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**Draft Regulatory Analysis for Proposed Rule:  
Low-Level Radioactive Waste Disposal  
(10 CFR Part 61)**

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**U.S. Nuclear Regulatory Commission**

**Office of Nuclear Material Safety and Safeguards**

**Division of Material Safety, State, Tribal, and  
Rulemaking Programs**

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## Executive Summary

The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations that govern low-level radioactive waste (LLRW) disposal facilities to require new and revised site-specific technical analyses and to permit the development of criteria for LLRW acceptance based on the results of these analyses. These amendments would ensure that LLRW streams that are significantly different from those considered during the development of the current regulations (i.e., depleted uranium and other unanalyzed waste streams) can be disposed of safely and meet the performance objectives for land disposal of LLRW. These amendments would also increase the use of site-specific information to ensure performance objectives are met that are designed to provide protection of public health and safety.

These amendments would:

- Revise the existing technical analysis for protection of the general population to include a 1,000-year compliance period.
- Add a new site-specific technical analysis for the protection of inadvertent intruders that would include a 1,000-year compliance period and a dose limit.
- Add new analyses that would include a 10,000-year protective assurance period and annual dose minimization target.
- Add a new analysis for certain long-lived LLRW that would include a post-10,000-year performance period.
- Add new analyses that would identify and describe the features of the design and site characteristics that provide defense-in-depth protection.
- Add a requirement to update the technical analyses at closure.
- Add a new requirement to develop site-specific criteria for the acceptance of LLRW for disposal, based on either the results of these technical analyses or the existing LLRW classification requirements.

Additionally, the NRC is proposing amendments to facilitate implementation and better align the requirements with current health and safety standards. This rule would affect LLRW disposal licensees or license applicants that are regulated by the NRC or the Agreement States.

This regulatory analysis examines the benefits and costs of the proposed requirements. The key findings of the analysis are as follows:

- **Cost to the Industry.** The proposed rule would result in an average undiscounted implementation cost per licensee of an estimated \$1,000,000, followed by an estimated undiscounted annual cost of \$4,000 per licensee. Overall, the industry will incur an estimated undiscounted implementation cost of \$4.0 million, followed by an estimated annual cost of \$16,000.
- **Cost to the Agreement States.** The proposed rule would result in additional costs to the Agreement States with all costs resulting from implementation. On average, each Agreement State would incur an estimated undiscounted implementation cost of \$525,000. Overall, the Agreement States will incur an estimated undiscounted implementation cost of \$2.1 million.

- **Cost to the NRC.** The NRC would incur an implementation cost for drafting and implementing a final rulemaking based on the proposed rule. This undiscounted cost is estimated to be \$333,000. Because the NRC does not have any LLRW disposal licensee, no annual NRC cost is expected. The NRC would also incur an estimated undiscounted implementation cost of \$216,000 for drafting a final guidance document based on the final rule.
- **Decision Rationale.** The NRC considered two alternatives, one in which the NRC takes no rulemaking action, and the second alternative that consists of three periods of analysis. The NRC selected alternative two. Alternative two results in a net overall cost; however, the rule does have many unquantifiable benefits. Although the NRC could not quantify the benefits of this rule, the agency did examine its benefits qualitatively. These include both the direct benefits that would accrue and the indirect benefits from risks that could be avoided if the NRC adopted the rule. The principal qualitative benefits of the proposed action would include: 1) ensuring that LLRW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely and meet the performance objectives for land disposal of LLRW without the need of future rulemakings to address those different streams on a case-by-case basis; 2) facilitating the use of site-specific information and up-to-date dosimetry methodology in site-specific technical analyses to better ensure public health and safety is protected; and 3) promoting a risk-informed regulatory framework that specifies what requirements need to be met and provides flexibility to a licensee or applicant with regard to what information or approach they use to satisfy those requirements. The waste acceptance criteria should also allow licensees to dispose of material more “risk efficiently” which is likely to reduce costs. In addition, being able to dispose of the depleted uranium waste stream is likely to be a revenue generator for the licensees and the State’s (through taxes) as well as decreasing the storage costs of the Department of Energy and uranium enrichment facilities. The NRC concluded that the rule is cost-justified because the proposed regulatory initiatives enhance public health and safety by ensuring the safe disposal of LLRW that was not analyzed in the original 10 CFR Part 61 regulatory basis (e.g., large quantities of depleted uranium).

## Abbreviations

|         |   |
|---------|---|
| ADAMS   | Agencywide Documents Access and Management System |
| CFR     | <i>Code of Federal Regulations</i>                |
| BLS     | Bureau of Labor Statistics                        |
| FTE     | Full-time equivalent                              |
| LLRW    | Low-level radioactive waste                       |
| mrem/yr | millirem per year                                 |
| mSv/yr  | millisieverts per year                            |
| NRC     | U.S. Nuclear Regulatory Commission                |
| OMB     | Office of Management and Budget                   |

## 1. Statement of the Problem and Objectives for Rulemaking

The NRC adopted licensing requirements for the disposal of commercial LLRW in land disposal facilities in 1982 (47 FR 57446). The proposed amendments would revise Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61 to require LLRW disposal licensees and license applicants to conduct site-specific analyses and permit the development of criteria for LLRW acceptance based on the results of these analyses. These amendments would ensure that LLRW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely and meet the performance objectives for land disposal of LLRW. These amendments would also increase the use of site-specific information to ensure that public health and safety is protected.

The NRC developed the current 10 CFR Part 61 regulations based on assumptions from a survey of LLRW generators regarding the types of LLRW likely to go into a commercial disposal facility.<sup>1</sup> The results of this survey formed the regulatory basis for the source terms used in the analysis to define the allowable isotopic concentration limits in Tables 1 and 2 of the current 10 CFR 61.55, "Waste classification," which established three classes of LLRW (Class A, Class B, and Class C) that are suitable for near-surface disposal. Tables 1 and 2 of 10 CFR 61.55 provide limiting concentrations for long-lived radionuclides and limiting concentrations for short-lived radionuclides, respectively.

Low-level radioactive waste streams generated by the U.S. Department of Energy, including large quantities of depleted uranium, were not considered in the original analysis to determine the concentration limits in Tables 1 and 2 of 10 CFR 61.55. LLRW streams from commercial uranium enrichment facilities and blended LLRW, which might result in large quantities of material near the upper bounds of an LLRW class, also were not considered. Further, new technologies might result in the future generation of different LLRW streams not evaluated when the current 10 CFR Part 61 regulations were developed. Thus, if LLRW differs significantly in quantity and concentration from what was considered in the development of the current 10 CFR Part 61, then it might be possible to dispose of LLRW that meets the disposal requirements but results in an intruder dose (if calculated) that exceeds the dose limit used to develop the LLRW classification tables (i.e., 5 milliSieverts per year (mSv/yr) (500 millirem per year (mrem/yr))).

### 1.1 Background

The regulations place emphasis on an integrated systems approach to the disposal of commercial LLRW, including site selection, disposal facility design and operation, minimum waste form requirements, and disposal facility closure. To reduce reliance on institutional controls, 10 CFR Part 61 emphasizes passive, rather than active, systems to limit and retard the release of LLRW to the environment. This integrated systems approach is similar to the defense-in-depth concept that has been well known for some time for the NRC's nuclear reactor safety design and licensing activities. However, defense-in-depth is not explicitly discussed in

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<sup>1</sup> NRC, "Final Environmental Impact Statement on 10 CFR Part 61, 'Licensing Requirements for Land Disposal of Radioactive Waste,'" NUREG-0945, Vols. 1-3, November 1982, Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML052590184, ML052920727, and ML052590187.

the existing 10 CFR Part 61 regulations. Currently, the defense-in-depth concept is implicitly contained in 10 CFR Part 61 regulations (e.g., requiring that the disposal site design complement and improve upon the ability of the site's natural characteristics to ensure the performance objectives will be met; imposing concentration limits on waste that presents a higher hazard through the waste classification requirements; requiring the segregation of unstable waste from waste that presents a larger hazard and should be stable for proper disposal; imposing requirements on wastefrom and packaging characteristics; and requiring the use of barriers to intrusion for wastes that will not decay to levels which present an acceptable hazard to an intruder within 100 years).

