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NUREG-1911, Rev. 3

NRC Periodic Compliance Monitoring Report for U.S. Department of Energy Non-High-Level Waste Disposal Actions

Annual Report for Calendar Year 2010

Office of Federal and State Materials and
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ABSTRACT

This is the U.S. Nuclear Regulatory Commission (NRC) staff's report of its monitoring of U.S. Department of Energy (DOE) non-high-level waste disposal actions in calendar year 2010, in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (the NDAA). Section 3116 of the NDAA requires that DOE consult with the NRC on its non high-level waste determinations and plans that the NRC, in coordination with the covered States of South Carolina and Idaho, monitor disposal actions that DOE takes to assess compliance with NRC regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart C, "Performance Objectives." The NRC has prepared this report in accordance with NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations," issued August 2007 (NRC, 2007c).

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EXECUTIVE SUMMARY

The purpose of this report is to document the U.S. Nuclear Regulatory Commission (NRC) staff's monitoring of the U.S. Department of Energy (DOE) non-high-level waste disposal actions in calendar year (CY) 2010. The NRC monitors DOE disposal actions in covered States in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (the NDAA). Section 3116 of the NDAA has two main subsections—subsection (a) requires DOE to consult with the NRC on its non-high-level waste determinations and plans, and subsection (b) requires the NRC, in coordination with the covered States of South Carolina and Idaho, to monitor the disposal actions that DOE takes to assess compliance with NRC regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart C, "Performance Objectives." This report is concerned exclusively with subsection (b) of Section 3116. Appendix A to this report provides the complete text of Section 3116 of the NDAA. This is the third report of what the NRC anticipates will be an annual report during the early phases of its NDAA monitoring activities. The content of this report follows the guidance in Section 10.4.2 of NUREG-1854, "*NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations*," issued August 2007 (NRC, 2007c).

In CY 2007, the NRC completed its initial monitoring plans in accordance with the guidance in NUREG-1854 (NRC, 2007c). The monitoring plans covered DOE disposal actions at the Saltstone Disposal Facility at the Savannah River Site (SRS) in South Carolina and the Tank Farm Facility (TFF) at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory (INL). In each plan, the staff identified a hierarchy of elements defining the overall scope of monitoring at each site. The scope of monitoring was defined by those factors that were most uncertain or significant in the DOE analysis of whether the disposal of these incidental wastes meet the NRC performance objectives, and can be considered non-high-level wastes. The NRC performance objectives of 10 CFR Part 61, Subpart C, are aimed at the protection of public health and safety. For the Saltstone facility, the NRC staff identified eight "factors," which are important model assumptions or parameter values described in its December 2005 technical evaluation report (NRC, 2005b). For each factor, the agency has one or more planned monitoring activities (i.e., specific tasks or actions). For Saltstone, 39 distinct monitoring activities exist to assess compliance with the performance objectives in Part 61, Subpart C. Similarly, for the INL INTEC TFF, the staff identified five key monitoring areas (which are analogous to the "factors" at Saltstone) from its technical evaluation report (TER) (NRC, 2005b) and 31 separate monitoring activities. Monitoring activities can be either onsite observations of disposal activities or in-office reviews of documents.

In CY 2010, in accordance with the monitoring plans described above, the staff performed both technical reviews and onsite observation visits at the SRS Saltstone facility. The staff performed only one onsite observation at the INL INTEC TFF and performed multiple technical reviews in accordance with monitoring the facility.

In CY 2010, the staff's monitoring activities resulted in no findings of noncompliance, no identification of any new open issues, and made no additional recommendations. The staff continued to follow up on two open issues identified in CY 2007 and one new open issue identified in CY 2009. The staff has continued to monitor DOE progress on closing open issues

in CY 2011. Open issues require additional follow-up by the NRC staff or additional information from DOE to address questions that the NRC staff raised regarding DOE disposal actions. Table 2 and Table 3 in the body of this report summarize the NRC staff's open issues and recommendations. The body of this report presents more information about the staff's observations. Appendix D contains the onsite observation reports.

Savannah River Site Saltstone Facility

In October 2007, the NRC staff observed that DOE had not generated hydraulic and chemical properties of saltstone grout over the range of compositions actually produced at the Saltstone Production Facility (SPF). The NRC staff concluded (in NRC [2008a]) that additional data over a range of compositions will greatly improve confidence in predictions of future performance of the Saltstone Disposal Facility (SDF). The staff also observed that, at the end of a production run, DOE uses water to flush transfer lines between the SPF and SDF. The flush water added directly to the SDF and may be blending with grout that has not yet set. The staff identified these issues as Open Issues 2007-1 and 2007-2, respectively, in NUREG-1911, "NRC Periodic Compliance Monitoring Report for U.S. Department of Energy Non-High-Level Waste Disposal Actions, Annual Report for Calendar Year 2007," issued August 2008 (NRC, 2008b).

In 2008, the staff observed that DOE was making progress in obtaining data that will provide additional support for assumptions that were used in DOE's performance assessment in support of the SDF waste determination. However, because this information was still under review at the end of CY 2009, both Open Issue 2007-1 and Open Issue 2007-2 remain open.

In March 2009, the NRC staff observed that DOE provided insufficient support for assumptions made regarding the sorption capabilities of the saltstone wasteform with respect to K_d values assumed in the 2005 performance assessment (DOE, 2005) and the reduction capabilities of technetium-99 in the saltstone wasteform.

In November 2009, the NRC staff began its review of the "*2009 Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site*," (updated PA) dated October 2009 (DOE, 2009), and the associated documentation provided. This review is being performed in accordance with NRC's monitoring plan (NRC, 2007b) Section *3.1.9, Performance Assessment Process Review*. The NRC staff's review of the updated performance assessment will be documented in a TER.

In 2010, the NRC staff reviewed the 2009 Saltstone Performance Assessment (PA) and completed three onsite observations to the Saltstone facility in 2010 (NRC, 2010d; 2010e; 2010g). In February 2010, the NRC staff observed disposal activities related to Disposal Cell Construction, Saltstone Production Facility Operation, Performance Assessment Process Review, and Radionuclide Inventory. In April 2010, the NRC staff observed disposal activities related to Disposal Cell Construction. In July 2010, the NRC staff observed disposal activities related to the Saltstone Quality Assurance Plan, Hydro-test results on Cell 2A and 2B, results from saltstone core samples tests, and the May 19, 2010, inadvertent transfer of saltstone into Vault 4.

Idaho National Laboratory, Idaho Nuclear Technology and Engineering Center, Tank Farm Facility

The NRC staff identified no open issues in CY 2010 for the TFF. As DOE was in the process of performing an annual PA checklist to determine the need for any PA updates or revisions (PA maintenance), NRC provided two recommendations to DOE with respect to PA maintenance decisions (NRC, 2010f). First, DOE should consider revising its PA to more clearly describe and provide information on the performance impact of the Big Lost River on containment flow and transport. Second, NRC staff recommended that the PA reflect the results of simulations performed and additional documentation generated during the NDAA consultation process to answer NRC staff inquiry regarding the cause and performance impact of the significant lateral spread of the contaminant plume emanating from the TFF to the south.

Conclusion

Based on its observations, the NRC staff continues to conclude that reasonable assurance exists that the applicable criteria of the NDAA can be met if key assumptions made in the DOE waste determinations prove to be correct. In accordance with the requirements of the NDAA and consistent with the NRC's monitoring plans, the NRC staff will continue to monitor DOE disposal actions at SRS and INL. The staff expects the monitoring activities to be an iterative process, and several onsite observation visits and technical reviews of various reports, studies, and other documents may be necessary to obtain the information needed to close all of the current open issues, as well as issues that may be opened in the future.

ABBREVIATIONS

ADAMS	Agencywide Documents Access and Management System
ALARA	as low as reasonably achievable
BLR	Big Lost River
CAP88-PC	Clean Air Act Assessment Package 1988
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CY	calendar year
DEQ	(Idaho) Department of Environmental Quality
DOE	U.S. Department of Energy
EM	environmental monitoring
HLW	high-level waste
HRR	highly radioactive radionuclide
ICRP	International Commission on Radiological Protection
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
K_d	Distribution Coefficient
KMA	key monitoring area
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	low-level waste
MDIFF	mesoscale diffusion air dispersion model
MEI	maximally exposed individual
mrem	millirem
mrem/yr	millirem per year
µSv	microsievert
µSv/yr	microsievert per year
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
NRC	U.S. Nuclear Regulatory Commission

PA	performance assessment
SDF	Saltstone Disposal Facility
SPF	Saltstone Production Facility
SRPA	Snake River Plain Aquifer
SRS	Savannah River Site
TER	technical evaluation report
TFF	Tank Farm Facility
WD	Waste Determination

1.0 PURPOSE OF THIS REPORT

The purpose of this report is to aggregate all monitoring activities performed at each site specified by Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (the NDAA), while not required by law; it is intended to keep the public informed about NRC monitoring of DOE's radioactive waste disposal process at these sites.

In October 2004, the U.S. Congress passed legislation that allows the Secretary of Energy to determine, in consultation with the U.S. Nuclear Regulatory Commission (NRC), whether radioactive waste resulting from the reprocessing of spent nuclear fuel is not high-level radioactive waste. The legislation in Section 3116 of the NDAA requires that the U.S. Department of Energy (DOE) consult with the NRC on its non-high-level waste (HLW) determinations and plans and that the NRC, in coordination with the covered State, monitor DOE disposal actions to assess compliance with NRC regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart C, "Performance Objectives." The covered States under Section 3116 of the NDAA are South Carolina and Idaho.

Under the NDAA, DOE will identify specific inventories of radioactive waste and associated facilities and equipment (e.g., tanks, piping, disposal cells) that are candidates for non-HLW decisions. The Secretary's decision is based on whether the residual radioactive waste meets several criteria in Section 3116 of the NDAA. For example, the subject of a Secretary's decision may be residual radioactive waste remaining in an HLW storage tank after the highly radioactive radionuclides (HRR) have been removed to the maximum extent practicable. Appendix A to this report provides the full text of Section 3116 of the NDAA, including the criteria.

To support the Secretary's decision, DOE prepares a document, called a waste determination (WD) that describes its basis for a determination under Section 3116 of the NDAA. This document describes the DOE analysis of whether a particular type of waste meets the NDAA criteria. As described in NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations," issued August 2007 (NRC, 2007c), the NRC staff consults with DOE on the draft waste determination and prepares a technical evaluation report (TER) that documents the NRC staff's evaluation. If the Secretary decides that all of the Section 3116 criteria are met, the Secretary may make a non-HLW determination, and DOE may publish a final waste determination.

After the Secretary's determination, the NRC staff will, in coordination with the covered State and as described in NUREG-1854 (NRC, 2007c), prepare a written plan to monitor DOE's disposal actions for the purpose of assessing compliance with the performance objectives established in Part 61, Subpart C. Because NRC monitoring is risk-informed and performance-based, it focuses on assumptions, parameters, and features that are expected to have either a large influence on the performance demonstration or relatively large uncertainties, or both. Table 1 presents the performance objectives from Part 61, Subpart C.

Table 1: Performance Objectives of Part 61, Subpart C

Section	Title	Text
§61.40[1]	General Requirement	Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §61.41 through §61.44.
§61.41[2]	Protection of the General Population from Releases of Radioactivity	Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.
§61.42	Protection of Individuals from Inadvertent Intrusion	Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.
§61.43	Protection of Individuals during Operations	Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in Part 20 of this chapter, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by §61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.
§61.44	Stability of the Disposal Site after Closure	The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

[1] In general, to assess compliance with the requirements of 10 CFR 61.40, the NRC will rely on its assessment of DOE's compliance with 10 CFR 61.41 through 10 CFR 61.44. Specifically, the NRC will view DOE as being in compliance with 10 CFR 61.40 as long as DOE is deemed to be in compliance with the other performance objectives.

[2] As stated in the Staff Requirements Memorandum for SECY-05-0073, "Implementation of New USNRC Responsibilities under the National Defense Authorization Act of 2005 in Reviewing Waste Determinations for the USDOE," dated June 30, 2005 (NRC, 2005a), the dose standard is 25 millirem (mrem) total effective dose equivalent using the methodology of International Commission on Radiological Protection (ICRP)-26, "Recommendations of the International Commission on Radiological Protection" (ICRP, 1977).

Since the NDAA was enacted in 2004, DOE has completed two waste determinations in consultation with the NRC staff. The first, in January 2006, was the waste determination for salt waste disposal at the Savannah River Site (SRS) in South Carolina (DOE, 2006). DOE issued a second waste determination under Section 3116 on the Tank Farm Facility (TFF) at the Idaho Nuclear Technology and Engineering Center (INTEC) in November 2006 (DOE-Idaho, 2006b).

The NRC staff prepared a TER (NRC, 2005b, 2006) and monitoring plan (NRC, 2007a, 2007b) for each facility. Section 1.1 of this report summarizes the NRC staff's approach to developing monitoring plans for DOE facilities in covered States. Additionally, DOE, on its own initiative, occasionally consults with the NRC staff on its non-HLW determinations at the Hanford site in the State of Washington and the West Valley Demonstration Project in the State of New York. However, neither Washington nor New York are covered States under the NDAA. Therefore, the NRC does not have a monitoring role at these sites under Section 3116 of the NDAA, and this report does not address these sites.

1.1 NRC's National Defense Authorization Act Monitoring Approach

Section 10, *NDAA Compliance Monitoring*, of NUREG-1854 (NRC, 2007c) describes in detail the NRC's approach to compliance monitoring in accordance with Section 3116 of the NDAA. This section summarizes some of the information in Section 10 to provide context for the NRC staff's observations.

Section 3116(b)(1) of the NDAA requires that the NRC shall "in coordination with the covered State, monitor disposal actions taken by the Department of Energy…for the purpose of assessing compliance with the performance objectives set out in Subpart C of Part 61 of Title 10, Code of Federal Regulations." Therefore, as described below, the NRC staff develops its monitoring plans in coordination with the covered States of Idaho and South Carolina.

The NRC has adopted a risk-informed and performance-based approach to monitoring DOE disposal activities under Section 3116 of the NDAA. A cornerstone of the NRC's approach is the identification of *key monitoring areas* (KMAs) related to DOE disposal actions that should be the focus of its monitoring efforts. KMAs are programmatic or technical subject matter areas, critical to DOE's ability to demonstrate compliance with the performance objectives of Part 61, Subpart C. The focus of KMAs is generally to build confidence in DOE models and parameters. The NRC staff identifies one or more *monitoring activities* to support each KMA in facility-specific monitoring plans. The performance objectives, KMAs, and monitoring activities form a hierarchy of plan elements that serves as the structure of each monitoring program.

Figure 1 illustrates the hierarchy of elements in an NRC monitoring plan by illustrating a hypothetical example of the relationship among Part 61 performance objectives, a single monitoring area, and the different types and categories of monitoring activities. Section 1.2 summarizes the NRC staff's process for developing these elements.

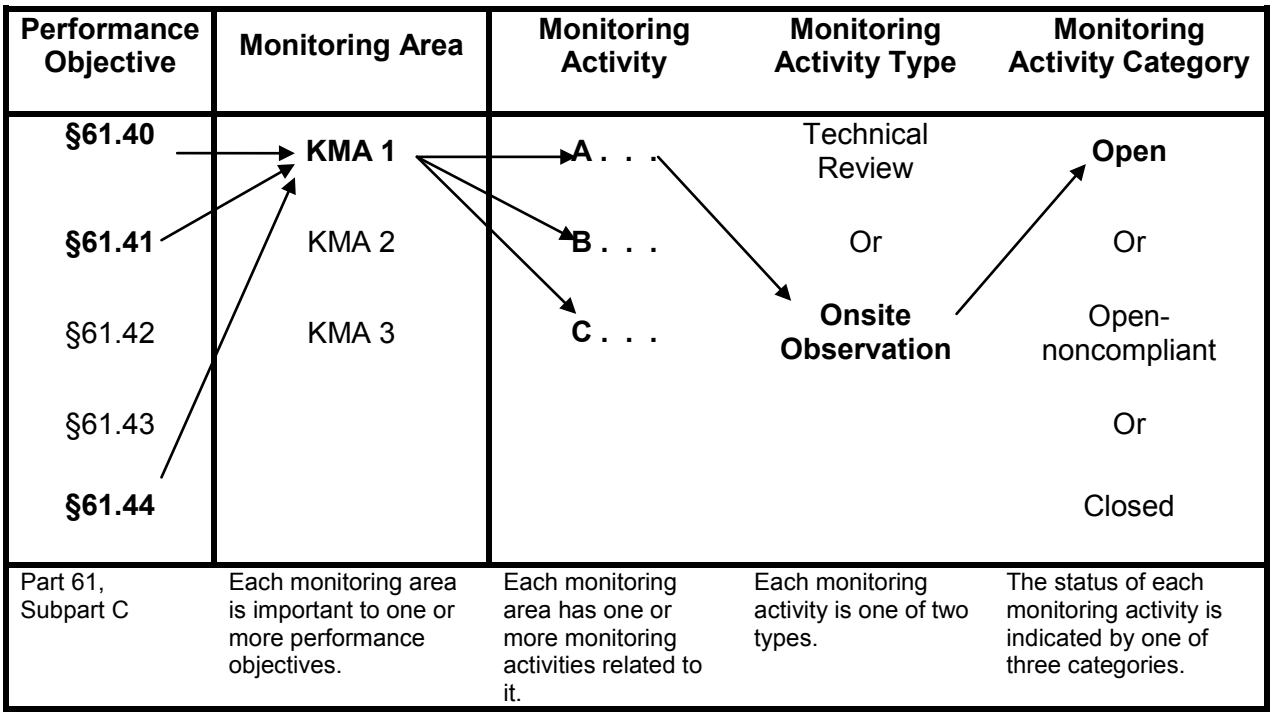

Figure 1: Hypothetical Example of Relationships between Monitoring Elements

1.2 Key Monitoring Areas

As the first step in the preparation of a monitoring plan for a specific waste determination, the NRC staff identifies KMAs. Monitoring areas are either programmatic or technical subject matter areas within which the staff will focus its monitoring efforts and which are important to DOE's ability to demonstrate compliance with the performance objectives of Part 61, Subpart C (see Table 1). The NRC staff typically identifies the monitoring areas during its review of the DOE draft waste determination and documents them in the TERs.

The NRC staff usually derives assurance that the requirements of protection of the general population from releases of radioactivity (§61.41), protection of individuals from inadvertent intrusion (§61.42), and stability of the disposal site after closure (§61.44) will be met on the basis of DOE predictions of long-term disposal site performance. As described further below, DOE uses a performance assessment (PA) to predict disposal site performance, which most often involves calculations performed with the aid of computer-based models.

Each site's performance assessment makes certain assumptions about physical and chemical parameter values that DOE believes are appropriate for the disposal action. As such, monitoring areas that build confidence in the DOE selection of parameters and models are typically designated as KMAs.

A PA is an important tool used by both DOE and the NRC to identify which facility attributes are important to meeting the Part 61, Subpart C, performance objectives. In fact, DOE typically uses a PA to demonstrate compliance with the requirements in §61.41, §61.42, and §61.44, in recognition that long-term modeling predictions are needed to demonstrate compliance with

performance objectives. A PA is a type of systematic (risk) analysis that addresses (i) what can happen, (ii) how likely it is to happen, (iii) what the resulting impacts are, and (iv) how these impacts compare to specifically defined standards. The NRC staff believes that sufficient PA model support, coupled with observation of disposal actions carried out in conformance with detailed closure plans, is necessary for the staff to assess whether these performance objectives can be met in the future. Therefore, the designation of KMAs under §61.41, §61.42, and §61.44 is generally related to the assumptions and parameter values chosen by DOE in its basis documents.

The NRC staff identified additional monitoring areas for compliance with protection of individuals during operations (§61.43). These additional monitoring areas are not typically derived from the NRC staff's review of a DOE PA, as are KMAs. For example, the requirements of §61.43 apply to facility *operations*, including DOE site programs for ongoing personnel site access control, *worker* and public radiation protection, and environmental monitoring (EM) and surveillance. These DOE site programs are required to ensure compliance with the §61.43 performance objective, but are not evaluated as part of the long-term PA of the disposal facility.

As noted in Table 1, there are generally no specific monitoring areas tied to the general requirements (§61.40). The NRC staff will rely on its assessment of DOE compliance with §61.41 through §61.44. Specifically, the NRC will view DOE as being in compliance with §61.40 as long as DOE is deemed to be in compliance with the other performance objectives.

1.3 Monitoring Activities

The next step in the preparation of a monitoring plan is the designation of one or more monitoring activities associated with each monitoring area. A monitoring activity is a specific type of NRC or covered State task or action with the purpose of monitoring DOE disposal actions to assess compliance with the performance objectives listed in Part 61, Subpart C. Examples of monitoring activities include staff (NRC and the covered State) reviewing the results of DOE measurements of residual radioactivity in tanks before tank closure, observing periodic maintenance of disposal facility closure caps, and observing onsite radiation safety procedures during waste-handling operations. These examples show that some monitoring activities are near-term, short-duration activities that the NRC or covered States will close soon after the completion of the DOE disposal action. Other monitoring activities are long term, and the NRC or the affected covered State staff may conduct them in perpetuity.

In a few instances, the staff identified monitoring activities during preparation of the monitoring plan that the corresponding TER did not previously identify. As a result, these activities are not related to any particular monitoring area, but are tied directly to a Part 61, Subpart C, performance objective. Examples would include environmental data and performance assessment process (i.e., PA update) reviews.

For NRC staff's planning purposes, monitoring activities are also categorized by type as either technical reviews or onsite observations. Technical reviews may take the form of reviews of data, such as from environmental management (EM) and surveillance programs, or reviews of technical literature that supports important assumptions or parameter values in DOE PAs. Data reviews are a subset of, and supplement to, technical reviews which focus on real-time monitoring data that may also indicate future system performance (e.g., sampling and analysis

of perched water underneath grouted vaults for changes in chemical conditions) or review of records or reports that can be used to directly assess compliance with performance objectives (e.g., review of radiation records). Onsite observations are coordinated with the affected covered State and the DOE site to ensure that the NRC staff has an opportunity to observe specific DOE disposal actions. The NRC staff conducts onsite observations in accordance with observation plans that are prepared in advance of the visits. The staff summarizes its conclusions in an observation report typically issued within 2 months of the onsite observation, unless DOE provides additional information following the site visit. In those cases, the reports are typically finished within 60 days of the staff completing its review of the additional information.

