Integrated Low-Level Radioactive Waste Disposal; Proposed Rule
Draft Regulatory Analysis for Comment

NRC-2011-0012; RIN 3150-AI92

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Rulemaking, Environmental, and Financial Support

[XXXX 2024]

ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste,” to require new and revised site-specific technical analyses and permit the development of site-specific criteria for low-level radioactive waste (LLW) acceptance based on the results of these analyses. This document presents the draft regulatory analysis prepared to support the proposed rule. To improve the cost estimates for this regulatory action, this analysis includes (1) an uncertainty analysis to consider the effects of input uncertainty on the cost estimate and (2) a sensitivity analysis to identify the variables that most affect the cost estimate (i.e., the cost drivers). Based on the NRC's assessment of the costs and benefits of the proposed rule, this analysis demonstrates that if the proposed requirements are issued in final format, the rule is justified.

CONTENTS

List of Figures

List of Tables

Abbreviations

10 CFR	Title 10 of the *Code of Federal Regulations*
AEA	Atomic Energy Act of 1954, as amended
AS	Agreement State
BLS	Bureau of Labor Statistics
CRGR	Committee to Review Generic Requirements
CY	calendar year
DOE	U.S. Department of Energy
DU	depleted uranium
EPA	U.S. Environmental Protection Agency
FEIS	final environmental impact statement
FR	*Federal Register*
GTCC	greater-than-Class C
HLW	high-level radioactive waste
LLW	low-level radioactive waste
LLWPAA	Low-Level Radioactive Waste Policy Amendments Act of 1985
m^3	cubic meter(s)
nCi/g	nanocurie(s) per gram
NPV	net present value
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982, as amended
OMB	Office of Management and Budget
PERT	program evaluation and review technique
SECY	Office of the Secretary of the Commission, U.S. Nuclear Regulatory Commission
SNM	special nuclear material
SRM	staff requirements memorandum
TCEQ	Texas Commission on Environmental Quality
TRU	transuranic (chemical elements with atomic numbers greater than 92, which is the atomic number of uranium, are referred to as transuranics)
WCS	Waste Control Specialists LLC
WIPP	Waste Isolation Pilot Plant
WVDP	West Valley Demonstration Project

Executive Summary

The NRC is proposing to amend its regulations that govern the land disposal of low-level radioactive waste (LLW) to require new and revised site-specific technical analyses and permit the development of site-specific waste acceptance criteria based on the results of these analyses. The NRC also proposes to authorize the near-surface disposal of certain Greater-Than-Class C (GTCC) waste streams and provide for Agreement State licensing of these waste streams. Licensees of currently operating LLW facilities that do not plan to accept GTCC or significant quantities of long-lived radionuclides after the effective date of this rulemaking would continue to comply with current regulations. The NRC is issuing for public comment draft implementing guidance with the proposed rule.

The proposed rule will affect LLW disposal licensees or license applicants that are regulated by the NRC or the Agreement States.

This regulatory analysis examines three alternatives: (1) the NRC takes no rulemaking action, (2) the NRC attempts to address the issues with guidance alone, and (3) the NRC addresses the issue through rulemaking, the proposed alternative. The NRC did not analyze alternative 2 quantitatively because issuing guidance alone would not resolve the regulatory problem and implement Commission direction.

This regulatory analysis examines the benefits and costs of the new and amended requirements, and makes the following key findings:

- Alternative 3: Conduct Rulemaking. The proposed rule would result in a cost beneficial change based on net (i.e., taking into account both costs and benefits) averted costs to the industry (including many government entities) that range from $136 million (7 percent discount rate) to $219 million (3 percent discount rate). The NRC would experience net costs that range from ($160,000) using a 7 percent discount rate to ($100,000) using a 3 percent discount rate. The cost estimate assumes Agreement State regulators would experience net costs that range from ($1.27 million) using a 7 percent discount rate to ($1.68 million) using a 3 percent discount rate. Table ES-1 shows the total costs and benefits to the industry, the Agreement State, and the NRC of proceeding with the proposed rule. The proposed rule would result in net averted costs to the industry, Agreement State, and the NRC ranging from $134 million using a 7 percent discount rate to $217 million using a 3 percent discount rate.

Table ES-1 Total Costs and Benefits for Alternative 3

Attribute	Costs		
	Undiscounted	7% NPV	3% NPV
Total Industry Costs:	($33,560,000)	($18,890,000)	($26,020,000)
Total NRC Costs:	($820,000)	($670,000)	($750,000)
Total Agreement State Costs:	($2,120,000)	($1,270,000)	($1,680,000)
Total:	($36,500,000)	($20,830,000)	($28,450,000)

Attribute	Benefits		
	Undiscounted	7% NPV	3% NPV
Total Industry Benefits:	$353,280,000	$154,580,000	$245,070,000

Total NRC Benefits:	$780,000	$510,000	$650,000
Total Agreement State Benefits:	$0	$0	$0
Total:	$354,060,000	$155,090,000	$245,720,000

Attribute	Net Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Net Industry:	$319,720,000	$135,690,000	$219,050,000
Net NRC:	($40,000)	($160,000)	($100,000)
Net Agreement State:	($2,120,000)	($1,270,000)	($1,680,000)
Net Total:	$317,560,000	$134,260,000	$217,270,000

*Values are rounded to the nearest $10,000. Totals between tables may differ due to rounding and modeling.
NPV = net present value

- Nonquantified Benefits. This regulatory analysis uses a conservative simplifying assumption for storage costs (averted costs), using only the costs for storing GTCC at the U.S. Department of Energy's West Valley Demonstration Project site in New York. Therefore, actual net averted costs would be much higher under the proposed rule. Many agencies (further described in section 4.2.2 Affected Entities) are storing GTCC, or GTCC-like wastes, or will be storing such wastes in the future, and will be able to use the NRC's regulations to dispose of those wastes. Additionally, the proposed rule would do the following:
  - Provide technical requirements for disposal of depleted uranium.
  - Facilitate the use of site-specific information and up-to-date dosimetry methodologies to better protect public health and safety.
  - Enable development of waste acceptance criteria from the results of the technical analyses, providing licensees flexibility to better manage disposal capacity and potentially allowing for additional revenue streams for disposal facility operators.
  - Allow licensees to dispose of material in a potentially more efficient manner, which is likely to reduce licensee costs.
  - Allow disposal facility operators to consider future waste streams for disposal in quantities or concentrations that may not have been considered previously.
  - Assist licensees in identifying the most relevant information to assess the safety of the current and continued disposal of LLW at their facilities, ensuring that LLW streams different from those considered during the development of the current regulations can be disposed of safely.
- Uncertainty Analysis. The regulatory analysis includes an uncertainty analysis that shows the estimated mean benefit for the proposed rule is $134 million using a 7 percent discount rate with greater than 99 percent confidence that the proposed rule is cost beneficial. A reasonable inference from the uncertainty analysis is that proceeding with the proposed rule represents an efficient use of resources and averted costs to the NRC and the industry.

1. Introduction

This document presents the draft regulatory analysis of the U.S. Nuclear Regulatory Commission's (NRC's) proposed rule amending its regulations that govern the land disposal of low-level radioactive waste (LLW). The NRC proposes to require new and revised site-specific technical analyses and to permit the development of site-specific criteria for LLW acceptance based on the results of these analyses. The NRC also is proposing to amend its regulations to authorize the near-surface disposal of Greater-Than-Class C (GTCC) waste streams and provide for Agreement State licensing of GTCC waste streams that meet the regulatory requirements for near-surface disposal and do not present a hazard such that the NRC should retain disposal authority. The proposed revisions will facilitate implementation and better align the requirements with current health and safety standards.

The NRC classifies LLW based upon its radiological hazard. Under its regulations in 10 CFR Part 61, the NRC currently categorizes LLW into three classes, namely Class A, Class B, and Class C, based on the radiological hazard as determined by the concentration and type of radionuclides prescribed for each class. In the NRC classification system, Class A waste is the least hazardous and Class C waste is the most hazardous. The United States currently has four operating LLW disposal facilities, located in (1) Barnwell, South Carolina, (2) Clive, Utah, (3) Richland, Washington, and (4) Andrews County, Texas. All four are regulated by their respective Agreement State, and all accept Class A, B, and C wastes, except the Utah facility, which only accepts Class A waste.

LLW that contains radionuclide concentrations exceeding the limits for Class C waste are referred to as GTCC waste. Some GTCC waste also contains radionuclides that are categorized as "special nuclear material" (SNM) (i.e., enriched uranium or plutonium).

The NRC's 10 CFR Part 61 regulations authorize the disposal of Class A, B, and C waste in land disposal facilities. Under the NRC's current regulations at 10 CFR 61.55, "Waste classification," GTCC waste must be disposed in a geologic repository unless the Commission approves a proposal for disposal of such waste in a land disposal facility licensed under 10 CFR Part 61. Currently, there is no land disposal facility licensed to accept GTCC waste.

The staff analyzed LLW issues in a draft regulatory basis "Disposal of Greater-than-Class C (GTCC) and Transuranic Waste," issued June 2019 (NRC, 2019), and SECY-16-0106, "Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-AI92)," dated September 15, 2016 (NRC, 2016a), and determined that many of the existing waste streams are potentially suitable for near-surface disposal and can be licensed by an Agreement State. In SRM-SECY-20-0098, "Staff Requirements—SECY-20-0098—Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings," dated April 5, 2020 (NRC, 2022), the Commission directed the staff to issue a new proposed rule that combines the efforts of both the regulatory basis on GTCC waste disposal and the draft final rule on LLW, resulting in the proposed rule provisions considered by this regulatory analysis. As part of this regulatory analysis, in Section 2.1.6 below, staff considered responses to its prior public solicitation of stakeholder views on broader and more fully integrated, but reasonably foreseeable, costs and benefits to the U.S. waste disposal system resulting from the proposed rule changes, including pass-through costs to waste generators and processors as directed in SRM-SECY-16-0106, "Staff Requirements - SECY-16-0106 – Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-AI92)" (NRC, 2017).

2. Background, Statement of the Problem, and Objective

2.1. Background

The following sections provide a summary of NRC regulatory actions on LLW, describe the current regulatory framework, and outline the issues that remain therein. For additional background, see the "Draft Regulatory Analysis for Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61)," issued August 2016 (NRC, 2016b), and the draft regulatory basis "Disposal of Greater-than-Class C (GTCC) and Transuranic Waste" (NRC, 2019).

2.1.1 Low-Level Waste

On December 27, 1982, the NRC promulgated its first comprehensive set of regulations for LLW disposal in 10 CFR Part 61. The NRC based the definition of "waste" upon Congress's definition of LLW at that time.

The 10 CFR Part 61 regulations also set forth definitions of the terms "land disposal facility" and "near-surface disposal facility" and distinguished these facilities for disposal of Class A, Class B, and Class C wastes from the geologic repository mandated by the Nuclear Waste Policy Act of 1982, as amended (NWPA) (U.S. Congress, 1983). The term "land disposal facility" is defined as "the land, building, and structures, and equipment which are intended to be used for the disposal of radioactive wastes"; the definition expressly excludes a geologic repository. The term "near-surface disposal facility," in turn, is defined as a type of land disposal facility, namely, one "in which radioactive waste is disposed of in or within the upper 30 meters of the earth's surface."

Under 10 CFR Part 61, the operational phase of a near-surface disposal facility involves the licensee's receipt of LLW, storage of LLW (typically, above ground or in an uncovered trench or other disposal unit before the trench or unit is permanently sealed), and disposal of LLW. Near-surface disposal methods can include burial in the form of trenches, engineered land disposal techniques (such as below-ground vaults), earth-mounded disposal units, and boreholes. After the licensed facility no longer accepts LLW for disposal, the site would need to be closed and stabilized.

The 10 CFR Part 61 regulations also include a series of performance objectives that licensees must meet. Specifically, Subpart C, "Performance Objectives," of 10 CFR Part 61 contains one general and four specific performance objectives for LLW land disposal facilities. The general performance objective, set forth in 10 CFR 61.40, "General requirement," states that "[l]and disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§ 61.41 through 61.44." The four specific performance objectives regulate the (1) protection of the general population from releases of radioactivity, (2) protection of individuals from inadvertent intrusion, (3) the protection of individuals during operation, and (4) stability of the disposal site after closure.

Section 61.55 defines the classes of LLW (i.e., Class A, Class B, and Class C) acceptable for near-surface disposal, with each class based on the concentrations of certain radionuclides. As prescribed by its 10 CFR Part 61 regulations, the NRC determined that Class A, Class B, and Class C waste streams are acceptable for "near-surface" disposal. Additional requirements in 10 CFR 61.52(a)(2) were placed on Class C waste, prohibiting disposal at shallow depths

(i.e., less than 5 meters below the top surface of the cover) unless an intruder barrier is used that prevents intrusion for 500 years.

2.1.2 Greater-Than-Class-C Waste

Radioactive waste that exceeds the concentration limits for Class C waste in the classification tables in 10 CFR Part 61 is referred to as "GTCC waste." The Commission first considered the concept of GTCC waste in a 1987 advance notice of proposed rulemaking (NRC, 1987) that defined high-level radioactive waste (HLW) without using the term "GTCC waste." The advance notice of proposed rulemaking sought public comment, and in the following year, the Commission issued a proposed rule (NRC, 1988). In that proposed rule, the Commission used the term "GTCC waste" and stated that it "proposes to require disposal of all GTCC wastes in a deep geologic repository unless disposal elsewhere has been explicitly approved by the Commission." The Commission further stated that its proposal would "obviate any need to reclassify certain GTCC wastes as HLW."

In 1989, the NRC issued a final rule (NRC, 1989) that adopted the substance of the regulatory approach identified in the 1988 proposed rule: that GTCC waste be disposed of in a geologic repository unless the Commission has approved an alternative disposal path to be licensed in accordance with 10 CFR Part 61. The statements of consideration for the 1989 final rule set forth the Commission's position that the disposal of GTCC waste in an intermediate disposal facility could be carried out under the Commission's regulations in 10 CFR Part 61 rather than under its regulations in 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories." In this regard, the Commission stated that because the term "land disposal facility" is "defined broadly (so as to include any facility other than a geologic repository), the reference to licensing under Part 61 is proper and in conformance with the existing regulatory structure."

GTCC waste is generated by nuclear power reactors and other supporting nuclear fuel cycle facilities as well as by facilities and licensees outside of the nuclear fuel cycle. GTCC waste can include: (1) plutonium-contaminated nuclear fuel cycle wastes, (2) activated metals, (3) sealed sources, and (4) radioisotope product manufacturing wastes (i.e., wastes occasionally generated as part of the manufacture of sealed sources, radiopharmaceutical products and other materials used for industrial, education, and medical applications). A distinction is made between GTCC waste generated by NRC licensees and Agreement State licensees (referred to as "commercial" GTCC waste) and DOE GTCC-like waste, as discussed below. Currently, there are no commercial land disposal facilities licensed to accept either GTCC or GTCC-like waste.

2.1.3 Statutes Relevant to Low-Level Radioactive Waste and Greater-Than-Class-C Waste Land Disposal

The first major legislative effort to resolve LLW disposal concerns was the Low-Level Radioactive Waste Policy Act (the 1980 Act) (Congress, 1980). The 1980 Act assigned responsibility for the disposal of commercial LLW generated within its borders. However, the 1980 Act was superseded in its entirety by the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLWPAA) (Congress, 1986). The LLWPAA provides a definition of LLW. To understand the definition of LLW, and the scope of radioactive waste in general, reference should also be made to the NWPA. The application of the LLWPAA and the NWPA results in a division of most radioactive waste into two broad categories, HLW and LLW. Under the NWPA, HLW is defined as the "highly radioactive material resulting from the reprocessing of spent nuclear fuel" and "other highly radioactive material that the [NRC], consistent with existing

law, determines by rule requires permanent isolation." An example of HLW, as classified by the NRC in its implementing regulations in 10 CFR 60.2 and 10 CFR 63.2, both titled "Definitions," is "irradiated reactor fuel." The NWPA requires that HLW be permanently disposed in a deep geologic repository.

The LLWPAA defines LLW as radioactive waste that is not HLW, spent fuel, or certain categories of byproduct material. Like the NWPA, the LLWPAA includes a provision allowing the Commission to classify other radioactive waste streams as LLW. The LLWPAA further revised the 1980 Act's definition of LLW to no longer exclude TRU waste from the statutory definition of LLW. The LLWPAA requires that the disposal of LLW result in the "permanent isolation" of the LLW. The principal objective of LLW disposal is the protection of public health and safety for long periods of time when the waste may remain hazardous, as the half-lives of some of the radionuclides that comprise LLW are on the order of thousands of years and longer.

Under the LLWPAA, a State is responsible for "providing, either by itself or in cooperation with other States, for the disposal" of LLW generated within the State that consists of or contains Class A, Class B, or Class C waste, except for that owned or generated by the DOE or the U.S. Navy (as a result of the decommissioning of Navy vessels), or federally owned or generated waste resulting from atomic weapons research, development, testing, or production. The LLWPAA directs that the Federal Government is responsible for regulating the disposal of GTCC waste streams and other federally owned or generated LLW streams. Further, the LLWPAA requires that all GTCC waste "that results from activities licensed by the Nuclear Regulatory Commission under the Atomic Energy Act of 1954, as amended (AEA) (Congress, 1954), shall be disposed of in a facility licensed by the Nuclear Regulatory Commission that the Commission determines is adequate to protect the public health and safety."