The regulations at 10 CFR Part 61, Subpart C, contain performance objectives, which set standards for a) 10 CFR 61.41, "Protection of the general population from releases of radioactivity;" b) 10 CFR 61.42, "Protection of individuals from inadvertent intrusion;" c) 10 CFR 61.43, "Protection of individuals during operations;" and d) 10 CFR 61.44, "Stability of the disposal site after closure." License applicants under 10 CFR Part 61 must prepare an assessment of potential dose impacts to the general population to demonstrate that they will meet the 10 CFR Part 61, Subpart C performance objectives. License applicants must also demonstrate adequate protection of potential inadvertent intruders into the LLRW disposal facility, who might occupy the site at any time after institutional controls over the LLRW disposal facility are removed and are unaware of the radiation hazard from the LLRW. Currently, licensees demonstrate protection of inadvertent intruders by complying with the LLRW classification (10 CFR 61.55) and segregation requirements (10 CFR 61.52, "Land disposal facility operation and disposal site closure,") and by providing adequate barriers to inadvertent intrusion.

Explicit dose limits for an inadvertent intruder are not currently provided in 10 CFR Part 61 because an intruder dose assessment is not required, but the concentrations limits for radionuclides, in Tables 1 and 2 of 10 CFR 61.55, were based on a dose of 5 millisieverts/year (mSv/yr) (500 millirem/year [mrem/yr]) to an inadvertent intruder. The final LLRW classification tables were developed assuming that only a fraction of the LLRW being disposed would approach the LLRW classification limits (Note that the dose to an intruder exposed to a large volume of disposed LLRW at the classification limits could exceed 5 mSv/yr (500 mrem/yr)). By complying with the LLRW classification and segregation requirements, a licensee can demonstrate that an inadvertent intruder will be protected if the LLRW stream proposed for disposal is sufficiently similar to that considered by the regulatory basis for the current 10 CFR Part 61 regulations and if the underlying assumptions are not compromised.

Currently, 10 CFR Part 61 does not specify a time period<sup>2</sup> for the protection of the general population from releases of radioactivity. The regulatory basis for 10 CFR Part 61 regulations and the related guidance documents recognize the need to use an analysis timeframe commensurate with the persistence of the hazard. Selection of an analysis timeframe generally considers the characteristics of the LLRW, the analysis framework (assumed scenarios, receptors, and pathways), societal uncertainties, uncertainty in predicting the behavior of natural systems over time, and national and international LLRW disposal practices. The analysis

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<sup>2</sup> Different terminology has historically been used to refer to the timeframe assessed for regulatory compliance or other analyses including "performance period," "time of compliance," "compliance period," and other variants.

timeframe needs to consider both technical factors (e.g., the characteristics and persistence of the radiological hazard attributed to the LLRW) and socioeconomic factors (e.g., transgenerational equity).<sup>3</sup> The purpose of assigning an analysis timeframe to the site-specific technical analyses is to ensure that public health and safety are protected to prescribed limits with an acceptable degree of confidence. Proposing a specific analysis timeframe in the regulations would ensure the safe disposal of LLRW by providing clear direction to licensees, license applicants, and the Agreement States.

The NRC's existing criteria for LLRW acceptance can be found in Subpart D of 10 CFR Part 61, which specifies technical requirements for land disposal facilities for commercial LLRW. The technical requirements specify the classes and characteristics of LLRW that are acceptable for near-surface disposal, as well as other requirements. Currently, 10 CFR 61.55 provides the primary criteria related to LLRW acceptance and identifies the classes of LLRW acceptable for near-surface disposal (i.e., the LLRW classification system). Section 61.56, "Waste characteristics," identifies minimum characteristics for all classes of LLRW and characteristics to ensure the stability of certain LLRW (i.e., Class B and Class C). Additionally, 10 CFR 61.52, "Land disposal facility operation and disposal site closure," specifies requirements for near-surface LLRW disposal facility operation, including segregation and intruder barrier requirements for various classes of LLRW. Section 61.58, "Alternative requirements for waste classification and characteristics," currently allows for other provisions for the classification and characteristics of LLRW on a case-by-case basis if, after evaluation, the Commission finds reasonable assurance of compliance with the Subpart C performance objectives.

## **2. Identification of Alternative Approaches**

The following discussion describes the two alternatives being considered in this regulatory analysis, with additional analysis presented in Section 3.

### **2.1 Alternative 1: No-Action**

Alternative 1, the no-action alternative, would maintain the regulations as written. Under this option, the NRC would not modify 10 CFR Part 61. The rules would continue to provide no performance period analyses requirements, no specified compliance period, no new intruder assessment or performance assessment requirements, no dose limit for the inadvertent intruder, no updated compliance and performance period analyses, and no LLRW acceptance plan. Alternative 1 would avoid the costs that the proposed rule revisions would impose, but would not update the existing LLRW disposal requirements to ensure the current level of protection for public health and safety. This alternative is equivalent to the status quo and serves as a baseline to measure against the other alternative.

### **2.2 Alternative 2: Three periods of analysis.**

Under Alternative 2, the NRC would ensure the safe disposal of LLRW by amending 10 CFR Part 61. The proposed amendments would require LLRW disposal facility licensees and license

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<sup>3</sup> ICRP, "Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste," ICRP Publication 81, Annals of the ICRP, Vol. 28, No. 4, ICRP Publication 81, 2000.

applicants to prepare new and updated site-specific technical analyses to demonstrate compliance with 10 CFR Part 61, Subpart C performance objectives.

The proposed changes introduce period analyses to 10 CFR Part 61. These proposed period analyses are broken down into three tiers (see figure 1). The first period of analyses, termed the compliance period, starts at the site closure and extends out to 1,000 years. The second period of analyses, termed the protective assurance period, starts 1,000 years after site closure and extends to 10,000 years after site closure. The last period of analyses, termed the performance period, starts after 10,000 years from site closure.

Figure 1.

|              |                                     |  |  |
|--------------|-------------------------------------|--|--|
|              | <b>Performance Period:</b>          | No Dose Limit  | No Dose Limit  |
| 10,000 Years |                                     |  |  |
|              | <b>Protective Assurance Period:</b> | 500 mrem/yr Annual Dose                                | 500 mrem/yr Annual Dose                                  |
| 1,000 Years  |                                     |  |  |
|              | <b>Compliance Period:</b>           | 25 mrem/yr Dose Limit                                  | 500 mrem/yr Dose Limit                                   |
| Site Closure |                                     |  |  |
|              |                                     | <b>Protection of general population (10 CFR 61.41)</b> | <b>Protection of inadvertent intruder (10 CFR 61.42)</b> |

This rulemaking would require LLRW disposal licensees or license applicants to prepare:

- An updated performance assessment to demonstrate the protection of the general population from releases of radioactivity (proposed 10 CFR 61.41) during the compliance and protective assurance periods.
- A new intruder assessment to demonstrate the protection of inadvertent intruders (proposed 10 CFR 61.42) during the compliance and protective assurance periods.
- A new performance period analysis to evaluate how the disposal system could mitigate the risk from disposal of long-lived LLRW (proposed 10 CFR 61.13(e)).

- A new analysis that would identify and describe the features of the design and site characteristics that provide defense-in-depth protection for all periods of analysis (proposed 10 CFR 61.13(f)).
- A new LLRW acceptance plan for shipments of LLRW (proposed 10 CFR 61.58), to provide greater assurance of compliance with the performance objectives of Subpart C in 10 CFR Part 61, and to ensure safe disposal of LLRW that was not analyzed in the original 10 CFR Part 61 regulatory basis (e.g., large quantities of depleted uranium).

Licensees would also be required to provide updated compliance, protective assurance, and performance period analyses with the application to amend the license for closure (proposed 10 CFR 61.28).