Based on their status, the NRC staff tracks key monitoring activities as either an *open activity*, an *open-noncompliant activity*, or a *closed activity*. The NRC characterizes a monitoring activity as an open activity when it has not obtained sufficient information to fully assess compliance with one or more Part 61 performance objectives. Should an ongoing open activity provide evidence that the performance objectives of Part 61, are currently not being met, or will not be met in the future, or if key aspects of the waste determination relied on to demonstrate compliance with the performance objectives are no longer supported, then the monitoring activity is categorized as an open-noncompliant activity. The NRC staff's TER and initial monitoring plan may also identify an open-noncompliant activity when the staff finds that the draft waste determination provides insufficient technical bases to determine that the performance objectives will be met. Finally, the NRC staff may categorize an ongoing monitoring activity as closed when it has either obtained sufficient information or received technical bases to fully assess compliance with one or more Part 61, Subpart C, performance objectives. However, the NRC staff may upon evaluation of new information, reopen a closed activity or open a new monitoring activity relating to any monitoring area. Any DOE revisions to its PAs may also trigger a review and possible revision of the NRC's monitoring plans.

1.4 Coordination with Covered States

The NRC staff consulted with the States of South Carolina and Idaho during the preparation of the monitoring plans for Saltstone and the Idaho National Laboratory (INL) INTEC TFF. For Saltstone, the staff had early interactions with the South Carolina Department of Health and Environmental Control (SC DHEC) during its review of the waste determination and later sought comments on the draft monitoring plan. As a result of these interactions, the staff considered in the development of its plan the regulatory activities of South Carolina relating to both a State wastewater permit for the Saltstone Production Facility (SPF) and a State industrial solid waste permit for the Saltstone Disposal Facility (SDF). Due to the combined roles of SC DHEC and NRC under Section 3116(b), the staff operates in a manner to leverage South Carolina's activities pertaining to these permits and avoid duplication of effort.

In CY 2010, the NRC staff coordinated each onsite monitoring activity with the State of South Carolina and in each activity at least one state representative was present onsite at the time of the activity.

Similarly, in CY 2010, the NRC staff also conducted one (1) onsite monitoring activity with the State of Idaho. A state representative was present onsite at the time of the activity.

Similarly, for the INL INTEC TFF, the staff engaged the Idaho Department of Environmental Quality (DEQ) early in the consultation process during the staff's review of the DOE waste determination. The two primary State regulatory responsibilities related to the TFF are (1) Resource Conservation and Recovery Act closure under the Hazardous Waste Management Act, and (2) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulatory activities associated with historical releases from the ancillary equipment associated with the TFF that resulted in soil and ground water contamination. In its monitoring plan and in practice, the NRC considered these and other non-regulatory environmental surveillance activities and has leveraged Idaho's activities to avoid duplication of effort. For example, NRC routinely relies on site reports published by Idaho DEQ for independent surveillance. As it does every year, NRC staff reviewed DOE's environmental surveillance reports and Idaho DEQ's quarterly surveillance reports for the first and second quarters of 2010 (DOE, 2009; Idaho DEQ, 2010b; and Idaho DEQ, 2010a)

1.5 Status of Monitoring Activities

Table B-1 and Table B-2 in Appendix B to this report summarize the monitoring areas and the current types and categorization of monitoring activities for SRS salt waste disposal and the INL INTEC TFF; Sections 2 and 3 respectively, in the body of this report discuss them in detail. Monitoring plans developed in consultation with the covered States (NRC, 2007a, 2007b) provided the information presented in Appendix B.

2.0 MONITORING AT THE SAVANNAH RIVER SITE SALTSTONE FACILITY IN CALENDAR YEAR 2010

2.1 Introduction

As noted in Section 10.1, *Overall Approach and Scope* of the NRC Staff Guidance Document, NUREG-1854 (NRC, 2007c), the staffs approach to assessing compliance with the performance objectives consists of two primary activities: (1) conducting technical reviews of DOE data and analyses and (2) physically observing DOE's disposal actions through onsite visits. Since monitoring activities began at the Saltstone facility in 2007, NRC has completed 11 onsite observations, 11 formal technical reviews, and various data reviews. Each monitoring activity is associated with a public document describing the details of the activity. Each onsite observation is preceded by an onsite observation guidance document, which states the objectives of the observation and the relationship between each objective and its respective Part 61 performance objective. Following the observation, the NRC Staff documents the activities that took place during the observation in an onsite observation report which provides an assessment of the staffs activities while on the observation, how those activities relate to their respective Part 61 performance objective, and what conclusions were made from the observations activities.

2.2 Background

On March 31, 2005, DOE submitted a "*Draft Section 3116 Determination Salt Waste Disposal Savannah River Site*" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in Part 61 (DOE, 2005). In its consultation role, the NRC staff reviewed the draft waste determination and concluded that there was reasonable assurance that the applicable criteria of Section 3116 could be met, provided certain assumptions made in DOE's analyses are verified via monitoring. NRC documented the results of its review in a Technical Evaluation Report (TER) issued in December 2005 (NRC, 2005b). DOE issued a final waste determination in January 2006 taking into consideration the assumptions, conclusions, and recommendations documented in NRC's TER (DOE, 2006).

On May 3, 2007, the NRC completed its monitoring plan for the Saltstone facility in accordance with the guidance in NUREG-1854 (NRC, 2007c). The monitoring plan covers DOE disposal actions at the Saltstone facility at the Savannah River Site (SRS) in South Carolina. The staff identified a hierarchy of elements defining the overall scope of monitoring at the site. The scope of monitoring was defined by those factors that were most uncertain or significant in the DOE analysis of whether the disposal of non-high-level waste meets NRC performance objectives, which are aimed at the protection of public health and safety. The NRC staff identified eight "factors," which are important model assumptions or parameter values described in its December 2005 TER (NRC, 2005b). For each factor, the agency has one or more planned monitoring activities (i.e., specific tasks or actions). For Saltstone, 39 distinct monitoring activities exist to assess compliance with the performance objectives in Part 61. Monitoring activities can be either onsite observations of disposal activities or in-office reviews of documents.

To carry out its monitoring responsibility under NDAA, NRC performs three types of activities: (i) technical reviews, (ii) onsite observations, and (iii) data reviews in coordination with the State of South Carolina site regulator, South Carolina Department of Health and Environmental Control (SC DHEC). These activities focus on key assumptions – called "factors" – identified in the NRC monitoring plan for salt waste disposal at SRS (NRC, 2007b). Technical reviews generally focused on obtaining additional model support for assumptions DOE made in its PA that are considered important to DOE's compliance demonstration. Onsite observations generally were performed to (i) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination, or (ii) observe key disposal (or closure) activities related to technical review areas (e.g., slag and other material storage, grout formulation and preparation, and grout placements). Data reviews supplemented technical reviews by focusing on monitoring data that may indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with performance objectives.

As the NRC staff completes technical reviews and onsite observations, it may identify open issues that arise during monitoring activities that require additional follow-up by the staff or additional information from DOE to address questions the NRC staff has raised regarding DOE disposal actions. Since inception of NRC monitoring of the Saltstone facility in 2007, NRC has identified four open issues and has closed one of these issues. A summary of these open issues can be found in Section 4.0 of this report.

Recommendations may address ways in which DOE can make progress on closing any open activities in the staff's monitoring plan; a monitoring area for which an open issue has been previously identified and closed and for which the NRC staff recommends further action to strengthen some aspect of the DOE disposal action; and monitoring areas that had no open issues or previously raised concerns, but for which the NRC staff recommends further improvements in DOE disposal actions.

Appendix C provides a visual depiction of the timeline of NRC monitoring of the Saltstone facility under NDAA.

2.3 NRC Monitoring Activities in 2010

On November 24, 2009, DOE submitted the updated PA for the Saltstone Disposal Facility (SDF) [DOE, 2009] to the NRC. The NRC is tasked with reviewing this PA in accordance with its monitoring responsibilities under the NDAA as stated in NRC's monitoring plan (NRC, 2007b) Section 3.1.9, *Performance Assessment Process Review*. The NRC staff will document this review in a TER similar to an analogous review completed in December 2005 on a previous version of the Saltstone PA (NRC, 2005b).

In addition to reviewing the 2009 Saltstone PA, the NRC staff completed three onsite observations to the Saltstone facility in 2010. Decision-making of activities to observe at each onsite observation presents a challenge as activities are derived from a combination of monitoring activities specifically identified in the monitoring plan, follow-ups from previous observations or technical reviews, currently open issues, or response to a specific disposal activity or event not specifically defined in the monitoring plan. In February 2010, the NRC staff

observed disposal activities related to Disposal Cell Construction, Saltstone Production Facility Operation, Performance Assessment Process Review, and Radionuclide Inventory (NRC, 2010d). In April 2010, the NRC staff observed disposal activities related to Disposal Cell Construction (NRC, 2010e). In July 2010, the NRC staff observed disposal activities related to the Saltstone Quality Assurance Plan, Hydro-test results on disposal cell 2A (Cell 2A) and disposal cell 2B (Cell 2B), results from saltstone core samples tests, and the May 19, 2010, inadvertent transfer of saltstone into Vault 4 (NRC, 2010g). Details of each of these observations can be found in Appendix D of this report.

In CY 2010, the staff's monitoring activities resulted in no findings of noncompliance. The staff continued to follow up on two open issues identified in CY 2007 and one new open issue identified in CY 2009. The staff has continued to monitor DOE progress on closing open issues in CY 2010. The body of this report presents more information about the staff's observations. Appendix D contains the onsite observation reports.

2.3.1 Onsite Observations

In 2010, the NRC staff conducted three observation visits: February 9-11, 2010, April 19, 2010, and July 28, 2010.

The staff's February 9-11, 2010, onsite observation visit focused primarily on the performance objectives found in §61.41 and §61.43. Meeting these two performance objectives is predicated heavily on the performance of the disposal cells within the period of compliance. During this trip the staff observed the Saltstone production operations and activities related to new disposal cell construction. The staff also participated in discussions related to radiological inventory and models used in the PA. Appendix D to this report contains the observation report dated June 7, 2010.

The staff's April 19, 2010, onsite observation visit focused primarily on the performance objectives found in §61.41 and §61.43. Meeting these two performance objectives is predicated in part on the performance of the disposal cells within the period of compliance. The staffs' visit was prompted initially by an interest in observing the hydrostatic test (hydro-test) of Disposal Cell 2B (cell 2B), however, shortly before DOE began the test, multiple damp or wet spots were evident at points around the base of the cell. Since the hydro-test procedure (CROM, 2009) states that no damp spots may be evident prior to beginning the test, DOE staff did not proceed with the hydro-test. The NRC staff was given a tour of the Cell 2B to observe the damp spots and the actions being taken by DOE to investigate the root cause of the spots. Although the agenda items of the observation changed, the intention remained the same, to focus on compliance with two of the four performance objectives (mentioned above), by observing activities related to new disposal cell construction. Appendix D to this report contains the observation report dated July 7, 2010.

The staff's July 2010, onsite observation visit focused on assessing compliance with all four performance objectives namely, §61.41, §61.42, §61.43, and §61.44. Meeting these four performance objectives depends on the performance of the disposal cells within the period of compliance. The staff planned to achieve this by observing Saltstone production operations and activities related to new disposal cell construction. In addition, the staff also participated in discussions with DOE representatives related to open issues previously identified as part of

NRC's monitoring responsibilities. Appendix D to this report contains the observation report dated November 19, 2010.

2.3.1.1 February 2010 Onsite Observation

Monitoring Areas

As discussed more fully in the observation report in Appendix D, NRC staff observed ongoing disposal cell construction activities and conducted a tour of saltstone productions at the SPF. The staff also evaluated the software used to model the SDF during development of the revised PA. Finally, the staff evaluated DOE and DOE contractor staff to verify the radioactive inventory disposed of at the SDF.

Disposal Cell Construction

The NRC staff has interest in observing construction that relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. Section 3.1.3, *Hydraulic Isolation of Saltstone*, of the May 2007 monitoring plan (NRC, 2007b) provides details of the staffs particular interests.

Saltstone Production Facility Operation

The objective of NRC staff observing the grouting operation is to evaluate any mechanisms that may contribute to contaminant release and transport and to evaluate Factor 2, "Hydraulic Isolation of Saltstone," which was identified as being a key factor in assessing compliance with the performance objectives in Section 3.1.3, *Hydraulic Isolation of Saltstone*, of the May 2007 monitoring plan (NRC, 2007b).

Performance Assessment Process Review

As noted in Section 3.1.9, *Performance Assessment Process Review*, of the May 2007 monitoring plan (NRC, 2007b), NRC staff must perform a consistent and thorough evaluation of the revised PA (DOE, 2009). As part of this review, the NRC staff was interested in obtaining more information about the software used to model the SDF during development of the revised PA.

Radionuclide Inventory Estimates

It is important for NRC staff to verify the radioactive inventory disposed of at the SDF because the inventory is an important factor in the compliance with the performance objective identified in §61.41, protection of the general population from releases of radioactivity.

Results

Disposal Cell Construction

Due to inclement weather, the construction schedule for the disposal cells was delayed resulting in an extended schedule for completion of the hydro-test. Because of this delay, the staff was unable to observe the hydro-test of Disposal Cell 2B and rescheduled that portion of the

observation. As the report for this observation was being completed, DOE staff observed damp spots while filling the cell with water in preparation for the hydro-test. The hydro-test was postponed; however, NRC staff visited the site for an Onsite Observation later in the calendar year which was documented in a separate report for that observation (NRC, 2010e).

Saltstone Production Facility Operation

Due to drain line maintenance prior to and during the observation, saltstone production was not taking place such that staff could observe its operation. Instead, operations staff and management provided a tour of the facility and a presentation of normal operations.

Performance Assessment Process Review

The NRC staff was provided with PORFLOW and GoldSim models that were used in support of the PA. An overview was presented on model structure and implementation. SRNL staff discussed the modular approach utilized in PORFLOW to facilitate the integration of elements, such as (i) temporal variability represented as a sequence of steady-state flow fields, and (ii) flow and transport of multiple hazardous constituents in the near and far field environment. SRNL and DOE staff discussed the benchmarking of GoldSim from PORFLOW flux output files, which was used to develop the probabilistic assessment.

Radionuclide Inventory Estimates

The staff participated in a discussion of procedures for tracking disposal of key radionuclides at the SDF and other topics related to radiological inventory at Saltstone. During the onsite observation, SRS staff also addressed the questions NRC staff had about documents related to the inventory in the SDF. In addition, the document that was provided on the crosswalk of the types of input used as the basis for the inventory of each radionuclide addressed the NRC question raised during the onsite observation. More detail about the review of the documents related the inventory that was performed by NRC staff will be documented in a Technical Review Summary. These discussions provided sufficient information to close two follow-up actions ([i] quarterly Saltstone permit reports support documentation and [ii] Tank 50 material balance).

2.3.1.2 April 2010 Onsite Observation

Monitoring Areas

As discussed more fully in the observation report Appendix D, the NRC staff observed ongoing construction at SDF Cells 2B.

Disposal Cell Construction

The staff's interest in observing construction relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. The staff's visit was prompted initially by an interest in observing the hydro-test of Cell 2B; however, shortly before DOE began the test, multiple damp spots were evident at points around the base of the cell. Due to the presence of damp spots on Cell 2B the hydro-test of Cell 2B was postponed and investigations were performed to determine the source of the wet spots.

Results

The NRC staff visited the site to observe the progress of examining the root cause of the damp spots. A total of 33 damp spots were identified at various locations around the circumference of the cell. These spots were slightly damp to the touch and mostly evident by sight. NRC Staff questioned the effect the damp spots would have on the hydro-test procedures and whether visual tracers would be used in future hydro-tests. DOE staff responded that the utilization of visual tracers will be considered in future hydro-tests. Photos taken during the observation are available in ADAMS (NRC, 2010a).

2.3.1.3 July 2010 Onsite Observation

Monitoring Areas

The observation began with a tour of both the interior and exterior of the Disposal Cell 2 (inside 2A and exterior of 2B). After the tour, DOE provided an update on the status of the damp spot activity and internal and external repairs of the disposal cells. DOE then provided an overview of an inadvertent transfer of 7,190 liters (1,900 gallons) of salt solution that took place on May 19, 2010, (DOE, 2010a) at the SPF. Following this discussion, technical discussions took place for the remainder of the observation (DOE, 2010b).

Saltstone Quality Assurance Plan

The staff's interest in discussing the Saltstone quality assurance plan is to ensure quality of the saltstone product and to make certain that conditions and controls are defined that will ensure future product quality. Verifying the quality of the saltstone wasteform is important to assessing grout formulation and placement which relates directly to ensuring compliance with §61.41 and §61.42. In March 2008, during an onsite observation at the Saltstone facility, DOE presented a saltstone product quality assurance strategy that would allow them to quantify the impact of factors such as (i) potential bulk component intrabatch variability, (ii) additives on processability, and (iii) flush water additions on final product properties and on the wasteform properties that are important to performance assessment. NRC had expressed concerns with quantifying the saltstone product quality in a previous onsite observation. DOE has provided periodic updates on the progress of this quality assurance strategy and the NRC staff requested another update as an objective of this observation.

Saltstone Disposal Cells Hydro-Test

The staff's interest in observing construction relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. Shortly before DOE began the hydro-test on Cell 2B in April 2010, multiple damp spots were evident at the base of the cell. The hydro-test was then suspended until the root cause of the spots was identified. Since April 2010, the hydro-test on Disposal Cell 2A (Cell 2A) also required suspension due to leaks identified by the insertion of a dye tracer into the water used during the test.

Saltstone Core Sample Analysis

The staff's interest in discussing core sample analysis and sampling procedures relates to ensuring the integrity of the waste form and verifying that the actual saltstone wasteform has properties that are consistent with the simulated saltstone samples. Saltstone core samples were removed from Vault 4, Cell E, in September 2008. The samples were discussed briefly in an onsite observation conducted in March 2009, which led to staff requesting additional information about the results of physical or chemical tests being performed on core samples (NRC, 2009). NRC staff had requested this discussion as a follow-up to the request made during this observation.

Saltstone Inadvertent Transfer Incident

The staff was interested in the specific incident on May 19, 2010, where 7,190 liters (1,900 gallons) of dilute untreated salt solution was transferred inadvertently into Vault 4, Cell F due to a valve misalignment. DOE stated that no material was released to the environment and approximately 92% of the untreated solution was recovered from Cell F. DOE presented the details of this event, responded to concerns the NRC staff had about the nature of this event, and agreed to provide the documentation concerning the details of this event that the NRC has requested to ensure compliance under monitoring. The NRC was notified of the transfer event on May 26, 2010. Though this notification was relatively timely, in the future when an event occurs that could impact compliance with the performance objectives, In the future, NRC staff would appreciate being notified as soon as practical so that NRC can fulfill its monitoring responsibilities.

Results

Saltstone Quality Assurance Plan

The NRC staff received an update on the saltstone product quality assurance strategy which included discussions about the status of current Open Issues and proposed measures for closure of the Open Issues. These specifically include the following:

Open Issue 2007-1: Hydraulic and Chemical Properties of Saltstone Grout: As a result of variations in the composition of saltstone grout actually produced at the SPF, DOE should determine the hydraulic and chemical properties of as-emplaced saltstone grout. To this effect, DOE plans to complete the saltstone core sample analyses and to implement a continuous sampling plan for on-going verification of hydraulic and chemical properties of as-emplaced saltstone.

Open Issue 2007-2: Intrabatch Variability of Saltstone Grout: DOE needed to demonstrate that intra-batch variability, flush water additions to freshly poured saltstone grout at the end of each production run, and additives used to ensure processability are not adversely affecting the hydraulic and chemical properties of the final saltstone grout. DOE should show that the hydraulic and chemical properties are consistent with the assumptions in the waste determination or show that any deviations are not significant with respect to demonstrating compliance with performance objectives. To this effect, DOE plans to use saltstone simulants to measure properties that can be used to estimate product quality. DOE provided a status of saltstone simulants testing. Simulants testing is needed to identify relationships between grout

quality and grout quality parameters such as aluminate concentration, water-to-premix ratio, cure temperature, and dry feeds variability. DOE stated that the simulants are being developed and cured in batches every two weeks and the samples are allowed to cure for 90 days before being sent out for analysis. The NRC staff considers these parameters and their relationships when calculating potential dose received by the general population (§61.41). Verifying these parameters ensures an accurate calculation of potential future dose to members of the public that may consume water from an aquifer local to the Z-Area. In addition, DOE stated that K_d (distribution coefficient) testing of simulated saltstone is currently underway and is expected to be complete by CY 2011.

2009-1: Technetium-99 Behavior in Saltstone Grout and Disposal Container: DOE needed to demonstrate that (1) technetium-99 in salt waste is converted to its reduced chemical form in saltstone grout during the curing of saltstone grout, and is thereby strongly retained in saltstone grout, and (2) the sorption of dissolved Tc-99 onto saltstone grout and vault concrete is consistent with Kd values for Tc-99 that were assumed in the PA To this effect, DOE provided a summary of the Tc-99 K_d testing underway and stated that a Tc-99-spiked saltstone stimulant had been prepared and was sent for analysis. DOE noted that this is a long-term study to assess the K_d and reduction behavior of Tc-99 over time. Reduction of Tc-99 is a key factor in future performance of the SDF. DOE stated that the intention of these experiments is to verify reducing conditions are achieved and to show that Tc-99 remains strongly sorbed to the waste matrix. NRC and DOE discussed the scope of the experiments and DOE's plans to address kinetics and flow conditions, as well as sorption onto vault concrete. Both parties agreed it was important to ensure that flow conditions and the duration of the experiments were appropriately incorporated into the experimental measurements. DOE indicated that laboratory measurement of sorption onto vault concrete had not been performed this year.

Saltstone Disposal Cells Hydro-Test

DOE provided a tour of the interior and exterior of Disposal Cell 2 to provide a visual status of corrective actions taken since leaks were found during the hydro-test in April 2010. DOE then gave a presentation on the ongoing repairs and corrective actions for the disposal cells under construction. The staff appreciated the opportunity to observe repairs being made to the inside of the cell and are encouraged by the progress in addressing the leaks observed during the hydrotesting of the new disposal cells. Leaks in the cells during the compliance period could potentially compromise compliance with the performance objectives; the staff maintains an interest in construction of the new disposal cells because inadequate performance resulting from design flaws or problems during construction could compromise compliance with the performance objectives.

