



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, DC 20555 - 0001

ACNWR-0231

December 9, 2005

The Honorable Nils J. Diaz  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: DEVELOPMENT OF A STANDARD REVIEW PLAN FOR U.S. DEPARTMENT  
OF ENERGY WASTE DETERMINATIONS

Dear Chairman Diaz:

The U.S. Department of Energy (DOE) is expected to pursue a number of determinations that certain wastes are not high-level waste as a prerequisite to allowing disposal. DOE is required or expected to request that the U.S. Nuclear Regulatory Commission (NRC) perform technical reviews of the Department's waste determinations and, in some cases, its disposal and monitoring plans for the wastes.<sup>1</sup> The NRC staff is currently developing a Standard Review Plan (SRP) for these reviews. In this letter the Advisory Committee on Nuclear Waste provides its recommendations on the development of the SRP based on information obtained from the following activities:

- The Committee held a 2-day public working group meeting on waste determination August 2 - 3, 2005, during its 162<sup>nd</sup> meeting. The working group meeting included background presentations by DOE and NRC staff; 12 presentations by experts from academia, research institutions, and private enterprise; three panel discussions involving these same experts and staff from the NRC Office of Nuclear Regulatory Research; and input from State agencies and public stakeholders.
- Three Committee members, ACNW staff, the Director of the Division of Waste Management and Environmental Protection in the Office of Nuclear Material Safety and Safeguards (NMSS), and a member of the public made a 1-day visit to the Savannah River Site (SRS) on August 10, 2005. They toured the tank farms, tank waste processing facilities, waste vitrification facilities, and equipment development facilities. The participants also benefitted from formal and informal discussions with SRS staff about their approach to tank cleanup and waste determinations.
- Members of the Committee, ACNW staff, and NRC staff toured the West Valley Demonstration Project (WVDP) site, participated in a working group meeting, and heard input from the public on October 18 - 20, 2005.

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<sup>1</sup> Section 3116 of the Ronald Reagan National Defense Authorization Act (NDAA) of Fiscal Year 2005 (Public Law 108-375-October 28, 2004) makes the NRC responsible for providing technical consultation to DOE on waste determinations in the States of South Carolina and Idaho and, in coordination with the concerned State, for monitoring DOE disposal actions.

- A Committee member who is also a member of a National Research Council committee addressing issues related to waste determinations visited DOE's tank waste storage sites at SRS, Hanford, and Idaho National Laboratory.
- An ACNW staff member attended a demonstration of waste retrieval technologies in Mooresville, North Carolina on September 7, 2005.
- An ACNW staff member attended a briefing to the National Research Council's Nuclear & Radiation Studies Board on previous and ongoing studies of issues related to waste determinations held in Washington, D.C., on September 12, 2005.

Based on the information obtained from these activities, the Committee developed the observations and recommendations provided in this letter. The observations and recommendations are organized as follows:

- C Section 1 concerns the overall scope of the SRP.
- C Section 2 addresses the overall consistency among criteria for waste determinations as well as the consistency of performance objectives and key phrases in the criteria, and the consistency of the criteria with other NRC regulations and guidance.
- C Section 3 provides insights concerning evaluation of two key components of waste determinations: the status of radionuclide removal technology and performance assessment.
- C Section 4 addresses how to evaluate whether wastes have been removed to the "maximum extent practical" and whether doses are "as low as reasonably achievable (ALARA)."
- C Section 5 addresses technical considerations regarding NRC guidance on monitoring of waste determined to not be high-level waste to assess compliance with the performance objectives of Subpart C to 10 CFR Part 61.

## **1. STANDARD REVIEW PLAN SCOPE**

The principal purposes of an SRP are to enhance the quality and uniformity of staff reviews and to present a well-defined base from which to evaluate proposed changes in the scope and requirements of reviews. The NRC has experience in developing and implementing SRPs in program areas related to waste determination reviews. The most relevant technical information can be found in NUREG-1200, "Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility," Revision 3, April 1994; NUREG-1757, "Consolidated NMSS Decommissioning Guidance," September 2003 along with draft Supplement 1, issued for public comment in September 2005; and NUREG-1573, "A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group," October 2000.

Guidance on risk-informed, performance-based approaches helpful to the development of the SRP can be found in NUREG-1549, "Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination-Draft Report for Comment," July 1998, and the June 1998 SRM-SECY-98-144 on the staff's white paper on risk-informed and performance-based regulation.

Developing the SRP for waste determinations is complicated by the diversity of radioactive materials to be considered, the existence of multiple sets of criteria for developing and reviewing waste determinations, and the NRC's role as consultant instead of statutory regulator.

