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Update on the Federal Facilities Compliance Act Disposal Workgroup Disposal Site Evaluation -- What Has Worked and What Has Not

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Abstract

The Department of Energy (DOE) has been developing a planning process for mixed low-level waste (MLLW) disposal in conjunction with the affected states for over two years and has screened the potential disposal sites from 49 to 15. A radiological performance evaluation was conducted on these fifteen sites to further identify their strengths and weaknesses for disposal of MLLW. Technical analyses are on-going. The disposal evaluation process has sufficiently satisfied the affected states' concerns to the point that disposal has not been a major issue in the consent order process for site treatment plans. Additionally, a large amount of technical and institutional information on several DOE sites has been summarized. The relative technical capabilities of the remaining fifteen sites have been demonstrated, and the benefits of waste form and disposal facility performance have been quantified. However, the final disposal configuration has not yet been determined. Additionally, the MLLW disposal planning efforts will need to integrate more closely with the low-level waste disposal activities before a final MLLW disposal configuration can be determined. Recent Environmental Protection Agency efforts related to the definition of hazardous wastes may also affect the process.

Introduction

A question frequently raised by many states working with the DOE on site treatment plans and consent orders under the Federal Facilities Compliance Act (FFCAct) [1] was related to the final disposition of the residuals from treatment. Although the FFCAct does not specifically require DOE to address disposal of treated mixed waste, both DOE and the states realized that these issues are an integral component of treatment discussions and have had representatives working on and discussing disposal issues for over two years. While the ultimate decisions on the final MLLW disposal configuration will necessarily be based on both technical and policy considerations, the work to-date has focused on the more tangible technical aspects of disposal.

This joint DOE-states effort has resulted in a successively refined screening of DOE sites based on their technical capability for MLLW disposal [2,3]. The most recent analysis provides estimates of "permissible waste concentrations" for 58 radionuclides at 15 sites. The analysis was a simple and consistent evaluation based on the performance objectives in DOE Order 5820.2A [4] for the water and atmospheric transport pathways and for inadvertent intruder scenarios. While no sites were eliminated by this analysis, it clearly demonstrated that the intrusion scenarios generally provide the most limiting waste concentrations for most radionuclides at all sites and that the water pathway provides the most limiting concentrations for several radionuclides at the more humid sites [3]. On-going work will compare the radionuclide concentrations in treated

DOE MLLW to the permissible radionuclide concentrations in waste at the 15 sites to determine the amount of waste that could technically be disposed of on-site and that which must be disposed of off-site.

History and Results of the Project

The DOE Disposal Workgroup (DWG) was established in June 1993 to work with the states to define and develop a process for evaluating disposal options. The DWG produced an overview document describing the history and status of low-level waste (LLW) and MLLW disposal [5]. Forty-nine sites identified in the first draft of the Mixed Waste Inventory Report (MWIR) [6] comprised the initial universe of potential candidates for MLLW disposal. The DWG initiated and implemented a tiered screening process to narrow the field of potential candidate sites from 49 to 15 sites in two phases [7]. The results of this screening process, which were reviewed and agreed to by the affected states, are illustrated in Figure 1.

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After combining five sites based on geographic proximity, the initial screening eliminated 18 of the most obviously poor candidate sites based on three criteria with regulatory or operational basis:

- must not be located within a 100-year floodplain [8],
- must not be located within 61 meters of an active fault [8], and
- must have sufficient area to accommodate a 100-meter buffer zone [9].

The second round of the screening process was based on a more refined evaluation of the remaining 26 sites [2] using several criteria grouped into three broad categories:

- technical considerations (e.g., hydrology, geology, topography, and volcanic and tectonic potential),
- potential receptor considerations (e.g., populations, significant groundwater resources, and sensitive environments), and
- practical considerations (e.g., ownership, mission, MLLW storage and generation, and regulatory considerations).

Based on this analysis, the states agreed to eliminate an additional 5 sites from further consideration and to assign a lower priority to another 6 sites. These 6 lower priority sites were to continue to be considered for on-site disposal and be considered for disposal of wastes from off-site only if a disposal configuration could not be defined with the remaining 15 sites.

A more technically detailed performance evaluation (PE) was performed on the remaining 15 sites (Figure 1) to estimate their strengths and weaknesses for disposal of MLLW [3]. The PE evaluated the water and atmospheric transport pathways and inadvertent intruder scenarios for 58 radionuclides and estimated the permissible radionuclide concentrations in grouted waste based on site-specific data and performance objectives from DOE Order 5820.2A. The hazardous constituents were addressed in the PE by assuming that the MLLW would be treated to RCRA

standards and that the disposal facility would be designed to meet RCRA standards. The methodology and results of the PE were reviewed by both internal and external review panels as well as DOE Headquarters, the affected sites, and the states.