The NRC staff asked about the effect the new cell design corrections might have on assumptions made in the PA concerning vault performance. The staff encouraged the DOE to consider performance issues observed in the new disposal cells and how the issues may apply to the existing cells (Vaults 1 and 4). The staff noted that if leakage occurred around the bolts used to fasten the drainage system to the vault floors in the new vaults, the existing vaults (1 and 4) may also experience similar leakage. NRC staff noted that it would be difficult to observe this type of leakage with the existing monitoring system for Vaults 1 and 4.

Saltstone Core Sample Analysis

The staff participated in a discussion about test methods and procedures used for the saltstone core samples that were extracted from the waste form in Vault 4 in September 2008. The core samples will provide direct verification of the quality and properties of the saltstone waste form. The discussion was useful in providing a status of the preliminary results of the core sampling methods and analysis.

The NRC staff stated that they maintain an interest in the results of the core sampling in order to gain a better understanding of some of the details of the test procedures and the measured parameters

DOE and NRC staff discussed activities to develop alternative recovery methods for core samples. NRC staff expressed concern that it may be difficult to achieve representative boundary conditions with the embedded tube-type sampling device being developed by DOE.

Saltstone Inadvertent Transfer Incident

DOE provided an overview of the inadvertent transfer event that occurred on May 19, 2010, at the SPF. DOE made progress on understanding the cause of the event and developing corrective action. At the time of the monitoring visit, DOE was still in the process of completing analysis on the radiological make-up of the transfer.

The NRC staff previously requested this information and the staff reiterated this request during the observation. This event involved a transfer of approximately 7,190 liters (1,900 gallons) of diluted salt solution from the SPF to Vault 4, Cell F while SPF was in a special test mode. This event was attributed to operator error resulting in a valve misalignment. The facility obtained a sample of the transferred liquid and an analysis of the chemical constituents was used to estimate that the liquid was dilute (~10%) salt solution (DOE, 2010a).

Based on the information provided to the staff prior to and during the observation, the NRC staff concludes that the SPF staff responded appropriately to this event. Due to the corrective actions that resulted from the inadvertent transfer, the NRC staff does not believe the event will impact compliance with the Part 61 performance objectives.

2.3.2 Summary of Open Issues, Follow-up Actions, and Recommendations

2.3.2.1 February 9-11, 2010 Observation

Review of the PORFLOW and GoldSim models provided insight regarding the integration of the data with the computational modules used in the 2009 PA. DOE contractors, SRNL and SRR, staff answered questions from NRC staff. NRC review of the models continued and comments regarding the computational models, as they related to the 2009 PA were provided to DOE on December 15, 2010 (NRC, 2010h).

During this observation, DOE staff provided proposed resolutions to currently open issues and follow-up actions. The discussions that occurred during this observation in combination with the recent release of the NRC's first RAI, RAI-2009-01 (NRC, 2010c), during review of the 2009 PA,

resulted in the closure of many follow-up actions (NRC, 2010b). Some of these follow-up actions migrated into being comments in RAI-2009-01.

2.3.2.2 April 2010 Observation

DOE provided preliminary results (DOE, 2010c) of the design changes to disposal Cells 2A and 2B after damp spots were found on the exterior of the cell B during the hydro-test. NRC continued to monitor the situation closely after this observation. Prior to the observation, DOE provided the vendors hydro-test procedure (CROM, 2009). Photos of the tour of the facility that took place in lieu of observing the hydro-test are available in ADAMS (NRC, 2010a).

Shortly after this observation, DOE inserted a fluorescent red dye into the cell water as a visual tracer. After mixing the dye throughout the cell, pink stains were evident at the interface between the cell base and the upper mud mat. DOE then worked to identify the mechanisms causing these potential flow paths and furthermore to identify corrective actions. NRC staff was concerned with the possibility that actions taken during investigation or corrective action (e.g., construction repairs) would not substantially change the assumptions made in the PA (DOE, 2009) or that any change in the assumptions supporting the PA would be accounted for in the NRC staff's review.

2.3.2.3 July 2010 Observation

Saltstone Quality Assurance Plan

Following the observation, the NRC continued to have reasonable assurance that the Part 61 performance objectives can be met as long as these open issues can be resolved, but continued to closely monitor information resulting from implementation of the saltstone quality assurance plan. The NRC staff continued to monitor DOE's actions for each of the Open Issues. The NRC staff stated an interest in seeing results from the saltstone simulant experiments, Tc-99 spiked sample experiments, and the core sample experiments and stated that they will be reviewing documentation produced from these experiments as they are provided to NRC.

Saltstone Disposal Cells Hydro-Test

Following the observation, the NRC staff expressed an interest ensuring that the proposed corrective actions for the disposal cells proved effective and stated that they would continue to closely monitor both the performance of Vault 4 and the continued construction and testing of the new disposal cells. The NRC staff continued to monitor the path forward and corrective actions implemented by DOE regarding the short-term performance problems associated with the new disposal cells. The new disposal cells have not yet been accepted by DOE for operational use.

Saltstone Core Sample Analysis

The staff found the discussion about test methods and procedures of saltstone core samples beneficial. The staff maintains an interest in the sample analysis methods and results, and would like to continue the discussion when more results are available. The NRC staff would like

more timely receipt of the core sample test results. Continued discussion about the sampling methods and processes will be conducted in future monitoring activities.

2.3.3 Summary of Technical Reviews

Due to the ongoing review of the 2009 Saltstone PA, the NRC Staff performed no technical reviews under monitoring in a fashion similar to previous years. Since most documents reviewed by the NRC staff under monitoring in CY 2010 were used as references to the 2009 PA, few technical reports suitable for NRC review and documentation were published by DOE in CY 2010 independent of actions stated in the PA. Though the PA review and associated TER preparation as a result do serve as a "technical review," the magnitude and scope of this review are sufficiently larger than those appropriate for this report. Details regarding future DOE disposal actions, as reported in the 2009 PA, will be fully documented in the upcoming TER on the 2009 Saltstone PA and in the 2011 revision of this Annual Report.

2.3.4 Key Monitoring Factors

2.3.4.1 Purpose of Key Monitoring Factors

In addition to environmental monitoring, NRC staff has identified specific technical areas that will be important in monitoring space to assess compliance with the performance objectives during its review of DOE's draft waste determination. NRC's Technical Reviews describe key assumptions DOE made in its analyses supporting its salt waste determination and the resulting technical areas, called "factors," that NRC staff plan to monitor to assess compliance with the performance objectives. NRC staff identified the following eight key factors to monitor: (i) oxidation of saltstone, (ii) hydraulic isolation of saltstone, (iii) model support, (iv) erosion control design, (v) infiltration barrier performance, (vi) feed tank sampling, (vii) Tank 48 wasteform, and (viii) removal efficiencies.

In general, the factors relate to three important aspects of the disposal system: wasteform and vault degradation, the effectiveness of infiltration and erosion controls, and estimation of the radiological inventory. Each factor is described in more detail in the sections below.

2.3.4.2 Factor 1 - Oxidation of Saltstone

NRC based its assessment of compliance for the performance objectives on a 10,000-year performance period. Because of the long performance period, several of the monitoring factors relate to the long-term degradation of saltstone and the concrete vaults that the saltstone will be poured into. Chemical oxidation of saltstone was identified as a monitoring factor primarily because of the possibility of unacceptable technetium doses if saltstone is oxidized more rapidly than DOE predicts. To confirm DOE's assumptions about saltstone oxidation, NRC staff expects to monitor the development of better predictions of saltstone oxidation during the 10,000-year performance period and the resulting release of technetium. Specifically, staff expects to monitor the results of oxidation experiments and refined radionuclide release models, among other possible activities. Realistic modeling of waste oxidation is needed to assure that §61.41 will be met. Adequate model support is essential to providing the technical basis for the model results.

2.3.4.3 Factor 2 - Hydraulic Isolation of Saltstone

Physical degradation of saltstone is expected to affect facility performance because more water can flow through a degraded wasteform than an intact wasteform, and increased water flow through the wasteform is expected to increase radionuclide releases to groundwater. Thus the physical degradation of saltstone during the 10,000-year performance period is of interest primarily because degradation is expected to compromise the hydraulic isolation of the waste.

Two important aspects of NRC's plan to monitor the hydraulic isolation of saltstone are (i) to confirm that the hydraulic properties of saltstone at the disposal site are consistent with the properties of the laboratory samples of saltstone described in the waste determination and (ii) to monitor the development of better predictions of saltstone degradation over long time periods. Waste in one of the tanks, Tank 48, is unlike the rest of the salt waste at SRS because it contains a substantial amount of organic salts; as a result, NRC staff expects to monitor the hydraulic properties and long–term degradation of saltstone made from this waste as a separate monitoring factor.

2.3.4.4 Factor 3: Model Support

Adequate model support is essential to assessing whether the saltstone disposal facility can meet the requirements of §61.41. The model support for the following items is key to confirming the performance assessment results: (i) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (ii) realistic modeling of waste oxidation and release of technetium, (iii) the extent and frequency of fractures in saltstone and vaults that will form over time, (iv) the plugging rate of the lower drainage layer of the engineered cap, and (v) the long-term performance of the engineering cap as an infiltration barrier. Implementation of an adequate erosion control design is important to ensuring that the provisions of §61.42 can be met. The erosion control barrier will help to maintain a thick layer of soil over the vaults, which reduces the potential for intrusion into the waste.

2.3.4.5 Factor 4: Erosion Control Design

The Infiltration and erosion controls are both part of an engineered cap that DOE plans to use to cover the saltstone disposal facility at facility closure. Implementation of an adequate erosion control design is important to protecting a potential inadvertent intruder, because the erosion control barrier will help to maintain a thick layer of soil over the vaults, which reduces the potential for intrusion into the waste. The primary activity the staff plan to perform to monitor the implementation of the erosion control design is to verify that the erosion control barrier is built as DOE described to NRC during consultation or that, if changes are made to the design, the new design will be as effective in limiting erosion as the design described in documents used to support the waste determination.

2.3.4.6 Factor 5: Infiltration Barrier Performance

The infiltration control system was identified as a factor for monitoring because the predicted dose to a potential member of the public was sensitive to DOE's assumption that the infiltration control system would significantly limit the amount of water reaching the waste for the entire 10,000–year performance period. To monitor the design and performance of the infiltration

control system, NRC staff expect to verify that the infiltration controls are implemented as described in the waste determination and supporting documents or that any changes made to the design do not degrade facility performance. Specifically, if the design is not changed, NRC staff expects to monitor the development of information to support assumptions DOE made about the rate at which the lower drainage layer in the infiltration system would become plugged and any information developed to support the performance of the cap as an infiltration barrier.

2.3.4.7 Factor 6: Feed Tank Sampling

Feed tank sampling is related to the final inventory of radionuclides in the saltstone disposal facility. Implementation of an adequate waste sampling plan is important to ensuring that the provisions of §61.41 and §61.42 can be met. It is necessary to confirm that the concentration of highly radioactive radionuclides (HRRs) in treated salt waste (or grout) is less than or equal to the concentration assumed in the waste determination. The staff expects to monitor how well each of the planned salt waste treatment processes removes radionuclides from the waste, because removal of radionuclides from the waste will affect the inventory of radionuclides in the salt waste disposal facility. In addition, staff will monitor radionuclide removal to assess whether potential doses to members of the general public will be maintained as low as is reasonably achievable (ALARA), as required by the performance objective for protection of the general public from releases of radioactivity.

2.3.4.8 Factor 7: Tank 48 Wasteform

The chemical composition of the salt waste in Tank 48 differs from the salt waste in other tanks because it contains a substantial amount of organic salts. To ensure that Tank 48 waste can be safely managed, tests are needed to measure the physical properties of the wasteform made from this waste to confirm that it will provide suitable performance. NRC Staff plans to monitor reported disposal site inventories as well as sampling of the salt waste preparation feed tank to assess whether the inventory and concentrations of radionuclides sent to the saltstone disposal facility are consistent with the inventories and concentrations that DOE used as a basis for their waste determination.

2.3.4.9 Factor 8: Removal Efficiencies

The removal efficiencies of HRRs by each of the planned salt waste treatment processes are a key factor in determining the radiological inventory disposed of in saltstone, which, in turn, is an important factor in determining that §61.41 and §61.42 can be met.

2.3.4.10 Model Support

In addition to these specific factors, the NRC staff also plans to monitor the development of model support in several technical areas. Essentially, model support provides assurance that the results of any models used to predict potential doses or intermediate results of submodels are consistent with independent data. In the TER, NRC staff indicated it would monitor the development of model support in the following technical areas: (i) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (ii) realistic modeling of waste oxidation and release of technetium, (iii) the extent and frequency of fractures in saltstone

and vaults that will form over time, (iv) the plugging rate of the lower drainage layer of the engineered cap, and (v) the long-term performance of the engineering cap as an infiltration barrier.

Each of these areas is related to other monitoring factors. However, the “model support” monitoring factor is different from the other factors because its goal is to provide confidence in aspects of the model or models used to make dose predictions. Thus, to monitor model support development, NRC staff expects to compare available data about the development of the disposal system or analogous systems with model predictions. Ideally, model support includes multiple lines of evidence supporting the conclusions of modeled dose predictions or intermediate submodels, such as radionuclide release or transport in the subsurface. Lines of evidence may include site characterization and design data, results of process-level modeling, laboratory testing, field measurements, analogs, and formal independent peer review.

3.0 MONITORING AT THE IDAHO NATIONAL LABORATORY IDAHO NUCLEAR TECHNICAL AND ENGINEERING CENTER IN CALENDAR YEAR 2010

3.1 Introduction

In total, there are fifteen waste storage tanks in the TFF which has eleven 300,000-gallon tanks, four 30,000-gallon tanks, interconnecting transfer piping, and secondary containment components for the transfer piping. Placed into service between 1953 and 1966, the eleven 300,000-gallon tanks (WM-180 through WM-190) are approximately 15.2 m (50 ft) in diameter and 6.4-7.0 m (21-23 ft) in height. Nine of the eleven 300,000-gal tanks are constructed of Type 304L stainless steel; two tanks (WM-180 and WM-181) use Type 347 stainless steel. Constructed in 1954, the four inactive 30,000-gallon stainless steel below-grade storage tanks, (WM-103 through WM-106), sit on reinforced concrete pads and were removed from service in 1983. The tanks are horizontal cylinders approximately 3.5 m (11.5 ft) in diameter and 11.6 m (38 ft) in length. All eleven 300,000-gallon tanks are housed in concrete vaults approximately 13.7 m (45 ft) below grade and the 30,000-gallon tanks do not have vaults.

The TFF has been used for the storage of a variety of radioactive wastes, including wastes directly from spent fuel reprocessing and other ancillary wastes since 1953. Spent fuel reprocessing wastes and other ancillary facility wastes were sent to the TFF until 1992.

Recent tank cleaning operations have resulted in the removal of the remaining sodium-bearing waste (SBW) and tank heels from seven 300,000-gallon tanks and four 30,000-gallon tanks. Four 300,000-gallon tanks remain to be cleaned, and these four tanks are anticipated to be cleaned as efficiently as the other 300,000-gallon tanks that have been cleaned. The residual waste inventories at closure in a stabilized form are expected to enable DOE to demonstrate that the TFF tank system residual waste at final closure will meet Section 3116 criteria. The TFF closure date is expected in 2012.

3.2 Background

On September 7, 2005, DOE submitted a draft waste determination for residual waste incidental to reprocessing, including sodium bearing waste, stored in the INTEC TFF to demonstrate compliance with the NDAA criteria including demonstration of compliance with the performance objectives in Part 61. In its consultation role, the NRC staff reviewed the draft waste determination and concluded that the NDAA criteria could be met for residual waste stored in the INTEC TFF. NRC documented the results of its review in a technical evaluation report (TER) issued in October 2006 (NRC, 2006). DOE issued a final waste determination in November 2006 (DOE-Idaho, 2006) taking into consideration the assumptions, conclusions, and recommendations documented in NRC's TER.

To carry out its monitoring responsibilities under the NDAA, NRC developed a monitoring plan for the INTEC TFF facility in April 2007 (NRC, 2007a). NRC conducted two onsite observations in 2007 to observe tank grouting operations (7 of 11 large tanks and 4 smaller tanks) at the INTEC TFF. All open items identified in the first onsite observation conducted in April 2007 were closed in the August 2007 onsite observation.

In August 2008, NRC staff participated in a third onsite observation to observe pipe grouting operations, radiation protection controls, and the environmental sampling program. No findings resulted from the three onsite observations. No tank farm closure activities occurred in CY 2009; therefore, NRC staff elected to forego an onsite observation.

In CY 2010, NRC made one site visit in August 2010 to conduct a tour of INL INTEC facilities (NRC, 2010f). During the visit, NRC staff obtained updates on closure activities and schedules, meet with state officials, and collect routine information related to several monitoring factors listed in NRC's monitoring plan for the INTEC TFF, such as radiation protection and environmental monitoring programs.

Appendix C provides a visual depiction of the timeline of NRC monitoring of the INTEC TFF facility under NDAA.

3.2.1 Radiation Protection Program

For §61.43, protection of individuals during operations, NRC staff will verify that DOE's radiation protection program is in place for its process line grouting operations. Onsite observations will include, as appropriate, but not limited to the following:

Radiation Protection Program Review

Review DOE's radiation protection program in order to validate various reports and records related to protection of individuals during its waste disposal operations.

Onsite Operations Review

Interview DOE's site radiation protection personnel and discuss its onsite implementation of the radiation protection program.

Personnel Monitoring Review

Verify that personnel who are involved in the waste disposal operations are provided with personal dosimetry and/or other adequate personal monitoring devices.

Site Access-Control Review

Tour the site to verify DOE's access-control program is in place.

INTEC TFF Verification Review

Verify the programs and policies presented in the DOE's INTEC TFF waste determination are in effect during the operational period.

Radiation Protection Program Review

Discuss with DOE the effectiveness of DOE's radiation protection program governing its waste disposal operations.

3.2.2 Environmental Sampling Program

Environmental Monitoring Review

Observe environmental monitoring activities that occur during the time that NRC staff is on site (if applicable).

Monitoring Activities Review

Obtain data, reports, and information about recent management and operations and state monitoring activities at the site

Environmental Sampling Review

Review environmental monitoring plans and Quality Assurance (QA) procedures for environmental sampling.

3.3 NRC Monitoring Activities in 2010

3.3.1 Onsite Observations

The NRC staff conducted one onsite observation trip to INTEC TFF in CY 2010 during which the NRC staff engaged in discussions with DOE regarding the radiation protection program and listened to presentations describing the current year activities with radiation protection at the INTEC TFF.

Additionally, during this onsite observation visit, NRC staff listened to presentations and participated in discussions with DOE regarding ongoing remedial actions and groundwater monitoring activities performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program at the INTEC TFF. Prior to the onsite observation, NRC staff also met with officials from the State of Idaho's DEQ to discuss its oversight of the site, specifically its environmental monitoring program.

The observation report can be found in Appendix D of this report.

3.3.2 Technical Reviews

Technical Review Area for KMA 3

> "Relevant recent and future monitoring data and modeling activities should continue to be evaluated to ensure that hydrological uncertainties that may significantly alter the conclusions in the PA and TER are addressed. If significant new information is found, this information should be evaluated against the PA and TER conclusions…" (Description of KMA-3; see Table B-2)

KMA 3 was developed as a result of NRC staff's review of the INTEC TFF draft waste determination and supporting PA as documented in NRC (2006), which showed a number of uncertainties associated with DOE's groundwater model used to support its demonstration of

compliance with the performance objective found in §61.41 for protection of the general population from releases of radioactivity. Some of the largest hydrogeological uncertainties impacting facility performance were related to infiltration rates and the impact of Big Lost River seepage on contaminant releases from the tank farm. Nonetheless, NRC staff was able to conclude with reasonable assurance that natural system uncertainty could be managed with conservative assumptions. In other words, given the large safety margin between the performance standard of 25 mrem/yr and DOE's estimated peak dose of 0.5 mrem/yr for the INTEC TFF, less natural system performance was needed than was taken by DOE in its PA to demonstrate compliance. For example, more easily supportable dilution factors attributable to mixing in the Snake River Plain Aquifer alone for key radionuclides such as technetium-99 and iodine-129 was found to be sufficient for DOE to demonstrate compliance with §61.41.

As stated in the monitoring plan for the INTEC TFF (NRC, 2007a), NRC staff planned to continue to stay abreast of relevant monitoring and modeling activities conducted by DOE, other agencies, or independent researchers until such time that NRC staff could confidently conclude that overall system performance was adequately studied and constrained. If issues arose during evaluation of KMA 2, related to engineered barrier system performance, then KMA 3 would become increasingly important. Therefore, NRC staff determined that the status of this KMA would remain open until KMA 2 was closed.

NRC staff typically reviews groundwater-monitoring reports related to the INTEC facility conducted under the CERCLA program. Data from historical releases collected under the CERCLA program is helpful to NRC staff with respect to evaluating hydrogeological system uncertainties. It is important to note that risks associated with historical releases are addressed under the CERCLA program and are not considered when evaluating potential compliance with performance objectives under the NDAA (i.e., only future releases associated with or following tank closure are considered when evaluating compliance with 10 CFR Part 61 performance objectives). Thus, CERCLA information is reviewed for the sole purpose of providing risk insights on future natural system performance rather than as a measure of contemporaneous compliance with performance objectives for LLW disposal under the NDAA.

DOE Idaho prepares an annual report (e.g., DOE Idaho, 2010) describing maintenance, inspection, and other activities performed to address contaminated soils and groundwater at INTEC as specified in the Record of Decision for the Tank Farm Soil and INTEC Groundwater Operable Unit 3-14, signed in May 2007 (DOE Idaho, 2007). DOE's annual report for FY 2009 (DOE Idaho, 2010) is not intended to interpret data, form conclusions, or determine the effectiveness of the selected remedy; these topics are the subject of DOE's 5-year review of the effectiveness of its CERCLA response actions. NRC staff will document its evaluation of DOE's 5-year review in the NRC's next compliance monitoring report.

