Strategic Assessment of NRC's Low-Level Radioactive Waste Program—an Update - 9205

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ABSTRACT

Late in 2007, NRC staff completed a strategic assessment of its low-level radioactive waste (LLRW) regulatory program [1]. This assessment was necessitated by continuing and new challenges in the national LLRW program, and finite NRC staff resources. Our assessment systematically evaluated and prioritized activities to improve our LLRW regulatory program and to contribute to NRC's fulfillment of its safety and security mission. The results of that assessment—a prioritized list of tasks to be completed in the next several years—have guided our actions for the last year. This paper will address the progress we have made since the assessment was completed and the outcomes of the actions we have taken. Ultimately, our actions are intended to help ensure the safe and secure management and disposal of LLRW generated from beneficial uses of radioactive materials in the U.S, consistent with NRC's overall mission.

INTRODUCTION

The national LLRW program continues to change and evolve. Last summer, the Barnwell LLRW disposal facility closed to out-of-compact generators in 36 States, thereby forcing them to store their Class B and C waste for an indefinite period of time. For most of the last 30 years, LLRW generators have had disposal options for all of their Class A, B, and C waste, and have not needed to store their waste on site for any extended periods of time. This increased storage raises questions concerning security measures needed, design requirements when separate facilities are built, licensing approvals needed, and the form of waste for storage, among others. In addition, the September 11, 2001, terrorist attacks heightened concern about the security of stored LLRW in general and sealed radioactive sources in particular. In a recent report to Congress [2], the Radiation Source Protection and Security Task Force provided several recommendations concerning sealed sources that no longer have a use and therefore must be managed and disposed of as radioactive waste. The report includes a number of recommendations related to disposal of sources, and highlights the importance of finding a permanent solution for disposition of sources to mitigate security concerns.

In addition to storage of Class B and C LLRW, there has recently been significant interest in the disposal of waste at the low-end of the radioactivity concentration spectrum. Generators of all types of radioactive waste have made increasing use of Resource Conservation and Recovery Act (RCRA) hazardous waste disposal facilities for disposal of low-activity waste (LAW)[1] from sites undergoing cleanup and decommissioning, such as industrial sites with large amounts of radioactive contamination. Limited disposal options for LLRW in general and the cost of disposal of LAW in conventional LLRW disposal facilities have been factors in the use of RCRA disposal facilities. These facilities are not licensed under the Atomic Energy Act (AEA), but are permitted under RCRA by the States in which they are located or EPA if the State does not have primacy. LAW includes not only LLRW at the low-end of Class A concentrations, but also waste containing naturally occurring radioactive materials (NORM), tailings from

[1] The International Atomic Energy Agency formally recognized this category of waste in its recent revision of the Safety Guide on the Classification of Radioactive Waste. The revision to this Safety Guide (DS 390) is expected to be issued in the near future.

the extraction of uranium from ore, and exempt concentrations of source material (e.g., less than 0.05 weight %). NRC has approved approximately two dozen LAW disposal requests in the last 10 years. However, there is currently no formal documented procedure for conducting the reviews of requests for these alternate disposals, and such guidance would facilitate the review and approval of these alternate disposal requests.

The nuclear industry is also generating new waste streams that may require regulatory changes. In the next few years, Louisiana Energy Services (LES) will begin operation of a uranium enrichment plant, the National Enrichment Facility, which will produce large amounts of depleted uranium (DU). In 2005, the Commission directed the staff to consider whether the waste classification of DU (currently Class A) from enrichment plants needs to be reassessed [3]. When NRC developed its LLRW disposal regulation in 10 CFR Part 61, the amount of DU assumed for disposal was small, and the new, larger anticipated volumes warrant a re-examination of the classification. In addition to enrichment plant wastes, more than two dozen new nuclear power reactors are planned, and while the volume of LLRW generated by nuclear power plant operations is relatively low, nuclear plants generate the majority of Class B and C waste in the U.S. Finally, there is renewed interest by industry in the commercial reprocessing of spent fuel, which would produce a variety of effluent releases and waste streams that may challenge the current LLRW regulatory scheme. Reprocessing waste streams were not considered in developing the technical basis for 10 CFR Part 61.

