

ACHIEVING RCRA COMPLIANCE IN DOE DEFENSE WASTE MANAGEMENT OPERATIONS

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ABSTRACT

The U.S. Department of Energy (DOE) generates significant volumes of radioactive mixed waste (RMW) through its defense-related activities. Defense RMW is co-regulated by DOE and the U.S. Environmental Protection Agency/State agencies in accordance with requirements of the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). This paper highlights some of the problems encountered in co-regulation and discusses achievements of the defense waste management program in integrating RCRA requirements into RMW operations. Defense waste sites are planning facility modifications and major new construction projects to develop treatment, storage and disposal capacity for existing RMW inventories and projected needs.

INTRODUCTION

The Department of Energy's (DOE) Office of Defense Waste and Transportation Management (DWTM) oversees a large, diverse organization that handles the majority of waste generated by the United States defense complex. DWTM supports waste management operations, construction projects, research and development, and environmental restoration activities at the Albuquerque, Idaho, Nevada, Oak Ridge, Richland, and Savannah River Operations offices. In addition, DWTM provides guidance and recommends waste management policy for the Department's defense waste.

Figure 1 shows the locations of field operations supported by DWTM and highlights the current level of Resource Conservation and Recovery Act (RCRA) authority for the states in which these sites are located.

DOE's defense activities generate a wide variety of waste forms ranging from purely radioactive to purely hazardous and the Department treats, stores, and disposes of the single largest volume of radioactive mixed waste (RMW) in the nation. Beginning in 1984, DOE set a course to manage its non-radioactive hazardous waste in accordance with RCRA and applicable State regulations. Today, these regulations are fully integrated within the Department's hazardous waste operations. Hazardous waste is collected from generation sources and transported to onsite staging areas or permitted storage facilities. DOE currently uses the commercial sector for hazardous waste treatment and disposal services.

In contrast, achieving RCRA compliance for RMW is an ongoing concern for defense waste operations. The Department acknowledged that its RMW was subject to RCRA regulation when it released the Mixed Waste Ruling in May, 1987. This ruling recognized dual regulation for the Department's RMW, with DOE regulating the radioactive component and the Environmental Protection Agency (EPA) regulating the hazardous component. States are required to apply for the authority to regulate RMW in lieu of the EPA, or risk the possibility of losing their primacy for hazardous waste.

Because of the varying levels of regulatory authority and different requirements from state to state, it has been difficult for the Department to maintain consistency in its RMW operations.

The application of RCRA requirements to RMW often involves professional judgement because of potentially conflicting mandates under the Atomic Energy Act (AEA). For example, treatment standards under the RCRA Land Disposal Restrictions (LDR) are based commercial industry wastes, and cannot be applied to defense RMW without consideration of the unique characteristics involved; i.e., the radioactive constituents and radiation levels. These and other issues have complicated the Department's planning efforts for RMW.

COMPLIANCE STRATEGY AND REGULATORY IMPACTS

The Office of Defense Waste and Transportation Management (DWTM) is approaching RCRA compliance as a three-part process: (1) implementing and maintaining the various administrative/non-technical requirements (e.g., permitting, waste inspections, security, recordkeeping); (2) upgrading existing facilities and constructing new facilities that comply with the technical requirements for treatment, storage and disposal (TSD) units; and (3) pursuing closure of TSD units that do not comply with RCRA requirements. The construction of new, large-scale waste treatment facilities is a critical step in this process, and will enable DWTM to reduce the toxicity and/or migration potential of RMW components while maintaining occupational radiation exposure levels as low as reasonably achievable (ALARA).

The Department is closely monitoring the progress of the EPA in setting treatment standards for hazardous wastes under the RCRA Land Disposal Restrictions. Of chief concern is the manner in which these standards will apply to DOE's RMW and potential impacts on current and planned operations. The Department has ongoing tasks to better characterize its RMW streams and inventories, and to evaluate treatment alternatives based on the standards promulgated for hazardous components as well as radionuclide characteristics and concentrations. DOE may seek variances where available technology to treat RMW

