

## **Results of a Strategic Assessment of NRC's Low-Level Radioactive Waste Program - 8133**

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as told to

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### **ABSTRACT**

NRC recently completed a strategic assessment of its low-level radioactive waste (LLW) regulatory program. In this paper, we provide the results of this assessment—a prioritized list of activities for our LLW program in the next several years—along with a description of the circumstances that required us to undertake this assessment and the process we used. We obtained ideas from a wide variety of stakeholders on activities we could undertake, and we evaluated them in light of our overall strategic objectives for ensuring safety and security, as well as a number of other factors. We ranked 7 of the 20 activities evaluated as high priority. Their completion in the next several years will help to ensure that LLW will continue to be managed and disposed of safely and securely.

### **INTRODUCTION**

The national LLW landscape is changing. Next summer, the Barnwell LLW disposal facility is expected to close 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. Although a private company is developing a new LLW disposal facility in Texas, it will be limited to DOE waste and waste from generators in Texas and Vermont (the Texas Compact). The prospects for generators to dispose of their higher activity waste in the near future are not good and thus LLW storage will become widespread beginning next year.

Although LLW has been safely stored in the past, the September 11, 2001, terrorist attacks heightened concern about the security of stored LLW in general and sealed radioactive sources in particular. In a recent report to Congress [1], 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 these higher activity wastes, there has been significant interest in low-level waste at the low-end of the spectrum in recent years. Generators of all types of radioactive waste have made increasing use of Resource Conservation and Recovery Act (RCRA) facilities, particularly hazardous waste facilities, for disposal of low-activity waste (LAW). Limited disposal options for LLW and the cost of disposal have been factors in the use of these facilities, which are not licensed under the AEA but are permitted under RCRA by the States in which they are located. LAW includes not only LLW at the low-end of Class A concentrations, but also waste containing naturally occurring radioactive materials (NORM), tailings from the extraction of uranium from ore, and exempt concentrations of source material (e.g., less than 0.05 weight %). Stakeholders continue to have a significant interest in the use of these disposal facilities and would like the NRC to issue additional guidance on the provision in 10 CFR 20.2002, “Method for Obtaining Approval of Proposed Disposal Procedures,” that enables licensees to obtain approval for such disposals. However, some stakeholders, particularly public interest groups, oppose the use of these facilities for AEA materials.

The nuclear industry is also generating new waste streams that may require regulatory changes. In the next few years, Louisiana Energy Services will begin operation of an enrichment plant that 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 [2]. When NRC developed its LLW disposal regulation in 10 CFR Part 61, the amount of DU assumed for disposal was small, and these new, larger amounts warrant a re-examination of the classification. In addition to enrichment plant wastes, more than two dozen new nuclear power reactors are being planned, and while the amounts of LLW generated by operations are relatively low, nuclear plants generate the majority of Class B and C waste in the U.S. Finally, the U.S. DOE is pursuing the proposed Global Nuclear Energy Partnership (GNEP) which, through reprocessing of spent fuel, would produce a variety of effluent releases and waste streams that may challenge the current regulatory scheme. An intermediate class for radioactive waste that is between low-level radioactive waste (LLW) and high-level waste (HLW) is used in other countries where recycling of nuclear fuels occurs and may be considered for our program.

The above circumstances suggest or require certain actions by the NRC, 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. Many LLW stakeholders also believe that other changes are needed, ranging from amending or eliminating the LLRWPA with the goal of creating a new system that will lead to new disposal options for commercial LLW, to specific suggestions for revising NRC LLW guidance.

Because the potential activities for our LLW program require more resources than are available, we needed a strategy to identify and prioritize the tasks to be performed in response to these internal and external considerations. Consequently, we undertook the effort described in this paper to assess the current LLW regulatory program to ensure that it remains positioned to achieve agency objectives.

