

INTEGRATION OF DOE'S LLW/MLLW MANAGEMENT SYSTEM: PROGRESS TOWARD DISPOSAL

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ABSTRACT

The Department of Energy (DOE) continues to face a legacy of wastes needing disposal. During much of the Department's history, DOE did not dispose of its waste streams in a timely manner, allowing these wastes to accumulate in storage. In an ever-changing regulatory environment, under unprecedented public scrutiny, and with the benefit of research and operational experience, the DOE is taking responsible steps to lead its nuclear waste to permanent disposition: disposal – the ultimate goal and end result of an effective waste management system.

“Integration” is looking at the big picture under magnification; that is, identifying complex-wide and site-specific details that are necessary and useful in the decision-making process. A major element of the overall program to integrate DOE's Environmental Management activities involves the integration of the Department's complex-wide low-level waste (LLW) and mixed low-level waste (MLLW) disposal capabilities.

The manner in which the DOE proposes to accomplish integrated LLW and MLLW disposal is the focus of this paper.

WHY INTEGRATE?

Although each DOE site and laboratory is unique in its capabilities, some problems are common throughout the complex: e.g., identifying the best technology to treat, store, and dispose of various types of radioactive and hazardous waste and how we best manage our nuclear materials inventory. Accordingly, DOE's Office of Environmental Management (EM) will be using existing unique capabilities and developing new technologies at sites to do business efficiently to achieve common objectives.

The integration effort means sharing across sites: consolidating treatment, storage, and disposal facilities where it makes good sense; applying innovative technologies among sites; working to ensure consistency in reporting data such as waste inventory and generation; and evaluating available packaging and transportation systems for shipments of waste and nuclear materials.

The DOE-EM program faces significant technical and financial challenges in cleaning up the environmental legacy of nuclear weapons production, and research and development, while working within the goals of a balanced federal budget. Historically, the sites have managed their program by focusing on the needs of the site. To meet the programmatic objectives within an acceptable budget, EM has committed to addressing problems common to multiple DOE sites from an integrated, complex-wide perspective. The first steps in identifying these integration

opportunities are to clearly define and communicate the baseline disposition path for EM waste and materials, and to ensure that quality data are provided.

THE INTEGRATION PROCESS

Integration will help the EM program achieve efficiencies by eliminating redundant facilities and optimizing the use of available waste management capacities, while providing a safe and equitable system for managing these wastes. This approach is deemed appropriate and necessary in order to accomplish the cleanup vision reflected in “Accelerating Cleanup: Paths to Closure.”

The process employed in selecting a preferred complex-wide, integrated LLW/MLLW disposal system has included:

1. Evaluating, under the Final Waste Management and Programmatic Environmental Impact Statement (WM PEIS), the potential health, safety, and environmental impacts and cost implications associated with a panel of candidate options for the disposal of these wastes;
2. Performing a detailed study of the current and planned disposal capacity;
3. Evaluating the recommendations of the complex-wide EM Contractor Integration Team;
4. Engaging in a dialogue with states, stakeholders, regulators, and tribal nations throughout the process concerning the aforementioned considerations.

This process and the results generated in its application will be reviewed in sufficient detail to provide an understanding of the basis for DOE’s upcoming integrated disposal decisions.

PAST AND PRESENT DISPOSAL PRACTICES

From the early 1960s until 1979, sites used either their own on-site disposal, or other DOE sites or commercial disposal facilities. However, in 1979, the governors of the states hosting the three operating commercial disposal sites took several actions (including shut downs and restrictions) that (1) affected the commercial disposal of LLW; (2) resulted in new policies at DOE for disposal of its LLW; and (3) generated legislation affecting both DOE and commercial disposal of LLW (the category of MLLW had not yet been defined). Following the governor of South Carolina’s 1979 restrictions upon the volume of waste allowed to go to the Barnwell facility, DOE consulted with each of its sites that was using commercial disposal. Seeking to minimize possible impacts to its LLW disposal operations from commercial disposal restrictions, the Department decided to revise its disposal policy. In October 1979, DOE directed its sites to stop using commercial disposal facilities.

