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Time for compliance

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List of Acronyms and Abbreviations

CFR	Code of Federal Regulations
DOE	Department of Energy
ELLWF	E-Area Low-Level Waste Facility
FR	Federal Register
ILAW	Immobilized Low-Activity Tank Waste
LLW	Low-level radioactive waste
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
SA	Special Analysis
SDF	Saltstone Disposal Facility
SRS	Savannah River Site
TRU	Transuranic
WIR	Waste Incidental to Reprocessing

1.0 Executive Summary

This study lays out the historical development of the time frame for a low-level waste disposal facility to demonstrate compliance with the DOE performance objectives and requirements. The study recommends that 1,000 years should be used as the time for compliance for all of the performance objectives and requirements (i.e., for the all-pathways, air pathway, radon emanation, water resource protection and inadvertent intruder analyses) for all low-level waste disposal facility performance assessments at the Savannah River Site.

2.0 Introduction

In 2002, a Special Analysis (SA)¹ was conducted to develop radionuclide disposal limits for low curie salt and other salt wastes in the Saltstone Disposal Facility (SDF). This Special Analysis was done to update the Saltstone Performance Assessment (PA)², which had assumed that only waste from the In-Tank Precipitation process and the Effluent Treatment Facility would be disposed in Saltstone, and to address requirements of the Department of Energy (DOE) Waste Management Order, DOE 435.1³, which became effective after the Saltstone PA was completed. An issue that arose in developing this special analysis was the time for compliance (i.e., the time over which the analysis must provide a reasonable expectation of not exceeding performance objectives and requirements). DOE 435.1 states that the time for compliance is 1,000 years. However, one of the measures taken to ensure that approval of the SA would be at the Field Office level was to have it be consistent with the E-Area Low-Level Waste Facility (ELLWF) PA⁴, which used 10,000 years for the compliance time. Subsequently, a plan was developed to revise the SDF PA⁵, which includes a task element to determine the appropriate time for compliance for Savannah River Site (SRS) PAs.

3.0 Discussion

3.1 Historical Development and Application of Time for Compliance for SRS Performance Assessments

DOE first established the PA requirement in DOE Order 5820.2A⁶, which became effective in September 1988. However, DOE 5820.2A did not specify the time frame over which the analysis was to be performed⁷. Thus, the SRS SDF PA, which was completed in 1992, determined the maximum impact even if that impact was not until a million years or more after closure. Subsequently, DOE recommended the time for compliance to be 10,000 years⁸. The original ELLWF PA⁹, which was completed in 1994, used 10,000 years as the time for compliance. The current DOE Waste Management Order, DOE 435.1³, which was issued in July 1999, established the time for compliance at 1,000 years. When the ELLWF PA was revised in 2000⁴, it was decided to continue to use 10,000 years as the time for compliance to ensure conservatism in the analysis and to provide for a potential reversion of the time for compliance to 10,000 years by DOE because the Nuclear Regulatory Commission (NRC) PA guidance recommends a 10,000-year time for compliance in PAs for NRC-licensed LLW disposal facilities^{10, 11}.

3.2 Current DOE Requirements

DOE 435.1 clearly states that the time for compliance for the PA is 1,000 years³. However, DOE 435.1 guidance^{12, 13} also recommends that, in the sensitivity/uncertainty analysis for all analyses other than the inadvertent intruder (i.e., all-pathways, air pathway, radon emanation, and water resources protection), the calculations should be carried out beyond 1,000 years to determine the maximum impact regardless of the time at which the maximum occurs. Thus, the time frame for the analysis should be long enough to capture the maximum impact even if the maximum does not occur for

millions of years. For the inadvertent intruder analysis, the guidance states that the sensitivity/uncertainty analysis should be limited to qualitative arguments. Therefore, for the inadvertent intruder analysis, the calculations should be carried out no further than 1,000 years¹⁴.

3.3 DOE Complex Performance Assessments

Performance assessments at other DOE LLW disposal facilities (i.e., Oak Ridge, Los Alamos, INEEL, Hanford, and the Nevada Test Site) used 10,000 years as the time for compliance prior to development of DOE 435.1. Following issuance of DOE 435.1³ in July, 1999, or, in some cases, following issuance of DOE PA guidance¹⁵ in 1996, all sites except SRS changed from 10,000 years to 1,000 years for the compliance time^{16,17,18,19,20}.

At the Hanford site, programs have been underway for many years, just as at SRS, to disposition waste in the high-level waste (HLW) tanks. As at SRS, the salt fraction of the waste is planned for disposal onsite. Initially, this salt waste was to be stabilized by mixing with cementitious materials and disposed in concrete vaults²¹. Subsequently, the Hanford program changed from a cementitious wasteform to a glass wasteform. The initial Hanford Immobilized Low-Activity Tank Waste (ILAW) PA²², which was issued in 1998, used 10,000 years as the compliance time. The current version²³ changed to 1,000 years to conform to the DOE requirement.

