Bend, but Not Break – Crafting Radioactive Waste Solutions in a Complex Environment - 11619

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ABSTRACT

This paper addresses recent developments in the nation's LLW programs, focusing particularly on the non-technical factors that must be addressed in order to ensure continued and efficient progress in LLW disposition. The paper discusses strategies employed by DOE's Office of Environmental Management to ensure success in its mission to dispose of legacy LLW and other radioactive waste streams generated by an historic national security mission. These include: stakeholder engagement; life-cycle waste forecasting; national strategy development; contract and project management; and negotiated agreements. However, the paper will also touch on modern challenges facing the nation's LLW programs, including: the current inability of LLW generators to disposal of Class B and C wastes; pending regulatory changes; economic challenges to commercial disposal facilities; the anticipated development of commercially owned Federal disposal facilities; management of the next wave of "federal" waste (commercial uranium enrichment wastes); ensuring timely disposal of disused sealed sources that present a national security risk; and developing a strategy for the nation's recovery from a national emergency involving release of radiological materials. The basic premise of the paper is that all the players in the nation's LLW programs – Federal agencies, State and local governments, Tribes, generators, industry, general public and activist organizations – must engage in a truly cooperative effort to ensure continued safe LLW disposal, despite regulatory and market constraints. The current national system is agile enough to respond to the current challenges.

INTRODUCTION

The United States has a long and established history of safely managing Low-Level Radioactive Waste (LLW). The Department of Energy (DOE) and its predecessor agencies have had a significant and influential role in domestic LLW programs – as an early and large volume generator during the Cold War and, more recently, as a leader in performance-based design and policy. As a self-regulating agency, the DOE's LLW programs have matured significantly during the last two decades. In the civilian sector, the statutory and regulatory framework for management of LLW has remained largely unchanged during the same time. While commercial disposal practices and capacity have grown and matured in some ways, the system has been somewhat stymied by a myriad of intertwined economic, stakeholder, policy and regulatory factors.

Although considerable volumes of LLW waste have been safely managed and technologies have improved in both the Federal and civilian sectors, changing economic and programmatic factors have led to increasing calls for changes to both statute and regulation. DOE's experience in developing and maintaining a complex and robust LLW disposal system offers evidence that the current national system need not be significantly revised. Rather, minor adjustments to key factors and increased cooperation among key players and stakeholders could achieve the paradigmatic shift needed within the current system to ensure continued progress in civilian and Federal LLW disposal programs.

Brief History of DOE and Commercial Disposal Facilities

DOE (or its predecessor agency, the Atomic Energy Commission (AEC)) has been disposing of LLW for over half a century. The Atomic Energy Act of 1954, as amended, authorized AEC/DOE to self-regulate the management of its radioactive wastes. Initially, the AEC operated the only disposal facilities within the nation for both commercial and government generated wastes. Most AEC/DOE sites developed on-site disposal facilities for wastes generated at each site. However, when commercial disposal facilities began to operate, AEC-generated wastes were routinely disposed at commercial facilities in an effort to support their development. In the mid-1970s, operational safety issues were identified, which led to the eventual closure of four commercial facilities. Over time, the States with the three remaining commercial sites took steps to restrict use of their facilities to avoid being the only sites accepting the wastes from throughout the nation. (This socio-political circumstance set the context for passage of the Low-Level Waste Policy Act.) In 1979, DOE adopted a policy of using only DOE disposal facilities in order to ensure reliable disposal capacity for DOE mission wastes and to limit potential legal liabilities associated with use of commercial facilities.

At that time, six DOE sites – Idaho National Laboratory, Hanford Site, Los Alamos National Laboratory, Savannah River Site, Oak Ridge National Laboratory and Nevada Test Site (now the Nevada National Security Site (NNSS)) – had operational LLW disposal facilities. Other DOE sites generating wastes were required to coordinate with one of the six sites with facilities for disposal. In general, laboratory and research facilities utilized Hanford disposal facilities and defense-related sites utilized disposal facilities at the Nevada disposal facility. In 1989, DOE established its Office of Environmental Management (EM) to more effectively address the legacy of radioactive wastes and contamination that had accrued during the Cold War. EM undertook a comprehensive planning and decision-making effort related to its waste management mission, pursuant to the National Environmental Policy Act (NEPA). In 1995, DOE published its Waste Management Programmatic Environmental Impact Statement (WMPEIS), which analyzed alternatives for management of its four major radioactive waste streams: high level waste; transuranic waste; LLW; and, mixed LLW. In 2000, DOE issued its Records of Decisions (RODs) pursuant to this EIS. For LLW and mixed LLW management, DOE selected two regional disposal facilities – Hanford and Nevada – in large part because these facilities had the greatest capacity for acceptance of a wide range and volume of waste streams. The selection of two regional sites was based, in part, on state equity considerations. The RODs also documented that, where practical, the Idaho, Los Alamos, Oak Ridge and Savannah River sites would continue to dispose of their own wastes at on-site facilities.