2.1.4 Transuranic Waste

The AEA defines TRU waste as "material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nanocuries per gram [nCi/g], or in such other concentrations as the [NRC] may prescribe to protect the public health and safety." Based on dose calculations, the U.S. Environmental Protection Agency's (EPA's) definition of TRU waste in 40 CFR 191.02, "Definitions," encompasses concentrations greater than 100 nCi/g of alpha-emitting TRU isotopes with half-lives greater than 20 years. The NRC has determined that several GTCC waste streams analyzed in DOE/EIS-0375, "Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste," issued January 2016 (FEIS) (DOE, 2016), contain TRU radionuclides that are long lived and exceed the limits for Class C waste as set forth in 10 CFR 61.55, table 1 (concentration not to exceed 100 nCi/g). Under the current 10 CFR Part 61 regulations, waste streams consisting of alpha-emitting TRU radionuclides with half-lives greater than 5 years and a concentration greater than 100 nCi/g are not considered to be generally acceptable for near-surface disposal.

The current 10 CFR 61.2 definition of "waste" excludes TRU waste. However, because the LLWPAA's definition of LLW does not expressly exclude TRU waste, the NRC in this rulemaking proposes to revise the definition of "waste" in 10 CFR 61.2 to include TRU waste.

2.1.5 Agreement State and U.S. Department of Energy Roles

This section discusses Agreement State licensing of GTCC waste disposal, the DOE's role, and potential limitations on Agreement State authority over specific quantities and types of

radioactive materials specified in the NRC's regulations with respect to criticality and physical security.

Agreement State Regulation of Greater-Than-Class-C Waste

Section 274 of the AEA provides a role for the States in the regulation of certain radioactive materials, authorizing the Commission to enter into an agreement with the Governor of a State whereby the Commission relinquishes some of its regulatory authority, which the State assumes. An Agreement State can assume authority for one or more of the following categories of materials within the State: (1) byproduct materials, (2) source materials, and (3) SNM in quantities not sufficient to form a critical mass. Generally speaking, Agreement States already have authority to license and oversee possession, use, and storage of radioactive materials that would be GTCC, but not for disposal. If the Commission ultimately approves a rulemaking allowing for the near-surface disposal of certain GTCC waste streams, then an Agreement State seeking to license and regulate facilities that can accept such GTCC waste streams will need to update its program to ensure that it has adequate and compatible legislation, regulations, licensing, inspection, staffing and training, enforcement, and incident response to support GTCC disposal. In SRM-SECY-15-0094, the Commission directed the staff to analyze whether, in accordance with section 274c.(4) of the AEA, disposal of GTCC waste presents a hazard such that the NRC should retain authority over its disposal, or if that authority can be relinquished to an Agreement State.

NRC Regulations Concerning Agreement State Authority

The NRC's regulations in 10 CFR Part 150, "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274," implement section 274 of the AEA. Because some GTCC waste streams contain SNM, any relinquishment of regulatory authority must comply with the AEA section 274b.(3) provision that such relinquishment be limited to SNM in quantities not sufficient to form a critical mass. The NRC implements this requirement through 10 CFR 150.11, "Critical mass." Under 10 CFR 150.14, "Commission regulatory authority for physical protection," an Agreement State licensee will need to obtain some form of NRC authorization if the licensee chooses to receive and store (i.e., storage incident to disposal) GTCC waste containing quantities of SNM that, by itself or together with other SNM stored on the site, exceed the 10 CFR 150.14 mass thresholds.

Likewise, two provisions of 10 CFR 150.15, "Persons not exempt," may also restrict the scope of potential Agreement State regulation of certain GTCC waste streams. The regulation in 10 CFR 150.15 lists those persons in Agreement States who are subject to NRC licensing and regulatory requirements with respect to certain activities. The list includes those persons who engage in the "transfer, storage or disposal of radioactive waste material resulting from the separation in a production facility of special nuclear material from irradiated nuclear reactor fuel," and those who seek to store and dispose of reactor-related GTCC waste.

Therefore, under the AEA, the NRC cannot relinquish its authority to regulate SNM in quantities sufficient to form a critical mass. The NRC regulations in 10 CFR 150.11 establish the critical mass thresholds for uranium-233, plutonium, enriched uranium-235, or a combination of these isotopes or elements. The staff concluded that a conservative and prudent approach in any potential rulemaking is to limit the scope of Agreement State licensing to those near-surface disposal facilities that can accept only those GTCC waste streams that do not exceed the mass thresholds of 10 CFR 150.11.

U.S. Department of Energy Considerations Relevant to This Rulemaking

The LLWPAA requires the DOE to submit to Congress a comprehensive report with recommendations ensuring the safe disposal of GTCC waste no later than 1 year after its enactment. In February 1987, the DOE completed this action by issuing DOE/NE-0077, "Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste: Report to Congress in Response to Public Law 99-240" (DOE, 1987). In the 1987 report, the DOE acknowledged its responsibility for the disposal of commercially generated GTCC waste, as described in section 3(b)(1)(D) of the LLWPAA.

In addition, section 631 of the Energy Policy Act of 2005 (Congress, 2005) prescribed further requirements for the DOE regarding the development of a GTCC waste disposal program. In response, the DOE issued its FEIS in 2016, which considered the potential environmental impacts associated with using an existing facility or constructing and operating a new facility or facilities for the disposal of GTCC waste.

In the FEIS, the DOE states the following:

> The NRC LLW classification system does not apply to radioactive wastes generated or owned by DOE and disposed of in DOE facilities. However, DOE owns or generates LLW and non-defense-generated TRU radioactive waste, [footnote omitted] which have characteristics similar to those of GTCC LLW and for which there may be no path for disposal. DOE has included these wastes for evaluation in this EIS because similar approaches may be used to dispose of both types of radioactive waste. For the purposes of this EIS, DOE is referring to this waste as GTCC-like waste.

Disposal of U.S. Department of Energy Greater-Than-Class-C-Like Waste

In the FEIS, the DOE stated that its preferred alternative for the disposal of GTCC waste is disposal in the DOE's Waste Isolation Pilot Plant (WIPP) geologic repository near Carlsbad, New Mexico, and/or land disposal at generic commercial facilities, or both. Currently, the WIPP is only authorized to accept defense-generated TRU waste pursuant to the Waste Isolation Pilot Plant Land Withdrawal Act (Congress, 1992). Unless there is a legislative change, GTCC waste disposal at the WIPP is not an option. Moreover, the NRC would have no regulatory role over any LLW disposal at the WIPP. This draft regulatory analysis addresses GTCC waste disposal in a commercially licensed near-surface disposal facility.

The DOE has asserted that there may be no path to disposal for GTCC-like waste and that the NRC LLW waste classification system in 10 CFR 61.55 does not apply to radioactive waste generated or owned by the DOE and disposed in DOE facilities. From a statutory perspective, the NRC recognizes that the DOE has the requisite authority, under sections 161g. and 161j. of the AEA, to dispose of GTCC-like waste in either a Federal or commercial land disposal facility, provided that the facility has the requisite waste acceptance criteria. In the case of an Agreement State-licensed facility, promulgation of an NRC rulemaking or other express approval by the Commission authorizing the near-surface disposal of GTCC waste, as well as satisfaction of the requirements of section 274 of the AEA, would be prerequisites for an Agreement State-licensed facility to accept GTCC and GTCC-like waste for disposal. The NRC acknowledges that the proposed regulatory revisions would be no different for waste that the DOE FEIS has identified as GTCC-like waste. Therefore, in this rulemaking, the NRC does not distinguish between GTCC and GTCC-like waste.

2.1.6 Results of Public Solicitation of Stakeholder Views on the draft final LLW RA

Background

In 2016 the NRC staff delivered to the Commission a draft final rule on low-level radioactive waste disposal in SECY-16-0106, "Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-AI92)" (NRC, 2016a). The Commission directed the NRC staff in SRM-SECY-16-0106 to make certain substantive revisions to the draft final rule and to publish it as a supplemental proposed rule for a 90-day public comment period (NRC, 2017a). The Commission also directed that the rulemaking "be informed by broader and more fully integrated, but reasonably foreseeable, costs and benefits to the U.S. waste disposal system resulting from the proposed rule changes, including pass-through costs to waste generators and processors." The NRC then published a *Federal Register* notice (NRC, 2017b) requesting public comment on the draft regulatory analysis for the draft final rule and seeking specific cost and benefit information to better inform the updated draft regulatory analysis. The NRC extended the comment period for 30 days (NRC, 2017c) and received 12 comment submissions on the regulatory analysis.

In 2020 the NRC staff recommended issuing a proposed rule that consolidates and integrates the GTCC waste and low-level waste rulemakings in SECY-20-0098, "Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal" (NRC, 2020b), as approved by the Commission in SRM-SECY-20-0098 (NRC, 2022). As part of that recommendation, the NRC staff planned to address the Commission's direction from the low-level waste draft final rule, in part, by documenting, in a revised regulatory analysis, the results of the staff's request for stakeholder views on costs and benefits to the U.S. waste disposal system resulting from the proposed rule changes (including pass-through costs to waste generators and processors). The Commission agreed with the recommendation and directed the NRC staff to proceed with rulemaking.

This section of the regulatory analysis supporting the integrated proposed rule describes the comments received on the low-level waste draft final rule regulatory analysis and how the comments were considered in the regulatory analysis. Some comments the NRC received are no longer relevant to the integrated proposed rule and this supporting regulatory analysis. Comments that were directed to the scope of the rulemaking or were relevant to the NRC's prior goals (e.g., those objectives that were eclipsed by the Commission's direction to only apply the new requirements to facilities that will accept large quantities of depleted uranium in the future) are not described here because they are not relevant to the integrated proposed rule regulatory analysis.

Summary of Comments Received

The comments on the 2017 draft final regulatory analysis fall into 6 categories: The RA Process, General RA updates, Costs due to Revised Analysis Requirements, NRC costs, DOE and New Applicant Disposal of DU, and Other Comments. Comments on the RA Process recommended the NRC use the guidance in NUREG/BR-0058 (that has now been updated as draft Revision 5) (NRC, 2020), be guided by certain executive orders and court decisions, and quantify to the extent possible while using qualitative analysis only to inform decision making.

In the General RA Updates category, comments recommended using more accurate and timely information, including updated labor rates and updated financial information on the site-specific assessments. This would reflect that the sites not planning to handle DU will have reduced

costs, and that EnergySolutions in Utah, and WCS in Texas have already performed site-specific performance assessments. The RA should include full implementation costs for Agreement States including the first performance assessment process, and consider additional costs associated with site closure. To ensure a broader and more fully integrated analysis, considering all reasonably foreseeable costs, the NRC should reach out to more entities for data, and include costs associated with the overall waste disposal system, to include generators and processors. Any changes in DU waste disposal techniques and other changes that are not one-time costs should be addressed, and the costs for the Performance Assessment/Safety Case need to be informed by the operational cost data provided.

In the Costs due to Revised Analysis Requirements category, comments identified several potential costs that could arise, including costs of compliance period, stability, defense-in-depth, and the human intrusion performance objective; additionally, cost differences between analyzing a 10,000-year vs. 1,000-year compliance period should be considered.

In the NRC costs category, commenters recommended that NRC costs due to staff preparation and review costs for reviewing DOE technical analyses should be included in the regulatory analysis.

In the DOE and New Applicant Disposal of DU category, commenters recommended that the NRC should review and include the DOE disposal option along with its cost estimates and consider disposal at the Nevada National Security Site. Additionally, the NRC should consider the impact on a potential new waste generator or disposer and new location. It should also evaluate the costs associated with DOE tank closure, disposal actions from NRC activities, and changes to cover thickness due to radon requirements.

Finally, the NRC received Other Comments that recommended the NRC address 1) pass-through costs to waste generators, 2) increased costs due to more stringent DU disposal criteria, 3) any restriction in the number of facilities that would lead to higher costs and more storage, 4) out-of-compact generator fees, and 5) costs to sites that are no longer operating but have a license still in effect.

How the 2017 Comments Were Considered in This Regulatory Analysis

As stated above, the comments on the 2017 draft final regulatory basis were grouped into six categories. The staff considered those comments in developing this regulatory analysis, as described in the following paragraphs.

As discussed in the introduction to Section 4, the NRC is using guidance in draft NUREG/BR-0058, Revision 5, to develop this regulatory analysis. The NRC's guidance incorporates instruction from multiple executive orders and court cases, some of which were mentioned in the comments. The regulatory analysis also follows the Commission's direction on the use of qualitative factors, which was paraphrased in the comments, regarding quantifying to the extent possible and using qualitative analysis only to inform decisionmaking.

The NRC's practice is to use updated BLS wage data in regulatory analyses, and the NRC staff has refined the data used in the site-specific analyses by reaching out to various agreement states and disposal licensees, and to DOE personnel. The NRC also considered the financial information provided in the comment responses. The costs to review waste acceptance criteria and to describe and update the safety case have been adjusted in this regulatory analysis to reflect the information gained through these efforts. The costs in this analysis reflect the work

already done by existing licensees and are lower for sites not expected to seek to handle DU or dispose of GTCC waste. Calculated costs for Agreement States include the costs to conduct rulemaking and to review the safety cases and disposal licenses to more fully reflect the implementation costs. Recurring costs have been added as appropriate, and the regulatory analysis includes a comprehensive set of costs and benefits to include averted storage costs and additional disposal costs, where applicable.

The proposed rule should not significantly increase costs for DU disposal, and therefore the regulatory analysis does not include estimates for costs related to DU. This is because DU disposal at WCS in Texas has been licensed since 2016 and Utah regulators have specified criteria for DU disposal that are consistent with NRC's proposed requirements. Additionally, there are only minor technical differences between the proposed rule and what DOE has commented on with respect to certain technical issues (e.g., radon, tank closure, 10,000 year vs. 1,000 year compliance periods) and therefore there are no associated costs included in this regulatory analysis. However, the safety case cost estimates do include analyses for the compliance period, stability, defense-in-depth, and human intrusion.

The NRC review of DOE technical analyses under the Ronald Reagan National Defense Authorization Act of 2005 (NDAA) for waste incidental to reprocessing should not be an incremental cost because the current practice and the proposed rule requirements do not differ significantly. The NRC does not expect the proposed rule to result in significantly increased costs for DU disposal or changes to DU disposal techniques, nor should the rule restrict the number of DU disposers. Both Utah and Texas have adopted requirements that are similar to those in the proposed rule. The rule would have no impact on out-of-compact generator fees or sites that have already closed but are still licensed. Regarding a new waste disposal facility for DU, the NRC considers this concept too speculative to include in the analysis since the NRC is not aware of any potential new waste disposal facility for DU, and because the proposed rule is not significantly increasing the costs of DU disposal, evaluation of a new disposal facility would not have an impact on the cost beneficial nature of the rule.

The NRC considered pass-through costs for both DU and GTCC disposal. For DU disposal, the proposed rule does not include more stringent requirements than have already been adopted by the Agreement States that can currently accept DU for disposal, and therefore there should be no increase in costs to disposers to pass-through. In fact, WCS commented on the 2017 regulatory analysis and noted that it did not anticipate increasing pass-through costs as they have licensed disposal of DU and saw no significant difference in meeting a 1,000-yr or 10,000-yr compliance period. For GTCC disposal, the NRC considered the fact that such disposal is not currently available other than through case-by-case licensing with the NRC, which would likely be granted only with similar restrictions to this proposed rule. Because this proposed rule presents a new path for GTCC disposal, it is likely that this path will be taken only by generators, processors, and disposers if it proves to be a net benefit in their business cases. Therefore, there are no foreseeable pass-through costs to include in this regulatory analysis.

2.2. Statement of the Problem

New LLW streams exist that were not envisioned during the original development of 10 CFR Part 61. These LLW streams include DU from enrichment facilities, LLW from DOE operations, and blended LLW streams in quantities greater than previously expected. In addition, new technologies might result in the future generation of different LLW streams that have not previously been considered.

The NRC currently has no specific technical safety and security requirements for the near-surface disposal of GTCC waste. The current regulations at 10 CFR 61.55(a)(2)(iv) prescribes that disposal in a deep geologic repository is the default disposal path for GTCC waste, although it allows for alternate disposal procedures that are approved by the Commission. However, the NRC currently has no established process for approving and licensing the initial site-specific GTCC disposal application. The NRC assumed that, due to the uncertainty of this case-by-case approach, a licensee and the agency would expend a level of effort similar to the costs anticipated under this rulemaking for the first licensee attempting to gain approval for near-surface disposal of GTCC waste. Many of the same steps that are being performed to determine the appropriate regulatory language would need to be taken if a licensee applied to the NRC without this rulemaking's existence. Therefore, in this regulatory analysis, the ability to dispose of GTCC waste is a benefit of the proposed rule.

The potential for postclosure hazards begins after the facility is permanently closed. Inadvertent intrusion can occur after the 100-year institutional control period, during which the site controls, if properly implemented, would preclude an inadvertent intrusion from occurring. TRU radionuclides that are long lived can contribute to significant radiation exposures to an inadvertent intruder when present in sufficient concentrations.

An Agreement State licensee may potentially be subject to the much lower 10 CFR 150.14 mass thresholds, which relate to a Category III quantity of SNM, that would preclude Agreement State regulatory oversight of near-surface disposal facilities containing waste exceeding the mass thresholds. The GTCC waste streams that would exceed the 10 CFR 150.14 mass thresholds are from the WVDP and account for approximately 25 percent of the overall volume of GTCC waste. If an Agreement State licensee exceeds the 10 CFR 150.14 mass thresholds, the Agreement State licensee most likely would either need to obtain an NRC license or become subject to an NRC order to allow for NRC oversight, inspection, and enforcement of the 10 CFR part 73 requirements.

3. Identification of Alternative Approaches

The following discussion describes the three alternatives being considered in this regulatory analysis, with additional analysis presented in section 5 of this document.