### Compliance and Protective Assurance Periods

The regulations at 10 CFR 61.41 contain the performance objective requiring licensees to protect the general population from releases of radioactivity. The performance assessment required by the proposed revisions to 10 CFR 61.41 and 61.13(a) would identify and evaluate the specific characteristics of the disposal site; degradation, deterioration, or alteration processes of the engineered barriers and natural system; and interactions between the site characteristics and engineered barriers that might affect the performance of the disposal system. The proposed three-tier approach for this assessment is an important additional technical parameter for these analyses over existing requirements and is significant when evaluating LLRW streams that were not considered in the original 10 CFR Part 61 rulemaking. The requirement to prepare a performance assessment is a risk-informed approach that provides flexibility to a licensee or applicant regarding what information or approach they may use to satisfy those requirements. The NRC believes that the proposed approach is warranted because of the site-specific nature of LLRW disposal, which can rely on different facility designs at different sites.

Currently, 10 CFR 61.42 does not require a site-specific technical analysis to demonstrate the protection of an inadvertent intruder. Instead, the safety of an inadvertent intruder is demonstrated by compliance with the LLRW classification system and the disposal requirements imposed for each class of LLRW. The connection between the LLRW classification system and protection of an inadvertent intruder is reflected in the LLRW classification tables in 10 CFR 61.55(a). The proposed revisions to 10 CFR 61.42 and 61.13(b) would require an inadvertent intruder assessment that quantitatively estimates the radiological exposure of an inadvertent intruder at a LLRW disposal facility following an assumed loss of institutional controls. The results of the inadvertent intruder assessment would then be compared to the performance objective in 10 CFR 61.42. The inadvertent intruder assessment would have to identify the intruder barriers, examine the capability of the barriers, and address the effects of uncertainty on the performance of the barriers. The capabilities of the barriers to inhibit contact with the disposed LLRW or to limit the radiological exposure of an inadvertent intruder and the time period over which the capability persists must be demonstrated with an intruder assessment. Proposed 10 CFR 61.42 would also include a proposed annual dose limit of 5 mSv/yr (500 mrem/yr) during the compliance period, which would ensure that the dose limit that provided the basis for the 10 CFR 61.55 LLRW classification tables (i.e., 5 mSv/yr (500-mrem/yr)), is not exceeded. The NRC proposed amendments to 10 CFR 61.42 to ensure

protection of any inadvertent intruder who occupies the disposal site or contacts the LLRW at any time after active institutional controls are removed.

The current 10 CFR 61.44 includes a performance objective for disposal site stability after closure. It states that 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. To demonstrate, with a reasonable assurance, that the 10 CFR 61.44 performance objective will be met, licensees must conduct site stability analyses. The NRC proposes to modify 10 CFR 61.44 to clarify that stability of the disposal site must be demonstrated for the compliance and protective assurance periods.

Currently, the defense-in-depth concept is implicitly contained in 10 CFR Part 61 regulations. The NRC believes that multiple layers of defense must each make a definite contribution to the isolation of the waste, so that the NRC may find, with reasonable assurance, that the land disposal facility will be able to achieve the overall safety objectives over timeframes of hundreds to thousands of years. Therefore, the NRC is now proposing to require additional analyses in proposed 10 CFR 61.13(f) to ensure that the land disposal facility includes defense-in-depth protections in their site-specific technical analyses.

#### The Performance Period

The current 10 CFR Part 61 regulations developed a system of analyses, LLRW classification, site-selection, LLRW characteristics, and other requirements to ensure protection of public health and safety. Impacts, regardless of timeframes, were expected to be assessed by licensees or license applicants. The need for a licensee or applicant to perform performance period analyses (after 10,000 years) was eliminated when NRC developed LLRW classification limits for long-lived radionuclides. The regulatory system was designed with the intent to ensure that short- and long-term impacts were limited by regulatory requirements such as the LLRW classification system. To account for the current and future changes to the waste inventory, the performance period analyses in proposed 10 CFR 61.13(e), "Technical analyses," would require licensees or license applicants to prepare performance period analyses (after 10,000 years) that assess how the LLRW disposal facility and site characteristics limit the potential long-term radiological impacts, consistent with available data and current scientific understanding. The analyses are proposed to only be required for land disposal facilities with long-lived LLRW that contains radionuclides with average concentrations exceeding the values listed in proposed Table A of 10 CFR 61.13(e), "Average Concentrations of Long-lived Radionuclides Requiring Performance Period Analyses," or if necessitated by site-specific conditions. The proposed amendment to 10 CFR 61.13(e) would evaluate any additional measures that are needed at a disposal site, including the defense-in-depth protections, to ensure the protection of the general population and the inadvertent intruder from disposal of long-lived LLRW.

#### Site specific waste acceptance criteria

The NRC is also proposing to amend 10 CFR 61.58, along with a new title "Waste acceptance," to require LLRW disposal licensees or license applicants to develop criteria for the acceptability of shipments of LLRW for disposal. These amendments maintain the existing LLRW classification system, but permit licensees or license applicants to account for facility design, disposal practices, and site characteristics to determine if LLRW would be acceptable for

disposal. Under the proposed 10 CFR 61.58(f), licensees are also required to conduct an annual review of the LLRW acceptance plan to determine if they need to be updated to ensure that the LLRW disposal facility complies with the Subpart C performance objectives. Because licensees or license applicants are permitted to develop site-specific LLRW acceptance criteria rather than rely on the LLRW classification system for acceptance criteria under the proposed LLRW acceptance amendments, the NRC is also proposing to amend Appendix G of 10 CFR Part 20, "Standards for Protection Against Radiation," to conform to the proposed requirements for LLRW acceptance.

#### New requirements for license amendments and site closure

Currently, 10 CFR 61.28, "Contents of application for closure," requires LLRW disposal licensees to submit an application to amend their license for closure. This application must include: a) a final revision and specific details of the disposal site closure plan, and b) an environmental report or a supplement to an environmental report. This section currently does not include site-specific technical analyses.

The proposed rule would require licensees to update site-specific technical analyses and the LLRW acceptance plan, as would be required by proposed 10 CFR 61.13(e), 10 CFR 61.13(f), 10 CFR 61.41, 10 CFR 61.42, and 10 CFR 61.58, to ensure that the LLRW disposal facility complies with the Subpart C performance objectives.

Section 5 discusses the reasons for choosing Alternative 2.

### **3. Estimation and Evaluation of Benefits and Costs**

This section describes the analysis that the NRC conducted to identify and evaluate the benefits and costs of the two regulatory alternatives. Section 3.1 describes how the benefits and costs were analyzed. Section 3.2 presents the assumptions of the analysis. Section 3.3 identifies the entities expected to be affected by the proposed rulemaking. Section 3.4 identifies the attributes expected to be affected by the proposed rulemaking.

#### **3.1 Analytical Methodology**

This section describes the methodology used to analyze the consequences associated with the proposed rule. The methodology for a regulatory analysis is specified by various guidance documents. The two documents that govern the NRC's voluntary regulatory analysis process are NUREG/BR-0058, Revision 4, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," dated September 2004 (RA Guidelines), and NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," dated January 1997 (RA Handbook). In addition, the methodology is in accordance with guidance from the Office of Management and Budget (OMB), Circular A-4. Based on OMB guidance, present-worth calculations are presented using both 3-percent and 7-percent real discount rates. The real discounted rates or present-worth calculation determines how much society would need to invest today to ensure that the designated dollar amount is available in a given year in the future. By using present-worth calculations, costs and benefits, regardless of time, are valued equally. The 3-percent rate approximates the real rate of return on long-term government debt which serves as a proxy for the real rate of return on savings. This rate is appropriate when the primary effect of the regulation is on private consumption. Alternatively, the 7-percent rate approximates the

marginal pretax real rate of return on an average investment in the private sector, and is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. Current trends in the marketplace have provided returns on investments well below the 3 percent and 7 percent discount rates, which OMB Circular No. A-4 is based. The NRC is providing a zero discount rate (e.g., undiscounted values) as a further sensitivity analysis. The NRC is reporting the undiscounted costs as part of the sensitivity analysis based on current market trends and future predictions. The regulatory analysis identifies all attributes related to the regulatory action and analyzes them either quantitatively or qualitatively. For the quantified regulatory analysis, the NRC staff developed expected values for each cost and benefit. First for each alternative, the staff determined the cost and benefit, and then discounted the consequences in future years to the current year of the regulatory action. Finally, the NRC staff summed the costs and the benefits for each alternative and compared them.

