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INTEGRATION OF U.S. DEPARTMENT OF ENERGY (DOE) CONTRACTOR INSTALLATIONS FOR THE PURPOSE OF OPTIMIZING TREATMENT, STORAGE, AND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE (LLW)

by

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INTRODUCTION

The U.S. Department of Energy (DOE) manages a multibillion-dollar environmental management (EM) program. In June 1996, the Assistant Secretary of Energy for EM, Al Alm, issued a memorandum with guidance and a vision for a ten-year planning process for the EM Program.[1] The purpose of this process, which became known as the Accelerated Cleanup: Focus on 2006 (hereafter referred to as the 2006 Plan), is to make step changes within the DOE complex regarding the approach for making meaningful environmental cleanup progress. To augment the process, Assistant Secretary Alm requested the site contractors to engage in an effort to identify and evaluate integration alternatives for EM waste stream treatment, storage, and disposal (TSD) that would parallel the 2006 Plan. In October 1996, ten DOE contractor installations began the task of identifying alternative opportunities for low-level radioactive waste (LLW).

Cost effective, efficient solutions were necessary to meet all requirements associated with storing, characterizing, treating, packaging, transporting, and disposing of LLW while protecting the workers' health and safety, and minimizing impacts to the environment. To develop these solutions, a systems engineering approach was used to establish the baseline requirements, to develop alternatives, and to evaluate the alternatives. Key assumptions were that unique disposal capabilities exist within the DOE that must be maintained; private-sector disposal capability for some LLW may not continue to exist into the foreseeable future; and decisions made by the LLW Team must be made on a system or complex-wide basis (versus a site-by-site basis) to fully realize the potential cost/schedule benefits. This integration effort promoted more accurate waste volume estimates and forecasts; enhanced recognition of existing treatment, storage, and disposal capabilities and capacities; and improved identification of cost savings across the complex.

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[1] A. L. Alm, *Guidance for the Ten-Year Plan*, U.S. DOE Memorandum to Distribution, June 20, 1996.

DISCLAIMER

DISCUSSION

The focus of the Complex-Wide EM Integration Team for low-level radioactive waste (LLW) included not only LLW, but also hazardous waste and what has been referred to as special case waste (SCW). SCW does not currently have a defined disposal path. Since the majority of alternative development and evaluation activities relate to LLW, the team refers to itself as the LLW Team.

The methods by which LLW is managed across the complex vary significantly from one site to another. The integration necessary to coordinate the transfer of LLW from one DOE site to another or to a treatment, storage, or disposal facility (TSD) has been lacking. While occasional new and different treatment, storage, and disposal facility (TSDF) options are available, little communication exists across the complex regarding those options, and each DOE site has a different contract for commercial treatment and/or disposal. Other factors considered were the availability, reliability, and optimal use of LLW dispositioning capabilities and optimized use. Therefore, the goal of the EM Complex-Wide LLW Team is to recommend alternatives that can be used uniformly by all the DOE installations in a manner that is consistent, and which results in reduced cost and risk, and in schedule acceleration.

Under the current configuration, LLW is managed through a combination of DOE-owned facilities, commercial facilities, and planned new DOE Environmental Restoration (ER) facilities. Extensive analysis of the management of LLW across the complex led to the study of three primary alternatives to the current management process. These alternatives include privatization, disposal consolidation, and disposal consolidation enhanced by policy changes. These alternatives are described below:

Alternative A - Privatization. This alternative would involve using a single private company for the management, treatment, and disposal of all LLW throughout the DOE complex. The vendor would operate under the jurisdiction of the DOE and would have responsibility for all disposal and treatment operations. The advantages to this approach include a limitation to DOE liability, consistency in waste management practices across the complex, and reduction in the costs associated with DOE management and oversight activities. The primary disadvantages to this approach include high transition costs, the amount of time and effort required for implementation, and low confidence in potential success of implementation. This alternative also has the potential of eliminating future competition, which could potentially result in increased future waste management costs.

Alternative B - Disposal Consolidation. This alternative would consolidate disposal activities across the complex. By operating fewer disposal sites, disposal practices would be conducted in a cost-effective manner to most effectively utilize disposal capabilities while protecting the workers' health and safety, and minimizing impacts to the environment. This approach should result in reduced costs to the DOE complex. Two to three sites (possibly NTS and Hanford) would become the primary LLW disposal sites for the complex. However, other currently existing or nearly completed DOE disposal sites would continue to operate where it is cost effective for the entire complex or until existing capacities are exhausted. New disposal capacity would only be added at the primary disposal locations (NTS and Hanford). Due to the low disposal costs and large capacity existing at DOE disposal sites, it is expected that nearly all LLW treatment (i.e., compaction, incineration, and metal melting) would be eliminated. For SCW, storage would be consolidated to

minimize risk. Direct funding for the selected disposal sites would be investigated, and portions of Alternative C would be incorporated as appropriate. Figure 1 summarizes the alternative comparisons.