In November 1979, DOE issued a memorandum clarifying and implementing the policy announced in October. The memorandum assigned, to the generator sites that were previously using a commercial disposal facility, two field operations offices managing DOE LLW disposal sites to arrange for disposal. The generators of LLW from DOE defense-related activities were assigned to the Nevada Test Site. The generators of LLW from DOE non-defense (e.g., energy research) activities were assigned to the Hanford Site. The memorandum also stated that no additional DOE LLW should be sent to the Oak Ridge National Laboratory due to severely limited disposal capacity.

DOE issued another policy memorandum in June 1980 addressing management of LLW. This memorandum reiterated that the November 1979 memorandum continued to be DOE policy and provided further guidance on implementing the policy for LLW that was difficult to define as either “commercial” or DOE” LLW.

DOE has a current policy concerning disposal of LLW and MLLW, which is stated in DOE Order 5820.2A Radioactive Waste Management (September 26, 1998).^a The Order provides that LLW and MLLW “...shall be disposed of on the site at which it is generated, if practical, or if on-site disposal is not available, at another Department disposal facility.”^b Exemptions from the requirements of this Order may be granted.^c Additional guidance on exemptions to use non-DOE facilities for disposal of LLW and MLLW is provided in a memorandum from the Assistant Secretary for Environmental Management^d:

- 1• The use of a non-Federal facility for LLW disposal must meet applicable federal, state, and local requirements and have the necessary permits, licenses, and approvals;
- 2• The activity must be sufficiently characterized and verified to meet the facility’s waste acceptance criteria;
- 3• The activity must be cost effective and in the best interest of the Department;
- 4• Appropriate National Environmental Policy Act (NEPA) review must be completed.

In addition, host states and state compacts must be consulted before approval of the exemption.

As a consequence of these actions, DOE disposal operations of LLW occurs at the six sites currently identified in the Preferred Alternative, with only two, the Hanford Site and the NTS, disposing off-site generated waste.

THE WM PEIS AND THE INTEGRATION EFFORT

With a history of changing environmental regulations, DOE is now on the cusp of issuing several disposal decisions regarding LLW and MLLW as a result of its WM PEIS studies. The WM PEIS is the springboard for integrated disposal options, since it examines in detail the status and capabilities of the whole DOE complex in regard to waste storage, treatment, and disposal. After evaluating its options against WM PEIS criteria, DOE has identified preferences based on analyses and impacts of mission compatibility; environment, safety and health; transportation; and cost.

The DOE must make waste disposal decisions to support ongoing and new missions as well as address the backlog of stored waste. In general, decisions based on the WM PEIS will allow sites to regionally dispose LLW in a configuration that efficiently supports the Department’s current and future missions. The WM PEIS MLLW disposal decision will give sites access to regional disposal capacity that for all intents and purposes is now unavailable, since only Hanford and the NTS have MLLW disposal capacity, and disposal at those sites is limited to on-site waste.

The WM PEIS identifies a preference for regional disposal but did not select preferred disposal sites. The finality of disposal site selection raises such a complex range of impacts that DOE

committed to further interactions with states, tribal nations, stakeholders, and regulators prior to announcing its preference.

The WM PEIS preferred alternatives for LLW disposal and MLLW disposal are the same: to select two or three regional disposal sites from the following six candidate DOE sites – Hanford, Idaho National Engineering and Environmental Laboratory (INEEL), Los Alamos National Laboratory (LANL), NTS, Oak Ridge Reservation (ORR), and Savannah River Site (SRS). Sites not selected as regional facilities could continue to dispose of on-site waste. DOE may also continue to use commercial disposal facilities, consistent with the DOE Radioactive Waste Management Order and policy. The sites selected for disposal of LLW do not necessarily have to be the same as those selected for disposal of MLLW. Because the WM PEIS was not specific in its Preferred Alternative, the DOE must now evaluate various options for LLW and MLLW disposal, considering differing roles for each of the six candidate disposal sites.

LOW-LEVEL WASTE DISPOSAL OPTIONS

To enable the selection of preferred sites, DOE has analyzed six options for LLW disposal and five options for MLLW disposal based on various usage of the six candidate sites. These options focus on where to dispose the LLW and MLLW that cannot be disposed of on site. (See Fig. 1) Each option varies where that waste is disposed of.

In **Option 1** (of six total), two sites (INEEL and LANL) dispose part of their own LLW on site; SRS disposes only its own LLW on site; and two sites (Hanford and NTS) dispose their own LLW on site plus provide regional disposal for other sites' LLW.

