
Regulatory Analysis for Interim Staff Guidance on Decommissioning Funding Plans for Materials Licensees

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Abbreviations and Acronyms

ADAMS	Agencywide Documents Access and Management System
CFR	<i>Code of Federal Regulations</i>
DCE	decommissioning cost estimate
DFP	decommissioning funding plan
FR	<i>Federal Register</i>
ISG	interim staff guidance
NPV	net present value
NRC	U.S. Nuclear Regulatory Commission
PERT	program evaluation and review technique
RAI	request for additional information
RG	regulatory guide

1 Introduction

This document presents the regulatory analysis of the U.S. Nuclear Regulatory Commission's (NRC) interim staff guidance (ISG) on decommissioning funding plans (DFPs) for materials facilities licensed under 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material" (Ref. 1), 10 CFR Part 40, "Domestic Licensing of Source Material" (Ref. 2), and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," (Ref. 3). The purpose of this ISG is to provide NRC staff and industry with guidance based on developments and lessons learned in financial assurance since the last update to NUREG-1757, "Consolidated Decommissioning Guidance," Volume 3, "Financial Assurance, Recordkeeping, and Timeliness," Revision 1, issued February 2012 (Ref. 4).

1.1 Background

Since 1988, the NRC has required its licensees to provide financial assurance for decommissioning activities. The NRC published its "Decommissioning Planning Rule" on June 17, 2011, in Volume 76 of the *Federal Register*, page 35512 (76 FR 35512) (Ref. 5). The rule became effective on December 17, 2012. The rule's purpose is to minimize the likelihood of new "legacy sites"—sites owned or controlled by licensees with insufficient resources to complete decommissioning. Successful completion of decommissioning is a prerequisite to NRC terminating the license. Licensees for these facilities are required to provide adequate financial assurance for decommissioning activities, in accordance with 10 CFR 30.35, 10 CFR 40.36, and 10 CFR 70.25, all titled "Financial Assurance and Recordkeeping for Decommissioning." The NRC staff uses NUREG-1757, Volume 3, Revision 1, as guidance to evaluate the DFPs that licensees submit in accordance with 10 CFR Parts 30, 40, and 70. NRC Regulatory Guide (RG) 4.22, "Decommissioning Planning during Operations," (Ref. 6) provides guidance to licensees during facility operations to minimize radiological contamination, including subsurface radiological contamination, and to properly retain survey results. Licensees whose facilities have or are likely to have significant residual radioactivity may use RG 4.22 for guidance on arranging for sufficient funding to complete decommissioning. Since 2016, the NRC has issued requests for additional information (RAIs) to these licensees on financial assurance.

1.2 Statement of the Problem

During recent reviews of 10 CFR Part 70 decommissioning cost estimates (DCEs), the NRC staff issued RAIs on how the licensee included inventory in the DCE or if the licensee was relying upon an existing plan to move the inventory off site, in support of its DCE. The DCE submittals assumed that inventory would be off site before the start of decommissioning. Over the last three years, the NRC staff has approved some DCEs for which licensees had provided assumptions with reasonable justifications on how the inventory is to be handled. Further, NRC corresponded with the Nuclear Energy Institute on this matter in a letter dated January 25, 2017 (Ref. 7).

NRC regulations in 10 CFR 30.35(e)(2), 10 CFR 40.36(d)(2) and 10 CFR 70.25(e)(2) require that DFP resubmittals (every three years and at license renewal) specifically consider the effects of the following eight decommissioning events on decommissioning costs:¹

- (1) spills of radioactive material producing additional residual radioactivity in onsite subsurface material
- (2) waste inventory increasing above the amount previously estimated
- (3) waste disposal costs increasing above the amount previously estimated
- (4) facility modifications
- (5) changes in authorized possession limits
- (6) actual remediation costs that exceed the previous cost estimate
- (7) onsite disposal
- (8) use of a settling pond

Past experience has shown that many DFP submittals do not specifically address these events in sufficient detail, thereby requiring the NRC staff to send RAIs to the licensee. Specifically, the licensees did not include narratives describing spills, radioactive waste inventories, possession limits, use of any settling ponds, and detailed costs for facility decommissioning.