After performing the quantitative regulatory analysis, the NRC staff addressed attributes that could only be evaluated qualitatively. The proposed rule includes changes that affect attributes in a positive but not easily quantifiable manner. For example, the attribute of public health (accident) would be enhanced by the changes made in requirements for intruder assessment such as in proposed 10 CFR 61.42, but it is difficult to assign a number to this benefit.

The benefits include any desirable changes in the affected attributes. The costs include any undesirable changes in affected attributes.

The NRC collected input assumptions using data and information from NRC staff experience, NRC documents, and other related documents.

## **3.2 Assumptions**

The NRC assumes the following for the purpose of this regulatory analysis:

### **3.2.1 General assumptions**

- The NRC assumes the final rule will be published in calendar year 2016. Because all four affected licensees are Agreement States' licensees and the Agreement States are allowed 3 years to develop conforming regulations, the NRC is assuming that the rule will not be implemented by licensees until calendar year 2019.<sup>4</sup>
- For this regulatory analysis, the proposed analyses costs are included in the implementation cost and are discounted to 2014 dollars when applicable. For this regulatory analysis, the NRC assumes the initial analyses are completed during 2019, any updated analyses required at license renewal are completed in 2024, and any analyses required at site closure are completed in 2029.
- The NRC calculates benefits and costs over a 10-year analysis period, discounted at a 7-percent and 3-percent discount rate and expressed in 2014 dollars. This allows

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<sup>4</sup> NRC, "Adequacy and Compatibility of Agreement States Program," Directive 5.9, February 1998, ADAMS Accession No. ML041770094.

the analysis to capture cost associated with both proposed renewal of license changes and site closure.

### 3.2.2 Site-specific technical analysis assumptions

- Currently, three of the four existing LLRW disposal facilities are subject to a 5-year license renewal period. One of the four existing LLRW disposal facilities just initiated its 15-year initial licensing period. Because most facilities are currently subject to a 5-year license renewal, for the purpose of this analysis, the NRC assumes that all license renewals will occur at 5 years and that the licensees will update their technical analyses as part of the renewal. Although a licensee is expected to update their technical analyses prior to accepting any new, previously unanalyzed waste streams, for the purposes of this analysis, the NRC assumes new waste streams are only introduced at the time of renewal.
- To determine the analysis which impacts a given facility, the NRC assumes for the purpose of this analysis, two of the four LLRW disposal facilities will accept only LLRW streams with short-lived radionuclides or limited concentrations of long-lived radionuclides and will only be required to do analyses for the compliance and protective assurance periods. The remaining two facilities are assumed to accept, in addition to the short-lived LLRW streams, LLRW streams with long-lived radionuclides in sufficient quantities and concentrations and so would be required to also do analyses for the performance period. These assumptions are based on information received from the Agreement States and NRC documents indicating two of the four existing LLRW disposal facilities have expressed an interest in accepting large quantities of long-lived LLRW. One existing LLRW disposal facility indicated that it would not accept more long-lived LLRW, and one existing LLRW disposal facility has not made its intentions known.
- OMB Circular A-4, recommends that the time frame for analysis should cover a period long enough to encompass all the important benefits and costs likely to result from the rule. This analysis covers a 10-year timeframe that the NRC feels is sufficient to encompass all the important costs included in this proposed rulemaking. To capture the facility closure costs in this analysis, the NRC assumes that all four LLRW disposal facilities will close 10 years after the rule becomes effective in the Agreement States. The costs associated with LLRW disposal facility closures are included in the implementation cost and are discounted.
- The NRC assumes that all four licensees would update their LLRW acceptance plans to meet the requirements of the proposed 10 CFR 61.58. Because NRC regulations already require a site stability analysis, the NRC does not anticipate any additional cost to the licensee resulting from the changes to 10 CFR 61.44.

### 3.2.3 Labor rate and full-time equivalent (FTE) assumptions

- The NRC's labor rates are determined using the methodology in Abstract 5.2, "NRC Labor Rates," of NUREG/CR-4627, "Generic Cost Estimates, Abstracts from Generic Studies for Use in Preparing Regulatory Impact Analyses." This methodology

considers only variable costs (including salary and benefits) that are directly related to the development, implementation, and continuing support of the proposed amendments. Currently, the NRC hourly labor rate is \$121, including all benefits. The estimation of costs for rulemaking is based on professional NRC FTE, without administrative staff support. Based on data from the NRC's time and labor system, the number of hours in 1 year that directly relate to a professional staff's implementation of assigned duties is 1,375; excluding hours such as leave, training, and completing administrative tasks. Therefore, an NRC professional staff FTE hourly rate is based on 1,375 hours. The NRC labor rate for one FTE is \$166,375.

- As described in the OMB Circular A-76, "Performance of Commercial Activities," the number of productive hours in 1 year is 1,776. As this actual value is likely to vary from State to State and no specific data are available, the FTE costs for the States and licensees are based on the number of hours estimated in OMB Circular A-76.
- The NRC staff determined Agreement State labor rates using National Wage Data available on the Bureau of Labor Statistics (BLS) web site ([www.bls.gov](http://www.bls.gov)). Because exact hourly rates for each state vary from State to State, nationwide mean hourly rates are used. Also, the exact rulemaking burden varies from State to State depending, among other things on the mix of different professional skills and administrative support required. For review of licensee documents, the NRC estimates \$31.54/hour, using the BLS Employer Costs for Employee Compensation data set for "Environmental Scientist." These rates are multiplied by 1.5 to account for items such as pension, insurance, overhead, and other legally-required benefits. For the development and review of site-specific technical analyses and LLRW acceptance plans associated with this proposed rulemaking, the NRC uses a labor rate of \$47.31/hour, 1.5 times the \$31.54 hourly rate from the BLS's employer cost data set for a state government "Environmental Scientist."
- Licensee labor rates were also obtained from Bureau of Labor Statistics National Wage Data available on the BLS web site. The NRC selected an appropriate mean hourly labor rate depending on the listed industry and the occupation (e.g., manufacturing, health and safety, etc.) and multiplying by 1.5 to account for pension, insurance, and other legally-required benefits. Because exact licensee hourly rates can vary significantly, the NRC used nationwide mean hourly rates. For the development of site-specific technical analyses and LLRW acceptance plans associated with this proposed rulemaking, \$49.62/hour is used ( $\$33.08 \times 1.5$ ), which is from the BLS employer cost data set for an "Environmental Scientist" in the private sector.

#### 3.2.4 Licensee and Agreement State effort assumptions:

- This analysis assumes two cost scenarios for these licensees. In scenario 1, the licensee accepts only LLRW streams with short-lived radionuclides, and, therefore, is required to conduct only compliance and protective assurance period analyses. These analyses include: 1) a performance assessment required by the proposed 10 CFR 61.41; 2) an intruder assessment required by the proposed 10 CFR 61.42; 3) defense-in-depth analyses required by proposed 10 CFR 61.13(f); and 4) a LLRW

acceptance plan required by proposed 10 CFR 61.58. The licensee or license applicant would also be required to conduct updated compliance and protective assurance period analyses with the application to amend the license for closure as required by proposed 10 CFR 61.28. In addition, the licensee is required to update its compliance and protective assurance period analyses and LLRW acceptance plan, as part of an operating license amendment. The NRC assumes that two licensees follow this scenario.

