EM-53 Lessons Learned Bulletin

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Lessons Learned on Waste Disposal Facilities

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Statement:

The Department of Energy has performed Decommissioning and Demolition (D&D) activities on many large-scale remediation projects across the complex. One option for disposal of low level radioactive waste (LLRW) from these D&D projects has been to use an on-site waste disposal facility. Many of these facilities are engineered above-grade disposal facilities that permanently store LLRW and treated mixed LLRW generated during D&D and soil remediation activities performed in order to achieve the final land use goal at the sites.

There are several existing facilities at sites around the country including:
• Environmental Restoration Disposal Facility (ERDF), Hanford, WA
• Idaho CERCLA Disposal Facility (ICDF), Idaho Falls, ID
• Environmental Management Waste Disposal Facility (EMWMF), Oak Ridge, TN
• Paducah Gaseous Diffusion Plant (PGDP) On-Site Disposal Facility (OSDF), Paducah, KT
• Portsmouth Gaseous Diffusion Plant On-Site Waste Disposal Facility (OSWDF), Portsmouth, OH
• Nevada Test Site (NTS) Areas 3 and 5, Las Vegas, NV
• Savannah River Site (SRS), Aiken, SC

Numerous studies of the waste disposal sites have been performed in the past decade with a number of valuable lessons learned developed from the engineering, construction, operation and closure process perspective (reference 1).

Discussion:

Waste disposal facilities typically consist of one or more disposal “cells”. Each cell is lined with a double liner system consisting of a clay liner, primary and secondary composite geosynthetic liners, a leak detection system and a leachate (liquid which passes through the liners) collection system. The leachate that is collected is conveyed to a wastewater treatment system. After a cell is filled to its capacity with waste, it is covered with a final cover system (cap) consisting of a clay liner, geosynthetic liners, a drainage layer, a bioinstrusion layer, a vegetative layer, topsoil, an erosion mat and finally, vegetation.

The on-site disposal alternative is considered critical to the success of many large-scale DOE remediation projects throughout the United States. Some of the advantages of using this option include:

• Acceleration and cost reduction of remediation activities
• Reduced risks and potential injuries from transport of wastes to an off-site facility
• Provision of a greater level of certainty that long-term disposal capacity would be available to support D&D and remediation activities
• Provision of jobs and service needs within local economies.

On-site disposal facilities are typically expected to function for at least 1,000 years and, therefore, represent an enormous engineering challenge to ensure that hazardous or radioactive waste does not leak into the environment. Despite having advantages as enumerated above, these facilities require closer attention to engineering behaviors than in conventional infrastructure projects to ensure the facility can be operated and maintained as designed for a long life expectancy. When significant operational irregularities were identified at the Hanford ERDF in 2006, the DOE commissioned an Independent Technical Review team (ITR) to conduct a technical and management review of this facility. This review uncovered test data that did not correspond to actual records from testing done in the contaminated area. Further research led to the discovery that test data on soil compaction had been fabricated for over a year. Based in part on finding these issues at the Hanford site, the DOE Office of Environmental Management (EM) sponsored the ITR to perform similar reviews at selected LLRW disposal operation facilities across the complex.

Analysis:

The lessons learned by the ITR team during the course of its review were varied from site to site, however, there were several common themes that emerged. The team concluded that:
• DOE facilities should periodically review and update their operating procedures to address changes in requirements and technologies, as many of the sites were doing.
• Facility management needs to be aware of changes in practices or technologies and to determine whether these changes can reduce cost and improve performance.
• Wider use of automation tools and technologies can prevent human error and reduce worker exposure. Use of automated systems and processes could include:
  - Monitoring systems (e.g., leachate levels, tank levels, detection zone flows)
  - Waste placement and compaction
  - Waste tracking and acceptance.
  Automated systems must also require periodic testing to ensure that system performance remains efficient and consistent.

In addition to periodic independent reviews, sites should ensure that historical data at their facilities is analyzed to provide valuable insight on critical trends and inconsistencies. For example, sites should evaluate whether leachate levels are consistent or rising over time and whether compaction testing data is consistent. In addition, the importance of effective auditing techniques to assess how such data are being generated and to minimize potential data collection problems should be stressed. Finally, the collection of meaningful data does more than measure performance; it also provides evidence to stakeholders at existing and new disposal sites that these facilities can be operated safely and effectively over time.

Actions:

The following are lessons learned that should be observed as new on-site waste disposal sites are being considered:

External/Regulator Influence:
• Recognizing that public involvement is critical to acceptance, DOE should involve stakeholders at the beginning and create a partnership in determining siting and environmental control designs.
• An independently chartered organization could be created to facilitate interaction between all interested parties and DOE.
• Documentation should be electronic and paper, presented at multiple technical levels to fully address the educational and functional interests of the stakeholders.
• Fully communicate the strong operating record of the on-site disposal facilities in the DOE Complex and the positive impact stakeholders have had at other sites (e.g. Hanford).
• Consider establishing a perpetual maintenance and monitoring fund at the onset to assure stakeholders of the integrity of the waste disposal facility over the long term.
Design/Engineering:
• Accurate waste forecasting is a critical aspect of cost-effective disposal operations – Site managers should optimize their waste stream as much as possible.
• Final cap cover will be the most important engineering factor affecting the long term viability and performance of the waste disposal facility, so much attention should be paid to its design.
• Liners may not be needed or required in all applications and therefore, their use should be evaluated in accordance with regulatory and technical requirements.
• Settlement of waste induced by collapse of voids (e.g., containers or vessels) are prevalent and problematic. Strategies such as dynamic compaction or smaller cell size should be considered.
• Site selection should avoid locations with existing ground water contamination and/or buildings.
• Sumps should be located to one side of the cell versus centrally located.
• Automated system and processes (e.g., waste tracking, level detection) should be considered where practical.
• A 10% buffer capacity should be designed into the disposal facility to ensure the facility can accommodate potential increases in D&D waste.
Construction:
• Pretesting of geosynthetic liners to ensure it meets performance criteria can save significant time for procurement, documentation approval and manufacturing/delivery.
• Leak detection testing provides additional quality control and can assist in maintaining stakeholder and regulatory trust.
Operations:
• Model for waste placement should be developed in accordance with a waste placement optimization plan.
• Placement of waste in the cells should be tracked by location, source and waste category.

Critical Decision(s): CD-1 to CD-4

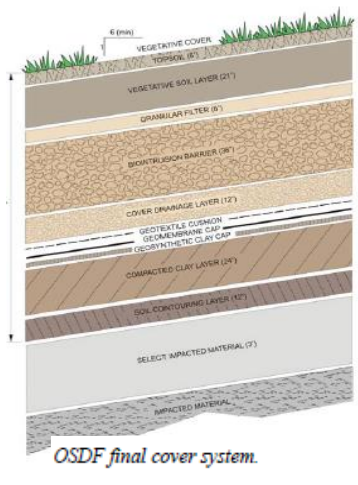
Facility Type(s): All

Work Function(s): Project Management, Engineering, Construction, Operations

Technical Discipline(s): All

Typical grid system for placement of impacted material

Aerial photo of Fernald site in final stages of closure October 2006



OSDF final cover system.

References:
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4. C. H. Benson, W.H. Albright, D.P.Ray, J. Smegal. "Review of Issues Associated with the Proposed On Site Waste Disposal Facility (OSWDF) at Portsmouth". The Office of Enginering and Technology (EM-20), February 25, 2008.