## **THE STRATEGIC ASSESSMENT OF NRC'S LLW REGULATORY PROGRAM**

The purpose of this LLW strategic assessment is to identify the actions that we could take and to prioritize them in accordance with our LLW program's strategic objective, as discussed below. Although the stakeholders have suggested many improvements and changes, this assessment places greatest emphasis on those that are directly related to the NRC's responsibilities to ensure safety, security, and environmental protection.

The strategic assessment process involved four major steps: (1) development of strategic objectives and goals; (2) information gathering; (3) evaluation of the information obtained; and (4) decisionmaking.

### **Development of Strategic Objectives and Goals for LLW Program**

With regard to the first step, we formulated a strategic objective to be consistent with, and to complement, the overall agency goals provided in the NRC's FY 2004 – 2009 Strategic Plan [3] draft FY 2007-FY 2012 Strategic Plan [4].<sup>1</sup> As indicated in both plans, the agency's overarching strategic objective is to, "enable the use and management of radioactive materials and nuclear fuels for beneficial civilian purposes in a manner that protects public health and safety and the environment, promotes the security of the nation, and provides for regulatory actions that are open, effective, efficient, realistic and timely." Both plans calls for the assessment of key issues affecting the safe management of civilian LLW and further note that NRC programs should ". . . anticipate challenges and respond quickly to changes in the regulatory and technical environment."

Consistent with the strategies and means identified in the strategic plans and briefly summarized above, we developed the following strategic objective for the NRC's LLW regulatory program:

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

The purpose of this strategic assessment was to identify and prioritize activities that will position the LLW program to meet this strategic objective. In striving to ensure stability and reliability in the LLW regulatory framework, we have a strong foundation already—our disposal regulation in 10 CFR Part 61, which was established over two decades ago. That regulation and its associated regulatory guidance have firm and clear procedures and criteria, and have facilitated the safe and secure disposal of LLW. At the same time, we want our overall approach to LLW management, including disposal, to be sufficiently flexible and adaptable to allow modifications to be made to accommodate changing conditions in a reasonably facile and straightforward manner.

Both stability and adaptability in the regulatory framework are important to licensees. Several thousand organizations in the U.S. generate LLW that requires disposal in a licensed facility. The form, packing and classification of the waste, which are determined by the LLW generators, or LLW processors on their behalf, must meet requirements in NRC's disposal regulation in 10

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<sup>1</sup> The draft plan, which will be finalized by the Commission after it receives and considers public comments, will replace the current FY 2004-2009 Strategic Plan.

CFR Part 61. These requirements act in concert with the disposal site and facility requirements to ensure that waste can be safely isolated from the environment. LLW generators and processors have developed programs and procedures and trained personnel to implement the existing regulatory requirements and guidance, and thus changes in the regulations or guidance can have a significant impact on existing programs. With respect to disposal facilities, there are only three in operation, and thus the impact is less significant. However, changes in the regulatory criteria can complicate the preparation and review of a license application for a planned facility. At the same time, a changing environment, particularly over a long time frame, may warrant revisions to the regulatory framework, based on new science, new waste streams, or scarce disposal capacity.

### **Stakeholder Input**

The solicitation and subsequent consideration of stakeholder views were major steps in the development of the low-level waste (LLW) Strategic Assessment. External stakeholder views and opinions were primarily obtained in the following ways: (1) from comments provided by invited speakers and other attendees at a May 2006 Advisory Committee on Nuclear Waste and Materials (ACNW&M) two-day Working Group Meeting (i.e., a “fact-finding” workshop), which was attended by representatives from industry, states and compacts, academia, other federal government agencies, environmental groups, and professional societies; (2) from responses to a Federal Register Notice (FRN) , issued on July 7, 2006 (and later modified on July 27, 2006 to extend the comment period), which asked for comments from the public on the staff’s approach toward the strategic assessment; (3) via teleconferences with certain Agreement State regulators; and (4) from comments received in a December 2006 public meeting with the Nuclear Energy Institute (NEI) and Electric Power Research Institute (EPRI). In addition, apart from the information received in the contacts described above, several national organizations have published position papers that express various concerns and opinions regarding LLW management in the U.S. Those written positions were also taken into consideration in the development of this Strategic Assessment. The following summarizes stakeholder positions on some key issues.