- In scenario 2, the licensee or license applicant would accept, in addition to the LLRW streams with short-lived radionuclides, LLRW with long-lived radionuclides and would therefore have to conduct a performance period analyses required by the proposed 10 CFR 61.13(e). Similar to scenario 1 licensees, the scenario 2 licensees would also be required to amend the license for closure as required by proposed 10 CFR 61.28, but in addition to updating the compliance and protective assurance period analyses, these licensees would also have to update their performance period analyses. The NRC assumes that in addition to updating their compliance and protective assurance period analyses, these licensees would also be required to conduct an updated performance period analysis and LLRW acceptance plan as part of an operating license amendment. The NRC assumes that two licensees follow this scenario.
- The analysis also assumes two cost scenarios for the Agreement States. An Agreement State regulating a licensee that falls under cost scenario 1 incurs costs to review its licensee's compliance and protective assurance period analyses and LLRW acceptance plan. These reviews would include: 1) a performance assessment required by the proposed 10 CFR 61.41; 2) an intruder assessment required by the proposed 10 CFR 61.42; 3) defense-in-depth analyses required by proposed 10 CFR 61.13(f); and 4) an initial LLRW acceptance plan required by proposed 10 CFR 61.58. An Agreement State would also review updated compliance and protective assurance period analyses with the application to amend the license for closure. In addition, the Agreement State also incurs costs to review its licensee's updated compliance and protective assurance period analyses and LLRW acceptance plan, as part of an operating license amendment. The NRC assumes that two Agreement States follow this scenario.
- An Agreement State regulating a licensee that falls under cost scenario 2 also incurs costs to review, in addition to its licensee's compliance and protective assurance period analyses and LLRW acceptance plan: 1) the performance period analyses as required by the proposed 10 CFR 61.13(e); 2) the performance period defense-in-depth analyses required by proposed 10 CFR 61.13(f); and 3) the updated performance period analyses as required by proposed 10 CFR 61.28 to be included with the application to amend the license for closure. In addition, the Agreement State also incurs costs to review its licensee's updated performance period analyses (and the other analyses that require updates during license amendment in scenario 1) and LLRW acceptance plan, as part of an operating license amendment. The NRC assumes that two Agreement States follow this scenario.

- The NRC assumes that the bulk of a licensee's development and an Agreement State's review costs would occur during development of the technical analyses for the compliance period. The scope of the analyses for the protective assurance period is assumed to be similar to the analyses for the compliance period, though the importance of some features, events, and processes may differ between the two periods. As a result, development and review costs for the performance assessments for the protective assurance and performance periods are assumed to be significantly lower than those costs related to the compliance period.
- The NRC assumes that a licensee expends twice the estimated effort developing all analyses provided below than the Agreement State expends reviewing the licensee's analyses. This estimated cost associated with developing analyses includes all computer modeling and programming.
- The NRC assumes that a licensee incurs 8,880 hours (five FTE) developing the compliance and protective assurance period analyses and 1,776 hours (one FTE) developing the performance period analyses.
- The NRC assumes that a licensee, when renewing their license or submitting their closure application, will expend 3,552 hours (two FTE) developing the updated compliance and protective assurance period analyses and 888 hours (0.5 FTE) developing the updated performance period analyses.
- The NRC assumes that a licensee expends 1,776 hours (one FTE) developing the initial LLRW acceptance plan.
- The NRC assumes that a licensee when renewing their license incurs 888 hours (0.5 FTE) developing the updated LLRW acceptance plan.
- The NRC assumes that a licensee incurs 40 hours annually reviewing LLRW acceptance plan.
- The NRC assumes that the estimated effort for an Agreement State to review a licensee's compliance and protective assurance period analyses is 4,440 hours (2.5 FTE) and the estimated effort for an Agreement State to review the licensee's performance period analyses is 888 hours (0.5 FTE).
- The NRC assumes that the estimated effort for an Agreement State to review a licensee's updated compliance and protective assurance period analyses is 1,776 hours (1 FTE) and the estimated effort for an Agreement State to review the licensee's updated performance period analyses is 444 hours (0.25 FTE).
- The NRC assumes that the estimated effort for an Agreement State to review a licensee's LLRW acceptance plan is 888 hours (0.5 FTE) and the estimated effort for an Agreement State to review a licensee's license renewal updated LLRW acceptance plan is 444 hours (0.25 FTE).

### 3.3 Affected Entities

The affected entities are those entities that could be impacted from any of the alternatives. Currently, no new LLRW disposal facility is expected to be built during the regulatory analysis period. The affected entities are four licensees located in four separate Agreement States. The affected entities (Agreement State licensees and Agreement States) are the following:

- a) The four existing LLRW disposal licensees are:
  1. EnergySolutions at Clive, Utah
  2. US Ecology, Inc., at Richmond, Washington
  3. Waste Control Specialists LLC at Andrews, Texas
  4. EnergySolutions at Barnwell, South Carolina
  
- b) The four existing Agreement States are:
  1. Utah
  2. Washington
  3. Texas
  4. South Carolina

### 3.4 Identification of Affected Attributes

This section identifies the factors within the public and private sectors that the proposed rule is expected to affect, using the list of potential attributes provided in Chapter 5 of the RA Handbook, and in Chapter 4 of the RA Guidelines. The evaluation considered each attribute listed in Chapter 5 of RA Handbook. The basis for selecting those attributes is presented below.

Affected attributes include the following:

- Licensee Implementation--The proposed changes require a licensee to develop: 1) compliance and protective assurance period analyses, which include a performance assessment (proposed 10 CFR 61.41), an intruder assessment (proposed 10 CFR 61.42), and the defense-in-depth analyses (proposed 10 CFR 61.13(f)); 2) the performance period analyses (proposed 10 CFR 61.13(e)) if long-lived LLRW is present; and 3) a LLRW acceptance plan (proposed 10 CFR 61.58). The licensee is also required to provide updated compliance, protective assurance, and performance period analyses with the application to amend the license for closure (proposed 10 CFR 61.28). In addition, the proposed changes in 10 CFR 61.28 also require a licensee to conduct updated compliance, protective assurance, and performance period (if applicable) analyses, and LLRW acceptance plan, as part of a license amendment or renewal. The proposed changes associated with 10 CFR 61.28 are included in implementation cost and are discounted to 2014 dollars.
  
- Licensee Operation--The proposed changes require a licensee to conduct an annual review of the LLRW acceptance plan as required under the proposed

10 CFR 61.58(f). In addition, licensees are also required to keep records under proposed 10 CFR 61.80(m).

- Agreement State Implementation--An Agreement State incurs costs to develop its conforming regulations to the 10 CFR Part 61 final rules. The proposed changes would also require an Agreement State to review its licensee's: 1) compliance and protective assurance period analyses, which include a performance assessment (proposed 10 CFR 61.41), an intruder assessment (proposed 10 CFR 61.42), and the defense-in-depth analyses (proposed 10 CFR 61.13(f)); 2) performance period analyses (proposed 10 CFR 61.13(e)) for those sites with long-lived LLRW; and 4) LLRW acceptance plan (proposed 10 CFR 61.58). The Agreement State is also required to review its licensee's updated compliance, protective assurance, and performance period analyses with the application to amend its license for closure (proposed 10 CFR 61.28). In addition, this proposed rule requires an Agreement State's licensee to conduct an update to its compliance, protective assurance, and performance period (if applicable) analyses, and LLRW acceptance plan, as part of a license amendment; this would also require that an Agreement State incur the cost of reviewing these amendments. The proposed changes associated with 10 CFR 61.28 are included in implementation cost and are discounted to 2014 dollars.
- NRC Implementation--Under the proposed action, the NRC develops the proposed and final rule packages to be published in the *Federal Register*. The NRC also develops an implementation guidance document to support the requirements that would be added or modified by the rulemaking process.
- Other Consideration—Under the proposed action, licensees would be permitted to consider LLRW streams, including large quantities of depleted uranium, which were not considered during development of the current rule. Also, LLRW streams from commercial uranium enrichment facilities and blended LLRW would be considered. New technologies could result in future generation of different kinds of LLRW streams to be developed. The proposed rule would allow industry to dispose of an increased variety of waste without compromising safety.
- Public Health (Accident)--The proposed rule requires new site-specific technical analyses to ensure that an inadvertent intruder, who occupies the site and might unknowingly be exposed to radiation from disposed LLRW, will be better protected. These analyses must demonstrate there is reasonable assurance that any inadvertent intruder will not be exposed to doses that exceed the performance objectives set forth in proposed 10 CFR 61.40.