3.4 Waste Incidental to Reprocessing

Requirements or guidance other than that for DOE LLW disposal should be considered in establishing the time for compliance for SRS PAs. DOE 435.1 establishes requirements for managing high-level radioactive waste (HLW). HLW must be disposed in a federal geologic repository in accordance with the *Atomic Energy Act of 1954*, as amended and the *Nuclear Waste Policy Act of 1982*, as amended. DOE 435.1 also establishes processes to determine that certain wastes, resulting from the reprocessing of spent nuclear fuel, are incidental to reprocessing and may be managed as LLW unless they contain sufficient transuranic radionuclides to be classified as TRU waste, in which case they would be managed accordingly.

There are two processes laid out in DOE 435.1³ for determining that waste is WIR. These are the citation and evaluation processes. The requirements for each are stated below, for wastes to be managed as LLW (DOE M 435.1, II.B):

- (1) **Citation.** Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the description included in the Notice of Proposed Rulemaking (34 FR 8712) for proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of reprocessing plant operations, such as, but not limited to: contaminated job wastes including laboratory items such as clothing, tools, and equipment.
- (2) **Evaluation.** Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations. Such wastes may include, but are not limited to, spent nuclear fuel reprocessing plant wastes that:
 - (a) Will be managed as low-level waste and meet the following criteria:
 1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
3. Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

For those wastes determined to be WIR by the citation process, no considerations other than DOE LLW disposal requirements are appropriate for establishing the PA time for compliance because such wastes are unquestionably DOE LLW and should be disposed accordingly.

However, for waste determined to be WIR by the evaluation process, the potential applicability of requirements and guidance for NRC-licensed LLW disposal should be considered.

For WIR waste that will be managed as LLW, DOE requires that the waste be disposed to meet performance objectives comparable to those for NRC-licensed LLW waste. A previous study²⁴ showed that the performance objectives of DOE 435.1 are comparable to those of 10 CFR Part 61¹¹. Nuclear Regulatory Commission guidance indicates that PA calculations should be carried out for 10,000 years and beyond except for intruder analysis¹⁰. For NRC-licensed LLW disposal, PAs do not need to analyze the intruder pathway at all if the disposal facility can demonstrate that it complies with requirements for stabilizing Class B&C wastes and provides an intruder barrier for Class C waste^{10,11,14}.

There are presently three LLW disposal facilities for NRC-licensed LLW operating in the United States. One is in Barnwell, SC, one is on the Hanford reservation near Richland, WA, and one is the Envirocare facility in Utah. The Barnwell and Richland NRC-licensed LLW disposal facilities have PAs through the respective States' permits since SC and WA are NRC Agreement States. The PA for the Richland, WA facility uses 10,000 years as the time for compliance²⁵. The PA for the Barnwell, SC facility spans 2,000 years; SCDHEC apparently requested that the calculations be carried out for 1,000 years to encompass "the 500-year compliance period" and "the 1,000-year sensitivity analysis period"²⁶. The Envirocare facility included PA-type calculations in its license application, which covered a period of "several thousand years"²⁷.

Therefore, for WIR waste managed as LLW at SRS, the time for compliance could be assumed to be 10,000 years to be consistent with NRC guidance or, it could be assumed to be 1,000 years to be consistent with DOE 435.1 and SCDHEC requirements for the Barnwell disposal facility. However, Section 3.3 shows that the PA for WIR waste managed as LLW at Hanford uses 1,000 years as the time for compliance. This precedent indicates that DOE WIR waste managed as LLW should conform to DOE requirements rather than NRC guidance. Additionally there is no requirement for WIR waste managed as LLW to conform to NRC guidance.

3.5 Regulation by Nuclear Regulatory Commission

It is possible that regulation of DOE LLW disposal will be transferred to the NRC. Since South Carolina is an agreement state, such regulation would be carried out by SCDHEC. As noted in Section 3.4, SCDHEC considers 1,000 years to be a sufficiently long time-frame for PA calculations.

Thus, changing to a 1,000-year time for compliance would not be inconsistent with regulation of SRS LLW disposal by SCDHEC (i.e., under agreement with NRC).

4.0 Analysis

For disposal of LLW regulated only by DOE (i.e., not complicated by being Waste Incidental to Reprocessing), the discussion above makes it clear that DOE has changed from a 10,000-year time for compliance to a 1,000-year time for compliance. DOE M 435.1 clearly states that the time for compliance is 1,000 years.

For disposal of Waste Incidental to Reprocessing, requirements and guidance for disposal of NRC-regulated LLW must be considered. However, disposal of DOE WIR waste at Hanford as LLW has established the precedent that such waste is properly disposed of per DOE requirements. In other words, performance assessments of DOE WIR waste disposed as LLW at DOE sites should use 1,000 years as the time for compliance.

Regulation of SRS LLW disposal by the NRC (i.e., by SCDHEC) would likely not require a time for compliance of more than 1,000 years.

5.0 Recommendation

I recommend that, for all SRS LLW disposal facilities (i.e., ELLWF and Saltstone), and for all PA analyses (i.e., for the all-pathways, air pathway, radon emanation, water resources protection, and inadvertent intruder analyses), results of calculations at 1,000 years be used to establish compliance with DOE performance objectives and requirements. For all PA analyses except the inadvertent intruder analysis, the calculations should be carried out to determine the maximum impact regardless of the time at which the maximum occurs, per DOE guidance for sensitivity/uncertainty analysis.

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