Alternative C - Disposal Consolidation Enhanced by Policy Changes. This alternative would continue with the consolidation listed in Alternative B and would introduce additional activities to further reduce costs. As an example, a national procurement contract could be initiated for LLW containers, analytical services, and transportation. As in Alternative B, this alternative incorporates waste minimization activities focused at waste avoidance rather than volume reduction after production of the waste. Storage of the Greater Than Class C (GTCC) portion of the SCW waste would be reduced by disposing of this waste at sites where the performance assessment indicates disposal is safe and effective or by potentially combining disposal with High Level Waste (HLW) or Spent Nuclear Fuel (SNF). (GTCC exceeds limits defined in 10 CFR 61.55). If a GTCC waste disposal solution cannot be developed, consolidation at a single site could be explored more fully. The establishment of a risk-based free release criteria for potentially contaminated material could also significantly reduce facility operation costs and reduce the volume of LLW within the complex.

Preferred Alternative. Following months of research and consideration, Alternative B was selected as the preferred alternative. This selection was based on the anticipated reduced risks, schedule improvements, reduced costs, and overall confidence in its implementation. Alternative B requires fewer changes in the LLW disposal structure and in the institutional and regulatory requirements than does Alternative C. While implementing many of its benefits, Alternative B also provides advantages not identified in Alternative A, such as stakeholder acceptance and site consensus (note Figure 1). The preferred alternative tries to orchestrate all the DOE-EM programs as one entity in the use of DOE capacities currently available for disposal. Resources at each site would be national resources to the complex. The fact that treatment of LLW would be accomplished at sites where it is generated, and only when cost-effective to do so, was viewed as a major component of this alternative. LLW will not be treated when it is not cost-effective to do so, and would be transported directly to the disposal site.

Existing commercial LLW disposal facilities do not have the capability to dispose of a significant quantity of LLW generated in the DOE complex: DOE classified and accountable LLW currently cannot be disposed of in the private sector; the type and concentration of radionuclides acceptable for disposal in the private sector is limited; and the stability and long-term availability of private sector disposal is uncertain. Because of the unique characteristics associated with DOE LLW and the lack of reliable private sector facilities that can accept these unique wastes, core disposal capabilities must be maintained in the DOE complex. The LLW Team has determined that Hanford and NTS are the two TSDFs within the DOE complex that could most effectively meet these core disposal needs. NTS and Hanford have appropriate geologic settings, sparse populations, and access controls which minimize risks associated with the protection of human health and the environment. By eventually consolidating disposal at these two sites, the operation can be optimized and the unit cost for disposal greatly reduced through economies of scale. Furthermore, direct funding of disposal operations at the two selected disposal sites may be the most effective way of realizing the economies of scale.