As EM sought to plan and optimize its site cleanup efforts, DOE also resumed use of commercial disposal facilities in the early 1990's. The 1999 issuance of the revised DOE radioactive waste management order and manual (DOE's self-regulatory requirements) established the policy for LLW and mixed LLW management: to the degree possible, LLW and mixed LLW wastes will be disposed on-site where generated; when on-site disposal is not practical, other DOE disposal facilities will be used. However, the policy also provides for an exemption to use permitted, commercial disposal facilities, when such use is demonstrated to be both cost-effective and in the best interest of the Federal government. This policy has remained in effect over the last decade, although circumstances have changed which have required DOE to tailor its implementation of several waste management projects. These tailored project strategies reflect the balancing of numerous programmatic factors and market changes, as will be highlighted in several of the examples that follow. Finally, it is important to note that DOE is currently in the process of updating its waste management order to formally incorporate some of these revised strategies as policy, as well as to codify best practices developed since the issuance of order in 1999. The update is likely to incorporate changes related to the factors considered in selecting disposal sites for DOE LLW and mixed LLW streams. This evolution of DOE's LLW disposal strategies and decisions reflects the need and ability for a large national program to be agile enough to revise and strengthen regulatory requirements as needed to improve safely, as well as refine policy as needed to respond to changing circumstances.

It is also notable that DOE developed detailed, enforceable site cleanup plans for most of its legacy contamination sites in consultation with the States and the U.S. Environmental Protection Agency (EPA), pursuant to the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA). The resulting CERCLA based cleanup strategies and agreements provided for establishment of several CERCLA-regulated disposal cells for disposal of the wastes generated through site remediation activities. CERCLA cells are currently in operation at Idaho, Hanford and Oak Ridge. A CERCLA cell was also critical to the waste management and site cleanup activities at the Fernald Environmental Management Project Site in Ohio, as summarized below. A new CERCLA cell is being considered as part of the regulatory planning for the remediation of the former gaseous diffusion plant at Portsmouth, Ohio as well. Considerations related to this evaluation and future decisions will also be briefly discussed below.

Brief History of DOE Disposal Strategy and Decisions

Notwithstanding the comprehensive technical analyses and public process that underlies DOE's WMPEIS and RODs, elements of the DOE's integrated waste management system have faced numerous legal challenges, and strategies have been revised in response to these factors. Several lawsuits were filed after the WMPEIS was published that sought to prevent the Hanford facilities from continuing to operate as regional LLW and mixed LLW disposal facilities. Although the Federal government ultimately prevailed in a case challenging the legality of a voter-based state statute that would prevent wastes from other states being disposed at the Hanford Site, DOE chose to enter into a negotiated settlement agreement with the State of Washington that suspended offsite shipments to Hanford (with very few exceptions) until additional NEPA review and decisions are completed. More recently, the suspension of off-site waste has been extended and formalized into the enforceable tri-party agreement that guides the cleanup of the Hanford Site. Future offsite waste imports to Hanford are subject to additional NEPA evaluation and decision, but will also not resume until after high-level waste vitrification activities are initiated at the site. As a result of these actions and decisions, the NNSS is the only regional DOE disposal facility currently available for disposal of LLW and mixed LLW from other DOE sites.