3.1. Alternative 1: Regulatory Baseline

Under Alternative 1, the NRC would not modify 10 CFR Part 61. Without modifying NRC regulations, waste streams containing DU would be allowed to be disposed under 61.55(a)(6) as Class A waste as long as other requirements for the waste are met. This alternative would not require additional analysis for disposal, unless previously required by the relevant Agreement State.

The NRC and the Agreement State would take no further action related to the disposal of GTCC waste in a land disposal facility until a licensee submitted a site-specific request and application. The Commission, after input from the staff, would determine whether to approve the request. If the request and application are approved, either the NRC would issue a 10 CFR Part 61 license or the Agreement State would update its program to support GTCC waste disposal, and issue the license after complying with Commission conditions or requirements. After issuing the license, the relevant regulatory authority (either NRC or the Agreement State) would be responsible for regulatory oversight, including conducting inspection and necessary enforcement activities. Because the primary disposal pathway for GTCC waste is disposal in a

geologic repository under 10 CFR Part 60 or 10 CFR Part 63, “Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada,” holders of GTCC waste would continue to store GTCC waste until such a repository is available.

The NRC assumes that if an Agreement State sought to license a disposal facility for GTCC waste under an Agreement State license, then the agency would need to evaluate whether other regulatory steps were appropriate, such as establishing a mechanism (e.g., issuance of an NRC order to the licensee) for ensuring the material is physically protected consistent with the requirements of 10 CFR 73.67, a “common defense and security” regulation, if the Agreement State licensee’s operations will result in exceeding the mass thresholds of 10 CFR 150.14.

3.2. Alternative 2: New Guidance

Under this alternative, the NRC would develop and issue guidance that describes the acceptable methods for meeting the performance objectives and other requirements of 10 CFR Part 61 and that describes the site-specific request and application process. However, the NRC would not undertake any regulatory changes to 10 CFR Part 61 or other parts of its regulations. Therefore, the activities following the applicant’s submission of its site-specific request and application are expected to be similar to those discussed in Alternative 1. he GTCC regulatory issues cannot be addressed through guidance alone; therefore, Alternative 2 was not assessed in further detail.

3.3. Alternative 3: Conduct Rulemaking

Under this alternative, the NRC would promulgate regulations and develop implementing guidance specifically for the disposal of GTCC waste and LLW in a near-surface disposal facility. This alternative would establish a regulatory framework for addressing the unique disposal and regulatory oversight requirements for GTCC waste and LLW. The regulatory requirements also would provide the basis for Agreement States to regulate the disposal of GTCC waste and LLW to the extent allowable under AEA section 274. Under this rulemaking alternative, currently licensed LLW facilities that do not plan to accept GTCC waste or significant quantities of long-lived radionuclides after the effective date of the rulemaking would be allowed to continue to meet the existing 10 CFR part 61 requirements for several revised sections.

In Alternative 3, the NRC is proposing to amend 10 CFR Part 61 to require LLW disposal licensees and license applicants to prepare a safety case that includes identification of defense-in-depth protections and new and revised site-specific technical analyses. This would ensure that LLW streams that are significantly different from the LLW streams considered when 10 CFR Part 61 was first issued can be disposed of safely and meet the performance objectives in Subpart C of 10 CFR Part 61.

Under this rulemaking alternative, the NRC is proposing to amend 10 CFR Part 61 to require LLW land disposal facility licensees or license applicants to develop site-specific criteria—waste acceptance criteria—for the acceptance of LLW for disposal. These amendments maintain the existing LLW classification system but permit land disposal facility licensees and license applicants to account for facility design, disposal practices, and site characteristics to determine criteria for accepting future shipments of LLW for disposal at their land disposal facilities. The waste acceptance criteria could provide flexibility to better manage disposal capacity consistent with the risks of disposal.

Because licensees and license applicants are required to develop site-specific criteria for the acceptance of LLW for disposal, the NRC also is proposing to amend Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests," to 10 CFR Part 20 to conform to the new requirements for LLW acceptance.

For Alternative 3, the NRC is proposing new and revised technical analyses to be added to the existing 10 CFR Part 61 requirements. An inadvertent intruder assessment is proposed under 10 CFR 61.13, "Technical analyses," to demonstrate compliance with the performance objective to protect inadvertent intruders at 10 CFR 61.42, "Protection of individuals from inadvertent intrusion." The inadvertent intruder assessment must demonstrate that the annual dose would not exceed a proposed 5 millisievert (500 millirems) limit over a newly defined compliance period that considers the longevity of the hazard of the waste being disposed.

Likewise, development of a site-specific performance assessment is proposed under 10 CFR 61.13 to demonstrate the protection of the general population from releases of radioactivity. The analysis updates the previous exposure-pathway analysis to use more modern performance-assessment methodologies that better align 10 CFR Part 61 with the Commission's policy "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement," dated August 16, 1995 (NRC, 1995). The performance assessment also incorporates a compliance period.

The NRC is proposing to revise 10 CFR 61.16(b) with respect to criticality safety during operations such that an applicant shall not consider radioactive waste containing fissile material meeting the requirements specified at 10 CFR 71.15(c). This revision will ensure criticality safety criteria are applied to those waste packages with a potential for a criticality event and not to waste packages with material that can be classified as nonfissile material.

The NRC is also proposing to revise 10 CFR 61.10(b) to ensure that information provided in an application comprises the safety case, supports the licensee's demonstration that the disposal facility will be constructed and operated safely, and provides reasonable assurance that the disposal site will be capable of isolating waste and limiting releases to the environment. This revision identifies the information submitted as part of a license application that comprises the safety case. The NRC expects this change will have minimal cost impacts on licensees and Agreement States during the license renewal and site closure analyses update and review, because much of the information has always been required of licensees. New requirements that differ from those currently related to a license application and their associated cost impacts are described below.

The NRC is proposing to revise 10 CFR Part 61 to require conditions that could make an excavation exposure scenario (e.g., GTCC waste buried within the depth for excavation of a dwelling) highly unlikely by amending the regulation to require that GTCC waste must be disposed at a minimum depth of 5 meters below the surface of the earth and with a 500-year intruder barrier in place. Such a requirement would preclude the types of excavation exposure scenarios considered during the development of the waste classification system in 10 CFR Part 61.

Under Alternative 3, the NRC is proposing to amend 10 CFR Part 73, "Physical Protection of Plants and Materials," to exempt certain waste material at a near-surface disposal facility from the requirements for physical protection of SNM of low strategic significance or a category III quantity of SNM. More specifically, the NRC is proposing a revision to its regulations at 10 CFR

part 73 to include an exemption from the physical protection requirements in 10 CFR part 73.67 for SNM of limited attractiveness (i.e., containing dilute concentrations of SNM) at a near-surface disposal facility. Adding an exemption to § 73.67(b)(1) for radioactive waste containing SNM of limited attractiveness would allow for more risk-informed security requirements for near surface disposal facilities accepting such waste than is currently provided for in § 73.56(b)(1)(i) through (iii). This revision is intended to provide appropriate flexibility to Agreement States for licensing certain radioactive wastes that meet the requirements for safe disposal at a near-surface disposal facility.

The proposed rule would revise provisions to allow GTCC waste, including waste containing concentrations of TRU radionuclides greater than 100 nCi/g, to be disposed in a near-surface disposal facility without the express case-by-case approval of the Commission, including specifically using the term “GTCC waste” for clarity. Further, based on the analyses described above, the NRC is proposing to revise 10 CFR 61.55(a)(3)(iii) to allow the near-surface disposal of GTCC waste streams containing TRU radionuclides with concentrations greater than 100 nCi/g.

4. Evaluation of Benefits and Cost

This section describes the methodology used to analyze the consequences associated with the proposed rule. The document that governs the NRC’s regulatory analysis process is NUREG/BR-0058, draft final Revision 5, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” completed January 2020 (NRC, 2020a). The NRC's methodology shows present-worth calculations using both 3 percent and 7 percent real discount rates. The real discounted rates or present-worth calculation determine 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, are valued equally, regardless of time. 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 it 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 investment well below the 3 percent and 7 percent discount rates upon which NUREG/BR-0058 is based. The analysis includes a zero percent discount rate (e.g., undiscounted values) as a further sensitivity analysis based on current market trends and future predictions.

This regulatory analysis identifies all attributes related to the regulatory action and analyzes them either quantitatively or qualitatively. For the quantified regulatory analysis, the staff developed expected values for each cost and benefit. For each alternative, the staff first determined the costs and benefits and then discounted the consequences in future years to the current year of the regulatory action. Finally, the staff summed the costs and the benefits for each alternative and compared them.

This regulatory analysis measures the incremental costs of the proposed rule relative to a “baseline” that reflects anticipated behavior if the NRC undertakes no additional regulatory action (Alternative 1, the “no-action” alternative). As part of the regulatory baseline used in this analysis, the NRC assumes full licensee compliance with existing NRC regulations. This alternative is equivalent to the status quo and serves as a baseline to measure against the other

alternatives. Section 4 presents the estimated incremental benefits and costs of the rule relative to this baseline.

After performing the quantitative analysis, the regulatory analysis addresses 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 (routine) (see section 4.1) would be enhanced by the changes made in requirements for intruder assessment such as in 10 CFR 61.42, but it is difficult to assign a number to this benefit, as the quantification would require the analysis to estimate the reduction in accident frequency and associated risk for the action and report this as person-rem avoided exposure.

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

This regulatory analysis uses data from subject matter experts, NRC documents, stakeholder comments, knowledge gained from past rulemakings, and information gained during public meetings and from correspondence.

4.1. Identification of Affected Attributes

This section identifies the components of the public and private sectors, commonly referred to as attributes, that the NRC expects to be affected by Alternative 3, to conduct rulemaking, the recommended alternative identified in section 3.3. Alternative 3 would apply to licensees and applicants for waste storage and disposal, and it may result in similar regulatory changes by the DOE. These licensees and the DOE would be the primary beneficiaries. The staff developed an inventory of the impacted attributes using the list in NUREG/BR-0058.

The rule would affect the following attributes:

- Industry Implementation. This attribute accounts for the projected net economic effect on affected licensees required by Alternative 3. The industry would incur a one-time cost to implement the rule, due to updating the safety case and modeling tools for LLW and setting up the record retention process for audits and other reviews.

- Industry Operation. This attribute accounts for the projected net economic effect on affected licensees caused by the routine and recurring activities required by Alternative 3. The changes to 10 CFR Part 61 require licensees to meet the new and amended requirements discussed in section 3.3. The proposed rule would require a licensee to analyze its LLW disposal site to ensure that disposal of waste streams not considered during the development of the current rule can occur safely and that the site will still meet the performance objectives in Subpart C of 10 CFR Part 61. The rule would also allow industry to dispose of an increased variety of waste without compromising safety. The site-specific waste acceptance criteria should allow licensees to optimize disposal capacity while ensuring protection of public health and safety, which is likely to reduce costs. In addition, ensuring that disposal of these new LLW streams occurs safely may minimize the likelihood that future mitigation would be required, thereby limiting potential future costs to licensees. For GTCC waste, licensees would gain efficiencies in submitting disposal requests and revising related procedures and would save costs related to the continued storage of GTCC waste (e.g., facilities, guards, surveillance equipment).

- Other Government. This attribute accounts for incremental costs and benefits to Agreement States from implementing Alternative 3. The Agreement States will incur costs to update its program to ensure adequacy and compatibility, including issuing compatible regulatory requirements and guidance as well as ongoing costs to review technical analyses (at renewal and closure) and waste acceptance criteria. In addition, Agreement States would incur costs from taking over the processes of reviewing disposal requests, ensuring environmental compliance, generating GTCC inspection procedures, issuing the license amendment, and performing other licensing actions.

- NRC Implementation. This attribute accounts for the projected net economic effect on the NRC to place Alternative 3 into operation. The NRC developed the proposed rule and will develop the final rule after the public comment period. In addition, the NRC is developing associated guidance documents. The costs incurred to develop these documents and all rulemaking activities in the proposed rule stage are considered sunk costs and are not included in this regulatory analysis. However, the final rulemaking process has incremental costs for this attribute.

- NRC Operation. This attribute accounts for the projected net economic effect on the NRC after Alternative 3 is implemented. The NRC will incur costs reviewing updates to an Agreement State program to support GTCC waste disposal. However, the NRC will have averted costs from not needing to review GTCC disposal requests, determining environmental compliance, generating GTCC inspection procedures, conducting license hearings and other related public meetings, and issuing GTCC disposal licenses.

- Public Health (Routine). This attribute accounts for changes in radiation exposures to the public during normal operations (i.e., nonaccident situations) that result from the proposed regulatory action. When used, this attribute would employ a radiological public exposure estimate; accident probabilities are not involved. The rule requires new site-specific technical analyses to ensure better protection for an inadvertent intruder who occupies the site and might unknowingly be exposed to radiation from disposed LLW. These analyses will demonstrate there is reasonable assurance that any inadvertent intruder will not be exposed to doses that exceed the performance objectives set forth in 10 CFR 61.42. In addition, the disposal of GTCC waste is expected to reduce the potential hazards from continued storage of the waste.

- Improvements in Knowledge. This attribute accounts for the potential value of new information. The new and revised analyses will help the licensee identify the relevant information to be gathered for use in the safety analyses for current and continued disposal of LLW at its facility, and of disposal of GTCC waste as well. This new information will ensure that waste streams that are significantly different from those considered during the development of the current regulations can be disposed of safely. Development of site-specific waste acceptance criteria should allow licensees to optimize disposal capacity while ensuring protection of public health and safety, which is likely to reduce a licensee's costs.

- Regulatory Efficiency. This attribute accounts for regulatory and compliance improvements resulting from the implementation of Alternative 3. Alternative 3 would increase regulatory efficiency because licensees managing or disposing of

LLW or seeking to dispose of GTCC waste would benefit from new regulatory language and additional guidance as a result of the NRC's rulemaking activities, which provide a clearer path to those activities and would reduce the potential for inefficiencies, requests for additional information, and other aspects that increase cost.

Attributes that are not affected include public health (accident), general public, occupational health (routine), occupational health (accident), offsite property, onsite property, environmental considerations, and safeguards and security considerations.

4.2. Analytical Methodology

This section describes the process used to evaluate the costs and benefits of the proposed alternatives. The benefits include any desirable changes in affected attributes (e.g., monetary savings, increased safety, improved security). The costs include any undesirable changes in affected attributes (e.g., monetary costs, increased exposure to radiation).

Of the eight affected attributes, the analysis considered five quantitatively: industry implementation, industry operation, other government, NRC implementation, and NRC operation. Quantitative analysis requires a baseline characterization of the affected attribute, including factors such as the number of affected entities, the nature of the activities currently performed, and the types of systems and procedures that licensees or applicants would implement, or would no longer implement, under each proposed alternative. Where possible, the analysis calculated costs for these attributes using three-point estimates to quantify uncertainty. Detailed cost tables appear in the individual sections for each of the attributes.

The staff evaluated the remaining three attributes qualitatively, either because the effects of the proposed rule on these attributes are not easily quantifiable, or because the data necessary to quantify and monetize these effects are not available.

The NRC has documented its assumptions throughout this regulatory analysis. The uncertainty analysis and appendix A summarizes the major assumptions and input data used in the analysis.

4.2.1 Regulatory Baseline

This regulatory analysis identifies the incremental impacts of the proposed rule relative to a baseline that reflects anticipated behavior if the NRC does not undertake regulatory or nonregulatory action. The regulatory baseline assumes full compliance with existing NRC requirements, including current regulations and relevant orders. This is consistent with NUREG/BR-0058, which states that "In establishing the baseline case, the analyst should assume that all existing NRC and Agreement State requirements and written licensee commitments are already being implemented." Section **Error! Reference source not found.** of this regulatory analysis presents the estimated incremental costs and benefits of the alternatives compared to this baseline. This regulatory baseline is the no-action alternative (i.e., Alternative 1).

4.2.2 Affected Entities

The affected entities are those entities that could be impacted by any of the alternatives. The NRC does not anticipate a new LLW disposal facility will be built during the next 20 years. The

affected entities are four licensees located in four separate Agreement States, as listed in Table 1 and Table 2.

Table 1 Impacted LLW Disposal Licensees

Licensee	Location
1. Energy*Solutions*	Clive, Utah
2. U.S. Ecology, Inc.	Richland, Washington
3. Waste Control Specialists LLC	Andrews, Texas
4. Energy*Solutions*	Barnwell, South Carolina

Table 2 Impacted Agreement States

1. Utah
2. Washington
3. Texas
4. South Carolina

The revised regulations would cover all new and currently operating near-surface LLW disposal facilities that would not apply the criteria under the proposed changes in 10 CFR 61.1(b). In addition, to the extent Agreement State compatibility applies, an Agreement State would need to agree to accept the waste and may be required to update its requirements if it decided to regulate the disposal of GTCC waste.

An Agreement State that currently has the authority to regulate LLW disposal would need to update its program to regulate the disposal of GTCC. It is likely that a disposal facility only would seek to dispose of GTCC waste if the facility determined that it would be to its financial benefit.

Agreement States

The Agreement States that license the four currently operating LLW disposal facilities are South Carolina, Utah, Washington, and Texas. However, a total of 32 Agreement States have the authority to regulate LLW disposal. If the Commission approves the near-surface disposal of all or some GTCC waste streams and for Agreement State regulatory oversight for such disposals (after promulgating an adequate and compatible program to do so), then an Agreement State may license a new or existing near-surface disposal facility that can accept GTCC waste provided that all the requirements of AEA section 274 have been satisfied.