*Recommendation:* The SRP should be a single document that provides integrated guidance to NRC staff on risk-informed reviews of waste determinations and implicit guidance to DOE on the information to be provided in the waste determination. The waste determination SRP should build on the generic format, content, and implementation of existing SRPs and on relevant information in existing SRPs. The Committee believes the integration will enhance uniformity and efficiency of the reviews.

## **2. CONSISTENCY**

### **2.1 Criteria for Determinating of Waste Classification**

The criteria for preparing and reviewing a waste determination depend on the specific waste and site:

- Section 3116 of the NDAA is applicable to some waste determinations at Savannah River and Idaho.
- NRC Decommissioning Criteria for the West Valley Demonstration Project (M-32) at the West Valley Site, Final Policy Statement [64 FR 67952, December 3, 1999] are applicable to some waste determinations there.
- DOE Order 435.1, "Radioactive Waste Management," and the supporting documents DOE M 435.1-1, "Radioactive Waste Management Manual," and DOE Guide 435.1-1, "Implementation Guide for use with DOE Manual 435.1-1," issued in 1999 and reissued in 2001, may be used as a basis for some waste determinations.

*Recommendation:* The SRP should adopt a consistent technical interpretation of similar criteria in the three sets of criteria.

### **2.2 Subpart C Performance Objectives**

The Committee notes that under Section 3116 NRC staff must review waste determinations to assess conformance with 10 CFR Part 61 Subpart C performance objectives. The other two sets of criteria allow disposal to meet safety objectives comparable to the objectives stated in Subpart C. The Committee believes that the SRP should focus on confirming that DOE's proposed safety objectives are essentially identical to those in Subpart C.

*Recommendation:* The SRP should accept use of Subpart C performance objectives per se in all sets of criteria. If DOE chooses to use a different set of objectives, the SRP should expect DOE to provide a compelling technical justification to show that the objectives are as protective as those in Subpart C.

## **2.3 “Highly Radioactive” and “Key” Radionuclides**

DOE Manual 435.1 and the WVDP criteria use the phrase “key radionuclides” in addressing radionuclide removal, whereas the Section 3116 criteria use the phrase “highly radioactive radionuclides.” “Highly radioactive” commonly refers to relatively short-lived radionuclides, particularly if they emit penetrating radiation. The Committee notes that this common interpretation would not lead to a risk-informed approach because (a) it excludes long-lived radionuclides that should be removed to the maximum extent practical because they are important to risk in many situations (e.g., Tc-99, Np-237) and (b) it is based on an inherent property of a radionuclide (its decay characteristics) instead of the risk posed by the waste of which the radionuclide is a part. The Committee believes a risk-informed interpretation of “highly radioactive” and “key” radionuclides can best be accomplished by analyzing the results of a risk-informed performance assessment for the radionuclides that are the dominant contributors to dose.

*Recommendation:* The SRP should adopt a risk-informed interpretation of “highly radioactive radionuclides” by defining it to mean the same as “key radionuclides,” i.e., radionuclides potentially important to meeting the Subpart C performance objectives.

## **2.4 Other NRC Regulations and Guidance**

After removal, processing, and conversion to a solid form, tank waste will be disposed of in much the same way as is waste at a commercial low-level waste (LLW) disposal facility. A grout and cap approach is typically planned for in-place isolation of residual waste in tanks. This approach has similarities to site decommissioning. Existing NRC regulations and guidance in these two areas reflect years of experience. Examples of such guidance documents for performance assessments are NUREG-1573, NUREG-1757, and NRC staff “Technical Position on Waste Form”, Revision 1, January 1991.

*Recommendation:* Existing NRC regulations and guidance documents should be used as a source of insights for developing the SRP.

# **3. TECHNOLOGY AND PERFORMANCE ASSESSMENT**

## **3.1 Technology for Removal of Radionuclides**

The Committee notes that DOE has many waste retrieval and radionuclide separation technologies available and has been relatively successful in its completed retrieval efforts. However, the Committee believes DOE will continue to face technical challenges in radionuclide removal because it has retrieved only a small portion of the waste that will eventually require retrieval and most of this waste has been retrieved from DOE's less complex tanks. Furthermore, DOE has separated radionuclides from only a fraction of the retrieved waste. The Committee observes that DOE continues to improve its radionuclide removal technologies and adopt new technologies to address challenges as they arise.

*Recommendation:* The NRC staff should review the approaches to waste retrieval and radionuclide separation in each waste determination in the context of relevant existing and projected technologies. The staff should expect DOE to have considered existing relevant technologies or technologies being developed by domestic and international organizations.

