refers to a treatability variance under the RCRA LDR program (40 CFR 268.44). A variance is available in cases where the petitioner can demonstrate that the treatment standard for a given waste cannot be met. The inability to meet a treatment standard may be due to a complex waste matrix or to existence of a waste that is significantly different from the wastes that EPA used in evaluating treatment technologies and setting the treatment standards. Another type of variance available is the equivalency variance (cited in 40 CFR 268.42(b)). This variance allows the petitioner to demonstrate that another method of treatment is equivalent to the method that has been specified by EPA. In each case, the approval of a treatability or equivalency variance is entirely up to the EPA. It has been recommended that a lead time of 18 months be given for review of these variances by EPA.

Treatability variances have been recommended and will be sought for a few of the SRS waste streams. Justification for SRS variances include:

- a one-time small volume generation waste stream with no apparent feasible treatment

- a small volume mixed waste with an extremely high radiation level

Permitting: Construction of the Treatment Building cannot begin without receipt of a RCRA Part B Permit. A RCRA Part B Permit application is anticipated to be ready for submittal to SCDHEC in September, 1992. As with the Disposal Vaults, it will be necessary to file an Erosion Control Plan with the State of South Carolina as well as a permit application for an SCDHEC Groundwater Monitoring program. In addition, it is anticipated that the Treatment Building will require an SCDHEC Air Pollution Control Permit, a National Emission Standards for Hazardous Air Pollutants (NESHAPS) Permit, and applicable water use and wastewater handling permits. The project must also comply with applicable SRS permitting requirements, including Site Use, Site Clearance, and Power Service Utilization.

Lessons learned in the Disposal Vaults permitting cycle have led to more realistic scheduling estimates and will be incorporated into project development for the Treatment Building.

FFCA: DOE-SR and EPA entered into a Federal Facility Compliance Agreement (FFCA) on March 13, 1991. This Agreement applies to the solvent and California list mixed waste streams, and the RCRA LDRs pertaining to past, ongoing and future generation, storage, treatment and/or disposal of radioactive mixed waste at SRS. The Treatment Building is an integral part of the SRS treatment plan for handling these wastes and is specifically identified in the Agreement along with project commitment dates.

SUMMARY

Waste management objectives at SRS are to eliminate effects of wastes on the environment, comply with applicable regulations and, to the extent possible, provide waste handling, treatment, storage, and disposal within the Site. The 1990's will focus on the safe start-up of previously conceptualized waste handling facilities. The HW/MWDF is part of the ongoing integrated effort at SRS to eliminate effects of wastes on the environment and comply with regulatory requirements while ensuring the continued support of the SRS mission.

