
Regulatory Analysis for Draft Interim Staff Guidance (DUWP-ISG-02) on Radiological Survey and Dose Modeling of the Subsurface to Support License Termination

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

September 2023

Abstract

The U.S. Nuclear Regulatory Commission (NRC) published Revision 2 to NUREG-1757, Volume 2, Rev. 2, "Consolidated Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria," in July 2022, to incorporate lessons learned and best practices from decommissioning experience. Comments received on NUREG-1757, Volume 2, Rev. 2, included the need for additional guidance on subsurface surveys and associated dose modeling to support development of clean-up levels. Two subsurface workshops were held in July 2021 and May 2022 with workshop findings and other information incorporated into the final NUREG-1757, Volume 2, document. NRC staff also contracted with SC&A, Inc. and Oak Ridge Associated Universities to provide more detailed, supplemental guidance. Since publication of NUREG-1757, Volume 2, Rev. 2, staff have completed draft interim staff guidance (ISG), DUWP-ISG-02, supplementing the subsurface guidance in NUREG-1757, Volume 2, Rev. 2, that includes information from reports and inputs provided by SC&A and Oak Ridge Associated Universities, as well as its own independent analysis. The ISG is expected to increase consistency across the industry and demonstrates the NRC's willingness to support the use of the most up-to-date and technically sound methodologies and techniques available to adequately protect public health and safety.

This document is a regulatory analysis for the draft ISG on radiological survey and dose modeling of the subsurface to support license termination (DUWP-ISG-02). The ISG supplements guidance in Revision 2 of NUREG-1757, Volume 2. Comments received on the draft document will be addressed in a comment response document and a final ISG will be issued. Ultimately the ISG will be folded into the next revision (Revision 3) of NUREG-1757, Volume 2. The NRC's analysis demonstrates that the revision of the NUREG through ISG results in negligible costs and considerable benefits to licensees and the NRC.

Table of Contents

<u>Section</u>	<u>Page</u>
Abstract	ii
List of Tables	v
List of Figures	v
Executive Summary	vi
Abbreviations and Acronyms	viii
1. Introduction	9
2. Statement of the Problem and Objective	9
2.1 Background	9
2.2 Statement of the Problem	9
2.3 Objective	10
3. Identification and Preliminary Analysis of Alternative Approaches	12
3.1 Alternative 1—No Action	12
3.2 Alternative 2—Revise NUREG-1757, Volume 2	12
4. Estimation and Evaluation of Costs and Benefits	13
4.1 Identification of Affected Attributes	13
4.2 Analytical Methodology	14
4.2.1 Regulatory Baseline	14
4.2.2 Affected Entities	14
4.2.3 Base Year	14
4.2.4 Sign Conventions	15
4.2.5 Analysis Horizon	15
4.3 Data	15
5. Results	15
5.1 NRC Implementation	15
5.2 Industry Operation	16
5.3 NRC Operation	16
5.4 Total Costs	17
5.5 Improvements in Knowledge	17
5.6 Regulatory Efficiency	17
5.7 Other Considerations—Increased Public Confidence	18

5.8	Uncertainty Analysis	- 18 -
5.9	Summary	- 18 -
5.9.1	<i>Quantified Net Cost</i>	- 18 -
5.9.2	<i>Non-quantified Benefits</i>	- 19 -
5.10	Safety Goal Evaluation	- 19 -
6.	Decision Rationale	- 19 -
7.	Implementation Schedule	- 20 -
8.	References	- 21 -
	Appendix A: Major Assumptions and Input Data.....	- 22 -

List of Tables

	<u>Page</u>
Table 1 NRC Implementation Costs	- 16 -
Table 2 Industry Averted Costs from a Reduction in RAIs	- 16 -
Table 3 NRC Averted Costs from a Reduction in RAIs	- 17 -
Table 4 Total Averted Costs (Industry and the NRC) for Alternative 2	- 17 -
Table 5 Summary of Totals	- 19 -

List of Figures

Figure 1 Total costs (industry and the NRC) for Alternative 2—7-percent NPV	- 18 -
--	--------