A regulatory program principally consists of the regulatory framework (i.e. the regulations and guidance that define safety and security criteria and licensing procedures), the licensing of facilities (i.e., the review of license applications and issuance of licenses to organizations that use radioactive materials), and an inspection program to ensure that licensees are implementing their programs appropriately. Because Agreement States perform most of the licensing and inspection of LLRW in the U.S., our efforts have been principally focused on the regulatory framework for LLRW. That framework is used by NRC and Agreement States as the basis for licensing and inspection.

Our LLRW Strategic Assessment was conducted with respect to the above developments in the national program. These developments suggest or require certain actions by the NRC to maintain an appropriate regulatory framework, ranging from updating storage guidance (because many generators may no longer have a disposal option for Class B/C waste beginning in mid-2008), to developing guidance for LAW disposal.

THE STRATEGIC ASSESSMENT OF NRC'S LLRW REGULATORY PROGRAM

The purpose of the LLRW Strategic Assessment was to identify the actions that we could take and to prioritize them in accordance with our LLRW program's strategic objective. The NRC's Strategic Plan [4] states that the agency's strategic goals are to 1) ensure adequate protection of public health and safety and the environment, and 2) to ensure adequate protection in the secure use and management of radioactive materials. Consistent with the strategic plan guidance, the staff developed the following strategic objective for the NRC's LLRW regulatory program:

> The objective of NRC's LLRW regulatory program is to provide for a stable, reliable, and adaptable regulatory framework for effective LLRW management, while maintaining safety, security, and protection of the environment.

The purpose of the LLRW Strategic Assessment was to identify and prioritize activities that will position the LLRW program to meet this objective. In striving to ensure stability and reliability in the LLRW regulatory framework, we have a strong foundation already—our disposal regulation in 10 CFR Part 61, which was established nearly three decades ago. That regulation and its associated regulatory guidance

have well established procedures and criteria, and have facilitated the safe and secure disposal of LLRW since first promulgated. At the same time, we want our overall approach to LLRW management, including disposal, to be sufficiently flexible and adaptable to allow modifications to accommodate changing conditions in the national program in a reasonably facile and straightforward manner.

Based on extensive input from stakeholders, we evaluated 20 specific activities, many suggested by stakeholders, that we could undertake to improve the LLRW regulatory framework and address new developments in the national LLRW program. These activities ranged from narrow, targeted activities (e.g., to update LLRW storage guidance) to much broader ones (to suggest legislative changes to Congress for improving the national program as a whole). The staff evaluated these activities against the NRC's strategic objectives for safety and security. We also considered NRC's organizational excellence objectives of openness (NRC appropriately informs and involves stakeholders in the regulatory process) and effectiveness (NRC actions are high quality, efficient, timely and realistic) in evaluating potential activities, although these were given less weight than the safety and security objectives. The result of the assessment was a prioritized list of activities for NRC LLRW staff for the next several years. The highest priority tasks we identified were as follows:

- Update LLRW storage guidance—with the closure of Barnwell looming, and NRC's storage guidance having been first published many years ago, updating this guidance was a clear priority.
- Determine whether DU waste streams from enrichment plants warrants a change in the waste classification of uranium. This waste stream did not exist at the time that Part 61 was promulgated in 1982, and therefore, was not considered in developing the technical basis for Part 61.
- Update guidance on concentration averaging—the closure of Barnwell to most U.S. generators of Class B and C waste warranted a re-examination of NRC guidance on averaging of waste concentrations for determining waste classification. Use of appropriate and risk-informed, performance-based methods could enable disposal of certain wastes as Class A, rather than their storage as Class B or C.
- Document procedures and processes for LAW disposal—although NRC has approved many LAW disposal requests, there is no formal, detailed procedure that describes the staff review. This procedure will ensure consistency in staff reviews, as well as enable licensees to understand staff information needs in their requests.

These activities are discussed in greater detail in the following sections.