Tribal Nations

A Tribal Nation may be a stakeholder in licensing a near-surface disposal facility that can accept LLW waste in accordance with Subpart F, “Participation by State Governments and Indian Tribes,” of 10 CFR Part 61.

The U.S. Department of Energy

The DOE is responsible for the disposal of commercially-generated GTCC waste. Permitting the near-surface disposal of GTCC waste would provide the DOE an alternative to the current expectation that GTCC waste would be disposed of in a geologic repository.

The U.S. Nuclear Regulatory Commission

The NRC is authorized to regulate the disposal of commercially generated LLW. The NRC's LLW regulations are set forth in 10 CFR Part 61. The NRC can relinquish its regulatory authority relating to the disposal of commercially generated LLW to an Agreement State pursuant to AEA section 274.

In addition to the entities above, agencies such as the U.S. Department of Defense, U.S. Environmental Protection Agency, Texas Commission on Environmental Quality (TCEQ), and others would be impacted by either this proposed rule or their own follow-on rulemakings in response, enabling more disposal paths.

4.2.3 Base Year

All monetized costs are expressed in 2022 dollars, the year of the currently available Bureau of Labor Statistics (BLS) labor rate data. This regulatory analysis assumes the final rule will be published in the CFR in 2025 and will become effective 30 days later. Because the affected licensees are Agreement State licensees and the Agreement States are allowed up to 3 years to develop conforming regulations (NRC, 2018a), the analysis assumes that the rule will not be implemented by licensees until 2028. Ongoing costs of operation under Alternative 3 are assumed to begin in 2029 and are modeled on an annual cost basis. Estimates of one-time NRC implementation costs are based on staff experience with similar rulemakings. The analysis assumes that these costs will be incurred in 2024 and 2025.

4.2.4 Discount Rates

In accordance with guidance in NUREG/BR-0058, the analysis employs net present value (NPV) calculations to determine 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 NPVs, the NRC can translate costs and benefits to a reference year for comparison, regardless of when they are incurred. The choice of a discount rate and its conceptual basis is a topic of ongoing discussion within the Federal Government. Consistent with the NRC's past practice and guidance, present-worth calculations in this analysis use 3 percent and 7 percent real discount rates. A 3 percent discount 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 reflects the concept of discounting based on the social rate of time preference.[1] A 7 percent discount rate approximates the marginal pretax real rate of return on an average investment in the private sector; it 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. A 7 percent rate is consistent with the concept of the opportunity cost[2] of capital; it reflects the time value of resources directed to meet regulatory requirements.

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[1] The "social rate of time preference" refers to the rate at which society is willing to postpone a marginal unit of current consumption in exchange for more future consumption.

[2] "Opportunity cost" is what is forgone by undertaking a given action. If licensee personnel were not revising procedures, they would be performing other work activities. Throughout this analysis, the NRC estimates the opportunity cost of performing these incremental tasks as the industry personnel's pay for the designated amount of time.

4.2.5 Labor Rates

For the purposes of this regulatory analysis, the NRC applied strict incremental cost principles to develop labor rates that include only labor and material costs directly related to the implementation, operation, and maintenance of the proposed rule requirements. This approach is consistent with the guidance in NUREG/CR-3568, "A Handbook for Value-Impact Assessment," issued December 1983 (NRC, 1983), and with general cost-benefit methodology. The NRC's incremental labor rate for FY 2022 is $143 per hour.[3]

This regulatory analysis uses the 2022 BLS Occupational Employment and Wages data (BLS, 2022), which provide labor categories and the mean hourly wage rate by job type. The labor rates used in the analysis reflect total hourly compensation, which includes wages and nonwage benefits (using a burden factor of 2.4, which is applicable for contract labor and conservative for regular utility employees). The staff used the BLS data tables to select appropriate hourly labor rates for the estimated procedural, licensing, and utility-related work necessary during and after implementation of the proposed alternative. These labor rates include wages paid to the individuals performing the work plus the associated fringe benefit component of labor costs (i.e., the time for plant management exceeding those directly expensed), which are considered incremental expenses. Table 3 summarizes the BLS labor categories the staff used to estimate industry labor costs to implement this proposed rule, and appendix A lists the industry labor rates used in the analysis. The regulatory analysis also includes an uncertainty analysis, which is discussed in Section 5.4.

Table 3 Position Titles and Occupations

Position Title (in This Regulatory Analysis)	Standard Occupational Classification
Executive	Top Executives (111000)
	Chief Executives (111011)
Managers	General and Operations Managers (111021)
	Industrial Production Managers (113051)
	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (172111)
	First-Line Supervisors of Office and Administrative Support Workers (431011)
	First-Line Supervisors of Mechanics, Installers, and Repairers (491011)
	First-Line Supervisors of Production and Operating Workers (511011)
Technical Staff	Nuclear Engineers (172161)
	Physical Scientists (192000)
	Physical Scientists, All Other (192099)
	Environmental Scientists and Geoscientists (192040)
	Nuclear Technicians (194051)
	Industrial Machinery Mechanics (499041)
	Nuclear Power Reactor Operators (518011)

[3] The NRC labor rates presented here differ from those developed under the NRC's license fee recovery program (10 CFR Part 170, "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services under the Atomic Energy Act of 1954, as Amended"). NRC labor rates for fee recovery purposes are designed for full-cost recovery of the services rendered and thus include nonincremental costs (e.g., overhead, administrative, and logistical support costs).

Position Title (in This Regulatory Analysis)	Standard Occupational Classification
Administrative Staff	Office and Administrative Support Occupations (430000)
	Office Clerks, General (439061)
Licensing Staff	Lawyers (231011)
	Paralegals and Legal Assistants (232011)

Source: BLS, 2022.

4.2.6 Sign Conventions

The sign conventions used in this analysis are that all favorable consequences are positive and all adverse consequences are negative. Negative values are shown using parentheses (e.g., negative $500 is displayed as ($500)).

4.2.7 Analysis Horizon

This regulatory analysis uses an analysis horizon from 2024 to 2056, which encompasses the period of time from issuance of the final rule to the current license expiration year for U.S. Ecology, Inc. (the later license expiration of the two potential affected entities).

4.2.8 Cost Estimation

To estimate the costs of each alternative evaluated, the staff used a work breakdown approach to deconstruct each requirement into its mandated activities. For each mandated activity, the analysis further subdivides the work across labor categories (i.e., executives, managers, technical staff, administrative staff, and licensing staff). The staff estimated the level of effort needed for each required activity and used a blended labor rate to develop bottom-up cost estimates.

The analysis uses data from subject matter experts, knowledge gained from past rulemakings, public outreach and correspondence, and the NRC budget for this rulemaking to estimate the costs and benefits associated with this proposed rule. NRC staff members provided quantitative and qualitative information on attributes affected by the proposed rule. The NRC considered the potential differences between the proposed and existing requirements and incorporated these incremental changes into the regulatory analysis. The staff gathered data from several sources, consulted working group members to develop level of effort and unit cost estimates, and applied several cost estimation methods to use collective professional knowledge and judgment to estimate many of the costs and benefits. The analysis also uses available information from licensees and extrapolation techniques to estimate costs and benefits.

The staff extrapolated some costs by relying on actual past or current costs to estimate the future costs of similar activities. For example, to calculate the costs of licensing activities and the costs of preparing the proposed rule and accompanying regulatory guidance, the staff used data from past projects to determine the labor categories of the personnel who would perform the work and to estimate the amount of time required under each category. If data were not available, the analysis estimated the level of effort based on similar steps in the process for which data were available.

To evaluate the effect of uncertainty in the model, the staff employed Monte Carlo simulation, which is an approach to uncertainty analysis in which input variables are expressed as probability distributions. The simulation was run 10,000 times, and values were chosen at

random from the probability distributions of the input variables provided in Table 12. The result was a distribution of values for the output variable of interest. Monte Carlo simulation also enables users to determine which input variables most strongly affect the value of the output variable. Section 5.4 describes the Monte Carlo simulation methods in detail and presents the results.

4.3. Assumptions

Assumptions used are identified throughout this document. For reader convenience, several high-level assumptions are listed below:

- The analysis assumed that the four current licensees have developed modeling tools to complete their existing technical analyses. In addition, the NRC assumed that the licensees would use these existing modeling tools with modifications to update their technical analysis to be in compliance with the new requirements. The cost of updating these modeling tools will vary by licensee, and these costs are reflected in the cost estimate results shown in section 5. In addition, the analysis assumed that each impacted licensee has already performed a technical analysis to demonstrate that its site meets the performance objectives. The NRC assumed that the bulk of a licensee's cost and an Agreement State's review costs will occur in connection with updating the technical analyses. The scope of the existing analyses is assumed to be similar to that of the updated analyses, though the importance of some features, events, and processes will differ.

- Although a licensee is expected to update its technical analyses before accepting any new, previously unanalyzed waste streams, for the purposes of this regulatory analysis, the NRC assumed new waste streams are only introduced at the time of license renewal and the impacted Agreement State will complete its review during the license renewal review time period.

- For Alternative 3, the NRC assumed that an Agreement State would license the facility for near-surface disposal of GTCC waste following the NRC's promulgation of the rule, and that all requirements of AEA section 274 and the NRC's Agreement State program have been met, including the Agreement State's promulgation of compatible regulations. Agreement States have the flexibility to determine whether they would allow disposal of GTCC waste, but the analysis uses this assumption to demonstrate the costs and benefits of disposal. If no Agreement State decides to allow for disposal of GTCC waste, then the costs of the rule would be the NRC's and the aforementioned Agreement States' rulemaking costs, and there would be no other costs or benefits.

- The analysis assumed that only one of the existing LLW disposal facilities would express interest in accepting and disposing of GTCC waste because of the comparably small volume of GTCC waste that has been or is expected to be generated. For additional sensitivity analysis, the NRC also evaluated the costs and benefits if a second disposal facility elects to accept GTCC waste for disposal.

In addition, this regulatory analysis uses some simplifying assumptions to make the analysis more practical, without biasing the analysis in the direction of benefits or averted costs (i.e., where applicable the assumptions are all conservative). These assumptions were necessary both due to the complexity of GTCC and DU storage across multiple government agencies and

at commercially-owned sites, and the difficulty in obtaining information from these various entities due to proprietary information and time:

- For the costs of storing GTCC and GTCC-like waste (averted costs in Alternative 3 once near-surface disposal is available), the NRC staff worked with DOE personnel to obtain the costs related to storage of these waste streams at the WVDP. Instead of using these data to extrapolate storage costs for all such waste streams across the many entities, this regulatory analysis conservatively uses only the storage costs at this single site as a source of averted costs for this proposed rule. This assumption means that the actual averted costs could be considerably higher than those in this regulatory analysis if additional sites were to store such waste streams. Furthermore, this analysis only calculated averted storage costs using a mean estimate of 10 years. Without a disposal path, these wastes might be stored indefinitely at their current locations, and this proposed rule is the only such effort underway at this time.

- For the costs of near-surface disposal of these waste streams as enabled by the proposed rule, the analysis used the inventory of GTCC and GTCC-like waste streams from the DOE FEIS augmented by a supplement to the waste inventories, ANL/EVS/R-10/1, "Supplement to Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste Inventory Reports," issued October 2010 (Argonne, 2010). The Argonne report provided an updated inventory from the FEIS that included separation of the inventory into either Group 1 wastes (wastes that were already generated and are in storage or that are projected to be generated by facilities currently in operation) or Group 2 wastes (wastes that might be generated as a result of proposed future activities). This regulatory analysis assumes identified waste would be disposed within 2 years after disposal commenced based on DOE data—and would need to be inspected and have issues addressed 5 years after that—as soon as the Agreement State(s) would have a compatible program in place to regulate GTCC waste. This assumption is conservative on the cost calculations because it uses the fastest possible timeline for disposal and the entire inventory, maximizing costs. For disposal fees, the analysis uses bid prices from the DOE's national disposal contract with WCS and Energy*Solutions* (Clive), using the lower price as the low input and the highest price as the high input in the uncertainty analysis. The NRC did not apply potential volume discounts as a further conservative assumption in this analysis. Additionally, these fees are an overestimation of the cost of disposal, because bid prices are intended to have a profit margin, making the cost estimate more conservative.

- This regulatory analysis represents the costs and averted costs from disposal and storage, respectively, as "Industry Operation" costs, when these would be distributed among many different entities as discussed above. This simplifying assumption is needed because the NRC could not obtain all the information necessary to divide these costs and averted costs appropriately among all affected entities.

5. Results

This section presents the quantitative and qualitative results by attribute, relative to the regulatory baseline. As described in the previous sections, costs and benefits are quantified where possible and can have either a positive or negative sign, depending on whether Alternative 3 has a favorable or adverse effect compared to the regulatory baseline

(Alternative 1). The section also discusses those attributes that are not easily represented in terms of monetary value. Although this ex ante cost-benefit analysis[4] provides information that can be used when deciding whether to select the rulemaking alternative, the analysis is based on estimates of future costs and benefits. Whether the estimates are an accurate reflection of future values, the process of conducting regulatory analyses has value in itself because it helps decision-makers evaluate alternatives and their results.

5.1. Alternative 1: Regulatory Baseline

The regulatory baseline alternative does not result in any change of benefits or costs. The baseline assumes full compliance with current NRC requirements.[5]

5.2. Alternative 2: Guidance Development

Due to the justifications in section 3.2 of this regulatory analysis, the NRC did not analyze this alternative's costs and benefits.

5.3. Alternative 3: Conduct Rulemaking

The NRC is proposing multiple changes to its regulations, described in section 3.3 on Alternative 3, for the reasons detailed in sections 2.1 and 2.2. Several of these changes result in implementation and operational costs and benefits to the NRC, licensees, and Agreement States.

5.3.1 Industry Implementation

The proposed change to 10 CFR 61.10, "Content of application," would require licensees to submit a safety case. The safety case includes the technical analyses that licensees are required to conduct under the proposed revisions to 10 CFR 61.13, including a performance assessment, an intruder assessment, and a site stability assessment to demonstrate compliance with the performance objectives in 10 CFR 61.41, 10 CFR 61.42, and 10 CFR 61.44, "Stability of the disposal site after closure." For those sites that have disposed of, or plan to dispose of, significant quantities of long-lived radionuclides, a performance period analysis is also required. Additionally, proposed revisions to 10 CFR 61.58, "Waste Acceptance," would require licensees to develop waste acceptance criteria, and proposed revisions to 10 CFR 61.10(b) would require licensees to describe the defense-in-depth protections that enhance the resiliency of the facility in complying with the performance objectives specified at 10 CFR 61.41 and 61.43. For disposal of some types of GTCC wastes, additional technical analyses (e.g., thermal, radiolysis, criticality) may be necessary according to proposed revisions to 10 CFR 61.13. In addition, some types of GTCC wastes may necessitate a quantitative evaluation of accidents to demonstrate compliance with 10 CFR 61.43.

The costs will vary for each licensee to update its safety case, including the technical analyses, waste acceptance criteria, and defense-in-depth protections. The NRC estimates that a

[4] An ex ante cost-benefit analysis is prepared before a policy, program, or alternative is in place and can assist in the decision about whether to allocate resources to that alternative.

[5] NUREG/BR-0058 states that, "In establishing the baseline case, the analyst should assume that all existing NRC and Agreement State requirements and written licensee commitments are already being implemented and that the costs and benefits associated with these requirements are not part of the incremental estimates prepared for the regulatory analysis."

licensee's labor effort, if seeking to dispose of GTCC waste, will be approximately 7,800 hours, resulting in estimated costs of ($809,000) using a 7 percent NPV. This part of the cost estimate includes updating waste inventories. In addition, each licensee will have varying implementation costs associated with updating its modeling, software, and other tools as required. The additional cost is estimated at ($426,000) using a 7 percent NPV. For licensees not seeking to dispose of GTCC waste, the additional requirements in the proposed rule are instead expected to result in approximately 300 hours of work. Table 4 shows these costs. The analysis also assumes one licensee will seek to use the proposed criteria provided in 10 CFR 61.1(b) and therefore would not experience significant incremental costs.

Table 4 Industry Implementation Costs

Update LLW Safety Case (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Update Safety Case	2	300	$167	($100,000)	($62,000)	($81,000)
				Total:	**($100,000)**	**($62,000)**	**($81,000)**

Update LLW Safety Case (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Update Safety Case	1	7,783	$167	($1,300,000)	($809,000)	($1,057,000)
				Total:	**($1,300,000)**	**($809,000)**	**($1,057,000)**

Update LLW Modeling Tools (U.S. Ecology)

Year	Activity	Number of Affected Entities	Unit Cost	Cost		
				Undiscounted	7% NPV	3% NPV
2029	Update Modeling Tools	1	$683,333	($683,000)	($426,000)	($556,000)
			Total:	**($683,000)**	**($426,000)**	**($556,000)**

*Values rounded to the nearest $1,000

However, the staff assumes that only one licensee, WCS, would dispose of GTCC waste. Because that licensee has already updated its technical analyses and modeling tools, the only anticipated industry implementation costs are minor updates to the safety cases at two of the affected entities. The other costs for U.S. Ecology in Table 4 are used in the sensitivity analysis.