Regarding the NNSS, following publication of the WMPEIS, the State of Nevada filed a suit challenging DOE's designation of the site as a regional disposal facility as inconsistent with the site uses authorized in the land withdrawal act that established the site for weapons testing purposes. Through a lengthy and legal consultation process, DOE and the State were ultimately able to resolve these issues. Through improved communication and partnering commitments, DOE and the State of Nevada have cooperatively developed a vision for the continued operation of the NNSS disposal facilities, as a central component to the DOE's integrated waste management system. Less than a decade ago, the environment was one where nearly every new waste stream faced a legal challenge by the State, and offsite mixed LLW streams were prohibited. In 2005, DOE and the State negotiated changes to the permit for the unlined mixed LLW facility; DOE committed to a closure strategy for the facility, and in exchange the State authorized out of state MLLW disposal during the final five years of operation. This successful negotiation was critical to ensuring higher activity DOE mixed LLW streams could be disposed. The unlined mixed LLW facility closed in November 2010, consistent with the permit requirements. Also in 2010, the State approved two new permits for the NNSS facilities – a permit for construction and operation of a new mixed LLW facility, which will continue to serve as a regional facility, and a permit for mixed LLW storage. It is also notable that at the NNSS, the role of the State regulatory agency in waste operations has been documented in an Agreement in Principle. State officials review and comment on all waste profiles to be disposed at NNSS. Additionally, DOE provides specific funding in conjunction with waste volumes disposed at NNSS, to support emergency preparedness along transportation routes to NNSS and regulatory oversight by State agencies.

In light of the suspended use of the Hanford facilities as a regional disposal site, and to ensure state equity considerations underlying the DOE policy are maintained, DOE has committed to evaluating expanded use of commercial disposal alternatives. Large volumes of lower activity LLW and mixed LLW continue to be disposed at the Energy*Solutions*' Clive, Utah facilities, consistent with current DOE policy requirements. In addition, DOE has recently taken actions that support the development of a dedicated Federal Waste Disposal Facility to be constructed by Waste Control Specialists in Texas. DOE and the State of Texas signed a memorandum of agreement documenting DOE's commitment to assume future ownership of the commercial Federal Waste Disposal Facility, following its decommissioning, if DOE wastes are actually disposed there. This commitment represented a significant policy decision for DOE, but it was made to ensure multiple disposal alternatives are available for higher activity DOE LLW and mixed LLW streams, as well as in recognition that the viability of a new commercial compact disposal facility was in part dependent upon DOE's use of the adjacent Federal facility. DOE has long worked to support the stability of the civilian LLW disposal system.

Embracing Input to Enable Project Success

As noted above, there have been (and will continue to be) times when even the most technically defensible, risk-informed and performance-based system or plan cannot be implemented. In many cases, the challenges come from an unsupportive stakeholder group. When challenges are technically informed and seek genuine improvements to the system, DOE welcomes this input. But, wouldn't it be better if the input were received during the development of the disposal system and the planning of the waste management strategies? To mitigate the adverse impact of delays during project execution, DOE is taking steps to institutionalize practices that ensure that its diverse set of stakeholders have access and input to its detailed project plans during the planning phases.

To facilitate broad understanding of DOE LLW and mixed LLW disposition strategies, DOE has developed a web-based system to share waste forecasts and disposition plans with all interested parties. Annually, DOE sites update their forecasts on a waste stream basis, identifying the volume, form, anticipated treatment form, transportation mode and disposal location. Through this process, technical and programmatic risks are also identified by waste stream, which has facilitated the early mitigation and resolution of issues that have previously impeded waste disposal progress. This information is posted via the Waste Information Management System (http://wims.arc.fiu.edu/wims). Resumption of life-cycle forecasting has significantly strengthened DOE's LLW and mixed LLW programs, as this data is consistently used for acquisition planning, NEPA reviews, strategic planning and stakeholder communications. DOE also maintains numerous regular communication processes with citizens groups, environmental/activist organizations and state regulators in which updated waste disposition information is provided throughout the year and during project execution.

In the transportation realm, DOE semi-annually provides stakeholders with a summary of the large volume waste shipping campaigns, to facilitate awareness and emergency preparedness. In addition, DOE has incorporated within its transportation policies the development of detailed transportation plans for shipping campaigns that meet specific criteria. These transportation plans are provided in draft to transportation stakeholders well in advance of the start of the campaigns.

As DOE is developing its strategies for the emptying and closure of tanks used to store high-level waste, scoping workshops are held with the public and the cognizant regulators to collect input on the strategies and the development of the performance assessment (model) that will be used to demonstrate the tank closure plans are compliant and fully protective of human health and the environment. This process was first used in the development of the performance assessment for the Savannah River Site F-tank farm closure, and it is now being used for other projects at Savannah River Site and other sites, such as the Hanford Site. The success of this process has been widely shared by DOE, and DOE is now supporting the State of Utah's and Energy*Solutions'* current efforts to conduct a public scoping process as part of the development of the performance assessment evaluating depleted uranium disposal at the Clive facility.