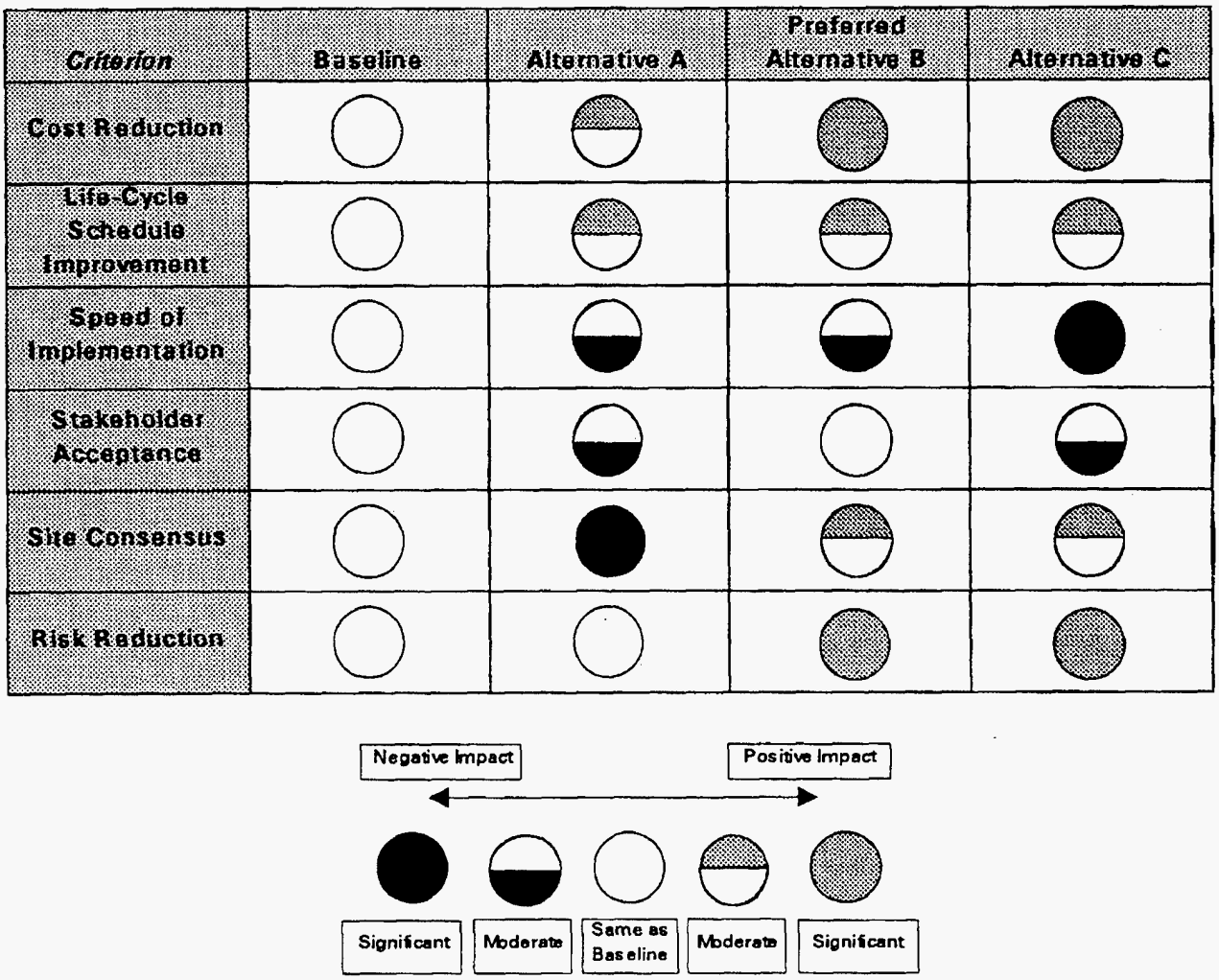

Figure 1 LLW Alternative Comparison

Disposal sites become strictly service enterprises, and are focused on assisting the generators with expeditious disposal of their LLW. Direct programmatic funding of LLW disposal, similar to that proposed for the Waste Isolation Pilot Plant (WIPP), could ensure that the DOE disposal sites remain operational through changes in generated waste volumes that will occur as programs expand and contract. Waste operation costs such as characterization, packaging, transportation, and treatment would be absorbed by the generators.

When considering only economics, there would be one designated location for disposal of all DOE LLW, and this facility would be staffed by personnel well trained in the handling of all types of LLW. The facility would handle all packaging acceptable to the Department of Transportation (DOT) delivered by various methods (truck, rail, ship, etc.), and the Waste Acceptance Criteria (WAC) at the facility could accept all known radionuclides, accountable waste, and classified waste. Such a facility would: eliminate the need for disposal personnel to be trained at other sites; reduce the quantity of handling equipment such as forklifts, earth moving equipment, buildings, and cranes;

and control redundant efforts associated with activities such as accounting and the National Environmental Policy Act (NEPA) documentation.

This ideal facility is not currently possible due to issues such as restrictive WACs, concerns associated with performance assessments (PAs), stakeholder agreements, lack of rail lines or shipping lanes, and disposal capacity. NTS currently has the capability of meeting the majority of these requirements and what it cannot meet, Hanford appears to have the potential to accommodate. Thus, by combining economies of scale with capabilities, NTS and Hanford encompass the preferred alternative as the primary TSDFs for DOE LLW. Competition between these two facilities would be neither necessary nor beneficial, particularly if the disposal at each site is direct funded. Each disposal facility would maintain its unique capabilities. It would be predetermined which DOE sites would use which TSDF, and which specific types of LLW would be sent to each TSDF.

SUMMARY

The preferred alternative and the recommendation of the EM Complex-Wide LLW Team is multi-faceted:

(1) Emphasize pollution prevention at the source of generation to reduce costs associated with the management of LLW across the DOE complex.
(2) Consolidate storage and the final disposition of special case LLW. This would potentially reduce the cost of management of this unique waste and could possibly resolve the disposal concerns associated with this waste.
(3) Minimize the storage and treatment of LLW other than the need to stabilize liquids (no regulatory drivers for the treatment of LLW). Since the treatment costs are generally higher than the costs associated with the packaging, transportation, and disposal of LLW, mandatory treatment should be eliminated. It is recommended that treatment (volume reduction, sterilization, and decontamination) of LLW occur only when it is cost effective to do so.
(4) Centralize disposal at NTS and Hanford and provide direct funding for disposal. Disposal sites that are not cost effective from a complex-wide standpoint would be closed on an accelerated schedule.