Update LLRW Storage Guidance

On July 1, 2008, the Barnwell LLRW disposal facility closed to LLRW generators in 36 States, leaving them no option for disposal of their Class B and C LLRW. One of the high priority tasks identified in our LLRW strategic assessment was to update guidance for the storage of LLRW. For materials and fuel cycle licensees, this guidance was first published in 1990, in Information Notice 90-09, "Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees," [5] and for nuclear power reactor licensees, in 1981, in Generic Letter 81-38, "Storage of Low-Level Radioactive Wastes at Power Reactor Sites" [6]. These guidance documents were particularly useful when access was denied to generators in Michigan from 1990 through 1995, and for many U.S. generators from 1994-1995, when Barnwell closed to all but generators in the Southeast LLRW Compact. There have been a number of changes since the guidance was first published that warranted an update. The September 11, 2001, terrorist attacks heightened concern about the security of stored LLRW in general and sealed radioactive sources in particular, and NRC has developed specific guidance to better ensure the security of high risk materials. This security guidance has now been referenced and/or included in the updated

LLRW storage guidance [7]. For instance, additional requirements have been imposed on radioactive materials licensees who are authorized to possess radionuclides of concern in quantities exceeding certain threshold limits (see, e.g., 70 Federal Register 72128 (December 1, 2005) (Order Imposing Increased Controls); 72 Federal Register 70901 (December 13, 2007) (Order imposing Fingerprinting, and Criminal History Record Checks Requirements for Unescorted Access to Certain Radioactive Materials)). As a result of having to store waste, rather than dispose of it, licensees may need to increase their license possession limits. This could result in possession of radionuclides of concern in quantities exceeding these threshold limits. In such cases, additional requirements – like those cited above – may be imposed on licensees, and this fact is highlighted in the revised storage guidance.

The nuclear power industry has also been taking steps to address the loss of access to Barnwell, including the development of its own guidance for use by power reactor licensees. The Electric Power Research Institute has developed at reactor storage guidance for use by power plants, and the Nuclear Energy Institute submitted it to NRC for review and endorsement [8]. The industry has developed these guidelines for generic use by Part 50 and 52 licensees to provide a consistent approach to implementing an operational program for safe interim storage of LLRW at a commercial nuclear power plant site. Designed for a storage period of as long as the full operational lifetime of a nuclear power plant, the guidelines describe an operational program that is structured to assure safe interim storage of LLRW for as licensed under 10 CFR Part 50 or 52. A group of industry experts in LLRW management developed the guidance. On December 30, 2008, NRC issued Regulatory Issue Summary (RIS) 2008-32, "Interim Low-Level Radioactive Waste Storage at Reactor Sites" [9], finding that the EPRI guidance ". . . to be consistent with NRC information contained in this RIS and other NRC guidance . . ." and ". . . provides an acceptable method for recordkeeping, determining waste forms, and waste containers and monitoring and inspecting the interim long-term storage of LLRW." Although NEI and EPRI had also indicated that Class B/C waste could be concentrated to greater than class C waste, NRC did not take a position on that proposal.

Updating the guidance for materials licensees and endorsing guidance for power reactors' LLRW storage helps to ensure that licensees will address the important issues in assuring safety and security of LLRW. This updated guidance is also the basis for revisions to NRC inspection procedures for LLRW storage. These procedures are used by NRC regional inspectors to evaluate licensee programs and will help to ensure that licensee programs are being appropriately implemented in this time of increased storage of LLRW.

DU Disposal

The building of new, commercial, uranium enrichment facilities in the United States has created a new waste stream, DU tailings, not previously managed as part of the commercial LLRW program. Enrichment facilities produce relatively high concentrations and large quantities of DU, but this waste stream was not evaluated in the Final Environmental Impact Statement (FEIS) supporting the development of 10 CFR Part 61 [10]. When the FEIS was issued in 1982, there were no commercial facilities generating large amounts of DU waste, therefore, the FEIS considered only the types of uranium-bearing waste streams typically being disposed of by NRC licensees at the time. NRC concluded that those waste streams posed an insufficient hazard to warrant establishing a concentration limit for uranium in the waste classification tables in 10 CFR 61.