Attributes that are not affected include the following: Agreement State operations, NRC operations, public health (routine), general public, regulatory efficiency, occupational health (routine), occupational health (accident), off-site property, on-site property, environmental considerations, antitrust considerations, safeguards and security considerations, and improvement in knowledge.

## 4. Presentation of Results

This section presents the results of the alternatives. Table 4-1 summarizes the costs of Alternative 2 by entity over the 10-year regulatory analysis period.

### 4.1 Alternative 1: No action

By definition, the No-Action Alternative, the baseline for the main analysis, does not result in any change of benefits or costs. The baseline assumes full compliance with current NRC requirements.<sup>5</sup>

### 4.2 Alternative 2: Rulemaking to amend 10 CFR Part 61

Alternative 2 is divided into four sections: licensee costs, including implementation and operation costs; Agreement State implementation costs; NRC implementation costs; and public health (accident).

#### 4.2.1 Licensees:

This analysis assumes that four separate licensees would incur costs for implementation and operation because of the rulemaking. Unless stated otherwise, each cost is incurred by all four licensees. Licensees could incur costs by the following impacts:

##### 4.2.1.1 Licensee Implementation:

##### Initial analyses forecasted to be conducted in year 2019.

- a) Conducting compliance and protective assurance period analyses.

Proposed 10 CFR 61.13(f), 10 CFR 61.41, and 10 CFR 61.42 require a licensee to conduct compliance and protective assurance period analyses, which include the defense-in-depth analyses, a performance assessment, and an intruder assessment, respectively. The NRC estimates that the costs for each licensee to conduct its compliance and protective assurance period analyses would equal 8,880 hours (five FTE). Thus, the estimated total cost, to conduct the technical analysis is \$440,600 per licensee and the total estimated cost to the industry is \$1,762,400.

- b) Conducting performance period analyses.

Proposed 10 CFR 61.13(e) requires a licensee to conduct performance period analyses. This requirement is assumed to impact two of the four affected licensees. The NRC estimates that the costs for each licensee to conduct the initial performance period analyses would be equal to 1,776 hours (one FTE). Therefore, the estimated cost to

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<sup>5</sup> NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," the NRC's staff guidance for regulatory analyses, states that, "in evaluating a new requirement...the staff should assume that all existing NRC requirements have been implemented."

conduct the initial performance period analyses is \$88,125 per licensee and the total estimated cost to industry is \$176,250.

- c) Development of LLRW acceptance plan.

Proposed 10 CFR 61.58 requires a licensee to develop a LLRW acceptance plan that impacts four licensees. The licensee's cost of developing a LLRW acceptance plan is estimated to be 1,776 hours (one FTE) for a total cost of \$88,125 per licensee and the total estimated cost to the industry is \$352,500.

Updated analyses required at licensee renewal forecasted to be conducted in year 2024.

- d) Updating of the compliance and protective assurance period analyses during facility operations.

To ensure compliance with the Subpart C performance objectives, proposed 10 CFR 61.13(f), 10 CFR 61.41, and 10 CFR 61.42 requires a licensee to update its compliance and protective assurance period analyses, including the defense-in-depth analyses, a performance assessment, and an intruder assessment, respectively. This would demonstrate that Subpart C would be met during the 10,000-year compliance and protective assurance period. This analysis assumes that each licensee would conduct this update during the fifth year of the regulatory analysis period. The NRC estimates that the costs for the updated compliance and protective assurance period analyses would require 3,552 hours (two FTE), or approximately \$176,250 per licensee with the total approximate cost to industry of \$705,000.

- e) Updating of the performance period analyses during facility operations.

To ensure compliance with the Subpart C performance objectives, proposed 10 CFR 61.13(e) requires licensees to update their performance period analyses. This impacts the two licensees that are assumed to accept long-lived LLRW. This analysis assumes that each licensee would conduct this update during the fifth year of the analysis period. The NRC estimates that each licensee's updated performance period analysis would require 888 hours (0.5 FTE), or approximately \$44,000 with the total approximate cost to industry of \$88,000.

- f) Updating of the LLRW acceptance plan during facility operations.

Proposed 10 CFR 61.58 ensures compliance with the Subpart C performance objectives by requiring licensees to update their LLRW acceptance plans. This analysis assumes that each licensee would conduct this update during the fifth year of the regulatory analysis period. The NRC estimates that each LLRW acceptance plan update would require 888 hours (0.5 FTE), or approximately \$44,000 per licensee with the total cost to industry of approximately \$176,000.

Updated analyses required at facility closure forecasted to be conducted in year 2029.

- g) Update of compliance and protective assurance period analyses with the application to amend the license for closure.

Proposed 10 CFR 61.28 requires a licensee to update its compliance and protective assurance period analyses, which include the defense-in-depth analyses, a performance assessment, and an intruder assessment, with the application to amend the license for closure. The NRC assumes that each licensee will conduct the analysis during the tenth year of the regulatory analysis period. The NRC estimates that the costs for each licensee to conduct its updated compliance period analyses would be 3,552 hours (two FTE), or approximately \$176,250 per licensee and the total estimated cost to the industry is approximately \$705,000.

- h) Updating of the performance period analyses with the application to amend the license for closure.

Proposed 10 CFR 61.28 also requires a licensee to update its performance period analyses, which would include an intruder analysis, with the application to amend the license for closure. This impacts the two licensees that are assumed to accept long-lived LLRW. The NRC assumes that each licensee will conduct the analysis during the tenth year of the regulatory analysis period. The NRC estimates that these updated performance period analyses would require 888 hours (0.5 FTE), or approximately \$44,000 per licensee and the total cost to the industry is approximately \$88,000.

#### 4.2.1.2 Licensee Operation:

- a) Conducting annual reviews of LLRW acceptance plan during facility operations.

Proposed 10 CFR 61.58(f) requires a licensee to review its LLRW acceptance plan annually to determine whether an update would be needed. The NRC estimates that each annual review of a LLRW acceptance plan would require 40 hours (0.02 FTE), or approximately \$2,000 per licensee with a total annual cost to the industry of approximately \$8,000.

- b) Recordkeeping requirements.

Proposed language for 61.80(m) requires licensees to maintain records of their audits and other reviews of program content and implementation. The NRC estimates that each recordkeeping effort would require 40 hours (0.02 FTE), or approximately \$2,000 per licensee with a total annual cost to the industry of approximately \$8,000.

#### **4.2.2 Agreement States:**

The NRC assumes that four licensees would locate their LLRW disposal facilities in four different Agreement States and the Agreement State also incurs costs as a result of this rulemaking. Unless stated otherwise, each cost is incurred by all four Agreement States. The impacts on the Agreement States are as follows:

##### 4.2.2.1 Agreement State Implementation:

- a) Conducting rulemaking and guidance documents.

The Agreement States' staff develops the rule packages and procedures to accommodate the requirements that would be added or modified by the rulemaking process. The effort to develop the rule package is estimated to require 888 hours (0.5 FTE) for each Agreement State. This would result in a total cost of approximately \$42,000 cost per Agreement State with a total cost for the Agreement States of approximately \$168,000.

Initial analyses review forecasted to be conducted in year 2019.

- b) Reviewing compliance and protective assurance period analyses.