Current risks associated with tank farm soil and INTEC groundwater from previous releases include external exposure to soil contaminated with Cs-137 and ingestion of contaminated Snake River Plain Aquifer (SRPA) groundwater. The SRPA currently contains significant concentrations of Sr-90 and nitrate from previous injection well operations and Tc-99 resulting from tank farm releases (DOE Idaho, 2010). If left unmitigated, perched water could become a continuing source of groundwater contamination to the SRPA above certain CERCLA action levels (e.g., maximum contaminant levels or MCLs) beyond 2095. CERCLA modeling shows that with decreased infiltration in a 9.5-acre area surrounding the Tank Farm Facility, the SRPA could meet action levels by 2095. This 9.5-acre area is designated a recharge control zone

under the selected remedy. Thus, remedial activities are focused on the control of recharge to the subsurface.

DOE's annual monitoring report describes various activities designed to control infiltration including inspection activities, remedial actions (e.g., laying down asphalt over decommissioned areas, constructing, and lining ditches), identification of anthropogenic sources of water, plugging abandoned wells, etc. Section 5 of DOE's annual monitoring report describes long-term monitoring activities.

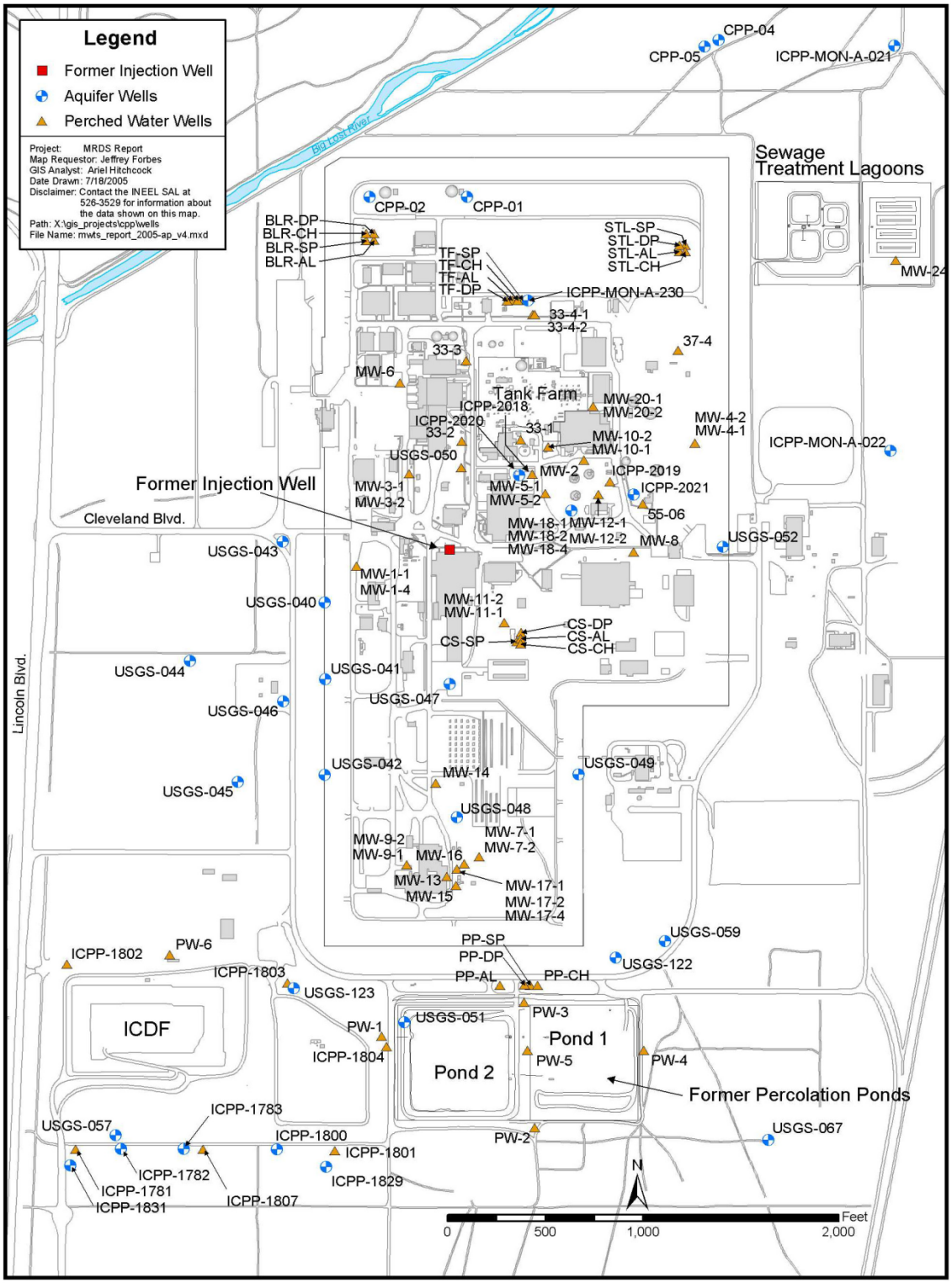

Figure 2: INTEC TFF Monitoring-Well Network (from DOE-Idaho, 2010)

Consistent with previous data, the highest Tc-99 concentrations were associated with monitoring well ICPP-MON-A-230 (2,220 pCi/L) located near the INTEC Tank Farm and the second-highest Tc-99 concentrations were measured at aquifer well ICPP-2021 (1,240 pCi/L), located southeast of the Tank Farm (see Figure 2 above). These two wells were the only wells to exceed the Tc-99 MCL of 900 pCi/L. ICPP-2020 was the only well that showed a significantly higher Tc-99 level (382 pCi/L) than was reported in previous years (e.g., 215 pCi/L in FY 2007). All other wells showed stable or declining trends.

Consistent with previous data, very high Sr-90 levels (>10,000 pCi/L) were observed in the northern shallow perched water across INTEC. The highest Sr-90 concentrations were observed in wells southeast of the Tank Farm. The maximum Sr-90 concentration detected was 130,000 pCi/L at monitoring well ICPP-2018 (see Figure 2). At most well locations, Sr-90 concentrations were similar to those observed during the previous year, but are approximately half those reported in the same wells during the mid-1990s due to decay and transport. Gross beta activity was detected at nearly all perched water sampling locations with the highest gross beta level occurring at well ICPP-2018 (311,000 pCi/L) consistent with the Sr-90 data.

Detectable gross alpha activity was reported at nearly all perched water sampling locations. The highest gross alpha activity was measured at well 33-2 at a value of 20.1 pCi/L. However, the gross alpha activity reported in a duplicate sample from the same well was only 5.75 pCi/L. No plutonium isotopes were detected in either sample from well 33-2 and uranium concentrations, although slightly elevated, could not account for all the alpha activity detected in this well. The high concentrations were thought to potentially be attributable to laboratory error given the results of the duplicate sample. NRC staff will continue to evaluate gross alpha measurements in this and other nearby wells to ensure that no new alpha emitting radionuclides that are not currently being targeted for sampling are identified.

The lateral extent of the northern shallow perched water was mapped in the FY 2009 report (DOE-Idaho, 2010). Shallow perched water wells MW-8, MW-11-2, MW-12-2, and MW-18-2 were essentially dry (<0.15 m [0.5 ft] of water) during the monitoring period. The Big Lost River flowed past INTEC between June 18 and July 4, 2009. However, only one monitoring well (Well BLR-CH) showed a significant water-level response to the river flow event. Well BLR-CH is the well closest to the river (i.e., 152 m [500 ft] from the river channel). After a 4-day time lag following the onset of flow in the river, the perched water level in Well BLR-CH rose 6.7 m (22 ft) over 16 days. This is essentially the same water-level response observed in the past at this well location. No other wells showed any response to flow changes in the river.

During the onsite observation conducted in August 2010, NRC staff listened to presentations and participated in discussions with DOE regarding ongoing remedial and groundwater monitoring activities performed under the CERCLA program at the INTEC TFF as described in the preceding paragraphs (NRC, 2010f). Prior to the onsite observation, NRC staff also met with officials from the State of Idaho's DEQ to discuss its oversight of the site, specifically its environmental monitoring program. NRC staff reviewed environmental monitoring reports generated by Idaho DEQ as described in the paragraphs below under KMA 4. DOE Idaho also indicated that it was in the process of determining whether the INTEC TFF PA should be updated. NRC staff made two recommendations for DOE to consider in its decision to update the PA.

Recommendation 2010-1: NRC staff recommended that the PA reflect the results of simulations performed and additional documentation generated during the NDAA consultation process to answer NRC staff inquiry regarding the cause and performance impact of the significant lateral spread of the contaminant plume emanating from the TFF to the south (e.g., caused by pressure gradient from BLR and resulted in up to a factor of 10,000 decrease in contaminant concentrations emanating from the tank farm facility for relatively mobile [non-sorbing] constituents such as Tc-99 and I-129).

Recommendation 2010-2: NRC staff also recommended that DOE consider (in its decision to update the PA) recent data collected under the CERCLA program that appears to be inconsistent with the DOE PA modeling results with respect to the impact of BLR flow on contaminant fate and transport at the INTEC TFF.

Following the onsite observation, NRC learned that DOE completed an annual review checklist to ensure that conclusions reached in the waste determination remain technically sound and based upon current information. The annual review checklist process indicated that the modeling approach and assumptions of DOE's PA should be assessed because recent CERCLA monitoring showed anthropogenic sources are the predominant recharge source rather than the Big Lost River. DOE conducted additional analyses for comparison to the TFF PA results to investigate the potential doses for more vertical movement of water due to the decreased influence of the BLR at the TFF. The results of the additional analyses showed that although the doses increased, they were still below the performance objectives. DOE does not plan to update its PA.

NRC staff also continues to recommend the following:

Recommendation 2007-3: NRC staff recommends that DOE evaluate any new and significant information related to hydrogeological system uncertainty at INTEC. NRC requests that DOE provide any recent reports or data related to hydrogeological system uncertainty at INTEC to NRC for review as that information becomes available.

NRC staff identified no new and significant information that would invalidate NRC staff's TER conclusions. Information on infiltration rates and the mobility of radiological constituents will continue to be assessed by NRC staff through review of INTEC monitoring data and other sources of information. Big Lost River seepage near the INTEC TFF will also continue to be evaluated to determine its impact on groundwater flow and transport mechanisms near the TFF. NRC staff continues to have reasonable assurance that performance objectives will be met for the INTEC TFF facility.

Technical Review Area for KMA 4

> "Closure and post-closure operations (until the end of active institutional controls, 100 years) will be monitored to ensure that the §61.43 performance objective (protection of individuals during operations) can be met. As part of this assessment radiation records, environmental monitoring, and exposure assessment calculations may be reviewed." [NRC, 2006]

KMA 4 in the NRC's TER for INTEC TFF addresses DOE compliance with the performance objective found in §61.43 related to protection of individuals during operations. To evaluate this performance objective the INL monitoring plan provides that NRC staff will review DOE worker radiation records, DOE's program to maintain worker doses as low as is reasonably achievable (ALARA), and offsite dose assessment methods and results. Technical review activities associated with protection of members of the public under KMA 4 discussed in this section include the review of information gathered during onsite observations along with environmental surveillance data and analyses performed by Stoller Corporation and Idaho Department of Environmental Quality (Idaho DEQ).

Current activities at the INTEC TFF include storage of spent nuclear fuel (SNF) in a modern water basin and in dry storage facilities, management of HLW calcine and sodium-bearing liquid waste, and the operation of the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF), which includes a landfill, evaporation ponds, and a storage and treatment facility. No significant tank farm closure activities occurred in CY 2009; therefore, NRC staff elected to forego an onsite observation. Although various activities, including the demolition of 23 structures previously associated with the grouted tanks at the site, occurred in CY 2010 no significant closure activities occurred at the INTEC TFF. However, given the length of time since the last onsite observation NRC staff decided to conduct an onsite observation visit in August 2010 (NRC, 2010f). During the visit, NRC staff obtained updates on closure activities and schedules, met with state officials, and collected routine information related to several monitoring factors listed in NRC's monitoring plan for the INTEC TFF (NRC, 2007a).

Data presented by INL during the onsite visit demonstrated that doses received by workers involved in decontamination activities at the INTEC TFF were consistently below the predicted ALARA values for the site. Based on this information NRC staff is confident that the current radiation protection program at INTEC TFF can meet the performance objectives as stated by §61.43. Additional monitoring data was also collected from DOE's environmental surveillance reports, the Idaho DEQ INL Oversight Program annual report for CY 2009, and Idaho DEQ's quarterly surveillance report for the first and second quarters of 2010 (DOE, 2009; Idaho DEQ, 2010b; and Idaho DEQ, 2010a). DOE's environmental monitoring program was used to evaluate the impacts of INL operations on members of the public while the environmental surveillance program evaluated air, soil, water, vegetation, animals, and foodstuffs on and around the INL site to confirm compliance with applicable laws and regulations. Since these reports cover the entire site and are not focused specifically on the INTEC TFF, NRC considers these to be a bounding analysis for the public.

The DOE-Idaho environmental surveillance program, which performs monitoring activities on the INL Site, at the INL Site boundary, and offsite emphasizes the measurement of airborne radionuclides because the air transport pathway is considered to be the principal pathway from the INL site for potential releases to the public. Results show that all radionuclide concentrations in ambient air samples were below DOE standards and within historical measurements and are considered to have no measurable impact on the environment. Two different computer programs were used to estimate doses. The Clean Air Act Assessment Package, 1988 (CAP-88) computer code was used to calculate the dose to the hypothetical, maximally exposed individual (MEI) and the mesoscale diffusion (MDIFF) air dispersion model was used to estimate the dose to the population within 80 km (50 miles) of the INL Site facilities. The maximum dose to the MEI was calculated to be 6.9×10^{-4} mSv/year (0.069 mrem/year), well

below the applicable radiation protection standard of 0.1 mSv/year (10 mrem/year). For comparison, the dose from natural background radiation was estimated to be 3.55 mSv (355 mrem). The maximum potential population dose to the approximately 306,000 people residing within a 80 km (50 mile) radius of any INL Site facility was calculated as $5.2x10^{-3}$ person-Sv (0.52 person-rem), below that expected from exposure to background radiation (1086 person-Sv or 108,608 person-rem).

Surface water and groundwater pathways are not considered to be major contributors to public dose because no surface water flows off the INL Site and no radionuclides from the INL site have been found in offsite drinking water wells.

The maximum potential individual doses from consumption of waterfowl and big game animals from the INL site were estimated from the highest concentrations of radionuclides measured in samples collected at the site. Current trends show that these doses are lower than the maximum dose estimates from previous periods. The maximum potential dose of $6x10^{-5}$ mSv ($6x10^{-3}$ mrem) for waterfowl samples is substantially below the $8.9x10^{-3}$ mSv (0.89 mrem) estimated from the most contaminated ducks, collected between 1993 and 1998 from sewage lagoons adjacent to the radioactive wastewater ponds. It is assumed that the ducks used the radioactive wastewater lagoons while in the area. The potential dose from consumption of meat from big game animals was estimated to be approximately $5x10^{-5}$ mSv ($5x10^{-3}$ mrem). Although considered in the past, contributions from the game animal consumption pathway to population dose are not considered because only a limited percentage of the population hunts game, few of the animals killed have spent time on the INL Site, and most of the animals that do migrate from the INL site have low concentrations of radionuclides in their tissues by the time they were harvested. In general the dose contributions from the game animal consumption pathway can be expected to be less than the sum of the population doses from inhalation of air, submersion in air, ingestion of vegetables, and deposition on soil. Based on the graded approach used to evaluate nonhuman biota it can also be concluded that there is no evidence that INL site-related radioactivity associated with the soil or water is harming the resident plant and animal populations.

NRC staff also reviewed environmental data collected by the State of Idaho. The Idaho DEQ maintains an environmental surveillance program that analyzes samples (e.g., air, water [surface and groundwater], soil, and milk) on and off the INL Site to help independently evaluate DOE's monitoring program and assess environmental impacts from INL facilities. Idaho DEQ publishes quarterly and annual reports and analyzes monitoring data (Idaho DEQ, 2010b). NRC staff has concluded that Idaho DEQ's independent environmental surveillance program is sufficient to address this technical review area. Therefore, NRC staff plans to continuously review data, analyses, and conclusions provided in Idaho DEQ quarterly and annual reports to help reach its conclusions regarding compliance with the §61.43 performance objective.

Idaho DEQ posts the latest quarterly and annual reports on the Idaho DEQ's INL Oversight website (see http://www.deq.idaho.gov/inl_oversight). NRC staff reviewed the annual report as well as the quarterly reports for CY 2009 and the first and second quarters of 2010 (Idaho DEQ, 2009, 2010a, and 2010b) to determine potential offsite impacts to members of the public, unexplained, or unexpected releases of radioactivity due to operations at INTEC, as well as to identify trends with respect to contaminant concentrations from onsite monitoring wells. While the monitoring network at INTEC is not as extensive as it is for the CERCLA program, onsite groundwater monitoring data collected by Idaho DEQ also helps to validate data collected

by DOE. Data reported in the 2009 annual report (Idaho DEQ, 2010a) and the quarterly reports for the first and second quarter of 2010 were generally consistent with historic trends. Concentrations of radioactivity in air, soil, and milk samples were consistent with background levels. Radiation levels were also consistent with historic background measurements. In general, there appears to be good agreement between the environmental monitoring data reported by Idaho DEQ and data collected by DOE.

NRC staff presumes that the consistency of data collected by Idaho DEQ and DOE provides confidence that both programs can be used to evaluate offsite environmental impacts associated with INL operations. Based, in part, on the environmental surveillance data collected by DOE and the State, NRC staff continues to have reasonable assurance that the §61.43 performance objective related to protection of individuals during operations will be met.

NRC staff will continue to evaluate worker and public exposure data or estimates through review of worker radiation records and review of environmental surveillance reports as the INTEC TFF closure activities progress in support of the technical review activities identified for KMA 4 in the INL monitoring plan (NRC, 2007a). The level of monitoring is expected to be higher during active closure operations conducted through the year 2012.

Recommendation: DOE should provide information on any violations of requirements related to workers and the general public (10 CFR Part 835 or DOE Order 5400.5) during its waste disposal operations. As information provided on the web may not be timely, NRC staff requests that DOE provide information regarding worker or public dose exceedances within a reasonable timeframe of their occurrence.

3.3.3 Summary of Open Issues, Follow-up Actions, and Recommendations

Based on the August 10, 2010, observation trip, NRC staff made two recommendations for DOE to consider in its decision to update the PA (NRC, 2010f). NRC staff recommended that the PA reflect the results of simulations performed and additional documentation generated during the NDAA consultation process to answer NRC staff inquiry regarding the cause and performance impact of the significant lateral spread of the simulated contaminant plume emanating from the TFF to the south (e.g., caused by pressure gradient from BLR and resulted in up to a factor of 10,000 decrease in contaminant concentrations emanating from the tank farm facility for relatively mobile [non-sorbing] constituents such as Tc-99 and I-129). NRC staff also recommended that DOE consider (in its decision to update the PA) recent data collected under the CERCLA program that appears to be inconsistent with the DOE PA modeling results with respect to the impact of BLR flow on contaminant fate and transport at the INTEC TFF. NRC staff recommends that DOE should consider the new information in the next update to its PA maintenance plan.

There are no new open issues from CY 2010. Based on the information presented by DOE during the onsite observation and NRC's review of documentation and site tour, NRC staff is confident that the current radiation protection program at INTEC TFF can meet the performance objectives as stated in §61.43. DOE provided proper documentation to demonstrate that activities were being conduct in a manner that is protective of individuals during operations.

4.0 SUMMARY OF ALL OPEN ISSUES AND RECOMMENDATIONS FOR SALTSTONE-SRS AND INL-TFF

Table 2 and Table 3 summarize the open issues and recommendations, respectively, which the NRC staff identified during its ongoing monitoring of DOE waste disposal actions from January 1, 2007, through December 31, 2010, under NDAA.

An issue is opened during monitoring activities for items identified by NRC staff of higher risk-significance than follow-up actions. Open issues require additional follow-up by the NRC staff or additional information from DOE to address questions that the NRC staff has raised regarding DOE disposal actions.

A recommendation is an NRC suggestion to DOE to address potential issues identified during monitoring and usually results from a follow-up action. By their nature, recommendations do not require follow-up, they are not considered open or closed.

Table 2: Summary Description of Open Issues in the NRC Section 3116(b) Monitoring Program

Open Issues		
Number	**Description**	**Status**
2007-1	At the SRS Saltstone facility, as a result of variations in the composition of saltstone grout actually produced at the SRS SPF, DOE should determine the hydraulic and chemical properties of as-emplaced saltstone grout. Inadequate saltstone grout quality could result in disposal actions that are not compliant with the §61.41 performance objective.	Open
2007-2	At the SRS Saltstone facility, DOE should demonstrate that intrabatch variability, flush water additions to freshly poured saltstone grout at the end of each production run, and additives used to ensure processability are not adversely affecting the hydraulic and chemical properties of the final saltstone grout. DOE should show that hydraulic and chemical properties are consistent with the assumptions in the waste determination or show that any deviations are not significant with respect to demonstrating compliance with the performance objectives.	Open
2009-1	At the SRS Saltstone facility, DOE should demonstrate that (1) technetium-99 in salt waste is converted to its reduced chemical form in saltstone grout during the curing of saltstone grout and is thereby strongly retained in saltstone grout, and (2) the sorption of dissolved technetium-99 onto saltstone grout and vault concrete is consistent with the K_d values for technetium-99 assumed in the performance assessment.	Open

Table 3: Summary Staff Recommendations under the NRC Section 3116(b) Monitoring Program

Recommendations	
Number	**Description**
2007-3	At the INL INTEC TFF, NRC staff recommends that DOE evaluate any new and significant information related to hydrogeological system uncertainty at INTEC. NRC requests that DOE provide any recent reports or data related to hydrogeological system uncertainty at INTEC to NRC for review as that information becomes available.
2010-1	At the INL INTEC TFF, the NRC staff recommends that the PA reflect the results of simulations performed and additional documentation generated during the NDAA consultation process to answer NRC staff inquiry regarding the cause and performance impact of the significant lateral spread of the contaminant plume emanating from the TFF to the south (e.g., caused by pressure gradient from BLR and resulted in up to a factor of 10,000 decrease in contaminant concentrations emanating from the tank farm facility for relatively mobile [non-sorbing] constituents such as Tc-99 and I-129).
2010-2	At the INL INTEC TFF, the NRC staff recommends that DOE consider (in its decision to update the PA) recent data collected under the CERCLA program that appears to be inconsistent with the DOE PA modeling results with respect to the impact of BLR flow on contaminant fate and transport at the INTEC TFF.