5.3.2 Industry Operation

Updating of the Safety Case Required at License Renewal during Facility Operations

To ensure compliance with the Subpart C performance objectives, 10 CFR 61.27, "Application for renewal or closure," specifies the requirements for renewal of a license. While the NRC is not proposing to revise 10 CFR 61.27 in this rulemaking, licensees may incur additional costs to update the safety case, including new and revised technical analyses, required by this rulemaking at license renewal. For renewal, licensees would be required to update their safety case (i.e., update their technical analyses, which include the performance assessment, intruder assessment, operational safety assessment, and site stability assessment) if changes affecting the safety case or technical analyses occur. Additionally, if a site has disposed of, or plans to dispose of, significant quantities of long-lived radionuclides, the performance period analysis

may also require updating. These analyses demonstrate that the performance objectives of Subpart C will continue to be met. Additionally, licensees may need to update their waste acceptance criteria, and identification of defense-in-depth protections, under proposed revisions to 10 CFR 61.58 and 61.10(b), respectively. While the costs to update the technical analyses, waste acceptance criteria, and defense-in-depth protections will vary from site to site depending on whether new information warrants significant revisions, the NRC estimates that updating these analyses would take approximately 850 hours, or approximately ($63,000) using a 7 percent NPV, for a site planning to dispose of GTCC waste. For other sites, the NRC estimates updating the safety case at renewal would take approximately 300 hours, leading to estimated costs of ($87,000) using a 7 percent NPV, for all of the planned license renewals at these sites. These incremental costs may be overestimated if there are no changes at the site between license renewals that require an update to the safety case.

Updated Safety Case Required at Facility Closure

The proposed revisions to 10 CFR 61.28, “Post-closure observation and maintenance,” would require a licensee to update its safety case (i.e., update the technical analyses, which consist of the performance assessment, intruder assessment, and site stability analysis) with the application to amend the license for closure. If a site has disposed of significant quantities of long-lived radionuclides, the performance period analysis would also need to be updated. Similarly, the licensee would need to update its identification of defense-in-depth protections as part of the final safety case. The NRC estimates updating the technical analyses and revising the identification of defense-in-depth protections would take approximately 900 hours, or approximately ($34,000) using a 7 percent NPV, for this work. For other sites, the NRC estimates updating the safety case at closure would take approximately 300 hours, leading to estimated costs of ($16,000) using a 7 percent NPV. These incremental costs may be overestimated if there were no changes at the site that would require updates to the technical analyses or identification of defense-in-depth protections after the last license renewal before the closure application is submitted.

Conducting Annual Reviews of Waste Acceptance Criteria during Facility Operations

The proposed revisions to 10 CFR 61.58(f) would require a licensee to review its waste acceptance criteria annually to determine whether an update is needed. The NRC estimates that each annual review of waste acceptance criteria would require 107 hours, resulting in approximately ($105,000) using a 7 percent NPV.

Recordkeeping Requirements

Proposed language for 10 CFR 61.80(m) would require licensees to maintain records of their audits and other reviews of program content and implementation. The NRC estimates that each recordkeeping effort would require 43 hours, or approximately ($34,000) using a 7 percent NPV.

In addition, as a result of the proposed rule, a licensee would gain efficiencies over the regulatory baseline in submitting the disposal request and in revising disposal procedures, estimated to save approximately 1,600 hours and 53 hours, respectively, and $178,000 and $6,000, respectively, using a 7 percent NPV.

As discussed in the assumptions, the final two cost items below would be incurred by various entities. They would incur costs for disposal in terms of fees estimated at ($15.6 million) using a 7 percent NPV and ($20.8 million) using a 3 percent NPV. Additionally, this regulatory analysis

uses the assumption that an inspection and potential mitigation 5 years after disposal will be needed. This results in estimated costs of ($2.88 million) using a 7 percent NPV and ($4.54 million) using a 3 percent NPV. These costs conservatively assume the burden of disposing of all known GTCC and GTCC-like waste streams, present and future, in the first 2 years after the Agreement State has a compatible program in place to regulate GTCC waste. On the other hand, the costs to store the disposed waste would be averted as a result of the proposed rule, and this analysis uses the storage costs at WVDP as noted in the assumptions above. The NRC estimates storage costs of $154 million (7 percent NPV) and $245 million (3 percent NPV) across 10 years would be averted. This regulatory analysis conservatively uses only the WVDP storage costs, and a conservative period of 10 years of storage if the proposed rule is not issued.

Table 5 depicts these costs and averted costs, including costs if U.S. Ecology applied to dispose of GTCC waste, selected for sensitivity and uncertainty. The sites have 5- and 10-year renewal terms, with different years of renewal scheduled. This analysis uses the current license terms for each licensee. Aside from storage and disposal, the costs and benefits in this section used in the totals for Alternative 3 were for one licensee applying to dispose of GTCC waste (WCS).

The NRC chose not to quantify physical security costs and criticality safety costs that may be incremental increases over the regulatory baseline as a result of Alternative 3. Physical security costs will depend on the types and concentrations of waste received at the disposal facility, but the NRC anticipates that there would be slight increases—if any—in costs for physical protection of GTCC wastes beyond those already incurred for other LLW. Criticality safety will depend on the same factors, but the NRC anticipates that the criticality controls would be limited (e.g., limits on stacking and placement of waste packages) such that only minimal costs are expected to be incurred.

Table 5 Industry Operation Costs

Review Waste Acceptance Criteria (WCS)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2044	Review Criteria	16	107	$167	($285,000)	($105,000)	($182,000)
				Total:	**($285,000)**	**($105,000)**	**($182,000)**

Review Waste Acceptance Criteria (U.S. Ecology)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2056	Review Criteria	28	107	$167	($499,000)	($135,000)	($272,000)
				Total:	**($499,000)**	**($135,000)**	**($272,000)**

Update LLW Safety Case at Renewal (WCS)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2034	Update Safety Case	1	853	$167	($142,000)	($63,000)	($100,000)
				Total:	**($142,000)**	**($63,000)**	**($100,000)**

Update LLW Safety Case at Renewal (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2033	Update Safety Case	1	300	$167	($50,000)	($24,000)	($36,000)

2036	Update Safety Case	1	300	$167	($50,000)	($19,000)	($33,000)
2038	Update Safety Case	1	300	$167	($50,000)	($17,000)	($31,000)
2043	Update Safety Case	1	300	$167	($50,000)	($12,000)	($27,000)
2048	Update Safety Case	1	300	$167	($50,000)	($9,000)	($23,000)
2053	Update Safety Case	1	300	$167	($50,000)	($6,000)	($20,000)
				Total:	**($300,000)**	**($87,000)**	**($170,000)**

Update LLW Safety Case at Renewal (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2033	Update Safety Case	1	553	$167	($92,000)	($44,000)	($67,000)
2038	Update Safety Case	1	553	$167	($92,000)	($31,000)	($58,000)
2043	Update Safety Case	1	553	$167	($92,000)	($22,000)	($50,000)
2048	Update Safety Case	1	553	$167	($92,000)	($16,000)	($43,000)
2053	Update Safety Case	1	553	$167	($92,000)	($11,000)	($37,000)
				Total:	**($460,000)**	**($124,000)**	**($255,000)**

Update LLW Safety Case at Closure (WCS)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2044	Update Safety Case	1	907	$167	($151,000)	($34,000)	($79,000)
				Total:	**($151,000)**	**($34,000)**	**($79,000)**

Update LLW Safety Case at Closure (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2045	Update Safety Case	1	300	$167	($50,000)	($11,000)	($25,000)
2056	Update Safety Case	1	300	$167	($50,000)	($5,000)	($18,000)
				Total:	**($100,000)**	**($16,000)**	**($43,000)**

Update LLW Safety Case at Closure (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2056	Update Safety Case	1	607	$167	($101,000)	($10,000)	($37,000)
				Total:	**($101,000)**	**($10,000)**	**($37,000)**

Retain Audit and Other Review Records (WCS)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2044	Retain Records	16	43	$136	($93,000)	($34,000)	($59,000)
				Total:	**($93,000)**	**($34,000)**	**($59,000)**

Retain Audit and Other Review Records (U.S. Ecology)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2056	Retain Records	28	43	$136	($162,000)	($44,000)	($88,000)
				Total:	**($162,000)**	**($44,000)**	**($88,000)**

Submit Disposal Request (efficiencies gained from proposed rule language) (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Disposal Request Efficiencies	1	1,600	$167	$267,000	$178,000	$224,000
				Total:	**$267,000**	**$178,000**	**$224,000**

Revise GTCC Disposal Procedures (efficiencies gained from proposed rule language) (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Procedure Revision Efficiencies	1	53	$167	$9,000	$6,000	$7,000
				Total:	**$9,000**	**$6,000**	**$7,000**

GTCC Disposal Fees and Expenses (all entities)

Year	Activity	Cost	Cost		
			Undiscounted	7% NPV	3% NPV
2029	GTCC Disposal Fees	($12,955,923)	($12,956,000)	($8,068,000)	($10,534,000)
2030	GTCC Disposal Fees	($12,955,923)	($12,956,000)	($7,540,000)	($10,228,000)
		Total:	**($25,912,000)**	**($15,608,000)**	**($20,762,000)**

Disposed GTCC Reinspection Costs (all entities)

Year	Activity	Cost	Cost		
			Undiscounted	7% NPV	3% NPV
2034	GTCC Disposal Reinspection Costs	($6,477,961)	($6,478,000)	($2,876,000)	($4,544,000)
		Total:	**($6,478,000)**	**($2,876,000)**	**($4,544,000)**

Averted GTCC Storage Costs (WVDP)

Year	Activity	Number of Years	Annual Cost	Cost		
				Undiscounted	7% NPV	3% NPV
2029–2038	Averted Cost to Store GTCC	10	$35,300,000	$353,000,000	$154,400,000	$244,835,000
			Total:	**$353,000,000**	**$154,400,000**	**$244,835,000**

5.3.3 Other Government

Agreement States would experience incremental costs and benefits from Alternative 3.

5.3.3.1 Agreement State Implementation

Conducting Rulemaking and Development of Guidance Documents

The Agreement States develop the rule packages, procedures, and guidance to accommodate the requirements that will be added or modified by the rulemaking process. The effort to develop the rule package is estimated to require approximately 2,000 hours for each Agreement State. This will result in a total cost of approximately ($172,000) using a 7 percent NPV per Agreement State.

Reviewing Safety Cases

Agreement States would need to review each licensee's safety case required by proposed revisions to 10 CFR 61.10, including technical analyses, waste acceptance criteria, and identification of defense-in-depth protections. The NRC estimates that the costs for each Agreement State to review a licensee's initial technical analyses, waste acceptance criteria, and defense-in-depth protections would be approximately 4,100 hours if the licensee is seeking to dispose of GTCC waste, or 150 hours for licensees not seeking to dispose of GTCC waste. TCEQ has already performed a similar review for WCS, so the estimate in Table 6 below for initial Agreement State review of a safety case for U.S. Ecology, with costs estimated at ($354,000) using a 7 percent NPV, is for the sensitivity analysis.

Table 6 Agreement State Implementation Costs

Agreement State Rulemaking (for each unique Agreement State)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2027	Rulemaking Activities	4	960	$129	($496,000)	($354,000)	($428,000)
2028	Rulemaking Activities	4	960	$129	($496,000)	($331,000)	($415,000)
				Total:	**($992,000)**	**($684,000)**	**($843,000)**

Review Initial LLW Safety Case (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Review Safety Case	2	150	$129	($39,000)	($26,000)	($32,000)
				Total:	**($39,000)**	**($26,000)**	**($32,000)**

Review Initial LLW Safety Case (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Review Safety Case	1	4,117	$129	($532,000)	($354,000)	($445,000)
				Total:	**($532,000)**	**($354,000)**	**($445,000)**

5.3.3.2 Agreement State Operation

Additional Review of Updated Safety Case Required at License Renewal

The regulations in 10 CFR 61.27 require an Agreement State to review a licensee's updated safety case, including technical analyses, waste acceptance criteria, and identification of defense-in-depth protections, to ensure compliance with the Subpart C performance objectives at license renewal. Each Agreement State reviews the updated technical analyses, waste acceptance criteria, and defense-in-depth protections as part of the license renewal authorization. The NRC estimates that these reviews would require about 430 hours, or approximately ($24,000) using a 7 percent NPV, for a site disposing of GTCC waste. These incremental costs may be overestimated if no changes occurred at a site between license renewals that would require updates to the technical analyses, waste acceptance criteria, or defense-in-depth protections. For licensees not disposing of GTCC waste, the Agreement State reviews are expected to take approximately 150 hours, for a total cost of ($34,000) using a 7 percent NPV.

Additional Review Required at Facility Closure

The proposed revisions to 10 CFR 61.28 require an Agreement State to review a licensee's updated safety case, including technical analyses and defense-in-depth protections, at facility closure. The NRC estimates that each Agreement State review of a licensee's updated technical analyses and defense-in-depth protections would require 450 hours, or approximately ($13,000) at a 7 percent NPV, for a site that has disposed of GTCC waste. These incremental costs may be overestimated if there were no changes that occurred at the site between the last license renewal and submission of the closure application that would require updates to the technical analyses or defense-in-depth protections. For licensees not disposing of GTCC waste, the Agreement State reviews are expected to take approximately 150 hours, for a total cost of ($6,000) using a 7 percent NPV.

To enable a licensee to dispose of wastes in accordance with this proposed rule, the Agreement State would need to review the licensee's disposal request, taking approximately 2,100 hours or ($184,000) using a 7 percent NPV. The Agreement State would also need to ensure environmental compliance, taking approximately 530 hours or ($43,000) using a 7 percent NPV. In order to take over these responsibilities from the NRC, the Agreement State would need to update its program to ensure that it has adequate and compatible legislation, regulations, licensing, inspection, staffing and training, enforcement, and incident response to support GTCC disposal, taking approximately 850 hours or ($84,000) using a 7 percent NPV. Various coordination and licensing actions are expected to cost approximately ($46,000) using a 7 percent NPV. For the Agreement State to issue the license amendment and generate waste acceptance criteria, the NRC estimates costs of ($17,000) and ($28,000) using a 7 percent NPV, respectively. Finally, the NRC estimates review of a licensee's waste acceptance criteria to cost approximately ($85,000) using a 7 percent NPV. Table 7 shows all of these costs for each affected site (and thus their respective Agreement State), but U.S. Ecology disposal of GTCC waste is used only in the sensitivity analysis.

Table 7 Agreement State Operation Costs

Review Updated LLW Safety Case at Renewal (WCS)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2034	Review Safety Case	1	427	$129	($55,000)	($24,000)	($39,000)
				Total:	**($55,000)**	**($24,000)**	**($39,000)**

Review Updated LLW Safety Case at Renewal (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2033	Review Safety Case	1	150	$129	($19,000)	($9,000)	($14,000)
2036	Review Safety Case	1	150	$129	($19,000)	($8,000)	($13,000)
2038	Review Safety Case	1	150	$129	($19,000)	($7,000)	($12,000)
2043	Review Safety Case	1	150	$129	($19,000)	($5,000)	($10,000)
2048	Review Safety Case	1	150	$129	($19,000)	($3,000)	($9,000)
2053	Review Safety Case	1	150	$129	($19,000)	($2,000)	($8,000)
				Total:	**($114,000)**	**($34,000)**	**($66,000)**

Review Updated LLW Safety Case at Renewal (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV

2033	Review Safety Case	1	277	$129	($36,000)	($17,000)	($26,000)
2038	Review Safety Case	1	277	$129	($36,000)	($12,000)	($22,000)
2043	Review Safety Case	1	277	$129	($36,000)	($9,000)	($19,000)
2048	Review Safety Case	1	277	$129	($36,000)	($6,000)	($17,000)
2053	Review Safety Case	1	277	$129	($36,000)	($4,000)	($14,000)
				Total:	**($180,000)**	**($48,000)**	**($98,000)**

Review Updated LLW Safety Case at Closure (WCS)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2044	Review Safety Case	1	453	$129	($59,000)	($13,000)	($31,000)
				Total:	**($59,000)**	**($13,000)**	**($31,000)**

Review Updated LLW Safety Case at Closure (not planning to accept GTCC)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2045	Review Safety Case	1	150	$129	($19,000)	($4,000)	($10,000)
2056	Review Safety Case	1	150	$129	($19,000)	($2,000)	($7,000)
				Total:	**($38,000)**	**($6,000)**	**($17,000)**

Review Updated LLW Safety Case at Closure (U.S. Ecology)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2056	Review Safety Case	1	303	$129	($39,000)	($4,000)	($14,000)
				Total:	**($39,000)**	**($4,000)**	**($14,000)**

Review Disposal Request (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Review Disposal Request	1	2133	$129	($276,000)	($184,000)	($231,000)
				Total:	**($276,000)**	**($184,000)**	**($231,000)**

Ensure Environmental Compliance (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Ensure Environmental Compliance	1	533	$129	($69,000)	($43,000)	($56,000)
				Total:	**($69,000)**	**($43,000)**	**($56,000)**

Updating Agreement State Program (for each unique Agreement State)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2026	Updating Agreement State Program	1	853	$129	($110,000)	($84,000)	($98,000)
				Total:	**($110,000)**	**($84,000)**	**($98,000)**

Coordination and Licensing Actions (any licensee)

Year	Activity				Cost

		Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Undiscounted	7% NPV	3% NPV
2028	Coordination and Licensing Actions	1	533	$129	($69,000)	($46,000)	($58,000)
				Total:	**($69,000)**	**($46,000)**	**($58,000)**

Issue License Amendment (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Issue License Amendment	1	213	$129	($28,000)	($17,000)	($22,000)
				Total:	**($28,000)**	**($17,000)**	**($22,000)**

Generate GTCC Inspection Procedures (any licensee)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Generate Procedures	1	320	$129	($41,000)	($28,000)	($35,000)
				Total:	**($41,000)**	**($28,000)**	**($35,000)**

Review Waste Acceptance Criteria (WCS)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2044	Review Criteria	16	107	$136	($232,000)	($85,000)	($148,000)
				Total:	**($232,000)**	**($85,000)**	**($148,000)**

Review Waste Acceptance Criteria (U.S. Ecology)

Year	Activity	Number of Years	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029–2056	Review Criteria	28	107	$136	($405,000)	($109,000)	($221,000)
				Total:	**($405,000)**	**($109,000)**	**($221,000)**

5.3.4 NRC Implementation

Under Alternative 3, the NRC would develop proposed and final rule packages, as well as the guidance document, estimated to cost ($482,000) using a 7 percent NPV, shown in Table 8. All rulemaking activities for the proposed rule are considered sunk costs and not included in this regulatory analysis.