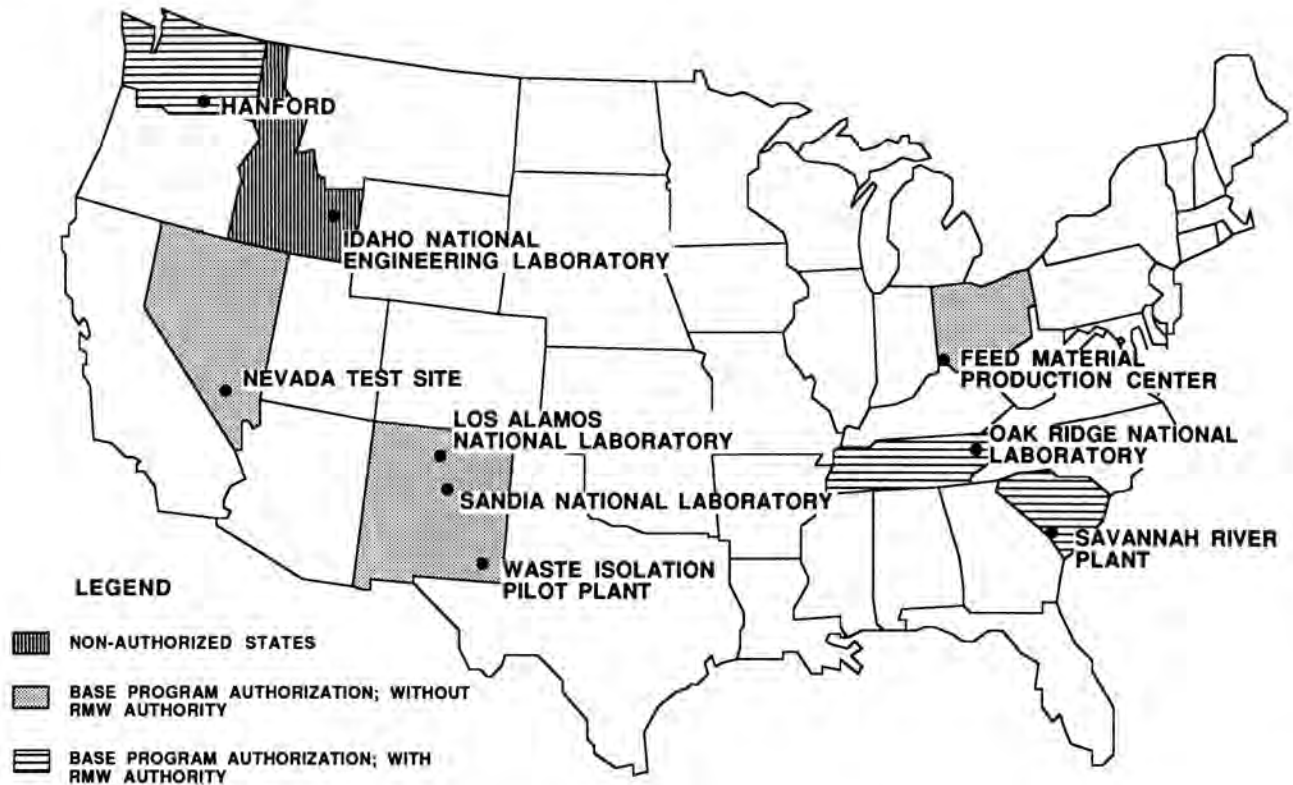


Fig. 1. Location of Defense Waste Facilities and Status of State RCRA Regulatory Authority.

cannot achieve the EPA standard; either because the waste is significantly different from the waste streams evaluated by EPA in setting the standard, or because treatment of the waste would be inconsistent with requirements of the AEA.

The Department will petition the EPA to allow disposal of restricted transuranic radioactive mixed waste (TRU-RMW) in the Waste Isolation Pilot Plant (WIPP). In its "no-migration" petition, DOE intends to demonstrate that such disposal will not allow migration of the hazardous constituents from the disposal unit for as long as the waste remains hazardous.

PROGRAM STATUS AND PLANS

The current status and plans for RMW operations are discussed in the following sections. Table I highlights the status of existing and planned RMW treatment, storage and disposal (TSD) units at defense waste sites.

Waste Treatment Operations

Defense waste sites have over 380,000 cubic meters of high-level waste (HLW) stored in underground tank systems (1) and are proceeding to develop treatment capacity for their HLW inventories. Once treated, defense HLW will be stored pending the availability of a federal geologic repository. All of DOE's HLW is considered to be RMW unless demonstrated to the contrary (2).

Three large vitrification facilities will be built to treat and immobilize HLW. These will be located at the Savannah

River Plant (SRP), the Hanford Reservation, and the Idaho National Engineering Laboratory (INEL). The Defense Waste Processing Facility (DWPF) at Savannah River is scheduled to begin operations in 1992 at an estimated construction cost of \$930M. The Hanford Waste Vitrification Plant (HWVP) is currently in the early phases of design; plant construction is scheduled for completion in 2001 at an estimated construction cost of \$965M. The Idaho facility is in the conceptual development stage.