Risk-Informing – NRC has taken a number of steps in the last decade to risk-inform its regulation in all of its major programs. NRC’s disposal regulation was promulgated in 1982, and most of the LLW guidance was developed in the 1980’s, before the widespread use of risk-informed regulation. Stakeholder statements on risk-informing LLW management and disposal generally involved the following four areas: (1) disposal of very low-level radioactive waste (VLLW); (2) assumptions and basis for the intruder protection requirements in 10 CFR Part 61; (3) waste classification; and (4) managing and disposing of radioactive waste in ways commensurate with its degree of hazard, not its origin. It is difficult to treat these issues separately, as in many ways they are interrelated. For example, the Part 61 waste classification system, which establishes maximum concentrations for specific radionuclides, is based on a desire to protect inadvertent intruders. The classification system is founded upon certain assumed scenarios that are described in the Draft Environmental Impact Statement for Part 61, involving resident farmers, residence excavations, and waste exhumations. Therefore, attempting to develop more “risk-informed” intruder scenarios or applying scenarios differently for different types of sites (e.g., arid versus humid sites), could have a significant effect on what

types and quantities of waste can be disposed of at a particular site (leaving aside other constraints that may be imposed by state or federal regulations or statutes).

For many, the subject of risk-informing LLW disposal regulations and practices is closely tied to the current origin-based system for disposal of LAW. Accordingly, the primary recommendation of one of the respondents to the staff's FRNs is that the regulatory agencies (viz., NRC and EPA) should implement risk-informed regulation of LAW through "integrated strategies" that would involve adoption of risk-informed approaches in incremental steps. In this respondent's view, this approach would improve communication with affected and interested stakeholders because the current system is so "rigid and hard to understand." As noted earlier, however, other respondents strongly oppose risk-informing and consider it to be tantamount to "deregulation."

The use of sound science and state-of-the-art methods to establish risk-informed and, where appropriate, performance-based regulations, is a strategy that NRC has committed to in its Strategic Plan [3]. Consequently, NRC staff activities are expected to adhere to that policy and approach. While all of the LLW program activities evaluated in this assessment are expected to be risk-informed to the extent practicable, tasks that would significantly employ risk-informing are those involving rulemaking and guidance development. Thus, activities related to the implementation of major revisions to 10 CFR Part 61; the development of guidance documents for implementing the LLW import/export regulations in 10 CFR Part 110 and alternative waste classification and characteristics provisions in 10 CFR Part 61.58; the updating of the Branch Technical Positions on Waste Concentration Averaging and Extended Storage of LLW; and the identification of alternatives for disposal of large quantities of depleted uranium (DU) are examples of activities that would support more risk-informed practices in LLW regulation.

Closure of Barnwell LLW Facility to Out-of-Compact Waste--The projected closing in June 2008, of the LLW disposal facility at Barnwell, South Carolina, to out-of-Atlantic Compact waste generators has been an issue of concern to several stakeholders and, not surprisingly, was a major focus in comments we received. Closure of the Barnwell facility to out-of-Compact waste could require waste generators in 36 states (encompassing over 80 percent of the nation's nuclear power reactors) to store their Class B and C LLW.

Nuclear utilities generally noted that the potential closure of the Barnwell facility would not present any significant problems in the short term, as they already either had in place or were making provisions to ensure that there would be adequate long-term storage capability on their reactor sites. In contrast, the closure of Barnwell was seen to be a potentially significant problem for universities and hospitals who have limited, if any, ability to store their Class B & C LLW. For some non-reactor licensees, the cost and liability issues associated with extended storage of LLW was seen to be a major problem that has rather broad, and possibly severe, societal implications in that it is reportedly already curtailing medical research. One respondent to the staff's FRN observed that many small generators faced with the need to store LLW are poorly located and equipped to deal with such storage and would require specific assistance. The staff has ranked the on-going review and update of guidance on extended storage of LLW as a high priority task, in large part due to the potential closure of the Barnwell facility.