Executive Summary

The NRC revised NUREG-1757, Volume 2, “Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria,” Revision 1, issued September 2006, to incorporate lessons learned and best practices from decommissioning experience. The final Revision 2 was published in July 2022. Following issuance of the revised guidance document, NRC staff continued to work on interim staff guidance (ISG) related to subsurface radiological surveys, as well as dose modeling considerations for subsurface soils and groundwater, with the assistance of NRC contractors. The draft ISG incorporates findings from NRC’s contractor, SC&A, Inc., as well as technical review procedures for surveys of open surfaces in the subsurface (e.g., open excavations, basement substructures and materials planned for reuse) developed by Oak Ridge Associated Universities. Additional topics include limitations on use of commonly used decommissioning dose modeling codes for modeling subsurface residual radioactivity on substructures, and technical issues associated with (i) assessing the risk of existing groundwater contamination, (ii) groundwater monitoring strategies, and (iii) groundwater modeling to support demonstration of compliance with radiological criteria for license termination found in 10 CFR Part 20, Subpart E. Comments received on the draft ISG will be addressed in a comment response document and the staff will issue the final ISG based on those comments. The final ISG is planned to be incorporated into the next revision (Revision 3) of NUREG-1757, Volume 2. The NRC’s commitment to continuous improvement in updating its key decommissioning guidance documents helps ensure consistency across the industry and demonstrates the NRC’s willingness to support the use of the most up-to-date and technically sound methodologies and techniques available to adequately protect public health and safety.

This regulatory analysis evaluates the costs and benefits associated with the issuance of the ISG relative to the baseline case (i.e., the no-action alternative). The staff makes the following key findings based on this analysis:

- **Cost Benefit Analysis.** Issuance of the ISG is estimated to result in some averted costs to the NRC and licensees. The primary source of averted costs is an expected reduction in requests for additional information (RAIs) as a result of more transparent and clear guidance. There are other potential sources of reduced costs that are difficult to quantify and the extent to which they would apply to each licensee is uncertain. These are therefore considered qualitative benefits. The staff did not quantify any estimated costs to licensees as a result of this ISG, however, revising and finalizing the ISG in response to comments is expected to result in costs of \$40,000 to the NRC. Table ES-1 shows the net averted costs to licensees and the NRC. These averted costs are conservative and do not take into account those from any potential rework that may be avoided (e.g., additional dose modeling or radiological surveys). Due to the difficulty of estimating licensee costs associated with rework, the staff only quantified averted costs associated with RAI responses. These averted costs are approximately \$681,000 using a 7 percent discount rate.
- **Uncertainty Analysis.** The staff conducted an uncertainty analysis that estimated averted costs to industry and the NRC ranging from \$120,000 to \$2.05 million (99-percent confidence level) using a 7-percent discount rate, meaning that issuing the ISG is cost beneficial in all simulations.
- **Decision Rationale.** Relative to the no-action baseline, the NRC concludes that issuing the ISG is acceptable when considering all costs and benefits because of the non-

quantified benefits and the averted costs. The analysis quantifies the current staff practice to issue RAIs when the basis for the demonstration of compliance with the license termination rule criteria is unclear or not adequately supported.

Table ES-1 Net Costs and Benefits

Attribute	Costs		
	Undiscounted	7% NPV	3% NPV
Industry Costs	\$0	\$0	\$0
NRC Costs	(\$40,000)	(\$40,000)	(\$40,000)
Total	(\$40,000)	(\$40,000)	(\$40,000)
Benefits			
Attribute	Undiscounted	7% NPV	3% NPV
	Industry Benefits	\$488,000	\$351,000
NRC Benefits	\$510,000	\$370,000	\$440,000
Total	\$998,000	\$721,000	\$862,000
Net Benefits (Costs)			
Attribute	Undiscounted	7% NPV	3% NPV
	Industry Net	\$488,000	\$351,000
NRC Net	\$470,000	\$330,000	\$400,000
Total Net	\$958,000	\$681,000	\$822,000

*There may be differences between tables due to rounding

Abbreviations and Acronyms

ADAMS	Agencywide Documents Access and Management System
BLS	Bureau of Labor Statistics
CFR	<i>Code of Federal Regulations</i>
CPI-U	Historical Consumer Price Index for All Urban Consumers
ISG	interim staff guidance
K_d	distribution coefficient
NPV	net present value
NRC	U.S. Nuclear Regulatory Commission
PERT	program evaluation and review technique
RAI	request for additional information
SRM	Staff Requirements Memorandum

1. Introduction

This document presents the regulatory analysis for the issuance of an ISG to supplement Revision 2 of NUREG-1757, Volume 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria."

2. Statement of the Problem and Objective

2.1 Background

Since 2002, the NRC has used NUREG-1757 to detail expected decommissioning actions and standards for licensees, as described below. Issuing this ISG to address stakeholder feedback on the recent NUREG revision continues that practice.