Proposed 10 CFR 61.13(f), 10 CFR 61.41, and 10 CFR 61.42 require an Agreement State to review its licensee's compliance and protective assurance period analyses and impacts four Agreement States. The NRC estimates that the costs for each Agreement State to review its licensee's initial compliance and protective assurance period analyses would be 4,440 hours (2.5 FTE). This cost is estimated to be approximately \$220,000 per Agreement State with a total cost for the Agreement States of approximately \$880,000.

- c) Reviewing performance period analyses.

Proposed 10 CFR 61.13(e) will result in the Agreement State needing to review its licensee's performance period analyses and impacts two Agreement States. The NRC estimates that the costs for each Agreement State to review its licensee's performance period analyses would be 880 hours (0.5 FTE), or approximately \$42,000 per Agreement State with a total cost for the Agreements States of approximately \$84,000.

- d) Reviewing the LLRW acceptance plan.

Proposed 10 CFR 61.58 will result in the Agreement State needing to review its licensee's LLRW acceptance plan and impacts four Agreement States. The Agreement State's cost for reviewing its licensee's LLRW acceptance plan is estimated to be 888 hours (0.5 FTE) for a total cost of approximately \$42,000 per Agreement State with a total cost for the Agreement States of approximately \$168,000.

Updated analyses review required at licensee renewal forecasted to be conducted in year 2024

- e) Reviewing updated compliance and protective assurance period analyses during facility operations.

Proposed 10 CFR 61.13(f), 10 CFR 61.41, and 10 CFR 61.42, will result in an Agreement State needing to review its licensee's updated compliance and protective assurance period analyses to ensure compliance with the Subpart C performance objectives. Each Agreement State reviews the updated performance and protective assurance period analyses during the fifth year of the regulatory analysis period. The NRC estimates that each Agreement State's review of its licensee's updated compliance period analyses would require 1,776 hours (1 FTE), or approximately \$84,000 per Agreement State with a total Agreement States cost of approximately \$336,000.

- f) Reviewing updated performance period analyses during facility operations

To ensure each licensee's compliance with the Subpart C performance objectives under proposed 10 CFR 61.13(e), each Agreement State will need to review its licensee's updated performance period analyses. This impacts the two Agreement States that have licensees accepting long-lived LLRW. Each affected Agreement State reviews the updated performance period analyses during the fifth year of the regulatory analysis period. The NRC estimates that each of these Agreement State reviews would require 444 hours (0.25 FTE), or approximately \$21,000 with a total Agreement States cost of approximately \$42,000.

- g) Reviewing updated LLRW acceptance plan.

To ensure compliance with the Subpart C performance objectives under proposed 10 CFR 61.58, an Agreement State is required to review its licensee's updated LLRW acceptance plan. Each Agreement State reviews the updated LLRW acceptance plan during the fifth year of the regulatory analysis period. The NRC estimates that each Agreement State would require 444 hours (0.25 FTE), or approximately \$21,000 per Agreement State with a total Agreement States cost of approximately \$84,000.

Updated analyses review required at facility closure forecasted to be conducted in year 2029.

- h) Reviewing updated compliance and protective assurance period analyses with the application to amend the license for closure.

Proposed 10 CFR 61.28 will result in the Agreement State needing to review its licensees' updated compliance and protective assurance period analyses at facility closure. The NRC estimates that each Agreement State review of its licensee's updated compliance and protective assurance period analyses during the tenth year of the regulatory analysis period requires 1,776 hours (1 FTE), or approximately \$84,000 per Agreement State with a total cost for the Agreement States of approximately \$336,000.

- i) Reviewing updated performance period analyses with the application to amend the license for closure.

Proposed 10 CFR 61.28 will result in an Agreement State needing to review its licensee's updated performance period analyses with the application to amend the license for closure. This requirement affects the two Agreement States assumed to have licensees accepting long-lived LLRW for disposal during the tenth year of the regulatory analysis period. The NRC estimates that each Agreement State review of its licensee's updated performance period analyses would require 444 hours (0.25 FTE), or approximately \$21,000 per Agreement State with a total cost for the Agreement States of approximately \$42,000.

### **4.2.3 NRC:**

The four currently existing LLRW disposal facilities are located in Agreement States and are not regulated by the NRC.

#### **4.2.3.1 NRC Implementation:**

a) Conducting rulemaking:

The NRC incurs the costs of drafting the proposed and final rule. The estimated NRC effort required is 2,750 hours (2 FTE) to respond to comments, draft the proposed and final rule, and complete the rulemaking, for an estimated total cost of \$333,000.

b) Developing the implementing guidance document:

The NRC incurs the costs of drafting the draft and final implementing guidance documents. The NRC estimates the NRC effort is 1,787.5 hours (1.3 FTE), for an estimated total cost of \$216,000.

### **4.2.4 Public Health (Accident)**

The proposed rule requires new site-specific technical analyses to ensure that an inadvertent intruder, who occupies the site and might unknowingly be exposed to radiation from disposed LLRW, will be protected. These analyses must demonstrate there is reasonable assurance that any inadvertent intruder will not be exposed to doses that exceed the performance objectives set forth in proposed 10 CFR 61.40. Several of the proposed amendments would result in reducing the potential for radiation exposure to the public, but it is difficult to quantify the actual number in rems reduced.

### **4.2.5 Other Considerations**

Under the proposed action, licensees would be permitted to consider LLRW streams, including large quantities of depleted uranium, which are not currently considered. Also, LLRW streams from commercial uranium enrichment facilities and blended LLRW would be considered. New technologies could result in future generation of different kinds LLRW streams to be developed. The proposed rule would allow industry to dispose of an increased variety of waste without compromising safety. Several of the proposed amendments would increase operational flexibility for the licensees, but this benefit for the licensees is difficult to quantify.

### **4.2.6 Totals**

**Cost to the Industry.** The proposed rule would result in additional costs to the industry with the majority of the costs resulting from implementation. On average, each licensee would incur an estimated implementation cost of \$1,000,000 followed by an estimated annual cost of \$4,000. Overall, the industry will incur an estimated implementation cost of \$4 million, followed by an estimated annual cost of \$16,000.

**Cost to the Agreement States.** The proposed rule would result in additional costs to the Agreement States with all costs resulting from implementation. On average, each Agreement

State would incur an estimated implementation cost of \$525,000. Overall, the Agreement States will incur an estimated implementation cost of \$2.1 million.

Cost to the NRC. The NRC would incur an implementation cost for drafting and implementing a final rulemaking based on the proposed rule. This cost is estimated to be \$333,000. Because the NRC does not have any LLRW disposal licensee, no annual NRC cost is expected. The NRC would also incur an estimated implementation cost of \$216,000 for drafting a final guidance document based on the final rule.

**Quantitative Results: Total Present Value for the Cost**

Table 4-1 summarizes the implementation costs by entity, over a 10-year analysis period for Alternative 2. Table 4-1 dollars are rounded to nearest thousandth.

| Description      | One-time Implementation Costs undiscounted | One-time Implementation Costs discounted at 3% | One-time Implementation Costs discounted at 7% |
|------------------|--|--|--|
| Industry Costs   | \$4,054,000                                | \$3,521,000                                    | \$3,072,000                                    |
| Agreement States | \$2,101,000                                | \$1,847,000                                    | \$1,632,000                                    |
| NRC Costs        | \$549,000                                  | \$526,000                                      | \$497,000                                      |
| Total            | \$6,704,000                                | \$5,897,000                                    | \$5,209,000                                    |

Table 4-2 summarizes the annual costs by entity, over a 10-year analysis period for Alternative 2. Table 4-2 dollars are rounded to nearest thousandth.

| Annual Operating Costs | Annual Operating Costs undiscounted for 10-year period | Annual Operating Costs discounted at 3% for 10-year analysis period | Annual Operating Costs discounted at 7% for 10-year analysis period |
|------------------------|--|---|---|
| \$16,000               | \$159,000  | \$135,000   | \$112,000   |
| \$0                    | \$0  | \$0   | \$0   |
| \$0                    | \$0  | \$0   | \$0   |
| \$16,000               | \$159,000  | \$135,000   | \$112,000   |

Table 4-3 summarizes the combined Implementation and Annual costs by entity, over a 10-year analysis period for Alternative 2. Table 4-3 dollars are rounded to nearest thousandth

| Description      | Total combined Implementation and Annual Cost for 10-year period undiscounted | Total combined Implementation and Annual Cost for 10-year period at 3% discount rate | Total combined Implementation and Annual Cost for 10-year period at 7% discount rate |
|------------------|---|--|--|
| Industry Costs   | \$4,213,000   | \$3,657,000  | \$3,183,000  |
| Agreement States | \$2,101,000   | \$1,847,000  | \$1,632,000  |
| NRC Costs        | \$549,000   | \$526,000  | \$497,000  |
| Total            | \$6,863,000   | \$6,030,000  | \$5,312,000  |

#### 4.3 Benefits and Costs

This section presents the benefits and costs from the proposed rule. To the extent that the affected attributes can be analyzed quantitatively, the net effect of each alternative is calculated and presented below. However, some benefits and costs could be evaluated only on a qualitative basis.