Today, there is a new commercial uranium enrichment industry, and commercial disposal sites licensed under 10 CFR Part 61, or compatible Agreement State regulations, are interested in accepting DU tails from these plants. In addition to tails generated by the LES National Enrichment Facility and the United States Enrichment Corporation's American Centrifuge Plant, U.S. Department of Energy stockpiles of DU at the Paducah and Portsmouth Gaseous Diffusion Plants may also be destined for commercial

disposal. All told, more than 1 million metric tons of depleted uranium hexafluoride (DUF6) will need a disposition path. Existing disposal facilities, such as, the Energy*Solutions* facility in Clive, Utah and the proposed Waste Control Specialists (WCS) LLRW facility in Andrews County, Texas, are both possible disposal sites for these materials.

In the adjudicatory hearing associated with the licensing of the LES National Enrichment Facility enrichment plant, the Commission considered the classification of DU tails. The Commission directed the staff, "outside the LES adjudication, to consider whether the quantities of depleted uranium (DU) at issue in the waste stream from enrichment facilities warrant amending section 61.55(a)(6) or the section 61.55(a) waste classification tables." As the Commission indicated in Order CLI-05-20, an Order associated with the LES hearing, the current waste classification for DU is "based upon § 61.55(a)(6), which specifies that if radioactive waste does not contain any of the radionuclides listed in either of two listed waste classification tables, it is Class A waste. DU does not contain the radionuclides listed in the specified tables, and therefore under a plain reading of the regulation, depleted uranium is a Class A waste." However, that Part 61 provision was based on the small amounts of uranium being disposed of at the time that Part 61 was promulgated, and not the much larger quantities produced by an enrichment facility. Thus, a re-examination of the waste classification for uranium is needed, as directed by the Commission.

We completed our assessment of DU classification in a Commission paper published in October 2008 [11]. In order to develop an informed response to the Commission direction, we performed a technical analysis to evaluate the impacts of near-surface disposal of large quantities of DU and to determine if amendments to §61.55(a) are necessary to assure that large quantities of DU are disposed of in a manner that meets the performance objectives of Part 61. We concluded that large quantities of DU can be disposed of in a near-surface disposal facility under certain conditions and meet the performance objectives of Part 61. However, the staff recommended a change to existing regulations to help ensure that large quantities of DU are disposed of safely due to the unique characteristics of the waste and additional considerations required for its disposal. We proposed to the Commission to conduct a limited rulemaking that would specify that a disposal facility licensee or applicant would need to conduct a site-specific analysis that addresses disposal of DU in large quantities. The Commission decision is expected in the near future.

Disposal Options for Low Activity/Very Low Level Radioactive Waste

Another issue that was ranked high in the LLRW Strategic Assessment is the disposal of LAW in Resource Conservation and Recovery (RCRA) facilities and the regulatory review and approval needed for such disposals. These disposals may occur either in facilities permitted to accept hazardous waste or in solid waste landfills for materials with very low concentrations of radionuclides, typically at or below levels for unrestricted release. Such wastes may be disposed under the provisions of NRC's regulation in 10 CFR 20.2002 (which allows for case-by-case NRC approvals for disposals in a facility other than a conventional Part 61 licensed LLRW facility). The NRC has not previously developed a formal, documented procedure for reviewing and processing such requests. Stakeholders have noted that NRC's process for authorizing disposals under this provision is not entirely consistent and needs to be clarified, simplified and made more transparent by the development of new regulatory guidance. Since then, we have developed an internal procedure for reviewing and processing 10 CFR 20.2002 requests, as well as requests to dispose of "unimportant quantities" of source material. "Unimportant quantities" of source material are exempt from regulation under the Atomic Energy Act, but if possessed by an NRC licensee, can be sent to an unlicensed person with NRC approval under 10 CFR 40.13(a). Next year, we will develop a standard review plan for these proposed disposals for use by licensees. In the meantime, the internal procedure is also useful for licensees who plan to submit LAW disposal requests to NRC.