Disposal Options for Low Activity/Very Low Level Radioactive Waste --Another issue that is of concern to many stakeholders involves the disposal of LAW, or very low-level waste (VLLW).

Many believe that the costs and limited disposal options for disposal of such wastes are not commensurate with the associated level of risk. Some participants expressed a desire for more risk-informed ways to dispose of such wastes (for example at RCRA/municipal sites). Others noted that, while many such wastes could be disposed under the provisions of 10 CFR 20.2002, NRC's process for authorizing disposals under this provision was inconsistent and needed to be clarified, simplified and made more transparent by the development of new regulatory guidance. The disposal of certain LLW under the provisions of 10 CFR 20.2002 was generally opposed by most of the respondents to the NRC's FRN who are members or supporters of public interest groups.

Use of DOE and/or EPA Sites for Disposal of Commercial LLW—Some commenters spoke to the possibility of disposal of commercial LLW at a federal (e.g., DOE) facility. Others suggested that a disposal facility could be sited on federal land and operated either by a federal or private entity. Disposal of commercial LLW at sites managed by the DOE is an approach that was recommended by the American Nuclear Society, in a November 2004 *Position Statement* [5] on issues related to the disposal of LLW. In contrast, a representative of a state compact commission, in response to the NRC's FRN, cautioned against allowing such an approach. The state respondent expressed the view that the rights of interstate compacts to control the flow of waste into processing or disposal facilities within their borders must be supported and upheld.

Several commenters offered up remarks concerning the use of EPA/RCRA sites for the disposal of LAW. The Health Physics Society has supported this proposal in its revised *Position Statement*. In the view of one current site operator, RCRA sites in arid regions, which are not susceptible to the so-called "bathtub effect," provide a very effective means of disposal that is equivalent or even superior to 10 CFR Part 61 sites for waste containment, especially for soil and debris materials.

Economic Considerations--Economic factors were a major concern to many stakeholders. In the words of one respondent to the staff's FRN, the concern stemmed from "the lack of a competitive cost environment." The rising costs of disposal of Class B & C LLW was the source of a recommendation from one respondent to allow disposals of commercial LLW at DOE sites. In a similar vein, a representative of a state regulatory agency opined that the expanded use of RCRA facilities to accept slightly radioactive materials could reduce future disposal costs for such types of waste. However, another state regulatory agency representative stated that the expanded use of RCRA facilities for disposal of LAW could impact the economic viability of the operating LLW disposal facilities and/or require LLW facilities to increase the price of waste disposal to compensate for the loss in revenue. The costs of transporting LLW over long distances was an issue raised by an industry trade association, which also expressed concerns that the lack of a disposal option for Class B and C LLW would likely translate into increased costs for LLW management (including long-term storage), and could dampen future investment in the nuclear industry.

Waste Classification--As noted in the discussion above regarding risk-informing, a number of stakeholder have made recommendations regarding the classification system established in 10 CFR Part 61. Some stakeholders advocate major changes in NRC's regulations that would result in a classification system that was better aligned with risk, rather than with the waste's origin or legislative stature. Others recommend that all radioactive wastes be reclassified according to the

“length of time they pose a hazard.” The latter group opposes risk-informed regulation on the grounds that the risks of ionizing radiation at low doses and the synergistic effects of hazardous waste are unknown and are being ignored. Thus, as with other issues, the subject of waste classification cuts across related issues such as risk-informed regulation, disposal options for very low activity waste, disposition of GTCC sealed sources and disposal options for large quantities of depleted uranium (DU).