Although the NRC did not quantify the benefits of this proposed rule, the agency did qualitatively examine the benefits. These include both the direct and indirect benefits that would accrue from risks that are avoided if the NRC adopted the rule. The qualitative benefits of the proposed action includes increased assurance that public health and safety would be protected from the disposal of LLRW and an improved regulatory structure that facilitates implementation and better aligns 10 CFR Part 61 requirements with current health and safety standards.

The proposed 1,000-year compliance period and 10,000-year protective assurance period are important additional technical parameter for these analyses over existing requirements and are significant when evaluating LLRW streams that were not considered in the original 10 CFR Part 61 rulemaking. Currently, there is ambiguity regarding how a compliance period should be selected by an Agreement State and what timeframes should be applied to the analysis supporting demonstration of compliance with different sections of the regulations. In addition, the proposed site-specific analyses use a risk-informed regulatory framework that specifies requirements that need to be met and provides flexibility to a licensee or applicant with regard to the information or approach used to satisfy those requirements. Also, proposed 10 CFR 61.42 would help ensure protection of any inadvertent intruder who occupies the disposal site or contacts the LLRW at any time after active institutional controls are removed; proposed 10 CFR 61.13(e) requires the evaluation of any additional measures that are needed at a disposal site, including the defense-in-depth protections, to ensure the protection of the general population

and the inadvertent intruder from disposal of long-lived LLRW; and proposed 10 CFR 61.58, when combined with the other revisions recommended for this rulemaking, provides reasonable assurance that public health and safety would be protected from the disposal of LLRW.

The waste acceptance criteria should also allow licensees to dispose of material more “risk efficiently” which is likely to reduce costs. In addition, being able to dispose of the depleted uranium waste stream is likely to be a revenue generator for the licensees and the States (through taxes) as well as decreasing the storage costs of the Department of Energy and uranium enrichment facilities.

Table 4-4 summarizes the results of the benefits and costs analysis. The rulemaking alternative results in additional costs when compared to the no-action alternative. The quantitative impact estimated of the rulemaking alternative is estimated to cost between approximately \$6.0 million and \$5.2 million (7-percent and 3-percent discount rate, respectively).

**Table 4-4 Summary of Benefits and Costs**

| Net Monetary Costs –<br>Total Present Value in Millions (\$)  | Nonmonetary Benefits/Costs  |
|---|---|
| <p><b>Alternative 1: No Action</b></p> <p>Licensee: 0<br/>NRC: 0</p>  | <p><u>Qualitative Benefits:</u> None</p> <p><u>Qualitative Costs:</u> None</p>  |
| <p><b>Alternative 2:</b></p> <p><u>Licensee:</u></p> <p>\$3.66M using a 3% discount rate<br/>\$3.18M using a 7% discount rate</p> <p><u>Agreement States:</u></p> <p>\$1.85M using a 3% discount rate<br/>\$1.63M using a 7% discount rate</p> <p><u>NRC:</u></p> <p>\$0.53M using a 3% discount rate<br/>\$0.50M using a 7% discount rate</p> <p><u>Total:</u></p> <p>\$6.0M using a 3% discount rate<br/>\$5.31M using a 7% discount rate</p> | <p><u>Qualitative Benefits:</u></p> <p>These amendments ensure that LLRW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely and meet the performance objectives for land disposal of LLRW.</p> <p>These amendments would facilitate the use of site-specific information and up-to-date dosimetry methodology to better ensure public health and safety is protected.</p> <p><u>Qualitative Costs:</u> None</p> |

## 5. Decision Rationale

This regulatory analysis evaluated two alternatives. Alternative 1, the no-action alternative, would maintain the regulations as currently written. Under this option, the NRC would not modify 10 CFR Part 61. The regulations at 10 CFR Part 61 would continue to provide no

performance period analyses requirements, no specified compliance and protective assurance periods, no new intruder assessment or performance assessment requirements, no dose limit for the inadvertent intruder, no updated compliance, protective assurance, and performance period analyses, and no LLRW acceptance plan. Alternative 1 avoids the costs that the proposed rule would impose, but would not update the existing LLRW disposal requirements to better ensure protection of public health and safety. Accepting the no-action alternative does not provide the assurance that the disposal of the LLRW streams not considered in the original 10 CFR Part 61 regulatory basis complies with the performance objectives in the regulations.

Alternative 2, the rulemaking alternative, would amend 10 CFR Part 61 by adding requirements for licensees and license applicants to prepare new and revised compliance, protective assurance, and performance period analyses. These analyses include: 1) a revised and renamed compliance period performance assessment and a new protective assurance period performance assessment to demonstrate the protection of the general population from releases of radioactivity, 2) a new compliance and protective assurance period intruder assessment to demonstrate the protection of inadvertent intruders, 3) the new defense-in-depth analyses to ensure that the land disposal facility includes defense-in-depth protections in their site-specific technical analyses, 4) new performance period analyses to determine whether limitations on the disposal of some LLRW streams at certain sites, including defense-in-depth protections, may be needed to properly manage the disposal of long-lived LLRW, and 5) a LLRW acceptance plan to provide assurance of compliance with the Subpart C performance objectives and to ensure the safe disposal of LLRW that was not analyzed in the original 10 CFR Part 61 regulatory basis (e.g., large quantities of depleted uranium). In addition, licensees and license applicants are required to update compliance, protective assurance, and performance period analyses in applications to amend a license for closure.

Requiring updated and new compliance, protective assurance, and performance period analyses to demonstrate compliance with the performance objectives better ensures the safe disposal of LLRW and provides assurance that the disposal of LLRW streams not considered in the original 10 CFR Part 61 regulatory basis comply with the Subpart C performance objectives. Further, these analyses may identify additional measures that should be implemented, and these amendments would facilitate implementation and better align the requirements with current health and safety standards. This rulemaking provides increased assurance that LLRW disposal meets the Subpart C performance objectives in 10 CFR Part 61. Therefore, the NRC staff recommends publishing the proposed rule for public comment.

## **6. Implementation**

Following the publication of the proposed rule and the draft regulatory guide, the staff would revise the proposed rule and draft regulatory guide in response to comments received, as necessary, and submit a draft final rule and draft final regulatory guide to the Commission in 2016.

## 7. References

- NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook, Final Report," U.S. Nuclear Regulatory Commission, Washington, DC, January 1997.
- NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," Revision 4, U.S. Nuclear Regulatory Commission, Washington, DC, September 2004.
- NUREG/CR-4627, "Generic Cost Estimates, Abstracts from Generic Studies for Use in Preparing Regulatory Impact Analyses."
- OMB Circular No. A-4, "Regulatory Analysis," September, 17, 2003.
- OMB Circular A-76 "Performance of Commercial Activities," May 29, 2003, as amended.
- Department of Labor (U.S.), Bureau of Labor Statistics. Occupational Employment Statistics, Occupational Employment and Wages.
- NRC, "Adequacy and Compatibility of Agreement States Program," Directive 5.9, February 1998.