These examples highlight the functional and cross-cutting processes DOE uses to ensure early and continuous stakeholder input in waste-related project planning and execution. However, there are several site specific examples that also demonstrate how stakeholder input and multiple programmatic factors are balanced in the development of optimized site-specific plans.

For example, the closure of Fernald involved considerable negotiation and trade-offs associated with waste stream disposal. Site cleanup and closure was planned and implemented under CERCLA, guided by an enforceable tri-party agreement among DOE, the State of Ohio and the EPA. In the development of the plan, the regulators and local community agreed to the use of an on-site CERCLA cell for disposal of much of the contaminated soil and facility debris generated during cleanup. This agreement was obtained, in large part, because DOE committed to remove from the site specific waste streams that could have safely and compliantly been disposed in the on-site cell.

In order to minimize the additional risks and costs of off-site shipment associated with this concession, DOE pursued rail transport of these waste streams, where possible. This led to a decision for much of the waste to be shipped to the Clive facility via rail. Thus the historic waste pits on site were exhumed, dried and shipped via rail to the Clive facility for disposal. During this successful six-year campaign, 979,000 tons of waste were shipped in 154 unit trains (9,100 rail cars). A uranium by-product material stream, known as the "silo residues," was also targeted for disposal at Clive. However, when a significant portion of the residues were determined to require a license modification at the Clive facility, and the State opposed such changes, efforts were initiated to redirect the remaining residue inventory to Nevada. When the State of Nevada opposed the disposal of the residues, threatening a legal challenge, DOE chose to pursue a new, commercial disposal alternative. To ensure the treated residues would not be stranded on-site at Fernald, the regulators delayed the processing of the silo residues until DOE was able to identify an off-site facility to receive the treated residues. Through an open and competitive process, DOE sought commercial storage and disposal services for the silo residues. Waste Control Specialists was awarded a contract, and DOE and Fernald site contractor (Fluor Fernald) worked closely with the elected officials and regulators from the State of Texas to ensure the necessary licenses and permits were issued and fulfilled. Waste Control Specialists' storage license was amended to provide for construction and use of a dedicated storage pad; and, DOE provided written assurances to Texas that the residues would be removed from Texas, if necessary. Waste Control Specialists subsequently obtained a license to construct and operate a by-product material disposal facility; the license included provisions that a ten percent fee be assessed on the unit disposal cost, to be provided to the State and host county.

This revised strategy presented several major deviations from historic DOE policy. First, the decision to ship to interim storage, rather than directly to disposal, required careful evaluation and justification. The decision to pursue a commercial alternative, rather than use the DOE facilities at Nevada, was a particularly sensitive policy matter. Although the residues could legally and compliantly be disposed at Nevada, DOE opted to honor the State of Nevada's objections. The written commitment to potentially remove the treated residues from Texas, knowing they could not be returned to the generator site, represented a challenging precedent and a project risk to DOE. Ultimately, the additional cost and schedule impacts, liability and risk associated with storage and disposal at the commercial facility were determined to be in the Department's best interest because this revised strategy enabled the processing of the residues to proceed. Processing enabled a significant reduction in the hazards of the material, as well as the removal of the residues from site – a step absolutely critical to final cleanup and closure of the Fernald Site. In short, had DOE been unwilling to compromise and refine elements of its strategy and policy, Fernald closure would not have been possible.

DOE is again addressing similar challenges with the State of Ohio and the EPA as the remediation plans for the former gaseous diffusion plant at Portsmouth are developed. Through the CERCLA planning process, several cleanup alternatives are being evaluated and discussed with the regulators. One alternative under consideration involves the construction of an on-site CERCLA disposal facility. While some stakeholders remain concerned that on-site disposal will adversely impact future economic development of the site, the cost and schedule impacts of shipping all wastes to off-site disposal could significantly extend the schedule for site cleanup. Discussions now include consideration of strategic initiatives to minimize the volume of wastes requiring disposal – either on-site or at off-site facilities – through reclamation and possible reuse of some building materials. These strategic alternatives may have significant impact on future site development and employment at the site, as well as be of interest to certain industry sectors and special interest groups. No decisions have been made, and there will continue to be extensive regulatory and public review and comment prior to final decisions. However, this very current project highlights the continued opportunity for DOE and its various stakeholders to come together to openly discuss and synthesize their views as the project plans are developed.