It is recognized that the three alternatives presented, and many others considered, contain both benefits and barriers. The charter of the LLW team was to identify the barriers, but not allow them to impeded recommending an alternative that could most benefit the entire DOE complex. Incorporation of Alternative B could result in complex-wide life-cycle savings to the DOE of more than $350M. A summary of the cost savings and the benefits and barriers are summarized in Table 1.

CONCLUSION

Managing DOE LLW as a complex-wide effort is a major initiative. Three alternative approaches for meeting the objectives of the Complex-Wide EM Integration charter were considered by the LLW Team, with the preferred alternative being disposal consolidation (Alternative B). Disposal consolidation is based on reduced risk, schedule improvement, reduced cost, and overall confidence in its implementation. This alternative emphasizes expedient utilization of existing disposal

capabilities and capacities, supports reduced treatment of LLW, embraces pollution prevention/waste minimization, suggests examination of direct funding for disposal of LLW, consolidates storage and eventual disposal of special case LLW, and integrates waste characterization. National procurement for containers, analytical services, and transportation of LLW are also recommended as future aspects of this complex integrating effort.

Table 1. LLW integration benefits and site-specific barriers.

Breakthrough Action by Site	TYP Savings (Life-Cycle) ($M)[a]	Cost Avoidance for TYP ($M)[b]	Schedule Improvement	Barriers	Near-Term Decision Date
Treatment Cost Savings					
INEEL					
• Eliminate treatment except where cost effective for transportation and packaging (save 50%), incineration, compaction, and sizing.	42.8	—	—	• DOE approval for disposal at NTS/Hanford (5820.2A variance).	9/00
Hanford					
• Eliminate compaction for 27,070 m^3.	14	—	—		12/98
Fernald					
• Eliminate private contract for treatment/disposal. Ship to Hanford from Operable Unit (OU)-1.	85	—	—	• Renegotiate ROD and obtain site management approval.	9/97
Oak Ridge					
• Eliminate treatment (compaction).	25	—	—		—
L4NL					
• Eliminate compaction	6.25	—	—		9/97
SRS					
• Eliminate compaction prior to obligation with private company.	18.2	—	—	• Change waste minimization policy.	9/97
• Consolidated disposal at NTS/Hanford.	—	—	—		—
Disposal Operations Cost Savings					
INEEL					
• Close site disposal (RWMC). Ship CH-LLW by 2000 and RH by 2007.	43.7	—	34	• Onsite generators subject to offsite WAC.	9/00
Hanford					
• Accepts 379,200 m^3 of Fernald waste.	(8)	—	—	• State equity issues.	9/98
SNL					
• Close Building 6596 in 2001 rather than 2015.	2.1	—	14		9/01
• Close six bunkers in 2001.	3.5	—	—		9/01
Oak Ridge					
• Eliminate offsite cell.	38	—	—		—
SRS					
• Consolidated disposal at NTS/Hanford reduce existing vault disposal through 2020.	42	60	10	• Renegotiate RODS and obtain site management approval.	—
• Eliminate building of two vaults.	40	—	—	• Renegotiate RODs and obtain site management approval.	—

Table 1. (continued).

Breakthrough Action by Site	TYP Savings (Life-Cycle) ($M)[a]	Cost Avoidance for TYP ($M)[b]	Schedule Improvement	Barriers	Near-Term Decision Date
NTS					
• Receive 3,000,000 ft^3 of EM.	(60)	—	—	• Eliminate charge back.	9/00
• Receive 11,000,000 ft^3 of ER.	—	1.8	—		9/00
• ER excludes Oak Ridge, INEEL, SRS, Hanford.	—	—	—		—
• Direct funding.	6	—	—		9/97
Rocky Flats					
• Ship 6,000 m^3 (routine waste) and 56,000 m^3 (ER waste) to NTS for disposal and save $17/$ft^3$.	37	—	—	• Direct fund NTS.	9/97
WVDP					
• Eliminate treatment except where required to meet WAC or cost effective.	16	—	2+	• Make decision on treatment and disposal.	—
• Ship 350,000 ft^3 of legacy wastes to NTS.	—	—	—		—
• Ship 20,000 ft^3/year to NTS.	—	—	—		—
TOTAL	**351**	**62**			

a. TYP savings are life-cycle costs currently in the TYPs. These savings reflect dollars that can be used to support additional scope or scope acceleration.

b. This column reflects program gaps that have been filled as a result of the integration effort. This represents dollars that will need to be added to the TYP to correct this situation if the integration alternative is not implemented.

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