

Staff Response to Discussion Points in the July 22, 2013, Advisory Committee on Reactor Safeguards Letter on Revisions to Low-Level Radioactive Waste Disposal Requirements (10 CFR Part 61)

In a letter dated July 22, 2013, the Advisory Committee on Reactor Safeguards (ACRS) provided the following four conclusions and recommendations on the U.S. Nuclear Regulatory Commission (NRC) staff's draft proposed revisions to the low-level radioactive waste disposal requirements in 10 CFR Part 61:

1. The proposed rule significantly expands the regulatory requirements for the licensing of low-level waste facilities and increases regulatory burden without sufficient justification.
2. The ACRS's primary concerns about the proposed changes to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61 are the requirements to demonstrate compliance for 10,000 years and protection of the inadvertent intruder.
3. The ACRS plans to hold additional meetings to better understand the technical justification for the elements of concern in the proposed rule.
4. Previously disposed wastes should not be subjected to additional compliance evaluations as proposed by the staff.

The ACRS provided four discussion points in support of its recommendations and conclusions, which are repeated below and accompanied by NRC staff's responses.

ACRS Discussion Point 1: The ACRS agrees with the need for requirements and strategies to protect from inadvertent intrusion. However, there are very large uncertainties about human intrusion scenarios for periods long after the cessation of institutional controls. Analysis of the durability of the measures chosen to provide intrusion protection (i.e., depth of disposal, barriers, waste form stability), as well as long-term stability of the site, should be considered sufficient to demonstrate compliance with the 10 CFR 61.42 performance objective for protection from inadvertent intrusion.

NRC Staff Response: Although the NRC staff agrees that an analysis of the durability of measures chosen to provide intrusion protection, as well as long-term stability of the site, may be important in demonstrating compliance with the 10 CFR 61.42 performance objective, an evaluation of the source term is also important in determining sufficient controls to protect potential intruders. Without the source term, the site-specific required properties of an intruder barrier, for example, cannot be determined, and instead the NRC would need to prescribe requirements for an engineered barrier that may be overly conservative or too liberal for some sites or source terms. The NRC staff's recommended use of an integrated site-specific approach using generic scenarios to limit speculation of exactly what future human activities could occur allows the use of a risk-informed performance based analysis to be used in the decision making process. This approach is consistent with the NRC's Safety Goal Implementation Strategies item 6 in NUREG-1614, Volume 5, "Strategic Plan: Fiscal Years 2008–2013." Performance based analyses would allow a licensee to determine what controls are important, such as the long-term durability of engineered barriers, and to take credit for those barriers. While barriers may be one way to meet the requirements of the performance

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objectives, other measures could be implemented (such as a limited source term) — so long as the measures employed assure that the performance objectives are met.

ACRS Discussion Point 2: Introducing significant uncertainties to the performance analyses through speculation on human activities, waste and site performance, and earth processes for millennia is unlikely to improve either the decision making process or the understanding of the safety decisions regarding near surface low-level radioactive waste (LLW) disposal.

NRC Staff Response: The NRC staff agrees that uncertainties in a performance analysis will increase as the time period being evaluated increases. However, the performance assessment and intruder assessment that would be required by the proposed rulemaking are not intended to be risk assessments (i.e., they are not calculating human risk even though they calculate a dose). Instead they are assessment methods, using “dose” as a surrogate, to evaluate relative risk and the degree of isolation of the waste to minimize future problems at the sites. As stated in International Commission on Radiological Protection (ICRP) Publication 103, “...dose estimates should not be regarded as measures of health detriment beyond times of around several hundred years into the future. Rather, they represent indicators of the protection afforded by the disposal system...”¹ The approach recommended by the staff in the draft proposed rulemaking is meant to constrain the societal uncertainties by using reasonably conservative receptor scenarios. The current regulation, in 10 CFR 61.42, states that the inadvertent intruder must be protected at any time in the future. By providing a 10,000-year compliance period for the performance and intruder assessments, the NRC staff is reducing ambiguity and ensuring compatibility within the Agreement State programs.

ACRS Discussion Point 3: Current regulations permit disposal of limited quantities and concentrations of long-lived radionuclides in near surface land disposal facilities. For example, three types of licensing decisions in the records of the NRC address disposal of uranium. These are uranium mill tailing remedial actions under 10 CFR Part 40, disposals approved under 10 CFR 20.2002, and license terminations under 10 CFR 20, Subpart E. The analyses supporting these decisions used a period of 1,000 years regarding the protection of individuals from the radioactive material. Additionally, the U.S. Department of Energy (DOE) evaluates the disposal of uranium and other low-level wastes using similar evaluation methodologies (a performance assessment and intruder analysis) for a time of compliance of 1,000 years.