2.2 Statement of the Problem

The NRC originally published NUREG-1757, Volume 2, in September 2003 to provide decommissioning guidance to licensees and the NRC staff (NUREG, 2003). The NRC issued Revision 1 to Volume 2 in 2006 (NRC, 2006). Volume 2 of the NUREG specifically details dose modeling and radiological survey approaches associated with demonstrating compliance with the radiological criteria for license termination. Between 2006 and 2022, lessons learned from decommissioning reviews and changes in technology provided the NRC with valuable experience and insights, which were captured in Revision 2 to NUREG-1757 published in July 2022. While significant improvements to the guidance document were made in Revision 2, NRC staff took additional time to address stakeholder comments on the need for additional detailed guidance in key technical areas. The draft ISG incorporates findings from NRC's contractor, SC&A, Inc., (SC&A, 2022) as well as technical review procedures for surveys of open surfaces in the subsurface (e.g., open excavations, basement substructures and materials planned for reuse) developed by Oak Ridge Associated Universities. The draft ISG addresses the following technical topics and challenges:

- Application of the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" to open surfaces found in the subsurface (e.g., open excavations, basement substructures, and materials planned for reuse) prior to back-fill.
- Guidance on subsurface survey unit classification, survey unit size, sample density, depth of samples, and statistical tests to demonstrate compliance with release criteria.
- Guidance on instrumentation and survey approaches used by NRC licensees for hard to access locations.
- Dose modeling considerations for buried materials including use of the commonly used decommissioning dose modeling code, called "RESRAD-ONSITE" by Argonne National Labs, to model residual radioactivity released from basement substructures located above and below the water table.
- Additional guidance on the need to obtain site-specific information to support selection of distribution coefficients or K_d s in dose modeling.

- Additional guidance on methods to provide further support for risk-significant parameters.
- Additional guidance on assessment of risk from existing groundwater contamination.
- Additional guidance on groundwater monitoring to support decommissioning and license termination.
- Lessons learned related to subsurface surveys and dose modeling.

Considering these new findings and knowledge, the NRC staff determined that it was appropriate to update the NUREG using a phased approach. Given the complexity associated with subsurface surveys, NRC staff developed this ISG, which will be issued for public comment and finalized prior to incorporation into the next revision of NUREG-1757, Volume 2. The ISG will better inform licensees on decommissioning best practices when subsurface residual radioactivity is present, reducing the need for the staff to issue RAIs, and may reduce unplanned costs associated with rework and associated inspection costs. This analysis considers the rework and inspection averted costs qualitatively. Section 2.3 of this document discusses proposed changes to decommissioning guidance that address these and other issues.

2.3 Objective

The objective of this regulatory action is to issue a draft ISG that will be finalized based on public comments and then folded into the next revision of NUREG-1757, Volume 2. The ISG incorporates lessons learned and best practices related to subsurface investigations from recent reviews of decommissioning plans, license termination plans, and final status surveys for complex material and reactor decommissioning sites where detailed guidance was previously lacking. This ISG includes numerous changes to address issues discovered from this experience, including those identified in Section 2.2. The NRC has updated decommissioning guidance primarily in the areas of dose modeling and hydrogeological considerations for buried residual radioactivity; and surveys of open excavations, reactor basement substructures, and materials planned for reuse, including statistical tests to demonstrate compliance with release criteria. This section describes these changes and the issues they are meant to address.

The draft ISG provides additional detail on how MARSSIM can be applied to open surfaces in the subsurface prior to backfill. The additional guidance is expected to lead to more efficient decommissioning (i.e., lead to fewer requests for additional information and reworks associated with inadequate methods). The following topics are included in the draft ISG:

- Information on survey unit classification, size, and sample density.
- Statistical tests that can be used to demonstrate compliance with release criteria, including alternative methods that may be more practical to implement for certain cases.
- Information on instrumentation that can be used to survey hard to access locations, including use of in-situ gamma spectroscopy.

- Examples of following the data quality objective process for survey of open excavations, basement substructures, and materials planned for reuse.

The draft ISG discusses limitations on the use of RESRAD ONSITE for basement substructures. Additional guidance in this area is expected to provide transparency and lead to more efficient reviews (i.e., fewer requests for additional information). The following technical issues are considered in the draft ISG:

- The RESRAD-ONSITE non-dispersion model assumes a receptor well is located at the downgradient edge of the site with natural groundwater flow conditions prevailing. In actuality, substructures may be resistive to flow and experience a “bath tub” effect.
- The RESRAD-ONSITE non-dispersion model also considers a “rise time” where concentrations are increasing as the center of mass of the plume is transported to a well, whereas the maximum well concentrations may occur earlier in time.
- The draft ISG provides examples on how the selection of the model influences the results and walks through calculation of dilution factors for various cases (unsaturated and saturated sources).
- The draft ISG provides sensitivity analysis showing comparisons of mass balance to non-dispersion model in RESRAD-ONSITE and the influence of the pumping rate on the mass balance model results.
- The draft ISG discusses benchmarking of RESRAD-ONSITE to more sophisticated codes to provide model support.