Option 2 identifies the same two sites (INEEL and LANL) to dispose part of their own LLW on site, SRS still disposes only its own LLW on site, and the same two sites (Hanford and NTS) dispose their own LLW on site plus provide regional disposal for other sites' LLW. In this option, Hanford disposes more off-site waste (60%) than NTS (40%).

In **Option 3**, two sites (INEEL and LANL) dispose part of their own LLW on site, one site (Hanford) disposes only its own LLW on site, and two sites (NTS and SRS) dispose on-site waste and provide regional disposal for other sites' waste.

Option 4 adds ORR as a disposal site. ORR and Hanford dispose all their own LLW on site. INEEL and LANL dispose part of their LLW on site. NTS and SRS each dispose on-site waste and provide regional disposal for other sites' waste.

Option 5 varies from Option 4 in the amount of on-site waste ORR disposes (-30% in this option versus 100% in Option 4). ORR joins INEEL and LANL as sites disposing part of their own LLW on site; and NTS and SRS dispose their own LLW on site and provide regional disposal for other sites' waste.

Disposal **Option 6** drops ORR as a disposal site, with INEEL and LANL disposing part of their own LLW on site, and Hanford and SRS disposing all of their own waste on site. Only NTS provides regional disposal for other sites' waste.

Figure 1. Site roles in current DOE LLW and MLLW disposal options

Disposal Roles	CANDIDATE DISPOSAL SITE					
	Hanford	INEEL	LANL	NTS	ORR	SRS
LLW Disposal Options						
Dispose On-Site	All Options	Partial in All Options	Partial in All Options	All Options	Some Options	All Options
Dispose Off-Site	Some Options	No Options	No Options	All Options	No Options	Some Options
MLLW Disposal Options						
Dispose On-Site	All Options	No Options	No Options	All Options	No Options	Some Options
Dispose Off-Site	Some Options	No Options	No Options	Some Options	No Options	Some Options

MIXED-LOW LEVEL WASTE DISPOSAL OPTIONS

Option A (of five total) has both Hanford and NTS disposing on-site waste and providing regional disposal for other sites' waste. Hanford disposes nearly all MLLW and NTS disposes only specific waste streams.

Option B expands NTS's role from that in Option A. Here, Hanford and NTS dispose on-site waste and provide regional disposal for other sites' waste.

Option C introduces an east-west configuration. In Option C, both Hanford and SRS dispose on-site waste and provide regional disposal for other sites' waste.

In **Option D**, only one regional disposal site is identified for MLLW. NTS disposes on-site waste only. Hanford disposes on-site waste and provides regional disposal for all the waste requiring off-site disposal.

Similar to Option D, **Option E** provides a single regional disposal site, specifically NTS. Hanford disposes on-site waste only. NTS disposes on-site waste and provides regional disposal for all the waste requiring off-site disposal.

DECISION CRITERIA FOR WM PEIS LLW AND MLLW OPTIONS

DOE has identified five decision criteria to aid in selection of regional disposal sites. Four criteria are objective: mission compatibility; environment, safety, and health; transportation, and cost. One criterion is subjective: stakeholder acceptance. Each of the options for LLW and MLLW were evaluated against these criteria. (See Fig. 2)

Mission compatibility measures how compatible the roles of each site are in each option, technically and operationally. The Department considers all LLW and MLLW options to be

compatible with existing and projected missions, though some options are deemed less compatible than others.

Environment, safety, and health (ES&H) criteria measure the potential impacts associated with site roles in each option. Specific ES&H impacts evaluated include potential worker fatalities and ability of sites to meet air and water standards. Resulting analysis did not evaluate potential off-site population fatalities since this figure usually came up as less than one, and all disposal options would further decrease this risk.

Transportation criteria estimates potential worker and public fatalities associated with waste transportation by either truck or rail. Reducing the total transportation miles obviously reduces risk. However, of the six LLW options, three options are listed with a total of two potential fatalities in a 20-year period; the other three options identify a total of less than one fatality during a 20-year period. None of the MLLW options indicate even one potential fatality in a 20-year period.