The PE demonstrated that the intrusion scenarios selected for evaluation, which were based on performance assessments of DOE LLW disposal facilities [10,11], provided the most limiting permissible waste concentrations for most radionuclides at most of the sites. The water pathway limited several radionuclides at sites in the humid region of the country, and the atmospheric pathway limited one radionuclide (carbon-14) at about half of the sites. The PE revealed that engineered barriers offer no long-term advantages for the disposal of wastes containing long-lived radionuclides and identified key parameters characterizing both the sites and the wastes.

On-going work includes a performance evaluation for the RCRA toxic metals in the disposed MLLW (RCRA organics are assumed to be destroyed by treatment prior to disposal) and an analysis of the capability of the 15 sites to dispose of the treated waste streams based on their resulting radionuclide concentrations. The latter effort will consist of first estimating radionuclide concentrations in treated MLLW by estimating the concentration changes due to the various treatment processes, and then comparing these concentrations with the PE results. Longer-term technical considerations in planning for the MLLW disposal configuration process will include site capacity (including consideration of nearby source terms), transportation and disposal costs, transportation risks, and the LLW disposal configuration.

What Has Worked

The DWG has had several successes to-date. Most importantly, the aggressive efforts of the DWG to define a process for developing a MLLW disposal configuration has averted the disposal issue from becoming a major obstacle in the signing by the states of consent orders for waste treatment plans. While disposal planning was not required by the FFCAct, many state governors had suggested that they would not sign the consent orders unless the disposal issues were addressed.

Another important benefit of the DWG efforts is the significant progress in the planning of the MLLW disposal configuration planning, which necessarily requires a long time to complete. The field of potential DOE disposal sites has been narrowed to 15. A tremendous amount of data pertaining to the DOE sites have been summarized [2], and the technical strengths and weaknesses of the 15 sites has been evaluated with a reviewed and accepted approach [3].

Another benefit of the DWG efforts is that the PE report provides a technical basis, using analyses of 15 sites with unique and varied conditions, for confirming many widely held beliefs about near-surface radioactive waste disposal that had never before been clearly demonstrated. For example, the advantages of disposal in arid environments were clearly demonstrated. The engineered barriers contained in a disposal facility were clearly shown to be effective only for the shorter-lived radionuclides and to be of only minor importance for the longer-lived radionuclides.

The more environmentally mobile and long-lived radionuclides (e.g., technetium-99 and iodine-129) were shown to be limited by the water pathway at most sites.

Working cooperatively with the affected states (both the regulatory agencies and governors' offices) in the early stages of the planning process added credibility to the process and identified important issues as they arose. While generally more time-consuming, this cooperative approach has tended to develop vocal proponents from the broad spectrum of interested parties.

What Has Not Worked

While significant progress in the MLLW disposal configuration planning has been made, the final disposal configuration has not yet been defined. Most interested parties agree that 15 distinct disposal sites are not necessary, and a credible way of reaching a more realistic number of disposal sites has not yet been found. The final configuration will necessarily need to consider many technical, social, and political factors. Among the technical factors are the disposal capability of the 15 sites for MLLW in terms of both concentrations and total inventory. These issues can only be addressed by integrating the planning of MLLW disposal configuration into the larger issues of LLW disposal evaluation.

The Defense Nuclear Facilities Safety Board has recently issued to the DOE its Recommendation 94-2, which concerns improving the LLW disposal management practices in the DOE complex [12], and the MLLW disposal planning must become integrated into this effort. The Environmental Protection Agency is under court order to develop changes to RCRA related to the definition of hazardous waste. These changes may reduce the number of DOE waste streams that are considered mixed, with the result of shifting some MLLW to LLW. These changes must also be factored into the MLLW disposal configuration planning.

Beyond the technical factors are all the social and political factors that must somehow be incorporated into the planning process for the MLLW disposal configuration. Many of these factors will be addressed in the revisions to the DOE Waste Management Programmatic Environmental Impact Statement that is currently out for public comment [13]. However, it is doubtful that all concerns have been anticipated, and the hardest work may be yet to come.

Summary

The DWG and states have made significant progress in developing a planning process for the MLLW disposal configuration by narrowing the universe of potential sites to 15 and identifying the strengths and weaknesses of those 15 sites in a performance evaluation. This aggressive work has contributed to preventing disposal issues from holding up the consent orders mandated by the FFCAct.