The draft ISG provides guidance on consideration of risk from existing groundwater contamination, as well as groundwater monitoring and modeling considerations, providing information on the following topics:

- When additional site-specific support is needed for risk-significant parameters such as distribution coefficient or K_{ds} .
- Examples of how use of literature values may lead to an underestimate of concentration and dose.
- Methods to obtain additional site-specific support for risk-significant parameters.
- Development of parameter distributions for distribution coefficients.
- Development of pathway dose conversion factors for groundwater dependent pathways (i.e., the dose per unit groundwater concentration).
- Methods to monitor groundwater to adequately assess risk from existing groundwater contamination.
- Monitoring well network considerations including frequency and location of monitoring wells.

- Performance monitoring for remedial activities.

Based on licensee concerns that additional site-specific support may be needed for K_d s (i.e., licensee concerns regarding the need to obtain experimental support for K_d s), the NRC staff provides further guidance in this draft ISG to clarify when additional support for risk-significant parameters such as K_d s is needed and how it can be obtained. In most cases, NRC licensees are not expected to obtain experimental support for selection of distribution coefficients. Nonetheless, increased transparency on this technical issue is expected to lead to more efficient and effective reviews and overall cost savings. In limited cases, a licensee may need to obtain additional site-specific support in the form of laboratory experiments, leading to increased costs. Nonetheless, the reduction in uncertainty in the compliance demonstration associated with this additional experimental support could lead to overall cost savings either from (i) lack of the need to select overly conservative parameter values which could lead to more costly remediation, or (ii) the benefits of more efficient technical reviews associated with the reduction in uncertainty in risk-significant parameters influencing the compliance decision.

3. Identification and Preliminary Analysis of Alternative Approaches

This section analyzes the two alternatives that the NRC considered related to ISG development: (1) no action (i.e., do not develop and issue ISG), or (2) develop and issue ISG to incorporate decommissioning lessons learned and best practices.

3.1 Alternative 1—No Action

Under this alternative, the NRC would not develop and issue the ISG, and licensees undergoing decommissioning would continue to use Revision 2 of NUREG-1757, Volume 2, Rev. 2. This alternative is considered the “no-action” alternative and provides a baseline condition from which any other alternatives will be assessed. This alternative would not leverage the additional lessons learned and best practices from decommissioning experience, and licensees would not benefit from the improvements and changes to the guidance that are discussed in the ISG.

3.2 Alternative 2—Develop and Issue ISG

Under this alternative, the NRC would develop and issue the ISG. This revision would incorporate lessons learned and best practices, resulting in the changes described in Section 2. By doing so, the NRC would ensure that its decommissioning guidance relies upon the best available information and practices.

Based on this regulatory analysis, the NRC staff concludes that issuance of an ISG to support the next revision of NUREG-1757, Volume 2, is warranted because this alternative does the following:

- results in averted costs to industry and the NRC,
- provides numerous qualitative benefits related to surveys and modeling, and
- incorporates lessons learned and best practices from industry and NRC experience with decommissioning.

Section 5 of this analysis discusses the costs and benefits of this alternative compared to the regulatory baseline (Alternative 1).

4. Estimation and Evaluation of Costs and Benefits

This section describes the process for evaluating the costs and benefits expected to result from Alternative 2 relative to the regulatory baseline (Alternative 1). This regulatory analysis monetizes costs and benefits where meaningful quantification is possible.

4.1 Identification of Affected Attributes

This section identifies the components of the public and private sectors, commonly referred to as “attributes,” that the staff expects the alternatives identified in Section 3 to affect. The alternatives would apply to licensees preparing for or undergoing decommissioning activities. The NRC developed an inventory of the impacted attributes using the list provided in Section 5 of NUREG/BR-0058, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” draft Revision 5 (NRC, 2020).

Revision of decommissioning guidance would affect the following attributes:

- NRC Implementation. This attribute accounts for the projected net economic effect on the NRC due to completing the regulatory action. Responding to public comments and finalizing the ISG are implementation costs for the NRC.
- Industry Operation. This attribute accounts for the projected net economic effect on new applications and applicants caused by routine and recurring activities required by the alternative. Fewer RAIs and fewer inspection activities are examples of averted industry operation costs that could result from this ISG.
- NRC Operation. This attribute accounts for the projected net economic effect on the NRC after the rule is implemented. If the NRC submits fewer RAIs and performs fewer inspection activities as a result of the ISG, that will result in a reduction in NRC operation costs.
- Improvements in Knowledge. This attribute accounts for improvements in knowledge as industry and the NRC staff gain experience with surveys and modeling as a result of issuing the ISG.
- Regulatory Efficiency. This attribute accounts for regulatory and compliance improvements resulting from the issuance of the ISG. Issuing the ISG would constitute a best practice by improving NRC regulations with lessons learned and best practices, and providing licensees undergoing decommissioning with regulatory certainty through a path for compliance that is more flexible and predictable.
- Other Considerations. This attribute accounts for considerations not captured in the preceding attributes. Specifically, it accounts for how issuing the ISG would improve public confidence.
- Attributes with No Effects. Attributes not expected to be affected under either alternative, include industry implementation, considerations of public health (accident and routine),

occupational health (accident and routine), offsite property, onsite property, other governments, the general public, safeguards and security, and the environment.