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6.0 GLOSSARY

closed activity	A monitoring activity for which a key assumption made or key parameter used by the U.S. Department of Energy (DOE) in its assessment has been either substantiated or determined not to be important in meeting the performance objectives of Subpart C, "Performance Objectives," of Title 10 of the *Code of Federal Regulations* 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."
Factor	An assumption made or a parameter used by DOE in its performance demonstration that the NRC has determined to be important through the review of a DOE waste determination, which describes its waste disposal actions and demonstrates that there is reasonable assurance that the performance objectives listed in 10 CFR Part 61, Subpart C, will be met.
highly radioactive radionuclides	Those radionuclides that contribute most significantly to risk to the public, workers, and the environment.
key monitoring area	An area that the U.S. Nuclear Regulatory Commission (NRC) has determined, through the review of a DOE waste determination that describes its waste disposal actions, to be important to demonstrating reasonable assurance that the performance objectives listed in 10 CFR Part 61, Subpart C, will be met.
K_d (Distribution Coefficient)	A measure of the partitioning of a substance between water and a solid (e.g., cement or sediment). It describes the ability of a porous material to retain chemical constituents.
monitoring activities	NRC and State activities to monitor DOE disposal actions to assess compliance with the performance objectives listed in 10 CFR Part 61, Subpart C.

noncompliance	A conclusion that DOE disposal actions will not be in compliance with the performance objectives of 10 CFR Part 61, Subpart C, or that there is an insufficient basis to assess whether the DOE waste disposal action will result in compliance with the performance objectives.
open activity	Monitoring activity that has not been closed and for which sufficient information has not been obtained to fully assess compliance with a 10 CFR Part 61, Subpart C performance objective.
open issue	An issue that arises during monitoring activities that requires additional follow-up by the NRC staff or additional information from DOE to address questions that the NRC staff has raised regarding DOE disposal actions. Items raised to the level of becoming an open issue are typically of high risk-significance.
open-noncompliant activity	An ongoing monitoring activity that has provided evidence that the performance objectives of 10 CFR Part 61, Subpart C, are currently not being met or will not be met in the future or for which insufficient technical bases have been provided to determine that the performance objectives will be met.
operations	The timeframe during which DOE carries out its waste disposal actions through the end of the institutional control period. For the purpose of this plan, DOE actions involving waste disposal are considered to include performance assessment development (analytical modeling), waste removal, grouting, stabilization, observation, maintenance, or other similar activities.
performance assessment	A type of systematic (risk) analysis that addresses (1) what can happen, (2) how likely it is to happen, (3) what the resulting impacts are, and (4) how these impacts compare to specifically defined standards.

performance objectives	The 10 CFR Part 61, Subpart C, requirements for low-level waste disposal facilities that include protection of the general population from releases of radioactivity (§61.41), protection of individuals from inadvertent intrusion (§61.42), protection of individuals during operations (§61.43), and stability of the disposal site after closure (§61.44).
recommendations	As used in this report, suggestions to DOE that address ways in which DOE can make progress in closing any open activities in the staff's monitoring plan; a monitoring area for which an open issue has been previously identified and closed and for which the NRC staff suggests further action to strengthen some aspect of the DOE disposal action; and monitoring areas where no open issues or concerns were previously raised but the NRC staff recommends further improvements to DOE disposal actions. The NRC staff provides recommendations to DOE to provide DOE with the NRC staff's insights on one or more aspects of the disposal action being monitored. Recommendations may address (1) the ways that DOE can make progress on closing any open activities in the staff's monitoring plan; (2) a monitoring area for which an open issue has been previously identified and closed and for which the NRC staff recommends further action to strengthen some aspect of the DOE disposal action; or (3) monitoring areas for which no open issues or concerns were previously raised, but for which the NRC staff recommends further improvements to DOE disposal actions.
waste determination	DOE documentation demonstrating that a specific waste stream is not high-level waste (also known as non-high-level waste determination).

worker	DOE personnel (including contractors) who carry out operational activities at the disposal facility. For the purpose of this plan, 10 CFR Part 835, “Occupational Radiation Protection,” dose limits (comparable to those in 10 CFR Part 20, “Standards for Protection against Radiation”) would apply for radiation workers.

APPENDIX A: NATIONAL DEFENSE AUTHORIZATION ACT

Section 3116, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005

SEC. 3116. DEFENSE SITE ACCELERATION COMPLETION.

(a) IN GENERAL—Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982, the requirements of section 202 of the Energy Reorganization Act of 1974, and other laws that define classes of radioactive waste, with respect to material stored at a Department of Energy site at which activities are regulated by a covered State pursuant to approved closure plans or permits issued by the State, the term "high-level radioactive waste" does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy (in this section referred to as the "Secretary"), in consultation with the Nuclear Regulatory Commission (in this section referred to as the "Commission"), determines—

(1) does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste;

(2) has had highly radioactive radionuclides removed to the maximum extent practical; and

(3) (A) does not exceed concentration limits for Class C low-level waste as set out in Section 61.55 of Title 10, Code of Federal Regulations, and will be disposed of—

(i) in compliance with the performance objectives set out in Subpart C of Part 61 of title 10, Code of Federal Regulations; and

(ii) pursuant to a State-approved closure plan or State-issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; or

(B) exceeds concentration limits for Class C low-level waste as set out in section 61.55 of Title 10, Code of Federal Regulations, but will be disposed of—

(i) in compliance with the performance objectives set out in Subpart C of Part 61 of Title 10, Code of Federal Regulations;

(ii) pursuant to a State-approved closure plan or State-issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; and

(iii) pursuant to plans developed by the Secretary in consultation with the Commission.

(b) MONITORING BY NUCLEAR REGULATORY COMMISSION

(1) The Commission shall, in coordination with the covered State, monitor disposal actions taken by the Department of Energy pursuant to Subparagraphs (A) and (B) of subsection (a)(3) for the purpose of assessing compliance with the performance objectives set out in Subpart C of Part 61 of Title 10, Code of Federal Regulations.

(2) If the Commission considers any disposal actions taken by the Department of Energy pursuant to those subparagraphs to be not in compliance with those performance

objectives, the Commission shall, as soon as practicable after discovery of the noncompliant conditions, inform the Department of Energy, the covered State, and the following congressional committees:

(A) The Committee on Armed Services, the Committee on Energy and Commerce, and the Committee on Appropriations of the House of Representatives.

(B) The Committee on Armed Services, the Committee on Energy and Natural Resources, the Committee on Environment and Public Works, and the Committee on Appropriations of the Senate.

(3) For fiscal year 2005, the Secretary shall, from amounts available for defense site acceleration completion, reimburse the Commission for all expenses, including salaries, that the Commission incurs as a result of performance under subsection (a) and this subsection for fiscal year 2005. The Department of Energy and the Commission may enter into an interagency agreement that specifies the method of reimbursement. Amounts received by the Commission for performance under subsection (a) and this subsection may be retained and used for salaries and expenses associated with those activities, notwithstanding Section 3302 of Title 31, United States Code, and shall remain available until expended.

(4) For fiscal years after 2005, the Commission shall include in the budget justification materials submitted to Congress in support of the Commission budget for that fiscal year (as submitted with the budget of the President under section 1105(a) of title 31, United States Code) the amounts required, not offset by revenues, for performance under subsection (a) and this subsection.

(c) INAPPLICABILITY TO CERTAIN MATERIALS—Subsection (a) shall not apply to any material otherwise covered by that subsection that is transported from the covered State.

(d) COVERED STATES—For purposes of this section, the following States are covered States:

(1) The State of South Carolina.

(2) The State of Idaho.

(e) CONSTRUCTION

(1) Nothing in this section shall impair, alter, or modify the full implementation of any Federal Facility Agreement and Consent Order or other applicable consent decree for a Department of Energy site.

(2) Nothing in this section establishes any precedent or is binding on the State of Washington, the State of Oregon, or any other State not covered by subsection (d) for the management, storage, treatment, and disposition of radioactive and hazardous materials.

(3) Nothing in this section amends the definition of “transuranic waste” or regulations for repository disposal of transuranic waste pursuant to the Waste Isolation Pilot Plant Land Withdrawal Act or Part 191 of Title 40, Code of Federal Regulations.

(4) Nothing in this section shall be construed to affect in any way the obligations of the Department of Energy to comply with section 4306A of the Atomic Energy Defense Act (50 U.S.C. 2567).

(5) Nothing in this Section amends the West Valley Demonstration Act (42 U.S.C. 2121a note).

(f) JUDICIAL REVIEW—Judicial review shall be available in accordance with Chapter 7 of Title 5, United States Code, for the following:

(1) Any determination made by the Secretary or any other agency action taken by the Secretary pursuant to this section.

(2) Any failure of the Commission to carry out its responsibilities under Subsection (b).

APPENDIX B: MONITORING SUMMARY TABLES

Summary Tables of U.S. Nuclear Regulatory Commission Monitoring Plans

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
61.41	Data review		Review information on reported inventories and concentrations in the Saltstone Disposal Facility. (SRS-SLT-41-00-01-T)	T	Open
			Review ground water monitoring data, updates to the monitoring plan, and quality assurance plans for sampling. (SRS-SLT-41-00-02-T)	T	Open
	Factor 1, Oxidation of Saltstone	The rate of waste oxidation is a key factor in the future performance of the Saltstone Disposal Facility because the release of technetium is very dependent on the extent of oxidation of the saltstone	Review information on vault design as it relates to oxidation. (SRS-SLT-41-01-01-T)	T	Open
			Review information on gas phase transport of oxygen within the saltstone. (SRS-SLT-41-01-02-T)	T	Open

[3] There are two main types of monitoring activities: T=technical review activities; O=onsite observation activities.

[4] The activities are tracked as open, open-noncompliant, or closed. The glossary defines these terms. Note that an open activity is different from an open issue.

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
		wasteform. Realistic modeling of waste oxidation is needed to assure that the performance objectives of Title 10 of the *Code of Federal Regulations* (10 CFR) 61.41, "Protection of the General Population from Releases of Radioactivity," will be met. Adequate model support is essential to providing the technical basis for the model results.	Review field and laboratory experiments and any additional modeling of saltstone oxidation and technetium release. (SRS-SLT-41-01-03-T)	T	Open
			Review information on grout formulation and grout curing conditions. (SRS-SLT-41-01-04-O)	O	Open
61.41 (cont.)	Factor 1, Oxidation of Saltstone (cont.)		Evaluate the adequacy of the U.S. Department of Energy (DOE) program for verifying the specifications of blast furnace slag. (SRS-SLT-41-01-05-O)	O	Open
	Factor 2, Hydraulic Isolation of Saltstone	To better understand the future performance of the disposal facility, it is important to understand the mechanisms of degradation of the wasteform to predict the rate of degradation, as well as the expected physical properties of the degraded wasteform, such as hydraulic conductivity and diffusivity.	Review information to support the exclusion from consideration of specific saltstone degradation mechanisms. (SRS-SLT-41-02-01-T)	T	Open
			Review information on curing technique and curing time for grout and concrete. (SRS-SLT-41-02-02-T)	T	Open
			Review information on water condensation within the vaults. (SRS-SLT-41-02-03-T)	T	Open

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
			Review information on the dissolution of salts and low-solubility matrix phases within the grout. (SRS-SLT-41-02-04-T)	T	Open
			Observe vault construction and performance. (SRS-SLT-41-02-05-O)	O	Open
61.41 (cont.)	Factor 3, Model Support	Adequate model support is essential to assessing whether the saltstone disposal facility can meet the requirements of §61.41. The model support for the following items is key to confirming the performance assessment results: (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier.	Review any new moisture characteristic data for concrete and saltstone. (SRS-SLT-41-03-01-T)	T	Open
			Review available information on the rate of equilibrium of water content within the saltstone. (SRS-SLT-41-03-02-T)	T	Open
			Review any additional modeling analysis of moisture flow in the saltstone. (SRS-SLT-41-03-03-T)	T	Open
			Review DOE conceptual model for oxidation and technetium release and any support for the model. (SRS-SLT-41-03-04-T)	T	Open
			Review laboratory and field studies on concrete and saltstone cracking. (SRS-SLT-41-03-05-T)	T	Open
			Observe any experiments performed to address issues related to Factor 3. (SRS-SLT-41-03-06-O)	O	Open

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
61.42	Factor 4, Erosion Control Design	Implementation of an adequate erosion control design is important to ensuring that the provisions of §61.42, "Protection of Individuals from Inadvertent Intrusion," can be met. The erosion control barrier will help to maintain a thick layer of soil over the vaults, which reduces the potential for intrusion into the waste.	Evaluate technical details of the proposed closure cap. (SRS-SLT-42-04-01-T)	T	Open
			Evaluate the design of erosion control features. (SRS-SLT-42-04-02-T)	T	Open
			Evaluate updates or revisions to DOE intruder analysis. (SRS-SLT-42-04-03-T)	T	Open
61.41	Factor 5, Infiltration Barrier Perf.	The design and performance of the infiltration control system is important for ensuring that the requirements of §61.41 can be met. The release of contaminants from the saltstone to the ground water is predicted to be sensitive to the amount of infiltration.	Review experiments and field studies that simulate processes related to plugging of the drainage layer through colloidal clay migration. (SRS-SLT-41-05-01-T)	T	Open
			Review any experiments, analyses, or expert elicitation regarding the long-term performance of the infiltration barrier. (SRS-SLT-41-05-01-T)	T	Open
	Factor 6, Feed Tank Sampling	Implementation of an adequate waste sampling plan is important to ensuring that the provisions of §61.41 and §61.42 can be met. It is necessary to confirm that the concentration of highly radioactive	Review DOE waste sampling plan and quality assurance procedures for sampling waste. (SRS-SLT-41-06-01-T)	T	Open
			Review waste sampling data for the feed tank (Tank 50). (SRS-SLT-41-06-02-T)	T	Open

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
		radionuclides (HRRs) in treated salt waste (or grout) is less than or equal to the concentration assumed in the waste determination.	Observe waste sampling activities. (SRS-SLT-41-06-03-O)	O	Open
61.41 (cont.)	Factor 7, Tank 48 Wasteform	The chemical composition of the salt waste in Tank 48 differs from the salt waste in other tanks because it contains a substantial amount of organic salts. To ensure that Tank 48 waste can be safely managed, tests are needed to measure the physical properties of the wasteform made from this waste to confirm that it will provide suitable performance.	Review DOE approach for treating waste in Tank 48. (SRS-SLT-41-07-01-T)	T	Open
			Review characterization information for Tank 48. (SRS-SLT-41-07-02-T)	T	Open
			Review information on the expected physical properties of the Tank 48 wasteform. (SRS-SLT-41-07-03-T)	T	Open
61.41 (cont.)	Factor 8, Removal Efficiencies	The removal efficiencies of HRRs by each of the planned salt waste treatment processes are a key factor in determining the radiological inventory disposed of in saltstone, which, in turn, is an important factor in determining that §61.41 and §61.42 can be met.	Review information on radionuclide removal efficiencies by the various treatment processes. (SRS-SLT-41-08-01-T)	T	Open
			Review estimates of the amount of sludge entrained in the salt waste during the deliquification, dissolution, and adjustment process. (SRS-SLT-41-08-02-T)	T	Open
			Evaluate updates or revisions to DOE performance assessment (PA) and special analysis. (SRS-SLT-41-08-03-T)	T	Open

Table B-1: Monitoring at Savannah River Site Saltstone Facilities (NRC, 2007b)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[3]	Status[4]
61.43	Radiation Protection and Environmental Protection		Review reports related to worker and general public doses. (SRS-SLT-43-RE-01-T)	T	Open
			Review air effluent data from the salt waste processing facility. (SRS-SLT-43-RE-02-T)	T	Open
			Review information on DOE quality assurance program for monitoring air emissions. (SRS-SLT-43-RE-03-T)	T	Open
			Review DOE radiation protection program. (SRS-SLT-43-RE-04-O)	O	Open
			Observe DOE process for obtaining air effluent data. (SRS-SLT-43-RE-05-O)	O	Open
			Review DOE ground water sampling process and installation of new wells. (SRS-SLT-43-RE-06-O)	O	Open
61.44			Observe the disposal facility for obvious signs of degeneration. (SRS-SLT-44-XX-01-O)	O	Open

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
61.41	KMA 1, Residual Waste Sampling	DOE should sample tanks WM-187 through WM-190 after cleaning, as stated in Section 2.3 of the Draft Section 3116 Determination Idaho Nuclear Technology and Engineering Center Tank Farm Facility (DOE, 2005). After cleaning, DOE should review sampling data and analysis of tanks WM-187 through WM-190 to ensure that the inventory for these tanks is not significantly underestimated (i.e., similar or better waste retrieval will be achieved).	Review sampling and analysis plans (SAPs) and data quality assessments for tanks WM-187 through WM-190. (INL-TFF-41-01-01-T)	T	Open
			Compare post cleaning WM-182 tank inventory to post cleaning tank inventories developed for WM-187 through WM-190. (INL-TFF-41-01-02-T)	T	Open
			Compare vault WM-187 liquid sampling to vault WM-185 liquid sampling. (INL-TFF-41-01-03-T)	T	Open
			Observe post cleaning sampling of tanks WM-187 through WM-190 against the SAP. (INL-TFF-41-01-04-O)	O	Open

[5] There are two main types of monitoring activities: T=technical review activities; O=onsite observation activities.

[6] The activities are tracked as open, open-noncompliant, or closed. The glossary defines these terms. Note that an open activity is different from an open issue.

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
			Observe use of video equipment to map out waste residual depths in the cleaned tanks to estimate waste residual volumes. (INL-TFF-41-01-05-O)	O	Open
61.42	KMA 1, Residual Waste Sampling (cont.)		Compare post cleaning WM-182 tank inventory to the post cleaning tank inventories developed for WM-187 through WM-190. (INL-TFF-42-01-06-T)	T	Open
61.41	KMA 2, Grout Formulation and Perf.	The final grout formulation used to stabilize the Idaho Nuclear Technology and Engineering Center (INTEC) Tank Farm Facility (TFF) waste should be consistent with design specifications, or significant deviations should be evaluated to ensure that they will not negatively impact the expected performance of the grout. The reducing capacity of the tank grout is important to mitigating the release of technetium-99. Short-term performance of as-emplaced grout should be similar to or better than that assumed in the Performance Assessment (PA) release modeling, or significant deviations should be evaluated to determine their significance with respect to the conclusions in the PA	Determine whether the vendor-supplied slag has sufficient sulfide content to maintain reducing conditions in the tank grout. (INL-TFF-41-02-01-T)	T	Open
			Determine whether slag storage is sufficient to maintain the quality and chemical reactivity of the slag. (INL-TFF-41-02-02-T)	T	Closed
			Assess the short-term performance of the as-emplaced grout. (INL-TFF-41-02-03-T)	T	Open
			Evaluate the final grout formulation for consistency with design specifications. (INL-TFF-41-02-04-O)	O	Open

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
		and technical evaluation report (TER). The short-term performance of the grouted vault is especially important to mitigate the release of short-lived radionuclides, such as strontium-90, from the contaminated sand pads that could potentially dominate the predicted doses from the TFF within the first few hundred years.	Evaluate the risk significance of any deviations in the final grout formulation from design specifications. (INL-TFF-41-02-05-O)	O	Open
61.41 (cont.)	KMA 2, Grout Formulation and Perf. (cont.)		Evaluate the DOE program for sampling, testing, and accepting grout materials. (INL-TFF-41-02-06-O)	O	Closed
			Verify conditions of grout placement in terms of temperature and humidity. (INL-TFF-41-02-07-O)	O	Closed
61.44			Review information on grout formulation, placements, and pours. (INL-TFF-44-02-08-T)	T	Open
61.41	KMA 3, Hydrologic Uncertainty	Relevant recent and future monitoring data and modeling activities should continue to be evaluated to ensure that hydrological uncertainties that may significantly alter the conclusions in the PA are addressed. If	Evaluate and assess the risk significance of any variations in DOE PA-predicted natural attenuation of strontium-90 through the vadose zone. (INL-TFF-41-03-01-T)	T	Open

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
		significant new information is found, it should be evaluated against the PA and TER conclusions.	Evaluate and assess the risk significance of any increased estimates of infiltration rates at the INTEC TFF above those assumed in the DOE PA. (INL-TFF-41-03-02-T)	T	Open
			Review hydrological studies and monitoring data for new and significant information related to natural attenuation at the INTEC TFF. (INL-TFF-41-03-03-T)	T	Open
61.43	KMA 4, Monitoring during Operations	Closure and post closure operations (until the end of active institutional controls, which is 100 years) will be monitored to ensure that the performance objective in §61.43, "Protection of Individuals during Operations," can be met.	Review DOE Idaho radiation protection program to ensure that it is consistent with that described in its waste determination. (INL-TFF-43-04-01-T)	T	Open
			Review pathway analysis, environmental data collected, and DOE estimate of doses to members of the public. (INL-TFF-43-04-02-T)	T	Open
			Observe risk-significant DOE closure activities. (INL-TFF-43-04-03-O)	O	Open

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
			Observe air sampling activities and DOE meteorological program or rely on Idaho Department of Environmental Quality (DEQ) environmental surveillance program.[7] (INL-TFF-43-04-04-O)	O	Open
61.41	KMA 5, Engineered Surface Barrier/ Infiltration Reduction	INTEC infiltration controls and the construction and maintenance of an engineered cap over the TFF under the Comprehensive Environmental Response, Compensation, and Liability program should be monitored to ensure that the PA assumptions related to infiltration and contaminant release are bounding.	Evaluate and assess the design, construction, maintenance, and as-emplaced performance of engineered barriers installed at the INTEC TFF against DOE PA assumptions regarding infiltration. (INL-TFF-41-05-01-T)	T	Open
61.41	KMA 5, Engineered Surface		Remain cognizant of any changes to the preliminary design of the infiltration-reducing cap. (INL-TFF-41-05-02-O)	O	Open

[7] As noted in the body of the report, the U.S. Nuclear Regulatory Commission (NRC) relies on the Idaho DEQ environmental surveillance program for this monitoring activity.