Cost criterion estimates the expenses DOE would incur to implement a given option. The single most significant cost savings to the Department would be to implement any disposal option versus continuing to incur costs inherent to ongoing storage of wastes awaiting disposal. As the number of disposal sites decreases, the system costs decrease due to elimination of fixed costs. The type of disposal facility is also a driver of unit cost. For example, humid sites with near-surface groundwater require engineered vaults, as compared with arid sites where trenches are used.

The final, and singularly subjective, criterion is stakeholder acceptance. The Department can perform no independent analyses or measurement. DOE has shared information about pending decisions with various stakeholders, such as the National Governors' Association, the National Association of Attorneys General, the League of Women Voters, the Transportation External Coordination Working Group, and participants of the low-level waste seminar sponsored by the Nevada Test Site Community Advisory Board, as well as state and tribal nation representatives.

Feedback from these stakeholders recommends the following considerations in the decision-making process:

- 1• address urgent risks
- 2• seek to minimize transportation of waste and materials
- 3• pursue consolidation efforts to address risks and allow site closures
- 4• consider sites' suitability and surrounding population in choosing regional disposal facilities
- 5• consider cost effectiveness
- 6• compensate site locations for receiving other sites' waste
- 7• continue ongoing discussion with the public about waste issues

Figure 2. Summary of Decision Criteria Ratings for LLW and MLLW Disposal Options

DOE DISPOSAL OPTION	DECISION CRITERIA						
	Mission Compatibility	Environment, Safety and Health			Transportation		Cost in \$M to Implement each option ^e
		Potential Worker Fatalities	# Sites Exceeding Air Standards	# Sites Exceeding Water Standards	Potential Fatalities from Truck Accidents	Potential Fatalities from Rail Accidents	
LLW Disposal Options							
Option 1	Yes	2	0	2	2	<1	600
Option 2	Yes	2	0	2	2	<1	590
Option 3	Less	2	0	2	<1	<1	580
Option 4	Less	2	0	2	<1	<1	840
Option 5	Less	2	0	2	<1	<1	700
Option 6	Least	2	0	2	2	<1	600
MLLW Disposal Options							
Option A	Yes	<1	1	1	<1	<<1	140
Option B	Yes	<1	1	1	<1	<<1	140
Option C	Less	1	1	2	<1	<<1	180
Option D	Least	<1	1	1	<1	<<1	130
Option E	Least	<1	1	1	<1	<<1	130

SUMMARY

The Department's next step, based on results of analyses of the waste disposal options, is issuance of a NEPA Supplement Analysis of the WM PEIS. This supplement analysis will look at updated LLW and MLLW disposal volumes and help determine if the change in current volumes is significant to warrant additional attention. The analysis results and stakeholder feedback will be presented to the Secretary of Energy for decision-making.

As committed in the WM PEIS, DOE will publish a notice in the Federal Register prior to issuing its programmatic Records of Decision (ROD). This notice will inform the public which specific sites it prefers for LLW disposal and which for MLLW disposal. Then, no less than 30 days after this notification, the DOE will issue its formal RODs on LLW and MLLW treatment and disposal.

In brief, DOE's integrated approach for LLW and MLLW disposal is designed to enhance safety through timeliness; distribute risks more equitably (share risk-related burdens); and ensure efficiency by reducing redundancy (save taxpayer money).

FOOTNOTES

- (a) DOE Order 5820.2A is being revised and is expected to be issued by October 1998 as DOE O 435.1
- (b) DOE Order 5820.2A, 1998, Chapter III, paragraph 2.c.
- (c) DOE Order 5820.2A, 1998, Section 9 - Exemptions.
- (d) Assistant Secretary Alm to Field Office Managers, October 24, 1996.
- (e) DOE's 20-year cost of implementing its current LLW baseline, including storing LLW pending disposal, is \$1,280 million; so all LLW disposal options offer significant savings off the current baseline. For MLLW, the current baseline is \$420 million, so again, each MLLW option offers significant savings over continued MLLW storage, complex-wide.

GENERAL REFERENCE

K. Guevara and H. Belencan, U.S. Department of Energy, *Information Package on Pending Low-Level Waste and Mixed Low-Level Waste Disposal Decisions*, (September 1998)

U.S. Department of Energy, *Final Waste Management and Programmatic Environmental Impact Statement*, DOE/EIS-0200-F (May 1997)