4.2 Analytical Methodology

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

The analysis evaluates NRC implementation, industry operation, and NRC operation on a quantitative basis. It evaluates the remaining three of the five affected attributes on a qualitative basis because those benefits are not quantifiable or because the data necessary to quantify and monetize the impacts on these attributes are not available.

The staff documents its assumptions throughout this regulatory analysis.

4.2.1 *Regulatory Baseline*

This regulatory analysis identifies the incremental impacts of Alternative 2 compared 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, Revision 4, as augmented by SRM-SECY-18-0042, which states that “in evaluating a new requirement..., the staff should assume that all existing NRC and Agreement State requirements have been implemented.” Section 5 of this regulatory analysis presents the estimated incremental costs and benefits of Alternative 2 compared to this baseline.

4.2.2 *Affected Entities*

The ISG is applicable to all licensees subject to 10 CFR Part 20, Subpart E. Most of the complex sites that would benefit from this ISG are operating reactors. This ISG will affect 94 operating reactors that will eventually be undergoing decommissioning. Several licensees are in the process of submitting or have submitted a license termination plan for review. Currently, there are 25 nuclear power and early demonstration reactors that are either in active decommissioning (17) or in SAFSTOR (8), 2 research and test reactors, and 4 complex materials facilities (31 entities in total) that are undergoing decommissioning or are in long-term safe storage. This regulatory analysis used these entities, including the related RAIs that the NRC has issued each year under NUREG-1757, Volume 2, as the basis for the quantitative calculations. Beyond these known entities, it is difficult to speculate about specific other entities that may enter decommissioning in the future. Therefore, this analysis uses only the aforementioned entities in quantified cost and benefit calculations.

4.2.3 *Base Year*

The NRC assumes that the ISG will be effective in 2024, and the base year of the analysis is 2022 to match the Bureau of Labor Statistics (BLS) data used. The staff assumes that the ongoing costs of operation related to the alternative being analyzed begin no earlier than 30 days after issuing the ISG, unless otherwise stated, and models these costs on a per-applicant basis.

One-time NRC implementation costs related to ISG development and issuance are considered sunk costs at this stage.

4.2.4 *Sign Conventions*

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

4.2.5 *Analysis Horizon*

The final ISG will remain in effect until the staff incorporates it into the next revision of NUREG-1757, Volume 2. This analysis assumes that all licensees will use the final ISG supplementing NUREG-1757, Volume 2, Rev. 2, after publication. The quantitative estimates in this analysis run through 2030, after which the number of sites entering decommissioning becomes too uncertain. Furthermore, the NRC may issue another revision to the NUREG in or soon after 2030; therefore, the staff chose to end quantitative estimates in that year.

4.3 Data

Analysts obtained qualitative (i.e., non-quantified) information on attributes affected by the alternatives from the staff and from public comments on the prior NUREG revision. The NRC considered the potential differences between the new guidance and the current guidance and incorporated the incremental changes into this regulatory analysis. Subject matter experts provided information on current quantities and level of effort estimates for RAIs. The labor rate for the NRC is based on a calculation the NRC performs annually, and the labor rate for industry is a blended labor rate from the most recent data from the BLS (BLS, 2022). Appendix A to this regulatory analysis shows the data inputs.

5. Results

This section presents the qualitative and quantitative results by attribute for Alternative 2, relative to the regulatory baseline (Alternative 1). As described in the previous sections, costs and benefits are quantified when possible and are shown to be either positive or negative, depending on whether the alternative has a favorable or adverse effect compared to the regulatory baseline. Those attributes that are not presented with monetary values are discussed in qualitative terms.

5.1 NRC Implementation

This attribute accounts for the projected net economic effect on the NRC issuing the ISG. The staff estimates that responding to public comments on the draft ISG, and revising and issuing the final ISG, would take approximately 300 hours. This results in estimated costs to the NRC ranging from (\$37,000) using a 7 percent NPV to (\$40,000) using a 3 percent NPV, as shown in Table 1.