Table 8 NRC Implementation Costs

Year	Activity	Number of Actions	Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2024	Finalize Rule	1	1,500	$143	($215,000)	($187,000)	($202,000)
2025	Finalize/Issue Rule	1	1,500	$143	($215,000)	($175,000)	($196,000)
2024	Finalize Regulatory Guides	1	500	$143	($72,000)	($62,000)	($67,000)
2025	Finalize/Issue Regulatory Guides	1	500	$143	($72,000)	($58,000)	($65,000)
				Total:	**($574,000)**	**($482,000)**	**($530,000)**

5.3.5 NRC Operation

Given the proposed rule language, if one of the licensees requested to dispose of GTCC waste, many NRC activities in the regulatory baseline would now be performed by the Agreement State regulator, if the Agreement State elects to allow disposal of GTCC waste. The NRC would no longer review disposal requests from licensees, representing approximately 2,500 hours of effort, or averted costs of $244,000 (7 percent NPV). The NRC would no longer establish environmental compliance, taking approximately 800 hours, resulting in averted costs of $71,000 (7 percent NPV). The NRC would incur a cost for reviewing updates to the Agreement State program to ensure adequacy and compatibility in order to enable this shift in activities, taking approximately 1,700 hours or costing ($186,000) using a 7 percent NPV. Also, the NRC would no longer have to develop inspection procedures or issue the disposal license, resulting in estimated averted costs of $30,000 and $33,000 (7 percent NPV), respectively. Finally, the NRC would experience averted costs from not attending any licensing meetings or hearings, estimated at $132,000 (7 percent NPV) based on approximately 1,400 hours. These costs are show in Table 9.

Table 9 NRC Operation Costs

Averted Disposal Request Review

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Averted Review	1	2,560	$143	$366,000	$244,000	$307,000
				Total:	**$366,000**	**$244,000**	**$307,000**

Averted Environmental Compliance Review

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Averted Review	1	800	$143	$114,000	$71,000	$93,000
				Total:	**$114,000**	**$71,000**	**$93,000**

Reviewing Updates to the Agreement State Program (for each unique Agreement State)

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2026	Reviewing Updates to the Agreement State Program	1	1,707	$143	($244,000)	($186,000)	($217,000)
				Total:	**($244,000)**	**($186,000)**	**($217,000)**

Averted Generation of GTCC Inspection Procedures

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Averted Procedure Development	1	320	$143	$46,000	$30,000	$38,000
				Total:	**$46,000**	**$30,000**	**$38,000**

Averted License Hearing and Public Meeting Attendance

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2028	Averted Meeting and Hearing	1	1,387	$143	$198,000	$132,000	$166,000
				Total:	**$198,000**	**$132,000**	**$166,000**

Averted Finalize and Issue License

Year	Activity	Number of Affected Entities	Labor Hours	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2029	Averted License Activities	1	373	$143	$53,000	$33,000	$43,000
				Total:	**$53,000**	**$33,000**	**$43,000**

5.3.6 Public Health (Routine)

The 10 CFR Part 61 LLW classification system remains protective of inadvertent intruders for the LLW streams that were analyzed in the development of the regulations, because of the reasonably conservative nature of the analysis used to develop the LLW classification system. However, inconsistencies between actual site conditions and practices at LLW land disposal facilities, and the generic assumptions used to develop the LLW classification system, may cause the radionuclide concentration limits to be either overly restrictive or permissive, depending on the specific site. If radionuclide concentration limits are overly restrictive based on actual site characteristics, facility design, and operational practices, the LLW classification system would ensure the safe disposal of LLW, but it would impose unnecessary regulatory burdens on licensees and LLW generators. In addition, wastes may be proposed for disposal that are significantly different from those analyzed to develop the generic concentration limits found in the current regulation. The addition of the proposed requirement for an inadvertent intruder assessment would require that these significantly different wastes are analyzed to ensure that the 10 CFR Part 61 performance objectives would be met prior to being accepted for disposal.

It is the 10 CFR Part 61 performance objectives, rather than the LLW classification requirements, that ultimately ensure protection of public health and safety. Therefore, if the Commission found that the LLW classification requirements were overly permissive at a particular land disposal facility, it could impose additional requirements to ensure that the 10 CFR Part 61 performance objectives would be met. The proposed revisions to this rule allow waste acceptance criteria to be developed from either the waste classification limits in 10 CFR 61.55 (generic) or the results of the analyses required in 10 CFR 61.13 (site specific). Regardless of the method used to develop waste acceptance criteria, licensees must demonstrate through the analyses required under 10 CFR 61.13 that the performance objectives will be met. Requiring licensees to demonstrate that waste acceptance criteria will be met also demonstrates reasonable assurance that the performance objectives will be met and will provide assurance that public health and safety will be protected, while offering the possibility for relief from unnecessary regulatory burdens for facilities with certain site characteristics, design, and operational practices.

Additionally, this proposed rule will facilitate the use of site-specific information and up-to-date dosimetry methodologies to better ensure protection of public health and safety.

5.3.7 Improvements in Knowledge

The new and revised analyses will help the licensee gather additional valuable information that will be used in the current and continued disposal of LLW at its facility. This new information will ensure that LLW streams that are significantly different from those considered during the development of the current regulations can be safely disposed. Development of new waste acceptance criteria should allow licensees to optimize disposal capacity while ensuring protection of public health and safety, which is likely to reduce licensee costs.

5.3.8 Regulatory Efficiency

Although there are already paths to dispose of DU, the proposed rule would enable additional sites for disposal that should benefit entities currently storing DU. Additionally, the development of waste acceptance criteria from the results of the technical analyses provides licensees flexibility to better manage disposal capacity consistent with the risks of disposal of LLW streams. This flexibility may allow for additional revenue streams for disposal facility operators than may be permitted using the waste classification limits, depending on the performance of the disposal site. Developing new waste acceptance criteria should allow licensees to dispose of material in a more "risk-efficient" manner, which is likely to reduce licensee costs. Additionally, the new flexibility would allow disposal facility operators to consider future waste streams for disposal in quantities or concentrations that may not have been evaluated as part of the original 10 CFR Part 61 rulemaking. It may also enhance access to disposal facilities for waste generators, potentially reducing disposal costs, particularly for those that may have had difficulty disposing of waste previously because the waste did not meet certain aspects of the waste classification limits or waste characteristic requirements. The new and revised analyses will help the licensee gather additional valuable information that would be used in the current and continued disposal of LLW at its facility.

5.3.9 Totals

Table 10 summarizes the combined implementation and operation costs by entity, over the analysis period for Alternative 3. As mentioned previously, the Industry Operation attribute includes costs and averted costs from many affected entities. The data were not readily separable, and therefore the NRC made simplifying assumptions, such as combining them into this one attribute, as described above in section 4.3.

Table 10 Net Costs and Benefits

Attribute	Total Averted Costs (Costs)		
	Undiscounted	**7% NPV**	**3% NPV**
Industry Implementation	($100,000)	($60,000)	($80,000)
Industry Operation	$319,810,000	$135,760,000	$219,130,000
Industry Totals	*$319,710,000*	*$135,700,000*	*$219,050,000*
Agreement State Implementation	($1,030,000)	($710,000)	($880,000)
Agreement State Operation	($1,090,000)	($560,000)	($800,000)
Agreement State Totals	*($2,120,000)*	*($1,270,000)*	*($1,680,000)*
NRC Implementation	($570,000)	($480,000)	($530,000)
NRC Operation	$530,000	$320,000	$430,000
NRC Totals	*($40,000)*	*($160,000)*	*($100,000)*
Net:	***$317,550,000***	***$134,270,000***	***$217,270,000***

*Values are rounded to the nearest $10,000. Totals may differ among tables due to rounding and modeling.

5.4. Uncertainty and Sensitivity Analysis

The NRC is including a Monte Carlo uncertainty analysis in this regulatory analysis using the specialty software @Risk.[6] The Monte Carlo approach answers the question, "What distribution of net benefits and costs results from multiple draws of the probability distribution assigned to key variables?"

5.4.1 Uncertainty Analysis Assumptions

Because this regulatory analysis is based on estimates of values that are sensitive to licensee-specific cost drivers and plant dissimilarities, the NRC provides the following analysis of the variables that have the greatest amount of uncertainty. As noted above, the staff performed this analysis with a Monte Carlo simulation analysis using the @Risk software program.

Monte Carlo simulations involve introducing uncertainty into the analysis by replacing the point estimates of the variables used to estimate base case costs and benefits with probability distributions. By defining input variables as probability distributions instead of point estimates, the influence of uncertainty on the results of the analysis (i.e., the net benefits) can be modeled effectively.

The probability distributions chosen to represent the different variables in the analysis were bounded by the range-referenced input and the staff's professional judgment. When defining the probability distributions for use in a Monte Carlo simulation, summary statistics are needed to characterize the distributions. These summary statistics include (1) the minimum, most likely, and maximum values of a program evaluation and review technique (PERT) distribution,[7] (2) the minimum and maximum values of a uniform distribution, and (3) the specified integer values of a discrete population. The regulatory analysis uses PERT distributions to reflect the relative spread and skewness of the distribution defined by the three estimates.

5.4.2 Uncertainty Analysis Results

The staff performed the Monte Carlo simulation by calculating the results for 10,000 realizations (samples) of the input parameters. For each iteration, this analytical tool chooses the values identified in the table randomly from the probability distributions that define the input variables. The analysis records the values of the output variables for each iteration and used these resulting output variable values to define the resultant probability distribution.

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[6] Information about the @Risk software is available at https://www.palisade.com.

[7] A PERT distribution is a special form of the beta distribution with specified minimum and maximum values. The shape parameter is calculated from the defined "most likely" value. The PERT distribution is similar to a triangular distribution in that it has the same set of three parameters. Technically, it is a special case of a scaled beta (or beta general) distribution. The PERT distribution is generally considered superior to the triangular distribution when the parameters result in a skewed distribution because the smooth shape of the curve places less emphasis in the direction of skew. Similar to the triangular distribution, the PERT distribution is bounded on both sides and, therefore, may not be adequate for some modeling purposes if the capture of tail or extreme events is desired.

For the analysis shown in each figure below, the analysis ran 10,000 simulations to assess the resulting effect on costs and benefits.