The outcome of formalizing this internal procedure and standard review plan will be to improve the consistency of our reviews; to enable licensees who plan to submit such requests to better understand the staff information needs; and to improve transparency for these types of disposals, a specific goal of the Commission.

Concentration Averaging Branch Technical Position

NRC regulations in 10 CFR Part 61 allow for the averaging of radionuclide concentrations in determining the waste classification. When articles with radioactivity contamination are packed in a disposal container, for example, they will have varying concentrations of radioactivity. Under certain circumstances, it may be appropriate to average the activity concentration over the volume of the container to determine the concentration for waste classification purposes. Such averaging may reduce the waste classification of some wastes by lowering the average concentration of the waste in the container, while still protecting the health and safety of a potential inadvertent intruder into the disposal site. NRC's guidance on acceptable methods for averaging of waste concentrations is contained in the Concentration Averaging and Encapsulation Branch Technical Position (BTP), first published on January 17, 1995 [12].
Averaging, or the related practice of blending of waste, can help mitigate the impacts of the closure of the Barnwell LLRW disposal site by reducing the amount of Class B/C waste and enabling its safe disposal at an existing facility authorized for receipt of Class A waste. The staff is reviewing and updating the BTP, particularly looking for opportunities where LLRW can be averaged or blended in a more risk-informed manner that could enable disposal of more LLRW. In soliciting stakeholder comments on the LLRW Strategic Assessment, there was general agreement that many statements in the current BTP were difficult to interpret and that the underlying rationale for many, if not most, statements, are not self-evident.

Since the LLRW Strategic Assessment was published, the staff has published a Commission paper that analyzes other regulatory approaches for addressing blending of wastes into a final homogeneous waste form. The original BTP contained non-performance based constraints on such blending, presumably because dilution of any kind was viewed to be undesirable. Although blending of waste into a homogeneous waste form is relatively straightforward, the blending of B/C wastes down to Class A to facilitate disposal has been controversial among stakeholders. The Commission paper addresses policy, regulatory and safety issues and Commission direction is expected soon.

The immediate outcome of this effort has been a better understanding of the BTP, its bases, and impacts on the national LLRW program. While there are stakeholder concerns regarding changes to the BTP, the staff's paper will enable the Commission to fully consider all of the issues and make an informed decision.

Agreement State Coordination

Agreement States have a significant role in the regulation of LLRW and their input has been important considering the above potential changes to the regulatory framework. The 35 Agreement States regulate most of the materials licensees in the U.S. The Agreement States also regulate all of the major LLRW management and disposal facilities. Except for storage guidance for reactors, we have sought the views of Agreement States and factored those into our decisionmaking and regulatory documents.

CONCLUSION

Last year, we completed a LLRW Strategic Assessment of the NRC LLRW program to identify and prioritize those tasks that could contribute the most to achieving NRC's safety and security goals. NRC's regulatory framework for LLRW management and disposal has a long history of achieving its purpose of

helping to ensure safety, security, and the protection of the environment. But the LLRW environment has changed and continues to change. We undertook this Strategic Assessment of our LLRW program with the objective of providing a stable, reliable, and adaptable regulatory framework for effective LLRW management, while maintaining safety, security, and protection of the environment, in light of these changes. Since then, we have been implementing those tasks to make adjustments to the LLRW regulatory framework appropriate to recent LLRW program developments. In response to the closure of the Barnwell LLRW disposal facility and the resulting need to store Class B/C LLRW by thousands of U.S. generators, the staff updated its guidance for LLRW storage. This new guidance helps licensees put into place means for storage of LLRW that is both safe and secure. We also found a storage guidance document prepared by industry for nuclear power reactors to be acceptable. In response to a new waste stream from the enrichment of uranium in commercial sites, the staff evaluated the disposal of depleted uranium and the measures needed to ensure its safe disposal. Regulatory changes are recommended. The staff also developed a procedure for the review of low-activity waste disposal in RCRA facilities not licensed by NRC. Finally, in response to industry proposals to examine blending of LLRW to mitigate the consequences of the closure of Barnwell, the staff completed an extensive analysis of this issue for Commission consideration. There are policy issues and considerable stakeholder interest associated with blending of LLRW.

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