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
	Barrier/ Infiltration Reduction (cont.)		Observe maintenance activities of the cap. (INL-TFF-41-05-03-O)	O	Open
61.41	Update Perf. Assessment	DOE Order 435.1, "Radioactive Waste Management," requires that the DOE PA be reviewed and revised when there are changes in wasteform or containers, radionuclide inventories, facility design or operation, or closure concepts or there is an improved understanding of facility performance.	Review any revisions and updates to the DOE PA model to assess the impact of changes on conclusions regarding compliance with the performance objectives. (INL-TFF-41-PA-01-T)	T	Open
61.41	Environmental Review and Environmental Sampling		Review analytical data on perched and saturated ground water at the INTEC TFF. (INL-TFF-41-RE-01-T)	T	Open
			Review hydrological studies relevant to flow and transport at the INTEC TFF. (INL-TFF-41-RE-02-T)	T	Open
61.41 and 61.43	Environmental Review and Environmental		Observe the installation of monitoring wells and instrumentation. (INL-TFF-41-RE-03-O)	O	Open

Table B-2: Monitoring at Idaho National Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility (NRC, 2007a)

10 CFR Part 61 Performance Objectives	Monitoring Area	Description	Activities		
			Monitoring Activity Code	Type[5]	Status[6]
	Sampling (cont.)		Observe sampling activities. or Rely on Idaho DEQ oversight program.[8] (INL-TFF-41-RE-04-O)	O	Open
61.44	N/A		Observe signs of system failure. (INL-TFF-44-XX-01-O)	O	Open
			Observe system performance after extreme events. (INL-TFF-44-XX-02-O)	O	Open

[8] As noted in the body of the report, the NRC relies on the Idaho DEQ environmental surveillance program for this monitoring activity.

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APPENDIX C: NRC MONITORING ACTIVITIES TIMELINE

Timelines for activities at the Savannah River Site, Saltstone Facility and at the Idaho National Laboratory Tank Farm Facility

Monitoring Activities at the Saltstone Facility at the Savannah River Site

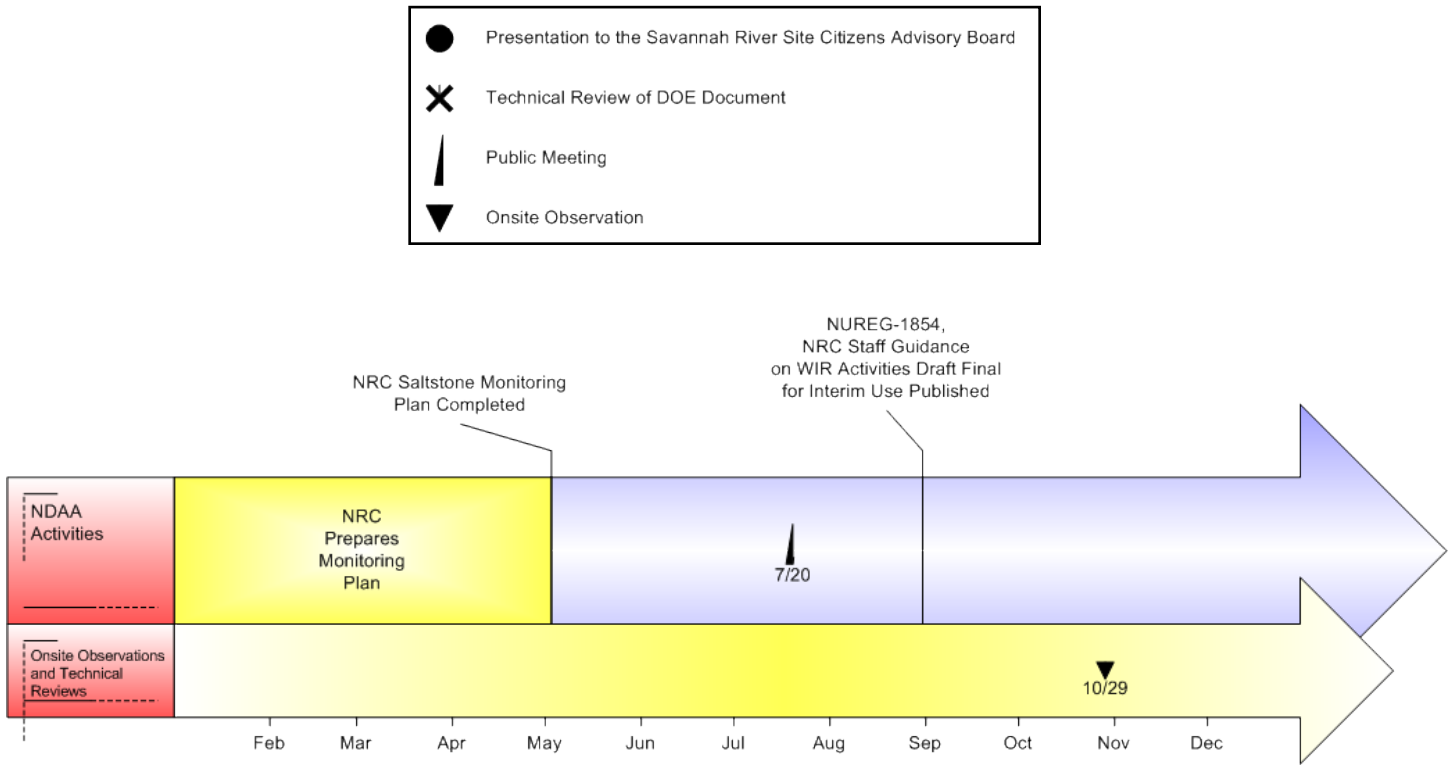

Figure C-1: NRC NDAA, Section 3116 Monitoring at Saltstone in 2007

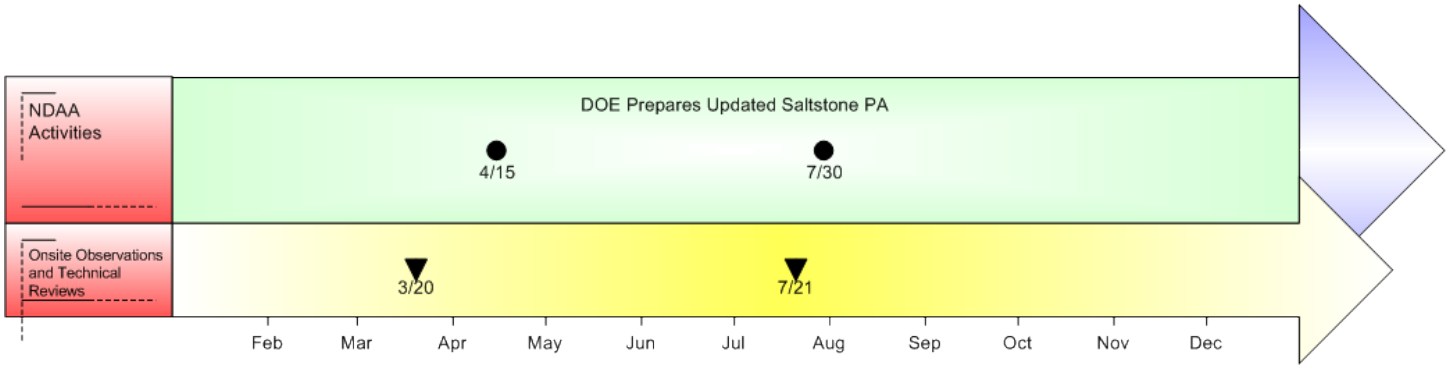

Figure C-2: NRC NDAA, Section 3116 Monitoring at Saltstone in 2008

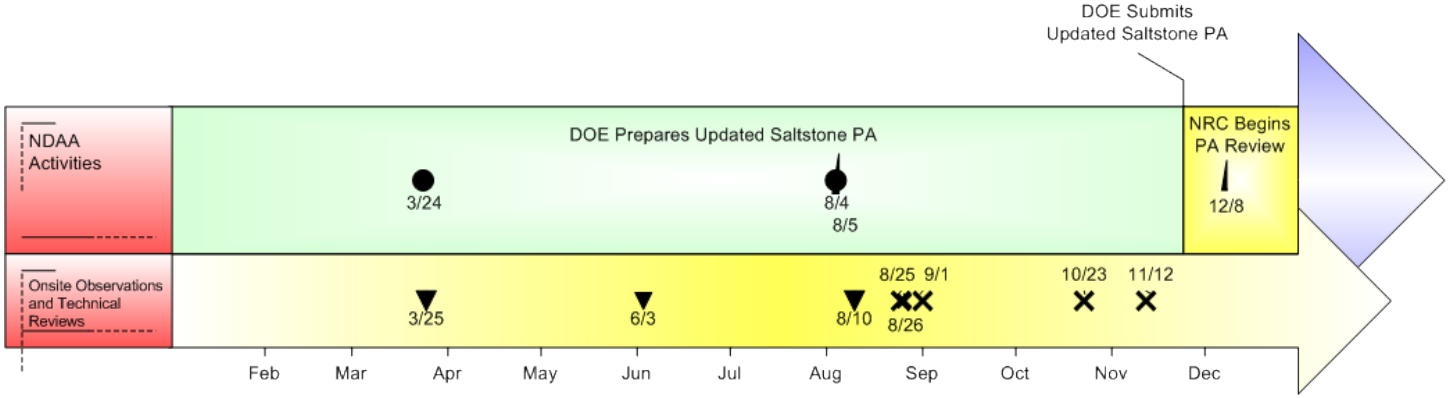

Figure C-3: NRC NDAA, Section 3116 Monitoring at Saltstone in 2009

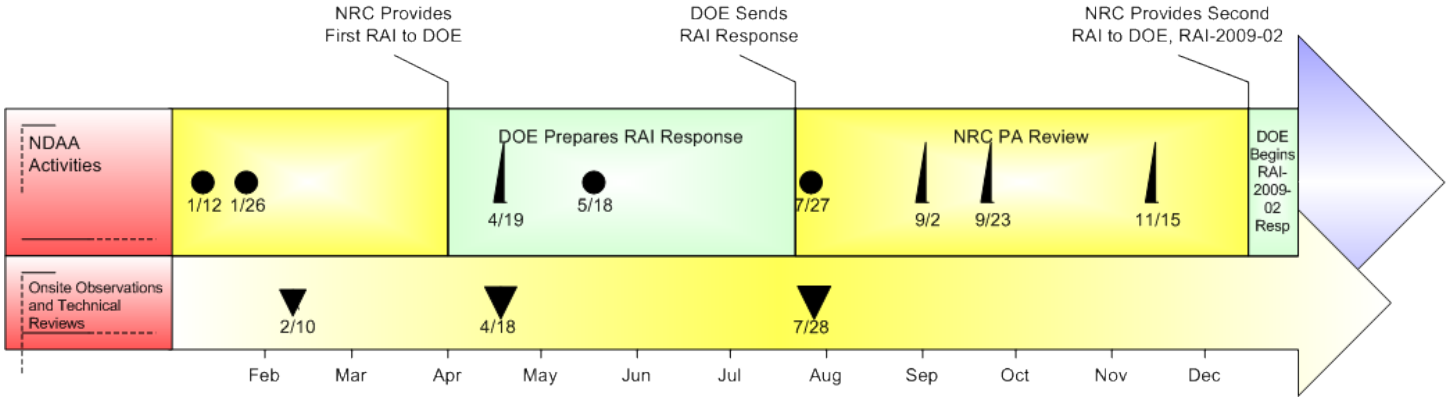

Figure C-4 : NRC NDAA, Section 3116 Monitoring at Saltstone in 2010

Monitoring Activities at the Tank Farm Facility at the Idaho National Laboratory

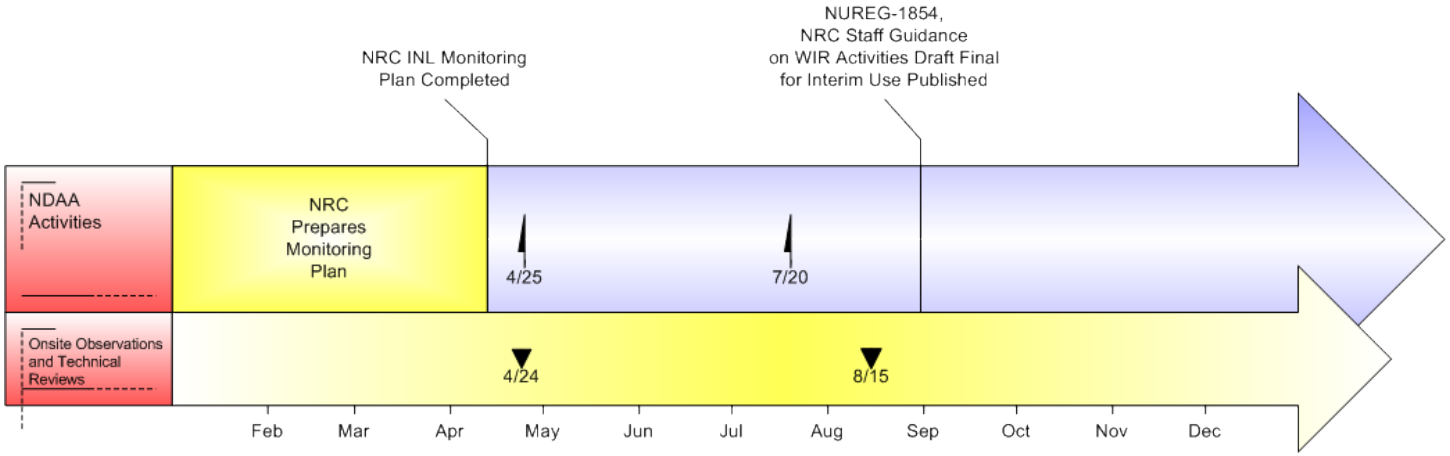

Figure C-5: NRC NDAA, Section 3116 Monitoring at INL in 2007

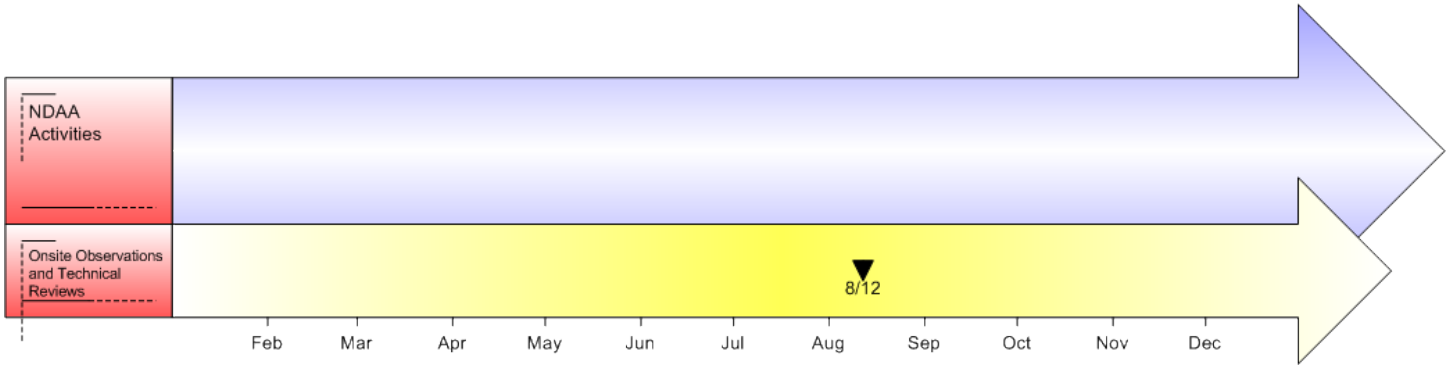

Figure C-6 : NRC NDAA, Section 3116 Monitoring at INL in 2008

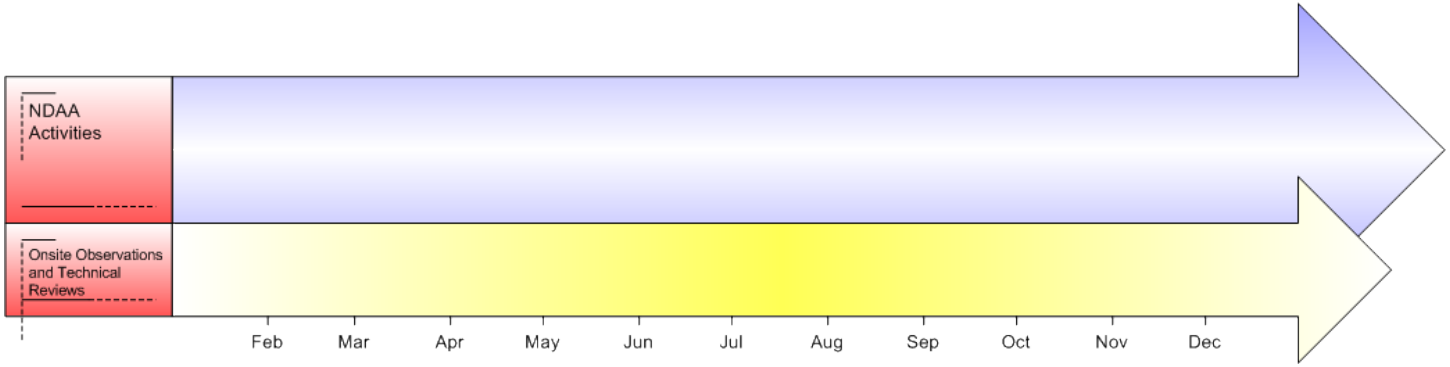

Figure C-7: NRC NDAA, Section 3116 Monitoring at INL in 2009

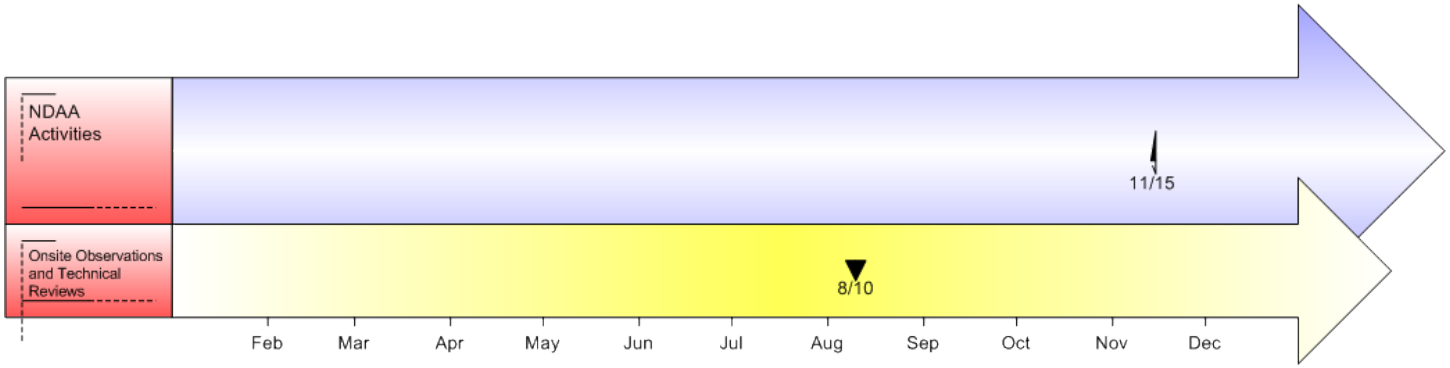

Figure C-8: NRC NDAA, Section 3116 Monitoring at INL in 2010

APPENDIX D: 2010 OBSERVATION REPORTS

U.S. Nuclear Regulatory Commission Observation Reports for Calendar Year 2010

June 7, 2010

Mr. Thomas Gutmann, Director
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION FEBRUARY 9 – 11, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

Dear Mr. Gutmann:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on February 9 – 11, 2010, at the Savannah River Site (SRS) Saltstone Facility. This onsite observation was conducted in accordance with Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116), which requires NRC to monitor disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in 10 CFR Part 61, Subpart C. The activities conducted during the site visit were consistent with those described in the NRC's monitoring plan for salt waste disposal at SRS (dated May 3, 2007) and NRC's staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007).

This onsite observation at SRS was focused on assessing compliance with two of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41) and (ii) protection of individuals during operations (10 CFR 61.43). Meeting these two performance objectives is predicated heavily on the performance of the disposal cells within the period of compliance.

While drafting this observation report, on April 19, 2010, NRC conducted a second Saltstone observation, to observe damp spots identified on the surface of the cell 2B found shortly before beginning the hydrostatic test. The test was postponed until the mechanism causing the spots was better identified. Details of the April 19 observation will be available in Onsite Observation Report CY 2010-2, which is currently being drafted.

NRC continues to conclude that there is reasonable assurance that the applicable criteria of Section 3116 can be met if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of Section 3116 and consistent with NRC's monitoring plan for the Saltstone Disposal Facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process. Several onsite observation visits and technical reviews may be necessary in order to obtain the information needed to close all of the current open issues, as well as issues that may be opened in the future.

If you have any questions or need additional information regarding this report, please contact Nishka Devaser of my staff at (301) 415-5196.

Sincerely,

/RA/

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
NRC Observation Report

cc w /encl:
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U.S. NUCLEAR REGULATORY COMMISSION FEBRUARY 9 – 11, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its seventh onsite observation visit to the Saltstone Facility at the Savannah River Site (SRS) on February 9 – 11, 2010. The intention of this visit was to focus on compliance with two of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41) and (ii) protection of individuals during operations (10 CFR 61.43) by observing and participating in various activities. The staff observed Saltstone production operations and activities related to new disposal cell construction. The staff participated in discussions related to radiological inventory and models used in the performance assessment. This report provides a description of NRC onsite observation activities and identifies NRC observations from the visit. Based on the results of the visit, the NRC continues to have reasonable assurance that the performance objectives of 10 CFR 61 can be met in the areas reviewed.

There are no new open issues resulting from this observation, however, SRR staff provided proposed resolutions to currently open issues and follow-up actions. The NRC staff participated in this dialogue and the presentation provided by SRR is accessible via NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), at ADAMS accession number ML100550009. These discussions, in combination with the recent release of the NRC staff's Request for Additional Information (NRC, 2010) resulted in the closure of many follow-up actions. Some of these follow-up actions migrated into being comments in the staff's Request for Additional Information (NRC, 2010).

A summary of the staff's observations and conclusions is provided below:

Disposal Cell Construction:

- Due to inclement weather, the construction schedule for the disposal cells was delayed resulting in an extended schedule for completion of the hydrostatic test (hydro-test). Because of this delay, the staff was unable to observe the hydro-test of disposal cell 2B and rescheduled that portion of the observation. As this report was being completed, SRR staff observed damp spots while filling the cell with water in preparation for the hydro-test. The hydro-test was postponed, however, NRC staff visited the site for Onsite Observation CY2010-2 which will be documented in a separate report that will be available in the near future.