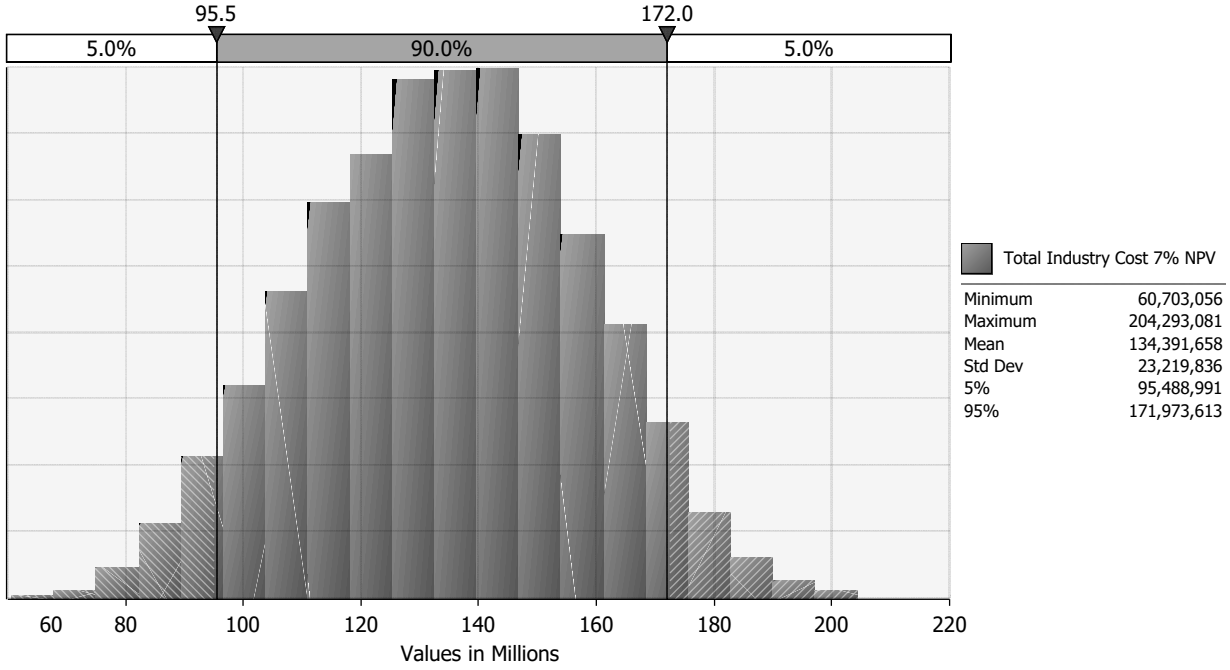

Figure 1 Industry Totals at 7 Percent NPV

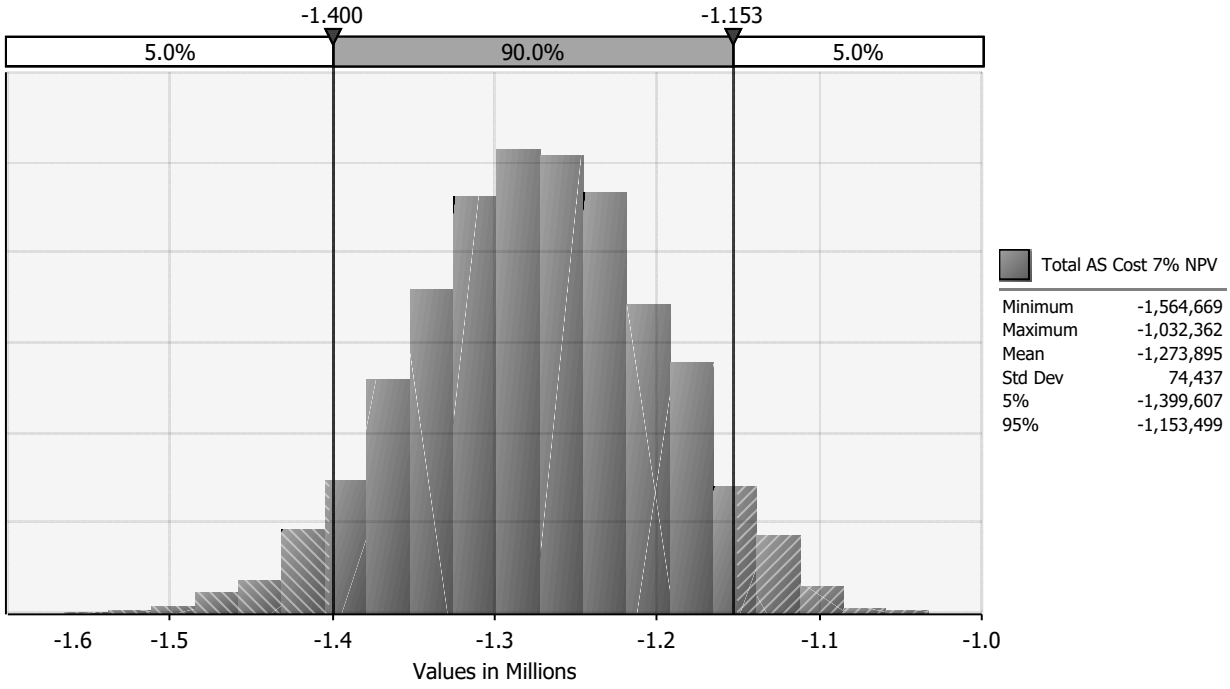

Figure 2 Agreement State Totals at 7 Percent NPV

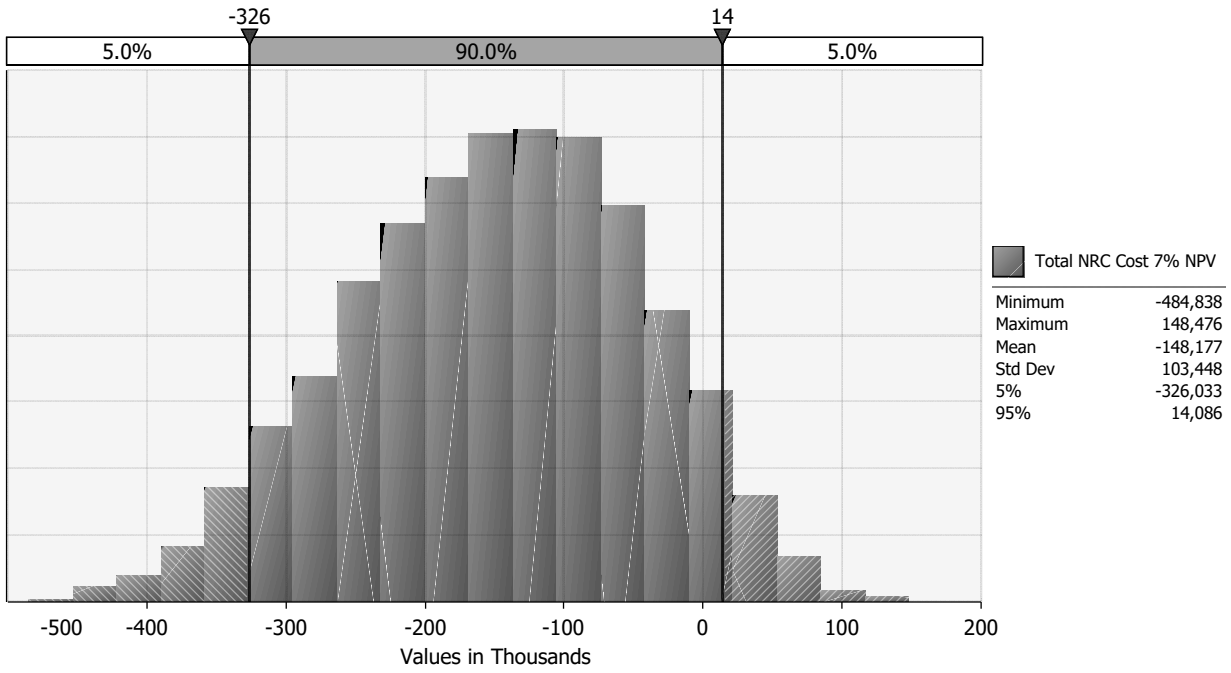

Figure 3 NRC Totals at 7 Percent NPV

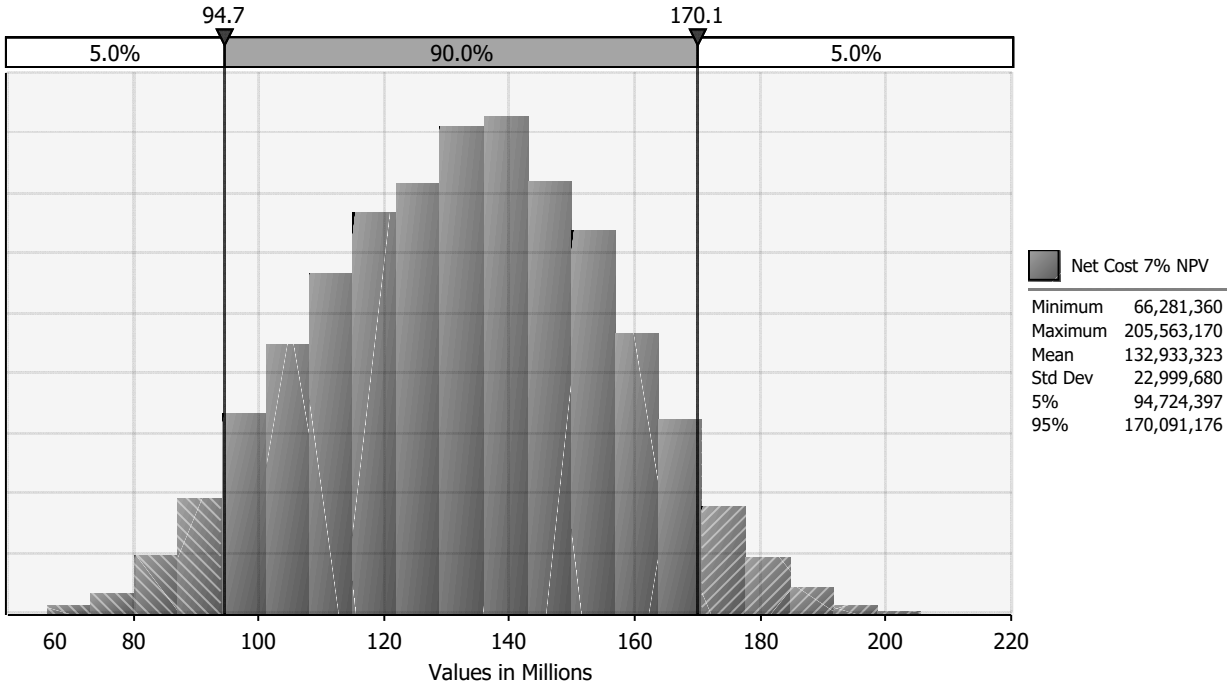

Figure 4 Net Totals at 7 Percent NPV

Figure 1 through 4 display the histograms of the incremental benefits and costs of Alternative 3, assuming one applicant expresses an interest in a disposal facility that can accept GTCC waste. The histograms display the cost estimates using a 7 percent discount factor.

Figure 5 is a sensitivity analysis that identifies the key variables whose uncertainty drives the largest impact on total costs for Alternative 3. These figures rank the variables based on their contribution to cost uncertainty.

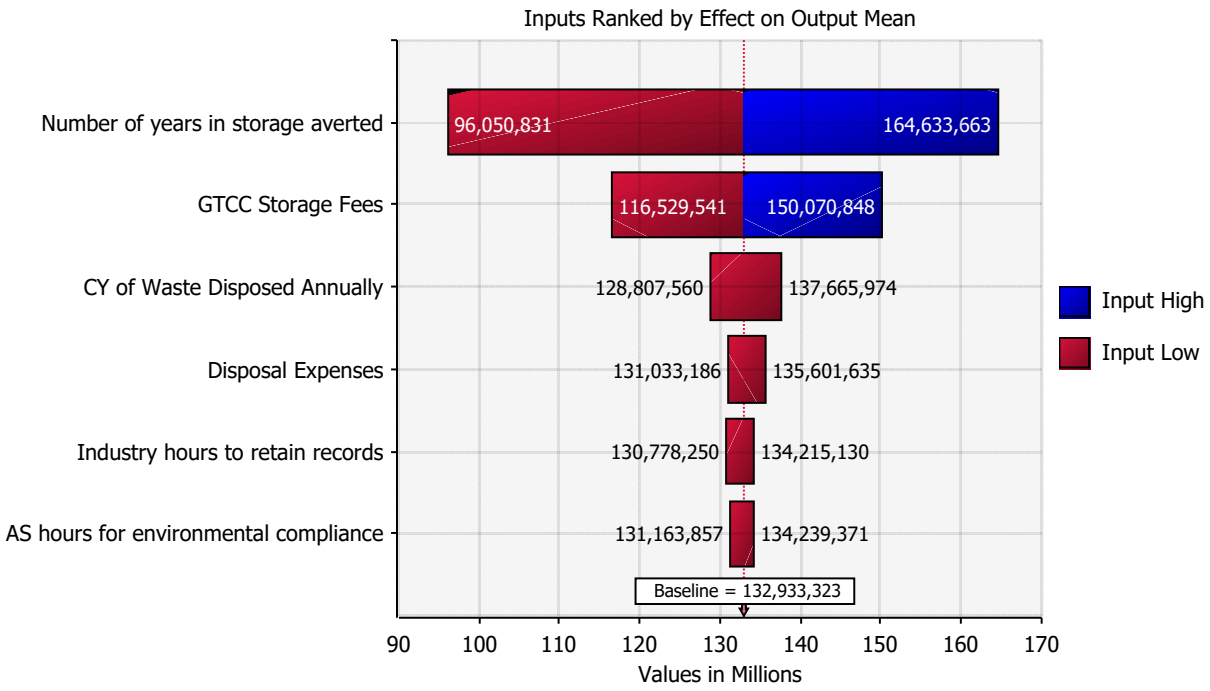

Figure 5 Key Variables Whose Uncertainty Drives the Largest Impact on Costs for Alternative 3 (7 Percent NPV)

Figure 5 shows that the parameters having the greatest cost impact on Alternative 3 are the number of years the waste streams would have been in storage without the proposed rule, and the storage fees for that waste. The influence of a variable on the output is not only a function of the value of that variable but also of the shape and range of its distribution. The other parameters shown have less impact on the results.

The NRC also presents a sensitivity analysis to determine whether a second disposal entity (in this case, U.S. Ecology) also applying for a license to dispose of these waste streams would impact the cost-beneficial nature of the proposed rule. Table 11 represents those results, which show the net benefits remain high at $131.6 million (7 percent NPV) and are only $2.6 million less than with one entity applying (see Table 10). Therefore, the proposed rule's cost-beneficial nature is not sensitive to the number of disposal entities applying. Table 12 details all of the inputs to the cost model and uncertainty analysis.

Table 11 Net Costs and Benefits, Two Licensees and Two Agreement States

Attribute	Total Averted Costs (Costs)		
	Undiscounted	7% NPV	3% NPV
Industry Implementation	($2,080,000)	($1,300,000)	($1,690,000)
Industry Operation	$318,870,000	$135,630,000	$218,710,000
Industry Totals	*$316,790,000*	*$134,330,000*	*$217,020,000*
Agreement State Implementation	($2,550,000)	($1,750,000)	($2,160,000)
Agreement State Operation	($2,310,000)	($1,130,000)	($1,630,000)
Agreement State Totals	*($4,860,000)*	*($2,880,000)*	*($3,790,000)*
NRC Implementation	($570,000)	($480,000)	($530,000)
NRC Operation	$1,070,000	$650,000	$860,000
NRC Totals	*$500,000*	*$170,000*	*$330,000*
Net:	***$312,430,000***	***$131,620,000***	***$213,560,000***

Table 12 Uncertainty Analysis Input

Description	Mean/Value	Distribution	Low	Best	High
Base Year	2022				
Rule Issuance Year	2026				
Agreement State Rule Implementation Year	2029				
WCS Closure Year	2044				
WCS Renewal Frequency	10 years				
U.S. Ecology Closure Year	2056				
U.S. Ecology Renewal Frequency	5 years				
Clive Closure Year	2045				
Clive Renewal Frequency	10 years				
Principal Discount Rate	7%				
Alternative Discount Rate	3%				
NRC Hourly Rate	$143				
Industry Hourly Rate (applications, etc.)	$136	PERT	$112	$137	$154
Technical Industry Hourly Rate (safety case, etc.)	$167	PERT	$143	$170	$181
Agreement State Rulemaking Labor Rate	$129	PERT	$111	$130	$143
Agreement State Reviewing Labor Rate	$117	PERT	$102	$118	$126
Licensee Perform Initial Safety Case (disposing of GTCC waste)	8,083	PERT	6,000	8,000	10,500
Licensee Perform Initial Safety Case (not disposing of GTCC waste)	300	PERT	200	300	400
Licensee Update Modeling Tools	$683,333	PERT	$300,000	$700,000	$1,000,000
Licensee Update Safety Case at Renewal (disposing of GTCC waste)	853	PERT	720	800	1,200

Description	Mean/Value	Distribution	Low	Best	High
Licensee Update Safety Case at Renewal (not disposing of GTCC waste)	300	PERT	200	300	400
Licensee Update Safety Case at Closure (disposing of GTCC waste)	907	PERT	640	800	1,600
Licensee Update Safety Case at Closure (not disposing of GTCC waste)	300	PERT	200	300	400
Licensee Review Waste Acceptance Criteria	107	PERT	90	100	150
Licensee Retain Records	43	PERT	36	40	60
Agreement State Rulemaking	853	PERT	720	800	1,200
Agreement State Review Initial Safety Case (disposing of GTCC waste)	4,267	PERT	3,600	4,000	6,000
Agreement State Review Initial Safety Case (not disposing of GTCC waste)	150	PERT	100	150	200
Agreement State Update Modeling Tools	$400,000	PERT	$300,000	$400,000	$500,000
Agreement State Review Safety Case at Renewal (disposing of GTCC waste)	427	PERT	360	400	600
Agreement State Review Safety Case at Renewal (disposing of GTCC waste)	150	PERT	100	150	200
Agreement State Review Safety Case at Closure (disposing of GTCC waste)	453	PERT	320	400	800
Agreement State Review Safety Case at Closure (disposing of GTCC waste)	150	PERT	100	150	200
Licensee Complete Disposal Request	1,600	PERT	1,350	1,500	2,250
Agreement State Review Disposal Request	2,133	PERT	1,800	2,000	3,000
Agreement State Develop GTCC Regulation	1,067	PERT	900	1,000	1,500
Agreement State Environmental Compliance	533	PERT	450	500	750
Agreement State Updates Its Program	853	PERT	720	800	1,200
NRC Reviews Updates to Agreement State Program	1,707	PERT	1,440	1,600	2,400
Agreement State Coordination and Licensing Actions	533	PERT	450	500	750
Agreement State Issue License Amendment	213	PERT	180	200	300
Licensee Revise GTCC Disposal Procedures	53	PERT	45	50	75
Agreement State Generate GTCC Inspection Procedures	320	PERT	270	300	450
Annual GTCC Storage Fees	$35,300,000	PERT	$29,600,000	$35,000,000	$42,200,000
Annualized One-Time Storage Fees	$1,718,333	PERT	$1,480,000	$1,730,000	$1,910,000
Averted Years of Storage	10	PERT	5	10	15

Description	Mean/Value	Distribution	Low	Best	High
GTCC Disposal Fees per Calendar Year	$2,212	PERT	$1,858	$2,200	$2,615
Total GTCC to Be Disposed (calendar year)	11,713	PERT	8,000	11,750	16,000
Disposed Waste Reinspection and Maintenance Fees per Calendar Year	$553	PERT	$465	$550	$654
Issue Final Rule	3,000	PERT	1,224	2,718	5,436
Issue Final Guidance with Rule	500	PERT	225	500	755

5.4.3 Summary of Uncertainty Analysis

The uncertainty analysis shows that the estimated mean averted costs for Alternative 3 are $134 million (7 percent NPV), and that there is a greater than 99 percent confidence that the proposed rule is cost beneficial. It is reasonable to infer that proceeding with the proposed rule represents an efficient use of resources and averted costs for many different entities.

5.5. Disaggregation

Aside from rulemaking costs for the NRC and the Agreement States, the primary cost drivers in the proposed rule are related to the safety case analyses, disposal requests, waste acceptance criteria, and, the most significant costs, disposal of the GTCC and GTCC-like wastes themselves. However, as can be seen in the net results, these costs are overwhelmed by the ongoing storage costs that would otherwise continue to be incurred, even with the conservative assumptions in this regulatory analysis. Because the above cost factors are those the staff is using to enable disposal of these waste streams, they are deemed to be related to the objective of the rulemaking and therefore cannot be separated from the proposed rule. Obviously, disposal costs are simply the result of the actual disposal process—enabled by this proposed rule, but not technically caused by it. Therefore, given that the conservatively estimated ongoing costs of storage—without this proposed rule—are so much higher in terms of averted costs, the rule is cost justified and disaggregation does not lead to any separable requirements.

5.6. Summary

This regulatory analysis identified both quantifiable and nonquantifiable costs and benefits that will result from conducting the rulemaking to near-surface disposal of LLW. Although quantifiable costs and benefits appear more tangible, the NRC urges decision-makers not to discount costs and benefits that cannot be quantified or monetized, as the latter may be of equal or greater importance. Based on this regulatory analysis, Alternative 3 is cost beneficial and the NRC recommends proceeding with the proposed rule.

5.6.1 Quantified Net Benefit

As shown in Table 10, the estimated incremental averted costs for Alternative 3 relative to the regulatory baseline (Alternative 1) range from approximately $134 million (7 percent NPV) to $217 million (3 percent NPV).

5.6.2 Nonquantified Benefits

In addition to the quantified costs discussed in this regulatory analysis, the proposed rule would lead to several nonquantified benefits for the many government and State entities, industry,

Agreement States, and the NRC, in relation to regulatory efficiency and improvements in knowledge.

This rule will facilitate the use of site-specific information and up-to-date dosimetry methodologies to better ensure protection of public health and safety. Licensees will be permitted to develop waste acceptance criteria from the results of the technical analyses, which will provide licensees flexibility to better manage disposal capacity consistent with the risks of disposal of LLW streams. This flexibility may allow for additional revenue streams for disposal facility operators than may be permitted using the waste classification limits, depending on the performance of the disposal site. Additionally, the new flexibility would allow disposal facility operators to consider future waste streams for disposal in quantities or concentrations that may not have been evaluated as part of the original 10 CFR Part 61 rulemaking. It may also enhance access to disposal facilities for waste generators, potentially reducing disposal costs, particularly for those that may have had difficulty disposing of waste previously because the waste did not meet certain aspects of the waste classification limits or waste characteristic requirements. The new and revised analyses will help the licensee gather additional valuable information that would be used in the current and continued disposal of LLW at its facility. This new information will ensure that LLW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely. Developing new waste acceptance criteria should also allow licensees to dispose of material in a more risk-efficient manner, which is likely to reduce licensee costs.

5.7. Safety Goal Evaluation

Safety goal evaluations are applicable only to regulatory initiatives considered to be generic safety enhancement backfits subject to the substantial additional protection standard at 10 CFR 50.109(a)(3) or the issue finality provisions in 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.” Materials licensees are not subject to these provisions, and therefore no safety goal analysis was performed.

5.8. Results for the Committee to Review Generic Requirements

This section addresses regulatory analysis information requirements for rulemaking actions or staff positions subject to review by the Committee to Review Generic Requirements (CRGR). This proposed rule is not within the scope of the NRC’s backfitting and issue finality provisions, and therefore, not subject to review by the CRGR. All information called for by the CRGR procedures (NRC, 2018b) is presented in this regulatory analysis or in the proposed rule. Table 13 cross-references the relevant information to its location in this document or the proposed rule.