Unintended Consequences—Several commenters advised caution in making changes to the LLW regulatory framework that could result in unintended consequences. As one speaker stated, proposals for alternative approaches should be carefully analyzed from the perspective of all parties, as it is important to consider political realities, economic consequences and regulatory concerns. An example of the kind of issue that could cause complications that are hard to quantify involves the waste classification provisions in Part 61. Those provisions are referenced and included in other regulations as well as federal and state legislation, so any changes in the waste classification system could have a cascading effect. One of the ACNW&M workshop attendees, representing an agreement state regulatory agency that is involved in the licensing review of a LLW disposal facility, expressed the view that any federal regulatory changes that might occur during the state’s licensing process could have significant, and potentially negative, effects and should therefore be avoided. In a similar vein, another state agency representative, responding to the staff’s FRN, opined that NRC should focus on identifying unique and emerging waste streams rather than furthering changes in regulations.

## **Evaluation of Activities**

After considering stakeholder input and factoring in our own experience and ideas, we developed a list of proposed activities that supported the strategic objective and were responsive to identified programmatic needs. We evaluated 20 activities and assigned them priorities of high, medium, or low. After consideration of the potential activities that the staff could undertake to improve the LLW regulatory framework, the staff believes, like ACNW&M, [6] that the current regulations are fully protective of the public health and safety and worker health and safety. At the same time, there are a number of opportunities for better risk-informing the LLW regulatory framework and improving the effectiveness of LLW management and regulation. The 20 activities evaluated in this assessment would contribute to those goals.

## **Results**

Table I shows the activities assigned a high priority. As shown in the table, the staff projects that it will complete the first three of the highest ranked tasks by the end of FY 2008.

Table I: LLW Program Tasks Prioritized as High

Task No.	Task Description	Schedule	Outcome
1	Review and Update Guidance on Extended Storage of LLW for Materials and Fuel Cycle Licensees, and Review Industry Guidance for Reactors	FY08	Help ensure safe and secure storage of LLW after Barnwell closes
2	Develop and Implement Guidance on 10 CFR 20.2002 Alternate Disposal Requests	FY08	Facilitate preparation of these requests by licensees and make staff review more efficient.
3	Determine if disposal of large quantities of depleted uranium from enrichment plants warrant change in uranium waste classification	FY08	Ensure safety of DU disposal in future
4	Update Branch Technical Position on Concentration Averaging and Encapsulation	Begin FY08	Risk-inform guidance.
5	Develop Procedures for Import/Export Reviews	Begin FY09	Facilitate preparation of these requests by licensees and make staff review more efficient.
6	Develop Guidance Document on Alternate Waste Classification (10 CFR 61.58)	Revisit FY09	Facilitate licensees requests under this provision, and staff reviews of same.
7	Perform Scoping Study on Byproduct Material Financial Assurance	Revisit FY09	Ensure funding for disposal, if required.

## CONCLUSION

Our regulatory framework for LLW 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 LLW environment has changed and continues to change. We undertook this strategic assessment of our LLW program with the objective of providing a stable, reliable, and adaptable regulatory framework for effective LLW management, while maintaining safety, security, and protection of the environment, in light of these changes.

## REFERENCES

1. Radiation Source Protection and Security Interagency Task Force, 2006, *The Radiation Source Protection and Security Task Force Report*.
2. U.S. Nuclear Regulatory Commission, 2005, *Memorandum and Order CLI-05-20*, October 19, 2005.

WM2008 Conference, February 24 – 28, 2008, Phoenix, AZ

3. U.S. Nuclear Regulatory Commission, 2004, *FY 2004–2009 Strategic Plan*, NUREG-1614, Vol. 3, August 2004.
4. U.S. Nuclear Regulatory Commission, *FY 2007 - 2012 Strategic Plan*, NUREG-1614, Vol. 4, August 2007.
5. American Nuclear Society, 2004, *Disposal of Low-Level Radioactive Waste - - Position Statement No. 11*; American Nuclear Society; <http://www.ans.org/>, November 2004.
6. Ryan, M., Chairman, Advisory Committee on Nuclear Waste and Materials, December 27, 2005 letter to Nils Diaz, Chairman, USNRC.