Saltstone Production Facility Operation:

- Due to drain line maintenance prior to and during the observation, saltstone production was not taking place such that staff could observe its operation. In lieu, operations staff and management provided a tour of the facility and a presentation of normal operations.

Enclosure

Performance Assessment Process Review:

- In accordance with the NRC's review of the 2009 Performance Assessment (PA), SRS staff provided a walkthrough of the GoldSim and PORFLOW models used in the PA. The NRC staff found the presentations provided and explanations therein to be very helpful in understanding thought processes and assumptions in the PA.

Radionuclide Inventory:

- The staff participated in a discussion of procedures for tracking disposal of key radionuclides at the Saltstone Disposal Facility (SDF) and other topics related to radiological inventory at Saltstone.

- The discussion provided sufficient information to close follow-up actions ML091320439-003 (quarterly Saltstone permit reports support documentation) and ML091320439-004 (tank 50 material balance).

1.0 BACKGROUND:

Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116) authorizes the Department of Energy (DOE), in consultation with the NRC, to determine that certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste, provided certain criteria are met. Section 3116 also requires NRC to monitor DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On March 31, 2005, DOE submitted a "Draft Section 3116 Determination Salt Waste Disposal Savannah River Site" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C (DOE, 2005a). In its consultation role, the NRC staff reviewed the draft waste determination and concluded that there was reasonable assurance that the applicable criteria of Section 3116 could be met, provided certain assumptions made in DOE's analyses are verified via monitoring. NRC documented the results of its review in a Technical Evaluation Report issued in December 2005 (NRC, 2005). DOE issued a final waste determination in January 2006 taking into consideration the assumptions, conclusions, and recommendations documented in NRC's Technical Evaluation Report (DOE, 2006).

To carry out its monitoring responsibility under Section 3116, NRC plans to perform three types of activities: (i) technical reviews, (ii) onsite observations, and (iii) data reviews. These activities will focus on key assumptions – called "factors" – identified in the NRC monitoring plan for salt waste disposal at SRS (NRC, 2007). Technical reviews generally will focus on obtaining additional model support for assumptions DOE made in its PA that are considered important to DOE's compliance demonstration. Onsite observations generally will be performed to (i) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination, or (ii) observe key disposal (or closure) activities related to technical

review areas (e.g., slag and other material storage, grout formulation and preparation, and grout placements). Data reviews will supplement technical reviews by focusing on monitoring data that may also indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with performance objectives.

2.0 NRC ONSITE OBSERVATION ACTIVITIES:

2.1 DISPOSAL CELL CONSTRUCTION:

2.1.1 Observation Scope:

The staff's interest in observing construction relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. Section 3.1.3, "Hydraulic Isolation of Saltstone," of the May 2007 monitoring plan provides details of the staffs particular interests.

2.1.2 Observation Results:

This portion of the observation did not take place during this observation due to schedule changes resulting from unexpected weather. In lieu of this portion and the portion described in Section 2.2 Saltstone Production Facility Operation, DOE operations staff and management provided a tour of the facility, which included the new disposal cells, 2A and 2B.

2.1.3 Conclusions and Follow-up Actions:

The staff maintains an interest in observing the hydro-test when it takes place. Prior to the observation, DOE provided the vendors hydro-test procedure (CROM, 2009). Photos of the tour of the facility that took place in lieu of observing the hydro-test are available in NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), at ADAMS accession number ML100550095.

2.2 SALTSTONE PRODUCTION FACILITY OPERATION:

2.2.1 Observation Scope:

The objective of NRC staff observing the grouting operation is to evaluate any mechanisms that may contribute to contaminant release and transport and to evaluate Factor 2, "Hydraulic Isolation of Saltstone," which was identified as being a key factor in assessing compliance with the performance objectives in Section 3.1.3 of the May 2007 monitoring plan.

2.2.2 Observation Results:

Saltstone production was not taking place during our visit due to routine maintenance needs. Alternatively, the staff was provided a tour of the facility as well as received a presentation on normal saltstone production operations which included a short video demonstrating the production of saltstone. During this tour, the staff observed the dry feed storage system. The staff climbed the large silos to evaluate their adequacy for slag and cementitious materials storage.

2.2.3 Conclusions and Follow-up Actions:

Photos taken during the tour of the dry feed storage system and other portions of the tour are available in NRC's document repository, ADAMS, at ADAMS accession number ML100550095. At the time of observation, the staff found the silos to be adequate storage facilities for slag and cementitious materials and found reasonable assurance that the Part 61 performance objectives were still being met. Details of the staffs interest in the dry feed storage can be found in Section 3.2.4 of the May 2007 monitoring plan.

2.3 PEFORMANCE ASSESSMENT PROCESS REVIEW:

2.3.1 Observation Scope:

As noted in Section 3.1.9, "Performance Assessment Process Review," of the May 2007 monitoring plan, NRC staff must perform a consistent and thorough evaluation of the revised PA (DOE, 2009). As part of this review, the NRC staff was interested in obtaining more information about the software used to model the saltstone disposal facility during development of the revised PA.

2.3.2 Observation Results:

NRC staff was provided with PORFLOW and GoldSim models that were used in support of the PA. An overview was presented on model structure and implementation. SRNL staff discussed the modular approach utilized in PORFLOW to facilitate the integration of elements, such as (i) temporal variability represented as a sequence of steady-state flow fields, and (ii) flow and transport of multiple hazardous constituents in the near and far field environment. SRNL and SRR staff discussed the benchmarking of GoldSim from PORFLOW flux output files, which was used to develop the probabilistic assessment.

2.3.3 Conclusions and Follow-up Actions:

Review of the PORFLOW and GoldSim models provided insight regarding the integration of the data with the computational modules used in the 2009 PA. SRNL and SRR staff answered questions from NRC staff. NRC review of the models is ongoing and additional comments may be submitted.

2.4 RADIONUCLIDE INVENTORY:

2.4.1 Observation Scope:

As noted in Section 3.1.1.1, "Data Reviews – Radioactive Inventory" of the May 2007 monitoring plan, it is important for NRC staff to verify the radioactive inventory disposed of at the Saltstone Disposal Facility because the inventory is an important factor in the compliance with the performance objective identified in 10 CFR 61.41, protection of the general population from releases of radioactivity.

2.4.2 Observation Results:

NRC staff previously discussed the processes used for waste sampling and for tracking the inventory of radionuclides disposed of at the Saltstone Disposal Facility during onsite observations in October 2007 (NRC, 2008a), March 2008 (NRC, 2008b), and March 2009 (NRC, 2009). Two action items remained opened from these onsite observations. The first action item is to provide an evaluation of the Tank 50 material balance (action item number ML091320439-004), and the second action item is to provide sufficient documentation to support quarterly Saltstone Permit Reports (action item number ML091320439-003).

During the onsite observation, SRS site staff provided the NRC with a document on the Tank 50 Material Balance to address action item ML091320439-004 (SRR-CWDA-2010-00008 Revision 1). This document contains flow charts of the process used to derive the inventory in the quarterly reports that are posted to the SRS website as well as the process used to derive the inventory on an annual basis. This document also contains a comparison of the concentration predicted using a material balance calculation to the measured concentration for 10 radionuclides (H-3, C-14, Ni-63, Sr-90, Tc-99, I-129, Cs-137, U-233, U-235, and Pu-241). The measured and predicted concentrations were generally comparable, though there were some differences for radionuclides that were present at levels near or below the detection limit. This document provided sufficient information to close action item ML091320439-004.

Prior to this onsite observation, NRC staff reviewed several documents related to the radionuclide inventory in Saltstone Disposal Facility. These documents included SRNS-J2100-2009-00014 (Unreviewed Disposal Question Evaluation: Evaluation of Updated Radionuclide Inventory in Saltstone Disposal Facility), X-CLC-Z-00027 (Inventory Determination of PODD Radionuclides in Saltstone Vaults 1 and 4), X-ESR-H-00188 (Alternative Determination of Saltstone Disposal Facility (SDF) Radionuclides Inventory as of March 31, 2009), LWO-RIP-2009-00025 (Evaluation of Saltstone Disposal Facility Radiological Inventory), and LWO-LWE-2009-00159 (Best Estimate of the Concentration of Radionuclides in a Tank 50 Influent Stream Aggregate). NRC staff transmitted a list of 17 questions on these documents to DOE on December 17, 2009 which are available at ADAMS accession number ML101370016. During the onsite observation SRS staff addressed these questions, and the questions and responses will be described in more detail in a forthcoming technical review summary for the inventory documents. The information presented by SRS site staff during the onsite observation was sufficient to address the NRC questions on the inventory documents and to close action item ML091320439-003 (quarterly Saltstone permit reports support documentation).

During the onsite observation, NRC staff raised a question about the basis for arriving at inventory estimates and any subsequent accounting practices for each radionuclide (e.g., was the inventory based on analytical sample results, material balance calculations, etc). In response to this question, SRS staff provided a document to the NRC staff containing crosswalk tables of saltstone inventory data bases (SRR-WSE-2010-00051). This document contains a list of the data source for each radionuclide for the quarterly reports from 3rd Qtr 2007 to 4th Qtr 2009 as well as the source for the data presented in X-CLC-Z-00027 (Inventory Determination of PODD Radionuclides in Saltstone Vaults 1 and 4). The information in this document is sufficient to address the question raised by the NRC staff.

2.4.3 Conclusions and Follow-up Actions:

The discussion on inventory held during the onsite observation provided NRC staff with a thorough explanation of the process used by SRS staff to quantify and track the inventory of radionuclides disposed of at the Saltstone Disposal Facility. This discussion provided sufficient information to close follow-up actions ML091320439-004 (evaluation of the tank 50 material balance) and ML091320439-003 (quarterly Saltstone permit reports support documentation). During the onsite observation, SRS staff also addressed the questions NRC staff had about documents related to the inventory in the Saltstone Disposal Facility. In addition, the document that was provided on the crosswalk of the types of input used as the basis for the inventory of each radionuclide addressed the NRC question raised during the onsite observation. More detail about the review of the documents related the inventory that was performed by NRC staff will be documented in a Technical Review Summary.

3.0 PARTICIPANTS:

U.S. NRC	SRR	SRNL
George Alexander	Doug Bumgardener	Heather Burns
Nishka Devaser	Ginger Dickert	Greg Flach
Christepher McKenney	Frank England	Jeff Jordan
Karen Pinkston	Victor Franklin	Glenn Taylor
A. Christianne Ridge	Jim French	
	Eric Harrison	
	Mark Layton	
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Tom Gutmann	E. Patten	
David Hoel	Lamesha Pressley	
Chun Pang	Tom Robinson	
Irene Seitz	Kent Rosenberger	
	Richard Sheppard	
SC DHEC	Aaron Staub	
Jason Shirley	Steve Thomas	
Josh Yon	John Tseug	
	Steve Wilkerson	

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July 7, 2010

Mr. Thomas Gutmann, Director
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
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SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION (NRC) APRIL 19, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

Dear Mr. Gutmann:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on April 19, 2010, at the Savannah River Site (SRS) Saltstone Facility. This onsite observation was conducted in accordance with Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116), which requires NRC to monitor disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in 10 CFR Part 61, Subpart C. The activities conducted during the site visit were consistent with those described in the NRC's monitoring plan for salt waste disposal at SRS (dated May 3, 2007) and NRC's staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007).

This onsite observation at SRS was focused on assessing compliance with two of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41) and (ii) protection of individuals during operations (10 CFR 61.43). Meeting these two performance objectives is predicated in part on the performance of the disposal cells within the period of compliance.

NRC continues to conclude that there is reasonable assurance that the applicable criteria of Section 3116 can be met if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of Section 3116 and consistent with NRC's monitoring plan for the Saltstone Disposal Facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process. Several onsite observation visits and technical reviews may be necessary in order to obtain the information needed to close all of the current open issues (the term "open issues" is defined in the NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations, dated August 2007), as well as issues that may be opened in the future.

If you have any questions or need additional information regarding this report, please contact Nishka Devaser of my staff at (301) 415-5196.

Sincerely,

/RA/

David L. Skeen, Deputy Director
Environmental Protection
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Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
NRC Observation Report

cc w /encl:

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U.S. NUCLEAR REGULATORY COMMISSION (NRC) APRIL 19, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its eighth onsite observation visit to the U.S. Department of Energy (DOE) Saltstone Facility at the Savannah River Site (SRS) on April 19, 2010. The staff's' visit was prompted initially by an interest in observing the hydrostatic test of disposal cell 2B, however, shortly before DOE began the test, multiple damp or wet spots were evident at points around the base of the cell. Since the hydrostatic test procedure (CROM, 2009) states that no damp spots may be evident prior to beginning the test, SRR staff did not proceed with the hydro-test. The NRC staff was given a tour of the disposal cell 2B to observe the damp spots and the actions being taken by SRR to investigate the root cause of the spots.

Although the agenda items of the observation changed, the intention remained the same, to focus on compliance with two of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41) and (ii) protection of individuals during operations (10 CFR 61.43) by observing activities related to new disposal cell construction. This report provides a description of NRC onsite observation activities and identifies NRC observations from the visit. DOE is currently assessing the root cause of the wet spots and the NRC continues to monitor the situation closely. Based on the preliminary information received to date, the NRC continues to have reasonable assurance that the performance objectives of 10 CFR 61 can be met in the areas reviewed.

There are no new open issues resulting from this observation, however, the NRC staff will continue to monitor the path forward and corrective actions considered and taken by DOE and its contractors regarding the damp spots found on cell 2B prior to the hydrostatic test. NRC staff also will monitor the outcome of the hydrostatic test performed for cell 2A following the test performed for cell 2B.

A summary of the staff's observations and conclusions is provided below:

Disposal Cell Construction:

- Due to the presence of damp spots on cell 2B, the hydrostatic test of cell 2B was postponed. The NRC staff visited the site to observe the progress of examining the root cause of the damp spots. Photos taken during the observation are available via NRC's document repository, the Agencywide Document Access and Management System (ADAMS), at ADAMS accession number ML101460045.

- The NRC staff will continue to monitor actions being taken to investigate the cause of the spots.

Enclosure

1.0 BACKGROUND:

Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116) authorizes the Department of Energy (DOE), in consultation with the NRC, to determine that certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste, provided certain criteria are met. Section 3116 also requires NRC to monitor DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On March 31, 2005, DOE submitted a "Draft Section 3116 Determination Salt Waste Disposal Savannah River Site" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C (DOE, 2005a). In its consultation role, the NRC staff reviewed the draft waste determination and concluded that there was reasonable assurance that the applicable criteria of Section 3116 could be met, provided certain assumptions made in DOE's analyses are verified via monitoring. NRC documented the results of its review in a Technical Evaluation Report issued in December 2005 (NRC, 2005). DOE issued a final waste determination in January 2006 taking into consideration the assumptions, conclusions, and recommendations documented in NRC's Technical Evaluation Report (DOE, 2006).

To carry out its monitoring responsibility under Section 3116, NRC plans to perform three types of activities: (i) technical reviews, (ii) onsite observations, and (iii) data reviews. These activities will focus on key assumptions – called "factors" – identified in the NRC monitoring plan for salt waste disposal at SRS (NRC, 2007). Technical reviews generally will focus on obtaining additional model support for assumptions DOE made in its PA that are considered important to DOE's compliance demonstration. Onsite observations generally will be performed to (i) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination, or (ii) observe key disposal (or closure) activities related to technical review areas (e.g., slag and other material storage, grout formulation and preparation, and grout placements). Data reviews will supplement technical reviews by focusing on monitoring data that may also indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with performance objectives.

2.0 NRC ONSITE OBSERVATION ACTIVITIES:

2.1 DISPOSAL CELL CONSTRUCTION:

2.1.1 Observation Scope:

The staff's interest in observing construction relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. Section 3.1.3, "Hydraulic Isolation of Saltstone," of the May 2007 monitoring plan provides details of the basis for the staff's intended review areas.

The staff's visit was prompted initially by an interest in observing the hydrostatic test of disposal cell 2B, however, shortly before SRR began the test, multiple damp spots were evident at points

around the base of the cell (Figure 1). Due to the presence of damp spots on cell 2B, the hydrostatic test of cell 2B was postponed and investigations were performed to determine the source of the spots.

2.1.2 Observation Results:

The NRC staff visited the site to observe the progress of examining the root cause of the damp spots. At the time of the observation, the vendor CROM was in the process of removing the outer layer of shotcrete on the outside base of the cell at the points exhibiting damp spots. In addition, spots noticed at a lower point (between the upper mud mat and the cell floor, note Figure 1) provided sufficient evidence for portions of the upper mud mat to be removed enough to see the circumference of the cell floor under the base of the cell. SRR staff walked NRC staff around the circumference of the cell and requested multiple photos be taken at various points during this portion of the tour (available at ADAMS accession number ML101460045). In all, 33 damp spots were identified at various spaces around the circumference of the cell. These spots were slightly damp to the touch, but were mostly evident by sight. NRC staff asked various questions pertaining to the timing of the damp spots and any correlations the location of the spots had with construction materials, components, etc. that might have been noticed by SRR or CROM staff. A question of note asked by NRC staff was what effect the presence of damp spots will have on the hydro-test procedures, specifically, will any chemical or visual tracers be used in future hydro-tests (e.g. cell 2A hydro-test). SRR staff responded to the question by saying that insertion of a tracer will be considered for the hydro-test of cell 2A. Damp spots are of interest to the NRC staff because their unexpected presence and the corrective actions to repair them could each have some effect on assumptions made in the performance assessment pertaining to vault performance.

A red dye tracer was then added to the water to distinguish between water inside the cell and water from the surrounding environment, outside the cell.

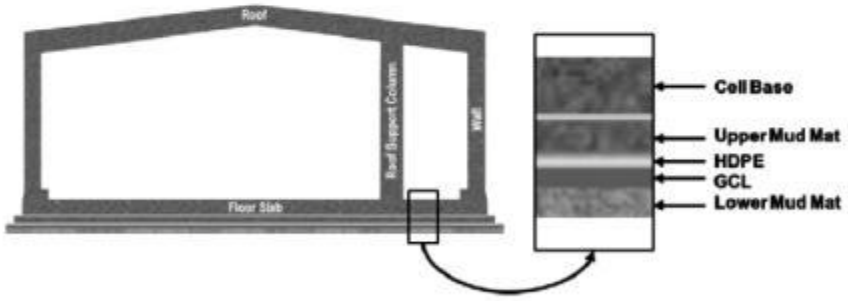

Figure 1: Disposal Cell Depiction (not to scale)

The NRC staff will continue to monitor actions being taken to investigate the cause of the spots.

2.1.3 Conclusions and Follow-up Actions:

Based on the results of the visit and the preliminary results provided by DOE (ML101660516), the NRC continues to have reasonable assurance that the performance objectives of 10 CFR 61 can be met but continues to monitor the situation closely. The NRC staff will monitor the path forward and corrective actions considered and taken by DOE and its contractors regarding the damp spots found on cell 2B prior to the hydrostatic test. Prior to the observation, DOE provided the vendors hydro-test procedure (CROM, 2009). Photos of the tour of the facility that took place in lieu of observing the hydro-test are available in NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), at ADAMS accession number ML100550095.

Shortly after this observation, SRR inserted a fluorescent red dye into the cell water as a visual tracer. After mixing the dye throughout the cell, pink stains were evident at the interface between the cell base and the upper mud mat. Since that time, SRR has been working to identify the mechanisms causing these potential flow paths and furthermore to identify corrective actions should they actually be flow paths. NRC staff will ensure that actions are taken during investigation or corrective action (e.g. construction repairs) will not substantially change the assumptions made in the PA (SRR, 2009) or that any change in the assumptions supporting the PA are accounted for in the NRC staff's review.

3.0 PARTICIPANTS:

U.S. NRC	SRR	U.S. DOE
Nishka Devaser	F. Malcolm Smith	Chun Pang
Gregory Suber	Kent Rosenberger	
		SC DHEC
		John McCain

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November 19, 2010

Mr. Thomas Gutmann, Director
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Savannah River Operations Office
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Aiken, SC 29802

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION JULY 28, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

Dear Mr. Gutmann:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on July 28, 2010, at the Savannah River Site (SRS) Saltstone Facility. This onsite observation was conducted in accordance with Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116), which requires NRC to monitor disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in 10 CFR Part 61, Subpart C. The activities conducted during the site visit were consistent with those described in the NRC's monitoring plan for salt waste disposal at SRS (dated May 3, 2007) and NRC's staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007).

This onsite observation at SRS was focused on assessing compliance with all four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41), (ii) protection of individuals against inadvertent intrusion (10.CFR.61.42), (iii) protection of individuals during operations (10.CFR.61.43), and (iv) stability of the disposal site after closure (10 CFR 61.44). Meeting these four performance objectives depends on the performance of the disposal cells within the period of compliance.

NRC continues to conclude that there is reasonable assurance that the applicable criteria of Section 3116 can be met, if key assumptions made in DOE's waste determination analyses are confirmed to be appropriate. In accordance with the requirements of Section 3116 and consistent with NRC's monitoring plan for the Saltstone Disposal Facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process. Presently, three issues previously identified by the staff remain open: (1) the hydraulic and chemical properties of the saltstone grout, (2) the variability of saltstone from batch to batch, and (3) the reduction capability and sorption rate of Technetium-99 onto the saltstone waste form. Further onsite observation visits and technical reviews may be necessary in order to obtain the information needed to close all of the current open issues, as well as other issues that may be opened in the future.

If you have any questions or need additional information regarding this report, please contact Nishka Devaser of my staff at (301) 415-5196.

Sincerely,

/RA/

David L. Skeen, Deputy Director
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
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and Environmental Management Programs

Enclosure:
NRC Observation Report

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U.S. NUCLEAR REGULATORY COMMISSION JULY 28, 2010 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its ninth onsite observation visit to the Saltstone Facility at the Savannah River Site (SRS) on July 28, 2010. The purpose of this visit was to focus on compliance with all four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41), (ii) protection of individuals against inadvertent intrusion (10.CFR.61.42), (iii) protection of individuals during operations (10 CFR 61.43), and (iv) stability of the disposal site after closure (10 CFR 61.44), by observing Saltstone production operations and activities related to new disposal cell construction. In addition, the staff participated in discussions with DOE representatives related to open issues previously identified as part of NRC's monitoring responsibilities. This report provides a description of NRC onsite observation activities and identifies NRC observations made during the visit. Based on the results of the visit, the NRC continues to have reasonable assurance that the performance objectives of 10 CFR 61 can be met in the areas reviewed, as long as key assumptions made in DOE's waste determination analysis are confirmed to be appropriate.