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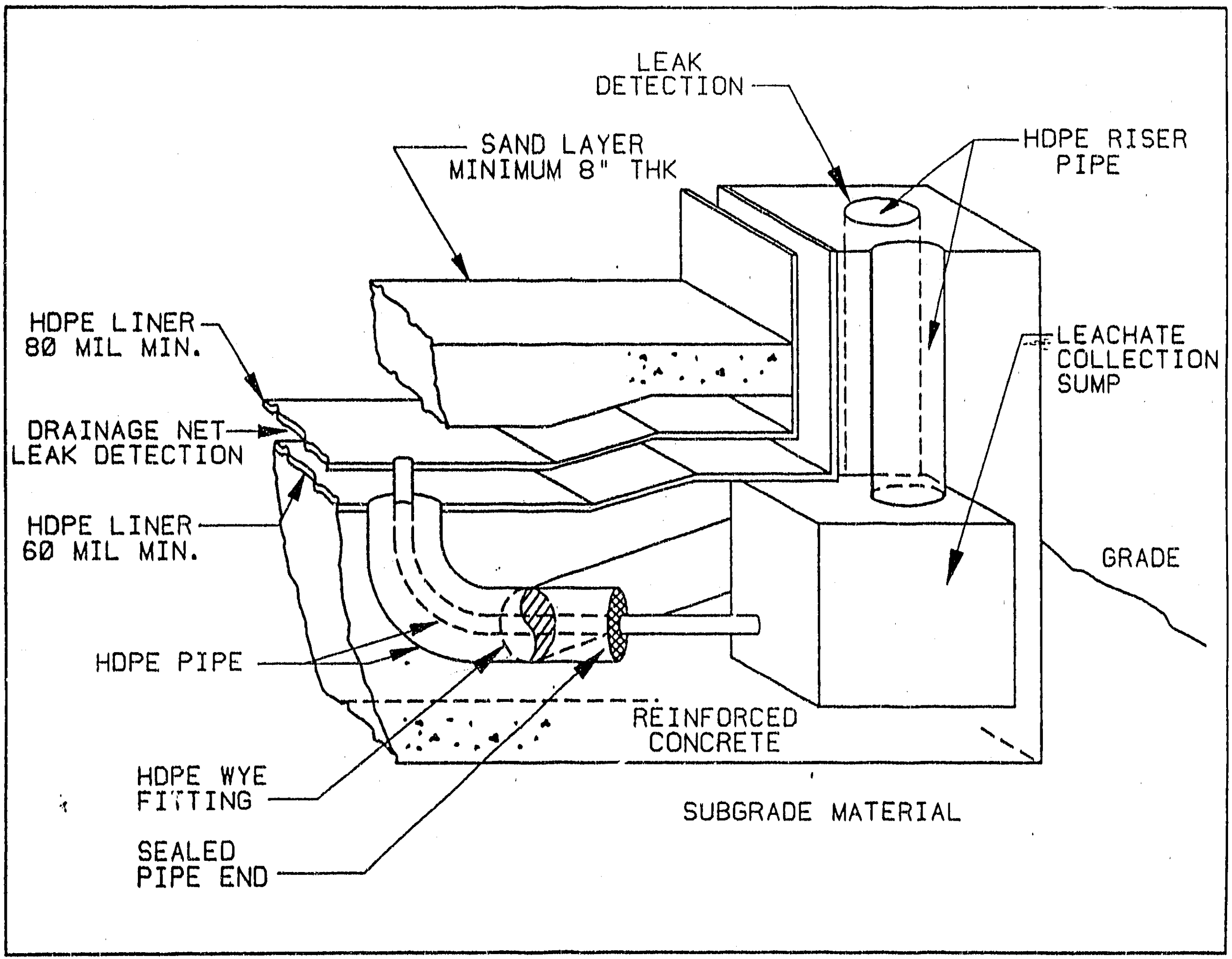