NRC Staff Response: The NRC regulations for approval of proposed disposal procedures in 10 CFR 20.2002, the radiological criteria for license termination in Subpart E to 10 CFR Part 20, and the criteria relating to the disposition of uranium and thorium mill tailings in Appendix A to 10 CFR Part 40 use a 1,000-year analysis timeframe to evaluate compliance with the regulations. However, the purpose and objectives of these analyses are different from those found in 10 CFR Part 61. The 10 CFR Part 20 and 40 requirements deal with limited quantities and concentrations of uranium and other wastes. As discussed with the Committee, the fact that uranium is present in each system does not mean that the rules address equivalent conditions. An analysis for residual radioactivity remaining at a decommissioned facility under 10 CFR Part 20 evaluates a situation where the material being evaluated is already in the environment rather than isolated from the environment as it would be in a disposal facility

¹ ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4).

licensed according to the regulations in 10 CFR Part 61. Therefore, the peak doses usually occur within a 1,000-year period (and frequently immediately at license termination). Because the requirements in Part 20 address residual radioactivity at decommissioning facilities, concentrations of uranium rarely exceed 0.05% by weight of uranium and often a licensee may be required to remove contamination to even lower concentration levels of uranium to meet the dose limits within the regulations. Evaluations under 10 CFR Part 40, Appendix A, involve low concentrations of uranium found in large volumes of uranium mill tailings and other byproduct material. In the current 10 CFR Part 61, disposal of uranium is not limited by either concentration or a predetermined inventory. For the large amounts of waste from uranium enrichment processes, there can be upwards of 50% by weight uranium – this is a much greater concentration than evaluated under the regulations referenced in Parts 20 and 40.

DOE, in Order 435.1, requires its disposal facilities to evaluate site performance using a 1,000-year analysis timeframe. DOE provides the basis for their approach in Appendix A to DOE Order 435.1, noting that its use of a 1,000-year analysis timeframe is consistent with NRC's practice. However, this rationale is linked to the regulations in 10 CFR Part 61 which do not currently specify an analysis timeframe, and were originally developed in the early 1980's from an analysis that evaluated impacts to 10,000 years. Also, in 2000, NRC staff developed guidance recommending a 10,000-year analysis timeframe for LLW performance assessments.

The NRC staff's recommended compliance period of 10,000 years is consistent with the licensing basis and original technical analyses used to establish the requirements in 10 CFR Part 61. An evaluation using a 10,000-year timeframe will provide a more comprehensive analysis of the ability of both the site (engineered) and natural system performance to isolate short and long-lived waste. This is in contrast to using a 1,000-year analysis timeframe, which will provide a reduced analysis of the natural system and connection to the longer-term performance associated with long-lived waste. This comparison is discussed in greater detail in the Regulatory Basis document (Agencywide Documents Access and Management System Accession No. ML12356A242). Further, this approach is consistent with NRC's regulatory philosophy of defense-in-depth that relies on multiple independent and redundant layers of defense so that no single layer, no matter how robust, is exclusively relied upon. This is a common practice in NRC regulatory programs and used to mitigate uncertainties especially when uncertainties are large. The 10,000-year analysis timeframe, along with a two-tier compliance period², is also consistent with the requirements in 10 CFR Part 63. Similar societal uncertainties that exist with respect to LLW disposal also apply to high-level waste disposal. Finally, several of the operating commercial LLW disposal facilities were licensed using analysis timeframes exceeding 1,000 years. Longer analysis timeframes, including beyond 10,000 years, did not prevent those facilities from being successfully licensed.

ACRS Discussion Point 4: The NRC staff stated that the four Performance Objectives, 10 CFR 61.41 through 61.44, have been consistently applied since promulgation of 10 CFR Part 61, and there are now 30 years of LLW disposal approved under these current

² 10 CFR Part 63 contains a two-tier compliance period of 10,000 years extending out to one million years.

Performance Objectives. Previously disposed wastes should not be subjected to additional compliance evaluations.

NRC Staff Response: The objective of the proposed revisions is to ensure protection of the public and potential intruders from both existing waste inventories and potential future inventories authorized for disposal after promulgation of the regulations. As staff noted in its presentation to the Committee, different analysis timeframes have been used in the licensing of the four operating commercial LLW disposal facilities (ranging from 500 to 50,000 years). In addition, although the 10 CFR 61.42 states that the inadvertent intruder must be protected at any time in the future, some stakeholders have assumed that protection would necessarily be afforded by the 10 CFR 61.55 waste classification tables even if the radiological source term is substantially different from that used to develop the tables — which is incorrect. Protection of an inadvertent intruder is ensured through performing an intruder assessment and limiting potential doses to the intruder.

Currently, the regulations in 10 CFR Part 61 require a disposal facility to provide the results of analyses pertinent to the long-term containment of emplaced waste within the disposal site prior to site closure; these analyses would include the entire inventory in order to demonstrate compliance with the performance objectives. The draft proposed rule does not change that requirement, although it does explicitly identify the technical analyses required in 10 CFR 61.13, and specifies a timeframe for the analyses that does not exist in the current rule. The explicit intruder assessment would be a new requirement; however, the assessment would allow disposal facility licensees to consider comingled waste and actual site conditions. In addition, to use a waste acceptance criteria approach, the total capacity of a disposal facility must be determined. This means the impacts from past disposals must be estimated and subtracted from the overall capacity.