There are no new open issues resulting from this observation. DOE provided the status of the Open Issues, and described the actions that are being taken to address them. The NRC staff participated in this dialogue, and the presentation provided by DOE (SRR, 2010a) is accessible via NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), at ADAMS accession number ML102180250.

A summary of the staff's observations and conclusions is provided below:

Saltstone Quality Assurance Plan:

- The NRC staff received an update on the saltstone product quality assurance strategy which included discussions about the status of current Open Issues and proposed measures for closure of the Open Issues.

Hydro-test results on Cell 2A and 2B:

- DOE provided a tour of the interior and exterior of Disposal Cell 2 to provide a visual status of corrective actions taken since leaks were found during the hydro-test in April 2010. DOE then gave a presentation on the ongoing repairs and corrective actions for the disposal cells. The staff appreciated the opportunity to observe repairs being made to the inside of the cell and are encouraged by the progress in addressing the leaks observed during the hydrotesting of the new disposal cells. Leaks in the cells during the compliance period could potentially compromise compliance with the performance objectives; the staff maintains an interest in construction of the new disposal cells because inadequate performance resulting from design flaws or problems during construction could compromise compliance with the performance objectives.

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- The NRC staff asked about the effect the new cell design corrections might have on assumptions made in the performance assessment (PA) concerning vault performance. The staff encouraged the DOE to consider performance issues observed in the new disposal cells and how the issues may apply to the existing cells (vaults 1 and 4). The staff noted that if leakage occurred around the bolts used to fasten the drainage system to the vault floors in the new vaults, the existing vaults (1 and 4) may also experience similar leakage. NRC staff noted that it would be difficult to observe this type of leakage with the existing monitoring system for Vaults 1 and 4.

Saltstone Core Samples:

- The staff participated in a discussion about test methods and procedures used for the saltstone core samples that were extracted from the wasteform in Vault 4 in September 2008. The core samples will provide direct verification of the quality and properties of the saltstone wasteform. The discussion was useful in providing a status of the preliminary results of the core sampling methods and analysis.

- The NRC staff stated that they maintain an interest in the results of the core sampling in order to gain a better understanding of some of the details of the test procedures and the measured parameters (grout strength, radionuclide concentrations, hydraulic properties, chemical properties, etc.).

- DOE and NRC staff discussed activities to develop alternative recovery methods for core samples. NRC staff expressed concern that it may be difficult to achieve representative boundary conditions (e.g. stress) with the embedded tube-type sampling device being developed by DOE.

Additional Discussion Topics - May 19, 2010 Saltstone Inadvertent Transfer:

- On May 19, 2010, 7,190 liters (1900 gallons) of dilute untreated salt solution was transferred inadvertently into Vault 4, Cell F due to a valve misalignment. DOE stated that no material was released to the environment and approximately 92% of the untreated solution was recovered from Cell F. DOE presented the details of this event, responded to concerns the NRC staff had about the nature of this event, and agreed to provide the documentation concerning the details of this event that the NRC has requested to ensure compliance under monitoring.

- The additional information on the inadvertent transfer provided during the observation was helpful to increasing the staff's understanding of the event. The NRC was notified of the transfer event on May 26, 2010. Though this notification was relatively timely, in the future when an event occurs that could impact compliance with the performance objectives, NRC should be notified as soon as practical so that NRC can fulfill its monitoring responsibilities. Based on our current understanding, the NRC does not believe the event will impact compliance with the 10 CFR Part 61 Subpart C Performance Objectives, but will follow up on this event during future observations.

1.0 BACKGROUND:

Section 3116 of the National Defense Authorization Act for Fiscal Year 2005 (Section 3116) authorizes the Department of Energy (DOE), in consultation with the NRC, to determine that certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste, provided certain criteria are met. Section 3116 also requires NRC to monitor DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On March 31, 2005, DOE submitted a "Draft Section 3116 Determination Salt Waste Disposal Savannah River Site" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C (DOE, 2005a). In its consultation role, the NRC staff reviewed the draft waste determination and concluded that there was reasonable assurance that the applicable criteria of Section 3116 could be met, provided certain assumptions made in DOE's analyses are verified via monitoring. NRC documented the results of its review in a Technical Evaluation Report issued in December 2005 (NRC, 2005). DOE issued a final waste determination in January 2006 taking into consideration the assumptions, conclusions, and recommendations documented in NRC's Technical Evaluation Report (DOE, 2006).

To carry out its monitoring responsibility under Section 3116, NRC plans to perform three types of activities: (i) technical reviews, (ii) onsite observations, and (iii) data reviews in coordination with the State of South Carolina site regulator, South Carolina Department of Health and Environmental Control (SC DHEC). These activities will focus on key assumptions – called "factors" – identified in the NRC monitoring plan for salt waste disposal at SRS (NRC, 2007). Technical reviews generally will focus on obtaining additional model support for assumptions DOE made in its PA that are considered important to DOE's compliance demonstration. Onsite observations generally will be performed to (i) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination, or (ii) observe key disposal (or closure) activities related to technical review areas (e.g., slag and other material storage, grout formulation and preparation, and grout placements). Data reviews will supplement technical reviews by focusing on monitoring data that may also indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with performance objectives.

2.0 NRC ONSITE OBSERVATION ACTIVITIES:

The observation began with a tour of both the interior and exterior of the Disposal Cell 2 (NRC toured the inside of unit 2A and then walked the circumference of the exterior of unit 2B). After the tour, DOE provided an update on the status of the damp spot activity and internal and external repairs of the disposal cells, which is explained in detail in Section 2.2 of this report. DOE then provided an overview of an inadvertent transfer of 7,190 liters (1900 gallons) of salt solution that took place on May 19, 2010 at the Saltstone Production Facility (SPF). Details of this event were provided in DOE's presentation and are continued in Section 2.4 of this report. Following this discussion, technical discussions took place for the remainder of the observation. Topics for discussion were (1) Open issues status (Section 2.1 Saltstone Quality Assurance

Plan) and (2) Vault 4, Cell E Saltstone core sample status and sampling techniques (Section 2.3 Saltstone Core Samples Analysis).

2.1 SALTSTONE QUALITY ASSURANCE PLAN:

2.1.1 Observation Scope:

The staff's interest in discussing the Saltstone quality assurance plan is to ensure quality of the saltstone product and to make certain that conditions and controls are defined that will ensure future product quality. Verifying the quality of the saltstone wasteform is important to assessing grout formulation and placement which relates directly to ensuring compliance with 10 CFR 61.41, "*protection of the general population from releases of radioactivity*" and 10 CFR 61.42, "*protection of individuals against inadvertent intrusion*".

In March 2008, during an onsite observation at the Saltstone facility, DOE presented a saltstone product quality assurance strategy that would allow them to quantify the impact of factors such as potential bulk component intrabatch variability, flush water additions, and additives on processability of final product properties and on the wasteform properties that are important to performance assessment. NRC had expressed concerns with quantifying the saltstone product quality in a previous onsite observation. DOE has provided periodic updates on the progress of this quality assurance strategy and the NRC staff requested another update as an objective of this observation.

Section 3.2.4, "Grout Formulation and Placement", of the May 2007 monitoring plan (NRC, 2007) provides the basis for the staff's intended review areas.

2.1.2 Observation Results:

DOE provided a presentation that covered each of the three Open Issues. The discussion of each is summarized below and in DOE's presentation (SRR, 2010a).

- **Open Issue 2007-1: Hydraulic and Chemical Properties of Saltstone Grout**

  ***Open Issue**: At the SRS Saltstone Facility, as a result of variations in the composition of saltstone grout actually produced at the Saltstone Production Facility, DOE should determine the hydraulic and chemical properties of as-emplaced saltstone grout*

DOE provided their proposed strategy for closing this open issue. DOE plans to complete the saltstone core sample analyses and to implement a continuous sampling plan for on-going verification of hydraulic and chemical properties of as-emplaced saltstone. For further detail on the core sample analysis discussion and a description of the importance of the core samples analysis to monitoring, please refer to Section 2.3 of this report.

- **Open Issue 2007-2: Intrabatch Variability of Saltstone Grout**

  ***Open Issue**: At the SRS Saltstone Facility, DOE should demonstrate that intra-batch variability, flush water additions to freshly poured saltstone grout at the end of each*

production run, and additives used to ensure processability are not adversely affecting the hydraulic and chemical properties of the final saltstone grout. DOE should show that the hydraulic and chemical properties are consistent with the assumptions in the waste determination or show that any deviations are not significant with respect to demonstrating compliance with performance objectives.

DOE stated that they use saltstone simulants to measure properties that can be used to estimate product quality. DOE provided a status of saltstone simulants testing. Simulants testing is needed to identify relationships between grout quality and grout quality parameters such as aluminate concentration, water-to-premix ratio, cure temperature, and dry feeds variability. Some details of this progress can be found on slide 8 of DOE's presentation (SRR, 2010a). DOE stated that the simulants are being developed and cured in batches every two weeks and the samples are allowed to cure for 90 days before being sent out for analysis. The NRC staff considers these parameters and their relationships when calculating potential dose received by the general population (10 CFR 61.41). Verifying these parameters ensures an accurate calculation of potential future dose to members of the public that may consume water from an aquifer local to the Z-Area.

In addition, DOE stated that K_d (distribution coefficient) testing of simulated saltstone is currently underway and is expected to be complete by CY2011.

- **Open Issue 2009-1: Technetium-99 Behavior in Saltstone Grout and Disposal Container**

  ***Open Issue**: At the SRS Saltstone Facility, DOE should demonstrate that (1) technetium-99 in salt waste is converted to its reduced chemical form in saltstone grout during the curing of saltstone grout, and is thereby strongly retained in saltstone grout, and (2) the sorption of dissolved technetium-99 onto saltstone grout and vault concrete is consistent with Kd values for technetium-99 that were assumed in the performance assessment*

DOE provided a summary of the Tc-99 K_d testing underway and stated that a Tc-99-spiked saltstone simulant had been prepared and was sent for analysis. DOE noted that this is a long-term study to assess the K_d and reduction behavior of Tc-99 over time. Reduction of Tc-99 is a key factor in future performance of the saltstone disposal facility. DOE stated that the intention of these experiments is to verify reducing conditions are achieved and to show that Tc-99 remains strongly sorbed to the waste matrix. NRC and DOE discussed the scope of the experiments and DOE's plans to address kinetics and flow conditions, as well as sorption onto vault concrete. Both parties agreed it was important to ensure that flow conditions and the duration of the experiments were appropriately incorporated into the experimental measurements. DOE indicated that laboratory measurement of sorption onto vault concrete had not been performed this year.

2.1.3 Conclusions and Follow-up Actions:

Based on the discussion that took place during the observation, the NRC continues to have reasonable assurance that the 10 CFR part 61 performance objectives can be met as long as these open issues can be resolved, but will continue to closely monitor information resulting from implementation of the saltstone quality assurance plan. The NRC staff will monitor DOE's actions for each of the Open Issues. The NRC staff appreciates the update and looks forward to seeing results from the saltstone simulant experiments, Tc-99 spiked sample experiments, and the core sample experiments and will be reviewing documentation produced from these experiments as they are provided to NRC.

2.2 SALTSTONE DISPOSAL CELLS HYDRO-TEST:

2.2.1 Observation Scope:

The staff's interest in observing construction relates to ensuring the integrity of the disposal units and identifying the potential mechanisms of contaminant release from the facility. Section 3.1.3, "Hydraulic Isolation of Saltstone", of the May 2007 monitoring plan (NRC, 2007) provides details of the basis for the staff's intended review areas.

2.2.2 Observation Results:

Shortly before DOE began the hydro-test on disposal cell 2B in April 2010, multiple damp spots were evident at the base of the cell. The hydro-test was then suspended until the root cause of the spots was identified. Since April 2010, the hydro-test on cell 2A also required suspension due to leaks identified by the insertion of a dye tracer into the water used during the test. For additional background information on the hydro-test and events that followed suspension of the test, please refer to the April 2010 Onsite Observation Report (NRC, 2010b). At the beginning of the observation, DOE provided a tour of both the interior and exterior of the disposal cells 2A and 2B. NRC staff observed the exterior condition of the cells which included walking the circumference of cell 2B observing repairs to the cell made to the leak points, and then entered cell 2A to observe conditions of the interior of the cell. During the tour, the NRC staff observed some of the interior coating installation, interior cell repairs, and the installation of CIM 1000 coating (©CIM) to the anchor bolts and internal curb. After the tour, DOE provided an update of the status of the damp spot activity and internal and external repairs of the disposal cells. DOE provided a description of their internal process for addressing issues and corrective actions associated with the disposal cells. DOE provided specific details on repair activities such as adding curbing on the exterior of the cell, cutting off the interior anchor bolts on the cell floor, and coating with the CIM 1000 material in a continuous coat up to 5 feet along the cell walls. The image shown on slide 3 of DOE's presentation (ML102180299) provides a useful depiction of corrective actions being considered for the new disposal cells.

NRC Concerns with Proposed Corrective Actions to Disposal Cells 2A and 2B

The NRC expressed concern about the installation of curbing to the exterior of the cell. This installation would cover potentially vulnerable points around the base of the cell making visual inspection impossible. Therefore conclusions about the effectiveness of internal repair activities

of the new disposal cells will be confounded by the presence of the curb on the exterior which may not allow leakage to be seen during the future hydrotest. The staff stated that insufficient confidence in the effectiveness of the repairs will be an additional consideration during review of the PA and in future observations.

Vault 4 Observations

Similar to the curbing proposed for the new disposal cells, the megamix curb installed to protect Vault 4 creates a similar concern to the installation of curbing to cells 2A and 2B, discussed above. During the observation, NRC staff expressed a concern because the megamix curb covers the vault at previously identified vulnerable points around the vault, and, as stated about the new disposal cell exterior curb, this would make visual inspection impossible.

In addition, the leakage observed during cell 2A and 2B hydrotesting was attributed to the bolts in the floors of disposal cells. The NRC staff raised a concern about the integrity of the Vaults 1 and 4 floors because a similar system was used to secure the drain system to the floor of both Vaults 1 and 4. Staff expressed concern that the older disposal vaults may have leakage similar to that observed in the hydrotests of the new cell design, but that DOE is unable to observe leakage underneath the disposal units. NRC staff suggested that direct evidence of leakage (or non-leakage) could be obtained with horizontal soil cores under the existing disposal vaults. NRC staff will evaluate this issue further in future monitoring visits.

2.2.3 Conclusions and Follow-up Actions:

Based on the results of the visit and the preliminary results provided by DOE (ML101660516), the NRC continues to have reasonable assurance that the 10 CFR part 61 performance objectives can be met if the proposed corrective actions for the disposal cells prove effective, but will continue to closely monitor both the performance of Vault 4 and the continued construction and testing of the new disposal cells. The NRC staff will monitor the path forward and corrective actions implemented by DOE regarding the short-term performance problems associated with the new disposal cells and will continue to monitor the situation. The staff looks forward to hearing the final corrective actions approved by DOE, as the final plans will influence the Technical Evaluation Report being prepared by the NRC staff during its review of the updated PA.

2.3 SALTSTONE CORE SAMPLES ANALYSIS:

2.3.1 Observation Scope:

The staff's interest in discussing core sample analysis and sampling procedures relates to ensuring the integrity of the wasteform and verifying that the actual saltstone wasteform has properties that are consistent with the simulated saltstone samples.

Saltstone core samples were removed from Vault 4, Cell E, in September 2008. The samples were discussed briefly in an onsite observation conducted in March 2009, which led to staff requesting additional information about the results of physical or chemical tests being performed

on core samples (NRC, 2009). NRC staff had requested this discussion as a follow-up to the request made during this observation.

Section 3.2.4, "Grout Formulation and Placement", of the May 2007 monitoring plan (NRC, 2007) provide details of the basis for the staff's intended review areas.

2.3.2 Observation Results:

Nine core samples were taken from three locations along the western wall of Cell E of Vault 4 in September 2008 from salt waste deposited in December 2007. Each core was approximately 9 cm (3.5 in.) in diameter and 15 cm (6 in.) deep. In March 2009, DOE explained its plans to test parameters such as porosity, saturated hydraulic conductivity, and distribution coefficients for radionuclides. In the discussion at the current observation visit, DOE provided a status of the progress made in testing these parameters. As can be seen in slide 5 of the presentation (SRR, 2010a), the samples analysis is currently still in progress, however, discussions were centered on techniques used for evaluating current samples, preliminary results of current samples, and the evaluation of sampling techniques proposed for use in the future.

Techniques Used for Current Samples

DOE noted that obtaining results from current samples has posed some difficulty because of the invasive sampling method. DOE provided documentation about the core samples (SRNL, 2009) which provides some description of the sampling method. NRC staff stated that it was important to verify the quality of the saltstone product, and core samples were one of the most direct ways to obtain the information. NRC understood the concern expressed by DOE that the core sampling technique may have affected the integrity of the samples. As seen in the aforementioned DOE core sample document, some of the samples were highly fractured, and the integrity of the samples appears to be low. NRC staff informed DOE that a contractor to the NRC had little difficulty obtaining core samples from large grout sample experiments when the grout had moderate or better strength (Walter, 2010). Although some of the grout parameters presented differences in the strength (between SRS saltstone and the NRC contractor simulant), the NRC contractors' grout was designed to simulate the wasteform as assumed in the Saltstone PA. Since the sampling technique used by NRC contractor was not as detrimental to the saltstone, NRC questions whether fracturing observed by DOE may be a function of product quality and not sampling technique. DOE and NRC agree to follow-up on core sampling techniques as more information is developed.

Preliminary Results of Current Samples

The DOE briefly provided some of the preliminary results from analyses of the current samples. DOE, SC DHEC, and NRC spoke at length about the sample results. NRC reiterated that the core sampling was a very important activity and DOE should continue to make progress in obtaining representative samples. Some samples or sections of core samples experienced significant fracturing and had poor integrity. DOE believed sample quality was caused by the coring process and sample recovery, and had devoted resources to different sample recovery methods. In-situ sample recovery methods are being investigated. NRC reiterated a previous suggestion by DHEC staff, that the core samples from saltstone could be leach tested to verify and provide model support for estimated radionuclide release rates in the current and future

performance assessments. NRC and DHEC stated that more samples should be taken and that it would be very beneficial to the PA review process and under monitoring of the saltstone process to provide the full results of the analyses to the NRC.

Proposed Future Sampling Techniques

Alternate methods were discussed and each had its strengths and weaknesses. DOE presented information on an in-situ sampling technique essentially using embedded pipes, for which they tested the force required to remove the sampling device. NRC expressed concern that the sampling device may allow less disruption of the sample, however the sampling device may change the in-situ conditions of the wasteform such that the sample is not representative. The NRC stated that when its contractor conducted experiments to test the properties of large-scale samples, scale effects were evident in the results. This highlights the importance of measuring properties of representative samples at appropriate scale.

2.3.3 Conclusions and Follow-up Actions:

The staff found the discussion about test methods and procedures of saltstone core samples beneficial. The staff maintains an interest in the sample analysis methods and results, and would like to continue the discussion when more results are available. The NRC staff would like more timely receipt of the core sample test results. Continued discussion about the sampling methods and processes will be conducted in future monitoring activities.

2.4 ADDITIONAL DISCUSSION TOPICS - SALTSTONE INADVERTENT TRANSFER:

2.4.1 Observation Scope:

This observation activity was not explicitly stated in the scope of the observation guidance; however, the inadvertent transfer occurred in the months preceding the observation and could relate to demonstrating compliance with the performance objectives (e.g. unanticipated inventory from transfer, changes to stability of wasteform in cell, inadequate retrieval of untreated salt waste, etc.).

2.4.2 Observation Results:

DOE provided an overview of the inadvertent transfer event that occurred on May 19, 2010 at the Saltstone Production Facility (SPF). DOE made progress on understanding the cause of the event and developing corrective action. At the time of the monitoring visit, DOE was still in the process of completing analysis on the radiological make-up of the transfer. The NRC staff previously requested this information and the staff reiterated this request during the observation. This event involved a transfer of approximately 7,190 liters (1900 gallons) of diluted salt solution from the SPF to Vault 4, Cell F while SPF was in a special test mode. This event was attributed to operator error resulting in a valve misalignment. The facility obtained a sample of the transferred liquid and an analysis of the chemical constituents was used to estimate that the liquid was dilute (~10%) salt solution. Additional details about the inadvertent transfer can be found in the presentation provided to the NRC by DOE (SRR, 2010c). The bullets below provide a summary of the document:

Inadvertent Transfer of Salt Waste Chain of Events

- On May 19, 2010, during performance of a Special Procedure to test Salt Feed Tank (SFT) pump and agitator, about 7,190 liters (1900 gallons) of liquid was inadvertently transferred from the SFT to Vault 4 Cell F.
- The Bleed Water level increased in Vault 4 Cell F due to the material. The Drainwater Return System was utilized to return the liquid to the SFT.
- Event was the result of the operator's failure to position a valve per the procedure coupled with a single point failure situation.
- Samples pulled (from hopper) and analyzed for pH, chromium, and mercury levels. Concentrations consistent with past samples (RCRA non-hazardous and LDR compliant)
- SC DHEC notified of the event, path forward and sample results.
- A Fact Finding has been conducted with Corrective Actions developed to prevent recurrence.

2.4.3 Conclusions and Follow-up Actions:

Based on the information provided to the staff prior to and during the observation, the NRC staff concludes that the SPF staff responded appropriately to this event. Due to the corrective actions that resulted from the inadvertent transfer, the NRC staff does not believe the event will impact compliance with the 10 CFR part 61 performance objectives. Prior to and during the observation, the NRC staff requested additional information on the radiological inventory of the transfer; this request will be tracked as *Follow-Up Action 2010-03-01*.

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11. ABSTRACT (200 words or less)

This is the U.S. Nuclear Regulatory Commission (NRC) staff's report of its monitoring of U.S. Department of Energy (DOE) non-high-level waste disposal actions in calendar year 2010, in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (the NDAA). Section 3116 of the NDAA requires that DOE consult with the NRC on its non-high-level waste determinations and plans and that the NRC, in coordination with the covered States of South Carolina and Idaho, monitor disposal actions that DOE takes to assess compliance with NRC regulations in Title 10 of the Code of Federal Regulations (10 CFR) Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart C, "Performance Objectives." The NRC has prepared this report in accordance with NUREG 1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations," issued August 2007.

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