Table 1 NRC Implementation Costs

Year	Activity	Number of Actions	Hours	Weighted Hourly Rate	Benefits (Costs)		
					Undiscounted	7% NPV	3% NPV
2024	Finalize and Issue ISG	1	300	\$143	(\$43,000)	(\$37,000)	(\$40,000)
Total:					(\$43,000)	(\$37,000)	(\$40,000)

5.2 Industry Operation

This attribute accounts for the projected net economic effect of routine and recurring activities resulting from the issuance of the ISG. The additional clarity in the ISG may obviate the need to generate RAIs on various decommissioning activities and reports. Additionally, decreased NRC inspection activity to verify the adequacy of licensee decommissioning activities may result. Examples of areas where the staff update current guidance to include alternative methods that might reduce costs or to increase transparency on acceptable methods to demonstrate compliance with release criteria are detailed in Section 2.

The NRC staff estimates the averted costs of no longer having to respond to as many decommissioning RAIs will range from \$350,000 (using a 7-percent net present value [NPV] [discount rate]) to \$430,000 (using a 3-percent NPV). Table 2 shows this estimate using a mean hourly labor rate for industry of \$136 (based on BLS data) and a mean hourly estimate of 26 hours to respond to RAIs. This is a conservative estimate, because increased transparency in guidance may also obviate the need for costly rework and additional inspections, and those averted costs are considered qualitatively due to their uncertainty. As discussed in Section 4.2.5, the staff considered data beyond 2030 too uncertain and ended the quantitative estimate in that year. The staff considered the current number of annual RAIs related to Volume 2 of NUREG-1757 and assumed that on average the issuance of the ISG would avert 20 RAIs annually.

Table 2 Industry Averted Costs from a Reduction in RAIs

Year	Activity	Averted RAIs per Year	Average Labor Hours per Request	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2024	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$60,000	\$70,000
2025	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$60,000	\$60,000
2026	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$50,000	\$60,000
2027	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$50,000	\$60,000
2028	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$50,000	\$60,000
2029	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$40,000	\$60,000
2030	Responding to a Reduced Number of RAIs from the NRC	20	26	\$136	\$70,000	\$40,000	\$60,000
Total:					\$490,000	\$350,000	\$430,000

5.3 NRC Operation

Many of the benefits to licensees discussed in Section 5.1 in terms of industry operation could also result in benefits for the NRC’s review activities. The NRC is expected to experience

incremental averted costs due to a reduction in RAIs and inspection actions due to the additional clarity in the ISG. The staff estimates the averted costs to the NRC will range from \$370,000 (using a 7-percent NPV) to \$450,000 (using a 3-percent NPV), at an NRC labor rate of \$143 per hour and 26 hours for generating and reviewing responses to the RAIs. Table 3 shows this calculation. Inspection actions associated with these RAIs were not quantified yet should be considered qualitatively as an additional averted cost.

Table 3 NRC Averted Costs from a Reduction in RAIs

Year	Activity	Requests Reviewed per Year	Average NRC Staff Hours per Request	Weighted Hourly Rate	Benefits (Costs)		
					Undiscounted	7% NPV	3% NPV
2024	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$60,000	\$70,000
2025	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$60,000	\$70,000
2026	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$60,000	\$70,000
2027	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$50,000	\$60,000
2028	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$50,000	\$60,000
2029	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$50,000	\$60,000
2030	Reduced Number of RAIs Generated	20	26	\$143	\$70,000	\$40,000	\$60,000
Total:					\$490,000	\$370,000	\$450,000

5.4 Total Costs

The staff estimates averted costs to industry and the NRC ranging from \$680,000 (using a 7-percent NPV) to \$820,000 (using a 3-percent NPV).

Table 4 Total Averted Costs (Industry and the NRC) for Alternative 2

Attribute	Net Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Industry Implementation	\$0	\$0	\$0
Industry Operation	\$490,000	\$350,000	\$420,000
<i>Net Industry Cost</i>	<i>\$490,000</i>	<i>\$350,000</i>	<i>\$420,000</i>
NRC Implementation	(\$40,000)	(\$40,000)	(\$40,000)
NRC Operation	\$510,000	\$370,000	\$440,000
<i>Net NRC Cost</i>	<i>\$470,000</i>	<i>\$330,000</i>	<i>\$400,000</i>
Net Cost:	\$960,000	\$680,000	\$820,000

*There may be differences between tables due to rounding

5.5 Improvements in Knowledge

Compared to the regulatory baseline (Alternative 1), Alternative 2 would improve guidance based on lessons learned and best practices from recent decommissioning experience. The updates reflect improvements in science, with additional flexibility in several areas related to dose modeling to derive cleanup levels and radiological survey approaches.

5.6 Regulatory Efficiency

By incorporating lessons learned and best practices from recent decommissioning experience, the ISG is expected to improve regulatory efficiency. As a result, licensees undergoing decommissioning activities will better understand the NRC's expectations and should

experience greater efficiencies from a resultant decrease in RAIs from the NRC. This leads to a qualitative benefit in addition to the quantitative benefit evaluated in Section 5.1.