Figure 1. Leachate Collection and Detection System

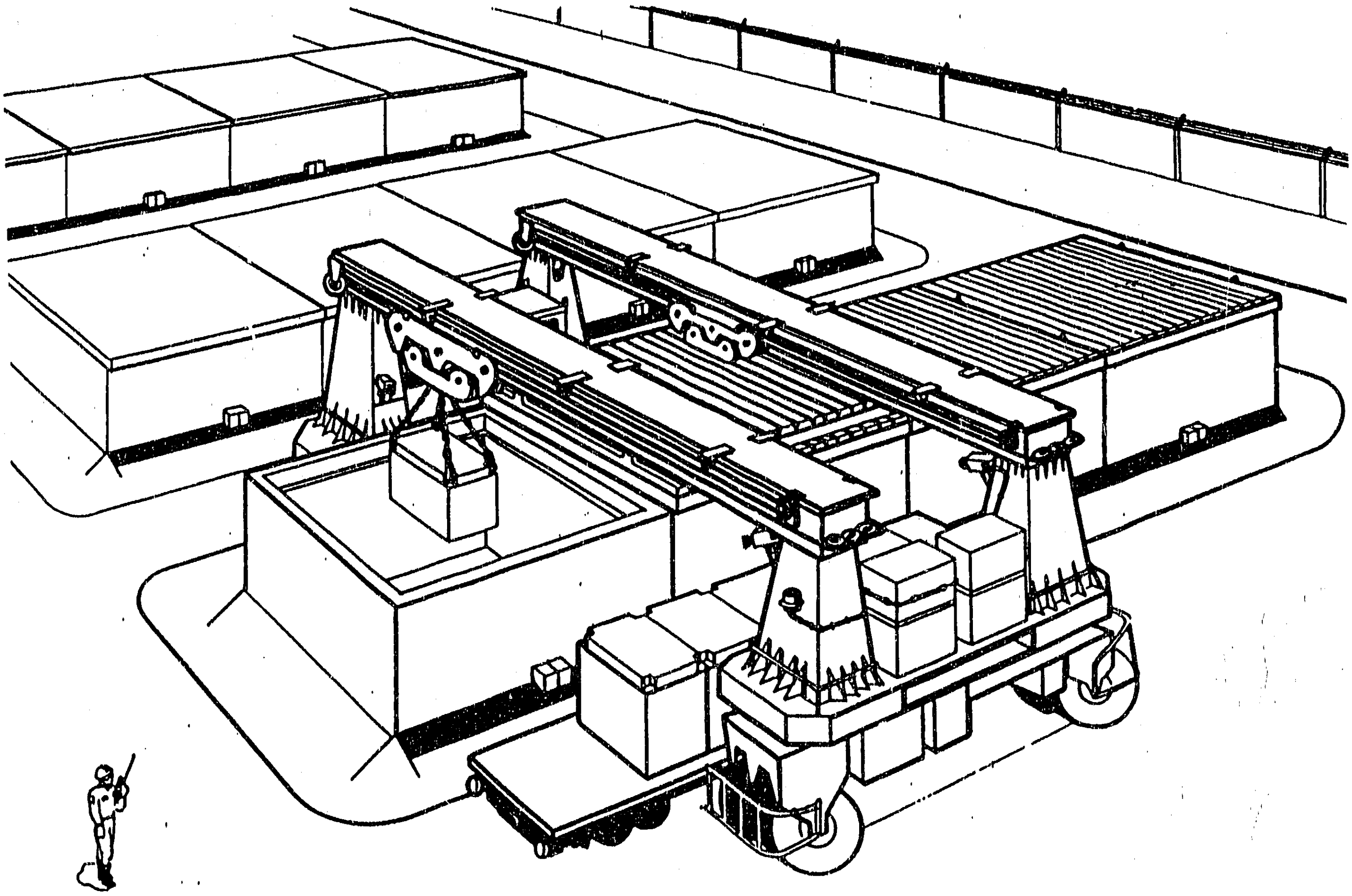

Figure 2. Concept Sketch - Operation of Hazardous/Mixed Waste Disposal Vaults

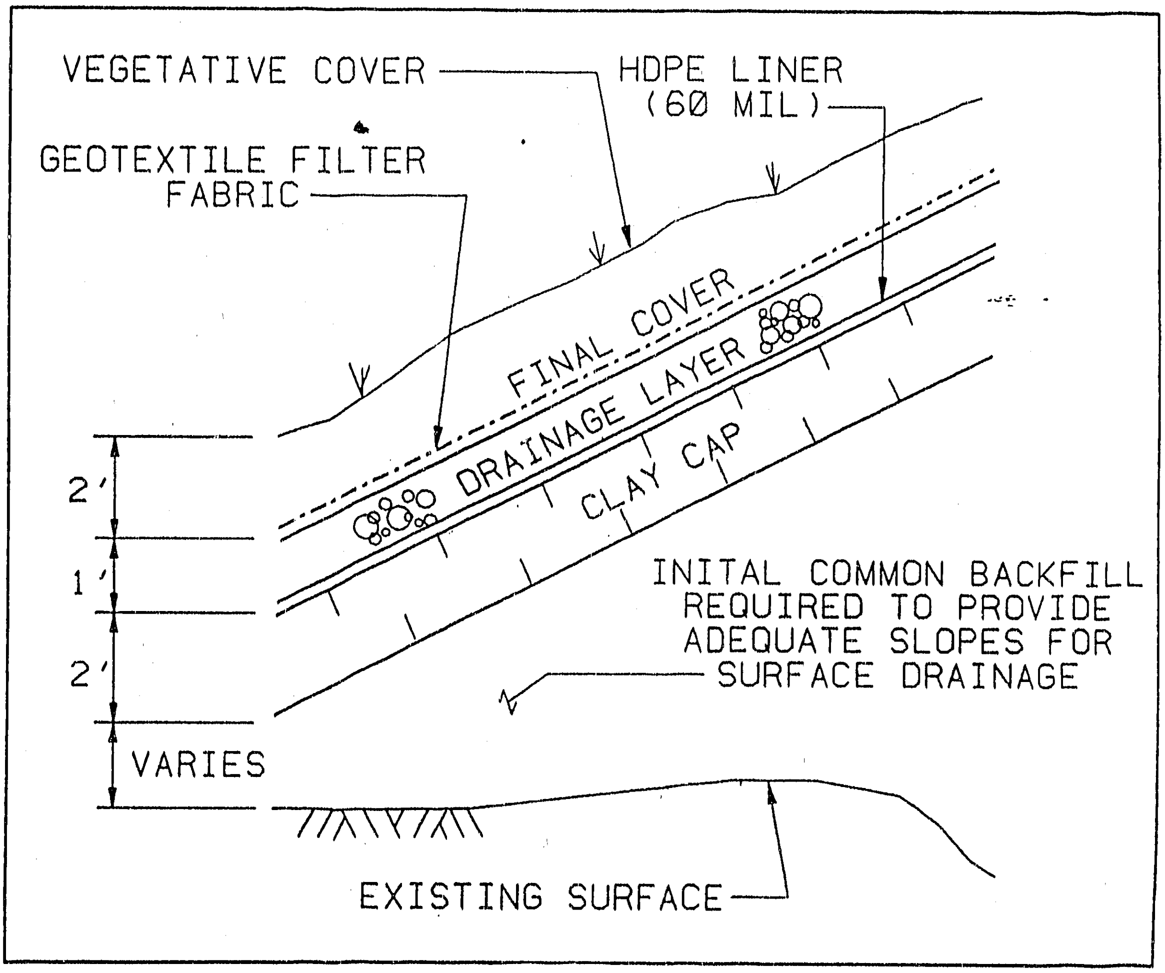

Figure 3. Sketch of the Final RCRA Cover of Disposal Vault

Table 1

Treatment Process Matrix Development

Waste Stream	Waste Inventory (cu. ft.)	Forecasted Generation (cu. ft./yr.)	Has Not Failed TCLP	No Further Treatment Direct Disposal to Vaults	Package Handling	Incineration at CIF	Macroencapsulation	Stabilization	Lead Surface Decontamination	Tritiated Waste Treatments	Soil Segregation/ Contamination Concn.	Alternative Oxidation Super Heated Water	Alternative Oxidation Solidification (Melter)	Mercury Recovery (Roast/Retort)	Mercury Amalgamation	TSCA Incineration
			▨	▨	░	▨	░	░	▨	░	☐	☐	☐	░	░	▨
Effluent Treatment Facility Waste Solids	?	?	X													
Spent Tower Packings	125	30		X												
Mercury	0	10												X	X	
Lead Shielding	9800	100							X	X						
Contaminated Process Equip.	750	250					X							X		
Consolidated Inciner-ation Ashcrete	0	8000		X												
Chromium Contaminated Wipes	0.6	0			X	X										
PCB Contaminated Waste	70	0														X
Laboratory Treatability Study Wastes	?	?			X	X		X								

☐ Treatment currently not required for known wastes
▨ Treatment to be provided at facility other than HW/MWDF
░ Core treatments for HW/MWDF

END

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