Table 13 Specific CRGR Regulatory Analysis Information Requirements

CRGR Procedure	Item Included in a Regulatory Analysis	Where Item Is Discussed
Appendix B, (i)	The new or revised generic requirement or staff position	Proposed text in proposed rule
Appendix B, (ii)	Draft papers or other documents supporting the requirements or staff positions	Preamble to proposed rule

CRGR Procedure	Item Included in a Regulatory Analysis	Where Item Is Discussed
Appendix B, (iii)	The sponsoring office's position on whether each requirement or staff position would modify, implement, relax, or reduce existing requirements or staff positions	Regulatory Analysis, section 5, and Section XIII, "Backfitting and Issue Finality," of *Federal Register* notice for the proposed rule
Appendix B, (iv)	The method of implementation	Regulatory Analysis, Section 7
Appendix B, (vi)	The category of power reactors, new reactors, or nuclear materials facilities or activities to which the generic requirement or staff position applies	Regulatory Analysis, Section 4.2.2
Appendix B, (vii)–(viii)	The items required at 10 CFR 50.109(c) and the required rationale at 10 CFR 50.109(a)(3) if the action involves a power reactor backfit and the exceptions at 10 CFR 50.109(a)(4) are not applicable	Backfitting and Issue Finality, Section XIII, proposed rule
Appendix B, (xvi)	An assessment of how the action relates to the Commission's Safety Goal Policy Statement	Regulatory Analysis, Section 5.7

6. Decision Rationale

This section presents the benefits and costs from the 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 could be evaluated only on a qualitative basis.

The NRC qualitatively examined both the direct and indirect benefits that accrue from risks that are avoided if the NRC adopted the rule. The qualitative benefits of the action include an increased assurance that public health and safety will be protected from the disposal of LLW and an improved regulatory structure that facilitates implementation and better aligns 10 CFR Part 61 requirements with current health and safety standards.

Defining a compliance period is an important additional parameter for technical analyses not included in the current regulatory scheme. The compliance period is significant when evaluating LLW streams that were not considered in the original 10 CFR Part 61 rulemaking. Currently, there is ambiguity regarding how an Agreement State should select a compliance period and what timeframes should be applied to the analyses to support demonstration of compliance with different sections of the regulations.

In addition, the new and revised technical analyses proposed in 10 CFR 61.13 enhance the NRC's risk-informed regulatory framework by specifying requirements that need to be met, and thus providing regulatory certainty and predictability, while allowing a licensee or applicant flexibility regarding the information or approach used to satisfy those requirements. The proposed performance-assessment requirements would ensure that essential elements are present in the analysis while allowing licensees to tailor the analysis to site-specific conditions. The new inadvertent intruder assessment would help ensure protection of any inadvertent intruder who occupies the disposal site or contacts the LLW at any time after active institutional controls are removed, even if the waste stream is significantly different than those used to

develop the original LLW waste classification system. The new performance period analysis will help ensure that disposal of long-lived radionuclides is done in a manner that protects public health and safety.

The proposed site-specific waste acceptance criteria may also allow licensees to dispose of an increased variety of waste without compromising safety, which would likely reduce costs. In some cases, disposal capacity may be increased at selected sites by using site-specific technical analyses, thereby spreading the initial capital costs over a longer operational life or additional waste volumes.

Table 14 summarizes the results of the benefits and costs analysis.

Table 14 Summary Table of Qualified Benefits and Quantified Costs (2022 dollars)

Net Monetary Savings or (Costs)—Total Present Value*	**Nonquantified Benefits or (Costs)**
Alternative 1: No action $0	None
Alternative 3: Conduct rulemaking Industry: $136 million using 7% NPV $219 million using 3% NPV AS: ($1.27 million) using 7% NPV ($1.68 million) using 3% NPV NRC: ($160,000) using 7% NPV ($100,000) using 3% NPV Net benefit (cost): $134 million using 7% NPV $217 million using 3% NPV	Qualitative Benefits: The proposed rule would ensure that LLW streams that are significantly different from those considered during the development of 10 CFR Part 61 can be disposed of safely and meet the performance objectives for land disposal of LLW. This proposed rule will facilitate the use of site-specific information and up-to-date dosimetry methodologies to better ensure protection of public health and safety. Licensees would be permitted to develop waste acceptance criteria from the results of the technical analyses. Development of waste acceptance criteria from the results of the technical analyses provides licensees flexibility to better manage disposal capacity consistent with the risks of disposal of LLW streams. This flexibility may allow facility operators additional revenue streams for disposal than may be permitted using the waste classification limits, depending on the performance of the disposal site. Additionally, the new flexibility would allow disposal facility operators to consider future waste streams for disposal in quantities or concentrations that may not have been evaluated when 10 CFR Part 61 was originally issued. It may also enhance access to disposal facilities for waste generators, potentially reducing disposal costs, particularly for those that may

Net Monetary Savings or (Costs)—Total Present Value*	Nonquantified Benefits or (Costs)
	have had difficulty disposing of waste previously because the waste did not meet certain aspects of the waste classification limits or waste characteristic requirements. The new and revised analyses will help the licensee gather additional valuable information that would be used in the current and continued disposal of LLW at its facility. This new information will ensure that LLW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely. Developing new waste acceptance criteria should also allow licensees to dispose of material in a more risk-efficient manner, which is likely to reduce licensee costs.

*Alternative 2 was not considered viable and therefore not assessed. There may be differences in totals among tables due to rounding and modeling.

This regulatory analysis evaluated three 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. Alternative 1 avoids the costs that the rule would impose, but it would not update the existing LLW 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 LLW streams not considered in the original 10 CFR Part 61 regulatory basis complies with the performance objectives in the regulations.

Alternative 2, the guidance alternative, was not assessed in detail because the staff found that Commission direction could not be met with guidance alone.

Alternative 3, the rulemaking alternative, would amend 10 CFR Part 61 by adding requirements for licensees and license applicants to prepare new and revised compliance and performance period analyses. The principal qualitative benefits of the regulatory action include (1) ensuring that LLW streams that are significantly different from those considered when the current regulations were developed can be disposed of safely and meet the performance objectives for land disposal of LLW without the need for future rulemaking to address those different streams on a case-by-case basis, 2) facilitating the use of site-specific information and up-to-date dosimetry methodologies in site-specific technical analyses to better ensure protection of public health and safety, and (3) promoting a risk-informed regulatory framework that specifies the requirements that need to be met, thus providing flexibility to a licensee or applicant with regard to the information or approach it uses to satisfy those requirements. The waste acceptance criteria would also allow licensees to dispose of material in a more risk-efficient manner, which is likely to reduce costs. In addition, ensuring that LLW streams that are significantly different from those considered during the development of the current regulations can be disposed of safely minimizes the likelihood that future mitigation would be required, thereby potentially reducing costs to licensees.

7. Implementation

The final rule would take effect 30 days after publication in the *Federal Register*. Because the NRC does not currently license any persons under 10 CFR Part 61, the NRC assumes that the final rule will be adopted by individual Agreement States, which this regulatory analysis assumes will occur in 2026. The Agreement States are generally expected to publish compatible regulations within 3 years after the NRC publishes a final rule. Licensees in the Agreement States are assumed to have up to 5 years or until the next renewal, whichever is shorter, to develop and submit their new safety cases to the Agreement States.

8. References

10 CFR Part 20. *U.S. Code of Federal Regulations* (CFR), "Standards for Protection Against Radiation," Part 20, Chapter I, Title 10, "Energy."

10 CFR Part 30. CFR, "Rules of General Applicability to Domestic Licensing of Byproduct Materia," Part 30, Chapter I, Title 10, "Energy."

10 CFR Part 37. CFR, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," Part 37, Chapter I, Title 10, "Energy."

10 CFR Part 50. CFR, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy."

10 CFR Part 60. CFR, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," Part 60, Chapter I, Title 10, "Energy."

10 CFR Part 61. CFR, "Licensing Requirements for Land Disposal of Radioactive Waste," Part 61, Chapter I, Title 10, "Energy."

10 CFR Part 63. CFR, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada," Part 63, Chapter I, Title 10, "Energy."

10 CFR Part 71. CFR, "Packaging and Transportation of Radioactive Material," Part 71, Chapter I, Title 10, "Energy."

10 CFR Part 72. CFR, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste," Part 72, Chapter I, Title 10, "Energy."

10 CFR Part 73. CFR, "Physical Protection of Plants and Materials," Part 73, Chapter I, Title 10, "Energy."

10 CFR Part 150. CFR, "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274," Part 150, Chapter I, Title 10, "Energy."

10 CFR Part 170. CFR, "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services under the Atomic Energy act of 1954, as amended," Part 170, Chapter I, Title 10, "Energy."

40 CFR Part 191 CFR, “Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes,” Part 191, Chapter I, Title 40, “Protection of Environment.”

Argonne National Laboratory, 2010. “Supplement to Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste Inventory Reports,” ANL/EVS/R-10/1, Argonne, Illinois, October 2010.

Bureau of Labor Statistics (BLS), 2022. “NAICS Code: North American Industry Classification System Code,” U.S. Department of Labor, December 2022, http://www.bls.gov/bls/naics.htm; last accessed on May 13, 2022.

BLS, 2022. “May 2022 National Industry Specific Occupational Employment and Wage Estimates;” NAICS 221100—Electric Power Generation, Transmission, and Distribution’ and 221113—Nuclear Electric Power Generation, U.S. Department of Labor, May 2022, http://www.bls.gov/soc/home.htm, https://www.bls.gov/oes/tables.htm.

U.S. Congress, 1954. “Atomic Energy Act of 1954,” Public Law 83-703, 42 U.S.C. 2011 et seq., as amended.

U.S. Congress, 1980. “Low-Level Radioactive Waste Policy Act of 1980,” Public Law 96-573, December 22, 1980, https://www.congress.gov/96/statute/STATUTE-94/STATUTE-94-Pg3347.pdf.

U.S. Congress, 1983. “Nuclear Waste Policy Act of 1982,” Public Law 97-425, January 7, 1983, https://www.congress.gov/bill/97th-congress/house-bill/3809.

U.S. Congress, 1986. “Low-Level Radioactive Waste Policy Amendments Act of 1985,” Public Law 99-240, January 15, 1986, https://www.congress.gov/bill/99th-congress/house-bill/1083.

U.S. Congress, 1992. “Waste Isolation Pilot Plant Land Withdrawal Act,” Public Law 102-579, October 30, 1992, https://www.congress.gov/bill/102nd-congress/senate-bill/1671.

U.S. Congress, 2005. “Energy Policy Act of 2005,” Public Law 109-58, August 8, 2005, https://www.congress.gov/109/plaws/publ58/PLAW-109publ58.pdf.

U.S. Department of Energy (DOE), “Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste: Report to Congress in Response to Public Law 99-240,” DOE/NE-0077, February 1987, https://www.energy.gov/em/articles/1987-report-congress-recommendation-management.

DOE, “Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste,” DOE/EIS-0375, Washington, DC, January 2016, https://www.energy.gov/nepa/downloads/eis-0375-final-environmental-impact-statement.

U.S. Nuclear Regulatory Commission (NRC), 1983. “A Handbook for Value-Impact Assessment,” NUREG/CR-3568, prepared by Pacific Northwest Laboratory, Washington, DC, December 1983, Agencywide Documents Access and Management System Accession (ADAMS) No. ML062830096.

NRC, 1987. "Definition of 'High-Level Radioactive Waste,'" advance notice of proposed rulemaking, *Federal Register*, Vol. 52, No. 39, pp. 5992–6001 (52 FR 5992), Washington, DC, February 27, 1987, https://archives.federalregister.gov/issue_slice/1987/2/27/5990-6001.pdf#page=3.

NRC, 1988. "Disposal of Radioactive Wastes," proposed rule, *Federal Register*, Vol. 53, No. 96, pp. 17709–17711 (53 FR 17709), Washington, DC, May 18, 1988, https://archives.federalregister.gov/issue_slice/1988/5/18/17706-17711.pdf#page=4.

NRC, 1989. "Disposal of Radioactive Wastes," final rule, *Federal Register*, Vol. 54, No. 100, pp. 22578–22583 (54 FR 22578), Washington, DC, May 25, 1989, https://archives.federalregister.gov/issue_slice/1989/5/25/22577-22583.pdf#page=2.

NRC, 1995. "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement," *Federal Register*, Vol. 60, No. 158, pp. 42622–42629 (60 FR 42622), August 16, 1995, https://www.nrc.gov/reading-rm/doc-collections/commission/policy/60fr42622.pdf.

NRC, 2015. "Staff Requirements—SECY-15-0094—Historical and Current Issues Related to Disposal of Greater-than-Class C Low-Level Radioactive Waste," SRM-SECY-15-0094, Washington, DC, December 22, 2015, ML15356A623.

NRC, 2016a. "Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-AI92)," SECY-16-0106, Washington, DC, September 15, 2016, ML16188A307.

NRC, 2016b. "Draft Regulatory Analysis for Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61)," Washington, DC, August 2016, ML16189A050.

NRC, 2017a. "Staff Requirements – SECY-16-0106 – Final Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-AI92)," SRM-SECY-16-0106, Washington, DC, September 2017, ML17251B147.

NRC, 2017b. "82 FR 48283 – Low-Level Radioactive Waste Disposal," Washington, DC, October 2017, available at https://www.govinfo.gov/app/details/FR-2017-10-17/2017-22459.

NRC, 2017c. "82 FR 55790 – Low-Level Radioactive Waste Disposal," Washington, DC, November 2017, available at https://www.govinfo.gov/app/details/FR-2017-11-24/2017-25341.

NRC, 2018a. "Adequacy and Compatibility of Program Elements for Agreement States Programs," Management Directive 5.9, April 26, 2018, ML18081A070.

NRC, 2018b. "Committee to Review Generic Requirements Procedures and Internal Administrative Process," Washington, DC, June 2018, ML17355A533.

NRC, 2019. "Disposal of Greater-than-Class C (GTCC) and Transuranic Waste," draft regulatory basis, Washington, DC, June 2019, ML19059A403.

NRC, 2020a. "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," NUREG/BR-0058, Revision 5 (draft final), Washington, DC, January 2020, ML19261A277.

NRC, 2020b. "Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal," SECY-20-0098, Washington, DC, November 2020, ML20143A164.

NRC, 2022. “Staff Requirements—SECY-20-0098—Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings,” SRM-SECY-20-0098, Washington, DC, April 5, 2022, ML22095A227.

Texas Commission on Environmental Quality (TCEQ), 2015. Letter from Charles W. Maguire, TCEQ, to Laura Dudes, NRC, “Re: Authority and Jurisdiction re Greater Than Class C (GTCC) type waste streams,” January 30, 2015, ML15034A174.

Appendix A: Additional Cost Estimate Inputs

This section lists the remaining inputs to the cost estimate that were not detailed above in the uncertainty analysis. Those inputs are the labor categories and rates used to calculate the weighted labor rates in the model.

Labor Category*	Labor Multiplier	2022 Dollars		
		BLS Burdened Hourly Mean Wage	BLS Burdened Hourly 25th Percentile Wage	BLS Burdened Hourly 75th Percentile Wage
Executive	2.4	$304.76	$199.58	$409.94
Managers	2.4	$193.45	$159.69	$200.80
Technical Staff	2.4	$128.14	$113.44	$141.77
Admin Staff	2.4	$97.42	$78.04	$112.55
Legal Staff	2.4	$170.24	$132.44	$194.05
Physicist	2.4	$136.90	$117.77	$147.62
Environmental Scientist	2.4	$133.58	$120.60	$151.34
Nuclear Engineers	2.4	$136.42	$113.62	$154.44
Nuclear Technicians	2.4	$119.59	$111.24	$130.66
Physical Scientists, All Other	2.4	$112.01	$92.95	$125.14
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	2.4	$148.49	$136.78	$152.23

*These labor categories consist of combinations of the individual occupations below, which were taken from Bureau of Labor Statistics (BLS) data.[1]

Occupation (Standard Occupational Classification Code)	Hourly Mean Wage	Hourly 25th Percentile Wage	Hourly 75th Percentile Wage
Nuclear Electric Power Generation (NAICS code 221113)			
Top Executives (111000)	$109.88	$77.34	$142.42
General and Operations Managers (111021)	$98.62	$77.34	$106.32
Industrial Production Managers (113051)	$87.13	$73.82	$98.93
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (17-2111)	$61.87	$56.99	$63.43
Nuclear Engineers (172161)	$56.84	$47.34	$64.35
Physical Scientists (192000)	$57.04	$49.07	$61.51
Environmental Scientists and Geoscientists (192040)	$55.66	$50.25	$63.06
Nuclear Technicians (194051)	$49.83	$46.35	$54.44
Office and Administrative Support Occupations (430000)	$37.76	$27.43	$47.80

[1] BLS, 2022. "'May 2022 National Industry Specific Occupational Employment and Wage Estimates,' NAICS 221100—Electric Power Generation, Transmission, and Distribution," and 221113—Nuclear Electric Power Generation, U.S. Department of Labor, May 2022, https://www.bls.gov/soc/home.htm, https://www.bls.gov/oes/tables.htm.

Occupation (Standard Occupational Classification Code)	Hourly Mean Wage	Hourly 25th Percentile Wage	Hourly 75th Percentile Wage
First-Line Supervisors of Office and Administrative Support Workers (431011)	$55.11	$46.34	$62.06
Office Clerks General (439061)	$28.90	$23.78	$30.83
First-Line Supervisors of Mechanics, Installers, and Repairers (491011)	$62.78	$52.16	$69.15
Industrial Machinery Mechanics (499041)	$49.83	$46.90	$54.19
First-Line Supervisors of Production and Operating Workers (511011)	$73.88	$62.83	$82.92
Nuclear Power Reactor Operators (518011)	$57.06	$48.47	$63.31
Electric Power Generation, Transmission and Distribution (NAICS code 221100)			
Chief Executives (111011)	$144.09	$88.98	$199.20
Physical Scientists, All Other (19-2099)	$46.67	$38.73	$52.14
Lawyers (231011)	$94.69	$72.15	$112.45
Paralegals and Legal Assistants (232011)	$47.18	$38.22	$48.08