5.7 Other Considerations—Increased Public Confidence

Public confidence will increase as a result of the NRC being responsive to stakeholder comments and using lessons learned and best practices to improve the effectiveness and efficiency of licensee review actions, as detailed above. Issuing this ISG will reassure the public that the NRC continues to improve and transform into a modern, risk-informed regulator.

5.8 Uncertainty Analysis

The NRC conducted an uncertainty analysis based on the costs and averted costs of Alternative 2, using a Monte Carlo analysis. The uncertainty analysis showed that the alternative has a greater than 99-percent chance of resulting in averted costs to industry and the NRC, with a mean estimate of \$684,000 using a 7-percent NPV. Appendix A shows the inputs for the uncertainty analysis. This mean may differ from the previous totals due to the simulation and rounding in the model.

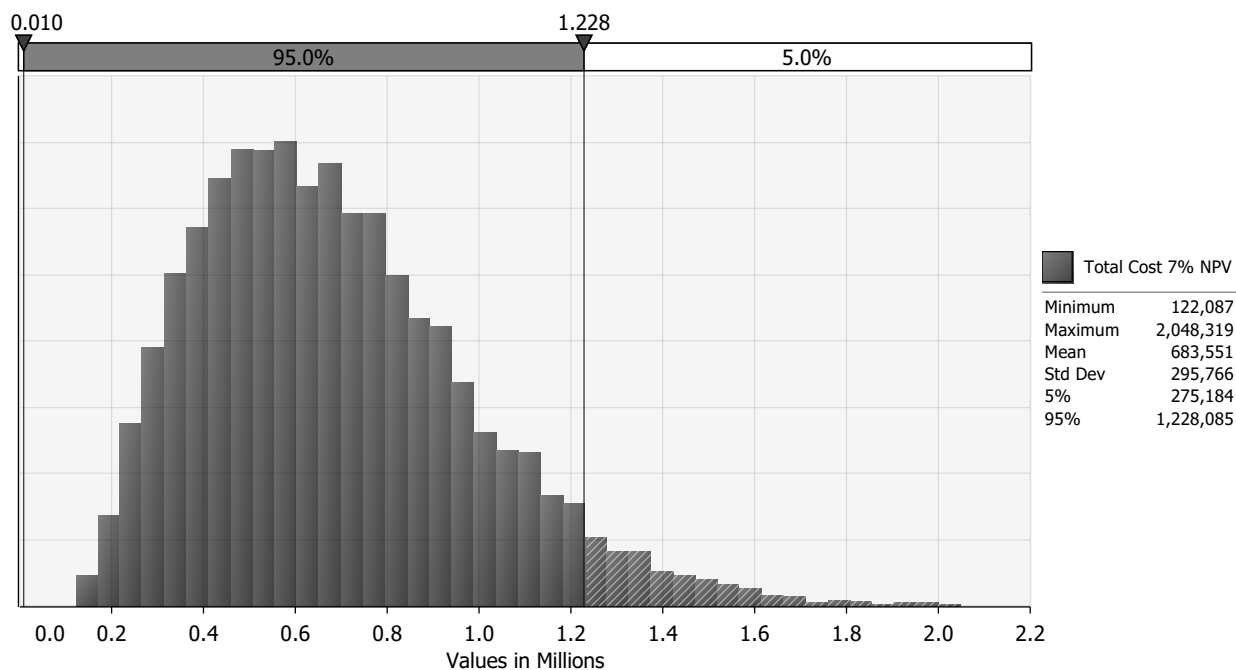


Figure 1 Total costs (industry and the NRC) for Alternative 2—7-percent NPV

5.9 Summary

This regulatory analysis identifies both quantifiable and nonquantifiable costs and benefits that would result from the issuance of the ISG supplementing NUREG-1757, Volume 2, Revision 2.

5.9.1 Quantified Net Cost

The staff estimates a quantified averted cost of \$680,000 (using a 7-percent NPV) as a result of issuing the ISG. These total costs can vary throughout the regulatory analysis due to the modeling used, for example in the uncertainty analysis, and due to rounding.

5.9.2 Non-quantified Benefits

The ISG would produce a number of non-quantified benefits for industry and the NRC under the attributes of improvements in knowledge, regulatory efficiency, and other considerations (increased public confidence). Sections 5.4, 5.5, and 5.6 detail these benefits.