At the SRP and Hanford, HLW will be pretreated to produce a low-volume, high-activity fraction and a high-volume, low-activity fraction. Pretreatment processing comprises various dissolution, precipitation and separation steps that enable cesium, strontium and transuranic constituents to be partitioned and incorporated with high-activity sludges. Inside the vitrification facility, the resultant high-activity fraction will be mixed with borosilicate glass, melted and poured into waste canisters. Extensive volumes of low-activity liquid waste from the pretreatment process will be blended with grout-forming solids and transferred as a slurry to large (greater than 1 million gallon), near-surface concrete vaults. The treatment units for these liquid streams comprise the Saltstone Facility at Savannah River, and the Grout Treatment Facility (GTF) at Hanford.

The GTF will treat and dispose of dilute aqueous low-level wastes generated by a variety of processes and facilities throughout the Hanford Reservation. Some of these waste streams contain or have the potential to contain small

TABLE I
Status of Major RMW TSD Facilities at Defense Waste Sites.

F.O.	SITE	HIGH-LEVEL MIXED WASTE	TRANSURANIC MIXED WASTE	LOW-LEVEL MIXED WASTE
ALBUQUERQUE	LANL		<ul style="list-style-type: none"> incinerator operating 	<ul style="list-style-type: none"> new incinerator planned storage facility completed
	SNLA			<ul style="list-style-type: none"> storage facility under const.
	WIPP		<ul style="list-style-type: none"> disposal facility nearing completion 	
IDAHO	INEL	<ul style="list-style-type: none"> waste immobilization facility planned 	<ul style="list-style-type: none"> upgrading existing incinerator new treatment/storage facility planned 	<ul style="list-style-type: none"> upgrading existing incinerator
NV	NTS			<ul style="list-style-type: none"> disposal facility under design
OAK RIDGE	ORNL		<ul style="list-style-type: none"> treatment/storage facility under design 	(planning to use TSCA incinerator)
	FMPC			(planning to use TSCA incinerator)
RICHLAND	HANFORD	<ul style="list-style-type: none"> modifications for pretreatment processing ongoing vitrification plant under design 	<ul style="list-style-type: none"> treatment/storage facility under design 	<ul style="list-style-type: none"> treatment facility under design storage facility under const. grout disposal ongoing
SAVANNAH RIVER	SRP	<ul style="list-style-type: none"> vitrification facility nearing completion 	<ul style="list-style-type: none"> treatment facility under design 	<ul style="list-style-type: none"> existing incinerator new incinerator under const. disposal facility under design

quantities of listed organic compounds (e.g., organic solvents, chelating agents) that were used in the chemical processing plants. Design features for the GTF disposal vaults include double liners and leachate collection to accommodate requirements associated with hazardous waste disposal. The GTF will be a RCRA-permitted facility. In contrast to the GTF, liquid feed to the Saltstone Facility has a more homogeneous origin and is hazardous by characteristic but does not contain listed hazardous constituents. The treatment process eliminates the hazardous characteristic and the resultant waste form is not considered RMW.

For transuranic (TRU-RMW) and low-level (LLW-RMW) radioactive mixed waste, DWTM will use incineration as the principle treatment technology. Incinerators offer two distinct advantages for RMW: they can treat a diverse mix of waste streams; and they can be designed to minimize radionuclide emissions and maintain worker radiation exposure within ALARA guidelines. Incineration is well demonstrated technology and the EPA has used incinerator performance data to establish treatment standards for a wide variety of hazardous waste under the RCRA Land Disposal Restrictions.

The Department has gained experience in incinerating radioactively contaminated materials through operations at

existing waste treatment facilities. Controlled-air and rotary-kiln incinerators are currently operating at the INEL, SRP and Los Alamos National Laboratory (LANL). Incineration capabilities are being upgraded in the Waste Experimental Reduction Facility (WERF) and the Process Experimental Pilot Plant (PREPP) at INEL. The SRP is building the Consolidated Incineration Facility (CIF) to replace the existing demonstration unit for low-level beta-gamma waste. LANL plans to install an additional LLW incinerator in the Treatment Development Facility (TDF). Incineration requirements for TRU waste are being assessed for the Transuranic Waste Facility (TWF) at SRP and the Waste Receiving and Processing Facility (WRAP) at Hanford. The Oak Ridge facilities will use the TSCA incinerator located at the Oak Ridge Gaseous Diffusion Plant.