### **3.2 Performance Assessment**

Historically, variability and uncertainty in performance assessments for near-surface waste disposal were addressed by selecting one or two different values for parameters believed to be important and observing how much the estimated dose from a deterministic performance assessment changes. Exclusion of probabilistic performance assessments has been justified by using conservative approaches in the deterministic performance assessment.

The Committee believes that assumptions such as the duration of effective institutional controls and selection of conceptual models such as those for groundwater flow can dominate the magnitude of the estimated dose from near-surface waste disposal facilities. Many assumptions such as those about institutional control cannot be validated because they involve predictions of the future behavior of people and there is a growing body of literature citing experience which raises concerns about the reliability of such controls. Conceptual models of physical systems are theoretically amenable to validation through analysis or testing, but many situations are so complex that validation may not be practical.

The Committee notes the extensive use of cementitious materials as structural barriers and solid matrixes for isolating, in near-surface disposal facilities, wastes determined to not be high-level waste. Assumptions about the rates at which the beneficial properties of cementitious materials degrade are therefore important to the results of performance assessments for such facilities.

*Recommendation:* The SRP should specify a preference for probabilistic performance assessments using best estimates with explicit analysis of uncertainties. Exceptions should include documentation of how uncertainties were addressed.

*Recommendation:* The SRP should recognize that some important performance assessment assumptions are incapable of validation. Such assumptions should be based on realistic consideration of empirical evidence to the extent such evidence exists and should be subjected to uncertainty analyses.

*Recommendation:* The SRP should provide guidance to the NRC staff on reviewing improvements in technical bases for assumptions concerning the long-term degradation rate of cementitious materials in waste disposal applications. The NRC staff should maintain the capability to review justifications for performance assessment assumptions based on cutting-edge research concerning cementitious materials.

#### **4. “MAXIMUM EXTENT PRACTICAL” AND ALARA**

All three sets of criteria require that the amount of radionuclides in a waste be reduced to the “maximum extent practical” or the “maximum extent technically and economically practical,” and that doses to workers or the public be ALARA. All of these goals are functionally the same: they require that factors such as the capability of technologies, costs, and risks associated with competing radionuclide removal alternatives be evaluated as a basis for deciding how much risk reduction (i.e., waste retrieval and processing, and use of engineered barriers) is enough. The potential importance of risks posed by other nearby waste disposal areas and contaminated environmental media is a factor to be considered in making this decision.

The Committee observes that complex decisions are likely to require consideration of stakeholder values and demands as well as technical issues. The waste determination decisionmaking process and the process for developing the SRP should be transparent and allow stakeholder participation. The November 10, 2005, NMSS public scoping meeting<sup>2</sup> to obtain input on the development of the SRP, was a good start toward achieving this goal.

*Recommendation:* The information necessary to support DOE's determination that radionuclides have been removed to the maximum extent practical or maximum extent technically and economically practical, and that estimated doses are ALARA should be the same for all sets of criteria.

*Recommendation:* A risk-informed evaluation of ALARA or radionuclide removal to the maximum extent practical or maximum extent technically and economically practical should be done in the context of the surrounding risk.

#### **5. MONITORING TO ASSESS COMPLIANCE WITH PERFORMANCE OBJECTIVES OF SUBPART C**

Under provisions of Section 3116, the NRC, in coordination with the host State, is required to monitor DOE disposal actions for the purpose of assessing compliance with the Subpart C performance objectives. The Committee believes compliance monitoring should be considered in the design of a system to isolate waste and the associated performance assessment. The Committee further believes that the types and quantities of waste likely to be disposed of onsite should be considered in selecting monitoring approaches and systems.

*Recommendation:* NRC staff activities to determine compliance with Subpart C performance objectives should review the design of barriers to radionuclide release to ensure that provisions have been made for future monitoring activities. Engineered barrier design has already been completed for some waste determinations. For these cases, the NRC will have to rely on reviewing the adequacy of the designs and determining whether improvements are necessary or feasible.

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<sup>2</sup> Attended by Committee Vice-Chairman Allen Croff and Committee staff member Latif Hamdan

*Recommendation:* Far-field and near-field monitoring, engineered barrier monitoring, and performance assessment are key elements of performance confirmation. The SRP should provide guidance to the NRC staff on these topics that includes information on how waste disposal facilities can be designed to facilitate monitoring.

The Committee looks forward to reviewing the draft SRP as the document evolves. As a result of the future opportunities for the Committee to provide its input, it does not expect a formal response to this letter from NRC staff in favor of allowing them to focus their energies on preparing the draft SRP.

Sincerely,

**/RA/**

Michael T. Ryan  
Chairman



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Sincerely,

Michael T. Ryan  
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