5.10 Safety Goal Evaluation

The NRC’s safety goal evaluation applies only to regulatory initiatives considered to be generic safety enhancement backfits subject to the substantial additional protection standard at Title 10 of the *Code of Federal Regulations* (10 CFR) 50.109(a)(3). The NRC does not regard the issuance of this ISG to be backfitting or to represent an inconsistency with any issue finality provisions in 10 CFR Part 52, “Licensees, Certifications, and Approvals for Nuclear Power Plants.” Based on the reasons described, a safety goal evaluation is not appropriate for this regulatory analysis.

6. Decision Rationale

Table 5 provides the quantified and qualified costs and benefits for Alternative 2. The quantitative analysis used best estimate values.

Table 5 Summary of Totals

Net Monetary Savings or (Costs)— Total Present Value	Non-quantified Benefits or (Costs)
Alternative 1: No Action \$0	None
Alternative 2: Issue ISG supplementing NUREG-1757, Volume 2, Revision 2 Industry: \$350,000 using a 7% discount rate \$420,000 using a 3% discount rate NRC: \$330,000 using a 7% discount rate \$400,000 using a 3% discount rate Net Benefit (Cost): \$680,000 using a 7% discount rate \$820,000 using a 3% discount rate	Benefits: <ul style="list-style-type: none"> • Improvements in Knowledge: Alternative 2 would improve guidance by providing additional information based on lessons learned and best practices from recent decommissioning experience. The updates also reflect improvements in science and tools used to perform radiological surveys and dose modeling. • Regulatory Efficiency: By incorporating lessons learned and best practices from recent decommissioning experience, the updated guidance is expected to improve regulatory efficiency. As a result of this updated guidance, licensees undergoing decommissioning activities will better understand the NRC’s expectations and should experience greater efficiencies from a resultant decrease in RAIs from the NRC.

Net Monetary Savings or (Costs)— Total Present Value	Non-quantified Benefits or (Costs)
	<p>This leads to a qualitative benefit in addition to the quantitative benefit evaluated in Section 5.1.</p> <ul style="list-style-type: none"> Increased Public Confidence: Public confidence will increase as a result of the NRC using lessons learned and best practices gained from experience with the review of complex material and reactor decommissioning to improve the effectiveness and efficiency of licensee review actions, as detailed above. Issuing this ISG will reassure the public that the NRC continues to improve and transform into a modern, risk-informed regulator.

Issuing the ISG to supplement guidance in Revision 2 of NUREG-1757, Volume 2, (Alternative 2) will avert costs due to fewer RAIs and inspection actions, affecting both licensees and the NRC. Industry and the NRC are expected to have net averted costs of approximately \$680,000 (7-percent NPV) from Alternative 2. Alternative 2 would also have the qualitative benefits of an improvement in knowledge, regulatory efficiency, and public confidence.

Considering quantified and non-quantified costs and benefits, the regulatory analysis shows that issuing the ISG is cost justified and supports the issuance the ISG.

7. Implementation Schedule

The draft ISG will be available for use upon publication, as announced in the *Federal Register*. However, the draft ISG is being published for comment, and the NRC staff may make revisions and corrections based on those comments in the final ISG. The final ISG, which is expected to be published in late 2024, will be effective upon publication and will also be announced in the *Federal Register*.

8. References

Bureau of Labor Statistics (BLS), 2022. "Occupational Employment and Wage Statistics," U.S. Department of Labor, May 2022. Available at <https://www.bls.gov/oes/tables.htm>; last accessed on May 5, 2023.

U.S. Nuclear Regulatory Commission (NRC), 2003. NUREG-1757, Volume 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," September 2003 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14093A221).

NRC, 2004. NUREG/BR-0058, Revision 4, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," September 2004 (ADAMS Accession No. ML042820192).

NRC, 2006. NUREG-1757, Volume 2, Revision 1, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," September 2006 (ADAMS Accession No. ML14093A221).

NRC, 2020. SECY-20-0008, "Draft Final NUREG/BR-0058, Revision 5, 'Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,'" January 28, 2020 (ADAMS Package Accession No. ML19261A277).

NRC, 2022. NUREG-1757, Volume 2, Revision 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," July 2022 (ADAMS Accession No. ML22194A859).

SC&A, 2022. SC&A, Inc., "Guidance on Surveys for Subsurface Radiological Contaminants," White Paper, September 2022 (ADAMS Accession No. ML22277A549).

Appendix A: Major Assumptions and Input Data

Data Element	Mean Estimate	Distribution	Low Estimate	Best Estimate	High Estimate
Issue RAI and Review Response (NRC)					
Weighted hourly rate (NRC)	\$143				
Number of RAIs	20	PERT	15	20	25
Hours to generate RAI	26	PERT	6	12	100
Respond to RAI					
Weighted hourly rate (Industry)	\$136	PERT	\$112	\$137	\$155
Hours to respond to RAI	26	PERT	6	12	100

PERT: program evaluation and review technique

RAI: request for additional information