Additional technical work is on-going, but the less tangible social and political factors will also need to be considered in formulating the DOE's policy for defining the final disposal configuration. The DWG efforts also must be integrated into the larger efforts related to LLW

disposal management to increase the efficiency of the total analysis, minimize redundancy, and pass on lessons learned from the last two and a half years of DWG success.

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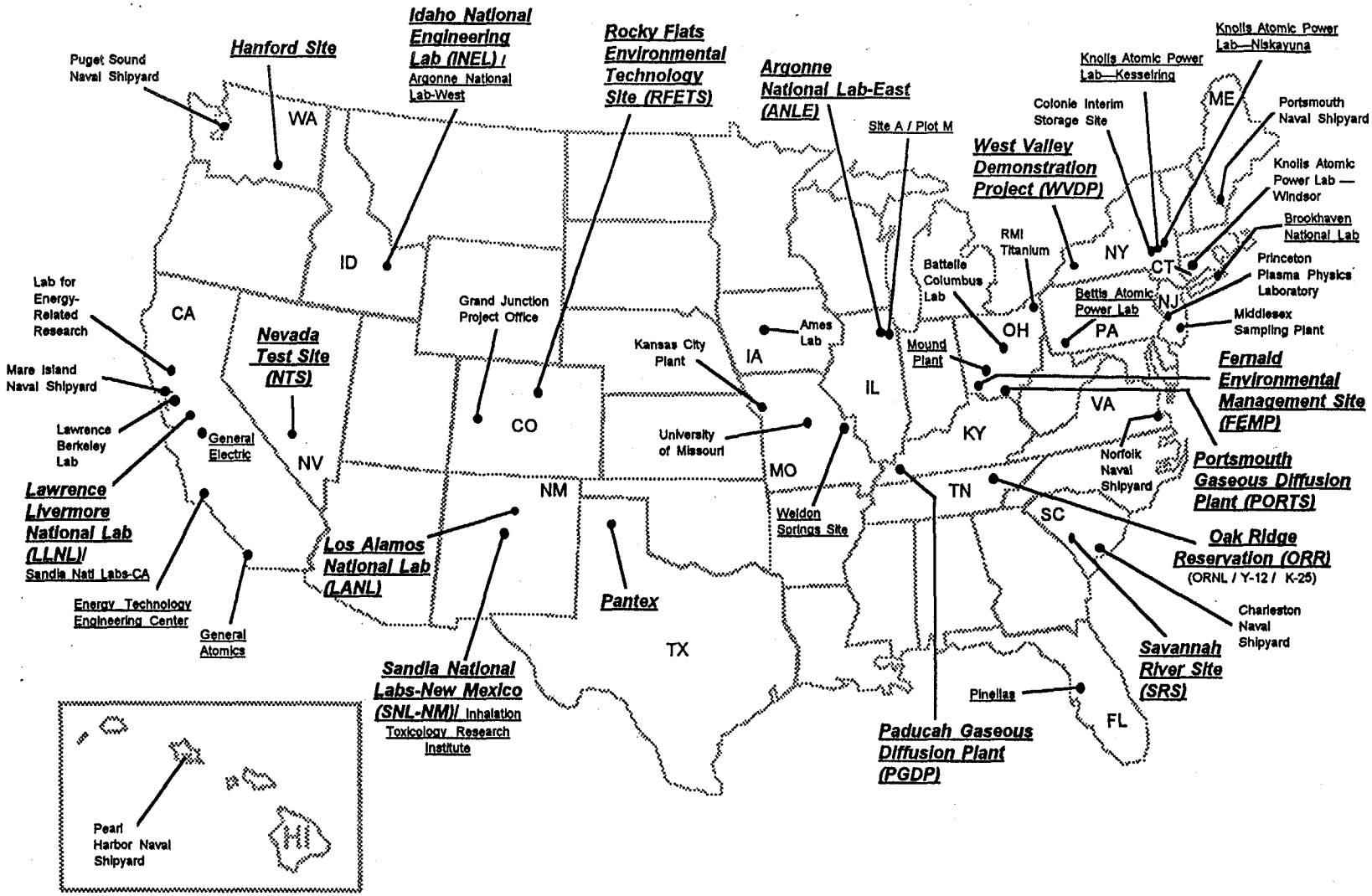

Figure 1. Forty-nine sites originally considered by the DWG in the screening process. The 26 underlined sites are those that remained after the initial screening. The 15 sites in bold italics are those for which performance evaluations were conducted.[3]

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