In accordance with DOE policy, the practice of releasing contaminated liquids to the soil column will be discontinued with all liquid discharges subject to the applicable federal and state regulatory limits. At Hanford, a construction project is ongoing to develop treatment systems for liquid effluents routinely or potentially contaminated with radioactive or hazardous constituents. These effluents include process and steam condensates and miscellaneous plant wastewaters (e.g., chemical/storm sewers, cooling waters, ventilation condensates) derived from fuel reprocessing, and uranium and plutonium recovery operations. The effluent treatment systems are being determined through an evaluation of Best Available Technology (BAT); treatment residues will be further processed based on the nature and level of radioactive and/or chemical contamination (6). The total estimated cost of this project is \$180M.

The SRP has constructed the Effluent Treatment Facility (ETF) to collect and treat process wastewater previously discharged to the F- and H-Area seepage basins. The ETF will reduce radioactive and nonradioactive hazardous materials in process effluents and eliminate further degradation of ground water in the vicinity of the basins. The seepage basins are currently undergoing closure.

Waste Storage Operations

Defense transuranic (TRU-RMW) and low-level (LLW-RMW) radioactive mixed waste are currently being stored pending the availability of treatment and disposal facilities. DOE's methods for storing waste have evolved over the years, adapting to the changing regulatory framework for its operations. Between about 1970 and 1985, DWTM stored transuranic (TRU) waste (some of which is mixed) on asphalt pads and covered it with plywood and/or vinyl sheeting and a layer of overburden. TRU waste was stored in a variety of packages, including 55-gallon drums, plywood and metal boxes, and concrete culverts designed to remain intact for a minimum of 20 years. This waste is fully retrievable and is scheduled to be recovered, processed as necessary, and emplaced in the Waste Isolation Pilot Plant (WIPP). Since 1985, TRU-RMW has been undergoing certification to meet the WIPP Waste Acceptance Criteria and placed in certified storage.

Since the Department published its Mixed Waste Rulemaking in May, 1987, defense LLW-RMW has been segregated from non-RCRA LLW and placed in RCRA compliant storage units. In some cases existing buildings have been modified to meet storage needs. Newly constructed and planned storage facilities are typically pre-engineered metal structures with an impervious base and curbing to contain potential leaks and spills. Most of this waste is stored in 55-gallon drums; storage tanks are used for bulk liquids such as radioactively contaminated spent solvents and waste oils.

High-level waste (HLW) is stored in large, subsurface tank systems at Hanford, INEL and SRP. Newly generated HLW is stored in doubly contained tanks equipped with full monitoring and leak detection capabilities. Liquid HLW at the INEL is processed in a fluidized-bed calciner and stored as a granular solid in stainless-steel bins.

Waste Disposal Operations

The current plans for defense waste include the development of mixed waste disposal facilities at three sites: the Nevada Test Site (NTS), the Savannah River Plant (SRP) and Hanford. Mixed waste operations are currently conducted under RCRA interim status at the NTS Area 5 waste disposal site. NTS has submitted a RCRA Part B permit application for its Mixed Waste Management Facility and recently submitted an Environmental Assessment as required by the National Environmental Policy Act (NEPA). Current plans are to complete construction and be permitted to operate by January, 1990. The Part B application proposed a vadose zone monitoring system at the facility, but requested waivers from groundwater monitoring and liner/leachate collection requirements due to the arid conditions at the site.

The Hazardous Waste/Mixed Waste Disposal Facility at Savannah River, authorized in FY 1989, will provide disposal capacity for existing inventories (9630 cubic meters) and approximately 20 years of waste generation. As currently conceived, this facility will consist of above-grade reinforced concrete disposal units. Each unit will contain a leachate collection system composed of two synthetic liners, a geotextile drainage fabric, and lined collection sumps. Construction is scheduled to commence in FY 1990 and be completed in FY 1993.

The Grout Treatment Facility (GTF) is a combined treatment/disposal unit for liquid LLW-RMW at Hanford. Grout slurry is pumped to large (1.4 million gallon), below-grade vaults where it solidifies into a concrete monolith. The vaults are constructed of reinforced concrete with a structural cover and a double liner leachate collection system. Hanford submitted a RCRA Part B permit application for the GTF in November, 1988 (7).

Hanford is currently defining its requirements and options for solid LLW-RMW disposal. Separate, lined

disposal trenches for high-activity waste are in the early stages of design.

CONCLUSION

The DOE continues to be challenged with the task of managing its defense waste in compliance with both RCRA and the AEA. The Department has modified its hazardous waste practices to attain full compliance with RCRA, but continues to contend with complex technical and institutional issues involving RCRA and RMW. Upgrades to existing facilities and construction of new TSD units will enable DOE to process and dispose of significant inventories of stored RMW in an environmentally sound manner.

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