A Look to the Current and Future Challenges We Face

DOE looks to these collaborative strategies and project successes as a model for addressing broader challenges facing the nation's LLW programs. Current affairs create a very complex environment within which to meet these challenges. The United States is facing severe economic challenges, real national security threats, and energy supply and critical infrastructure vulnerabilities. Our population continues to grow rapidly, accelerating and exacerbating natural and environmental resource concerns. A large percentage of the population is living longer and facing more medical challenges while cancer occurrences and treatment needs are increasing and medical care programs are revamped. What many Americans fail to realize is that radioactive waste management is germane to all of these broader national issues. *The sustainment of a robust, reliable and cost-effective national LLW management system, then, is critical to our shared well being.*

This fact should be a predominant consideration as we address the current waste related challenges. Are we capable and willing to curtail individual perspectives and interests on LLW disposal issues to move toward a common position that will achieve shared success?

Radioactive waste continues to be generated by industry, research and medical activities, but not all commercially generated wastes can be disposed and, therefore, must remain in storage. While safe and secure storage is an acceptable short-term condition, indefinite storage presents economic liabilities, potential future environmental hazards and possible security vulnerabilities. In particular, disused sealed sources present a real risk to national security, general public and the environment due to the potential for them to be stolen and used within a radiological dispersal device. The recent progress in the development of a commercial compact facility that may accept out-of-compact wastes is incredibly encouraging. This is especially encouraging in its likelihood that real national security vulnerabilities of disused sources, those requiring disposal as Class B or C LLW once designated as waste, will be mitigated. Notably, this progress in the Texas-Vermont Compact provides evidence that multi-state cooperation and market forces can provide solutions within the current statutory and regulatory framework.

Despite the recent inability since 2008 to provide disposal for Class B and C wastes from 36 states, the existing system appears to be agile enough to provide solutions. A significant revision may not be required, as some have claimed or feared.

Even if disposal capacity is available for all the nation's LLW streams, a real and tangible threat still exists that a radiological dispersal device will be detonated somewhere in the United States – resulting in wide-spread contamination, requiring a rapid and effective response to protect human health and the environment and to mitigate the financial and social impact of the attack. Federal and state agencies throughout the nation are working to develop plans to mitigate the occurrence and impact of such an event, including identifying waste disposal issues and strategies. As we plan for the worst-case, however, it may be necessary to revisit current technical, regulatory and policy requirements in order to develop response and recovery strategies that will assure human health is protected in the near team, as well as optimize environmental and economic recovery. In planning for "what-if" scenarios, diverse stakeholders and parties will be challenged to compromise individual interests, in favor of a national solution for managing "recovery" waste streams.

A similar, collaborative and balanced dialogue will likely be needed to develop a national strategy that ensures disposal of depleted uranium streams resulting from commercial uranium enrichment and conversation processes – activities that are critical to our nation's energy supply goals.

A collaborative and balanced dialogue will be needed as DOE works to evaluate disposal alternatives for the Greater-Than-Class C (GTCC) LLW. Public comment will be collected and reviewed on the draft EIS on GTCC LLW disposal throughout this year. It is highly probable that new regulations and statutory changes will be required to support disposal decisions in the future.

As the U.S. Nuclear Regulatory Commission undertakes its various rulemaking efforts related to waste management and disposal, they will surely seek the input from all affected parties. Can our collective input be considerate of a goal for ensuring the broad interests of the nation are best served?

Conclusion

DOE experience has shown that, as a nation and industry, we have the means to effectively address these challenges. We have the technology, we have the assets – in land and fiscal resources - and, most importantly, we have the experience to develop a solution. It is the ideological and programmatic challenges to LLW waste projects that are often the most difficult to address and resolve, perhaps because the positions of the opposing party appear so unchangeable. Cooperating to address the legacy and current waste volumes need not demonstrate support for continued radioactive waste generation. In fact, dialogue should continue to ensure even the most strident activist organizations' views are factored into future waste project plans during their development – such that efforts are taken to minimize waste generation, optimize waste management strategies, reduce waste handling and transportation risks, and reclaim and reuse potentially valuable materials generated during site and facility remediation projects when possible in order to reduce consumption of natural resources.