1.3 Objective

The NRC's radioactive materials licensing regulations in 10 CFR Parts 30, 40, and 70 require licensees to provide financial assurance for all decommissioning activities. The objective of this regulatory action is to provide final guidance to NRC staff and industry on acceptable methods for providing financial assurance for all decommissioning activities based on developments and lessons learned in financial assurance since the last update to NUREG-1757, Volume 3. The ISG provides guidance on DCEs accurately describing current facility conditions, evaluating events since the last DFP approval, and updates for certain financial instruments.²

2 Identification and Analysis of Alternative Approaches

This section presents an analysis of the alternatives that the NRC staff considered in meeting the regulatory objective. The staff considered two alternatives: no action and issue the ISG. The NRC staff considered the incremental costs and benefits between the no action and the ISG issuance alternatives as well as their regulatory impacts. The following sections discuss each alternative.

¹ In accordance with 10 CFR 30.35(e)(1)(A), 10 CFR 40.36(d)(1)(A), and 10 CFR 70.25(e)(1)(A), the DCE must reflect the cost of an independent contractor to perform all decommissioning activities. Thus, any cost estimates developed in response to the eight events should be premised upon an independent contractor performing the decommissioning work.

² The DCE is a component of the DFP (see 10 CFR 30.35(e)(1), 10 CFR 40.36(d)(1), and 10 CFR 70.25(e)(1)).

2.1 Alternative 1: No Action

Under this alternative, the NRC would not issue the ISG to address the identified problem. This alternative is considered the “no-action” alternative and serves as the baseline against which the impacts of the other alternative are measured. Because this no-action alternative would not provide clarifications related to the DFPs, cost estimates, or lessons learned from regulatory oversight, this alternative would not make clear the NRC’s objectives for financial assurance of decommissioning activities that pertain to the affected licensees. As a result, the staff expected that licensees and the NRC would continue to expend resources on RAIs associated with DCEs and DFPs.

2.2 Alternative 2: Issue Interim Staff Guidance on Decommissioning Funding Plans

Under this alternative, the NRC would provide guidance so that materials licensees under 10 CFR 30.35, 10 CFR 40.36 and 10 CFR 70.25 would provide enough detail to adequately support a DCE, address the eight decommissioning events in a DFP submittal, and provide a narrative in the DFP describing how surveys of radioactive contaminants are conducted or, if surveys are not conducted, describe the circumstances that prevented the surveys from being conducted.

Specifically, the licensee should include the costs for packaging, loading, and transporting material to another facility, as specified below for the eight decommissioning events:

- (1) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material—The DFP should describe any spills of radioactive material that have led to subsurface contamination.
- (2) Waste inventory increasing above the amount previously estimated—The DFP should describe the current amount of waste inventory on site, including, if available, the reason for the waste inventory increasing above the amount previously estimated.
- (3) Waste disposal costs increasing above the amount previously estimated—The DFP should describe the current waste disposal costs.
- (4) Facility modifications—The DFP should describe the facility and provide a detailed breakdown of estimated costs for facility decommissioning, including any modifications made to the facility.
- (5) Changes in authorized possession limits—The DFP should describe any changes in possession limits and compare the possession limit amounts to those covered by the previous DFP.
- (6) Actual remediation costs that exceed the previous cost estimate—The DFP should describe any actual remediation costs that exceeded the previous cost estimate.
- (7) Onsite disposal—The DFP should describe any onsite disposal.
- (8) Use of a settling pond—The DFP should describe the use of any settling ponds; if settling ponds are used, the narrative should include information obtained from samplings, surveys, and site records.

The estimated amount of radioactive contamination in onsite subsurface material should be based on subsurface surveys, as reasonable under the circumstances, and the DFP or DCE (or both, as appropriate) should describe these subsurface surveys.

The impact of this alternative upon licensees would be the expenditure of resources needed for their evaluation to clarify their DFPs or DCEs and for otherwise following the guidance in the ISG. The NRC staff's expectation is that the ISG, if followed by licensees, will result in fewer RAIs, and as such, would reduce NRC oversight costs. The NRC expects that this alternative would benefit licensees as the ISG would clarify how a licensee should complete its DCE or DFP.

3 Identification of Affected Attributes and Analytical Method

This section evaluates the incremental costs and benefits expected to result from this ISG when compared to the no-action alternative. In accordance with NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," Revision 5, dated April, 2017 (Ref. 8), regulatory analyses should consider the incremental costs from any action taken by the licensee, including voluntary actions.

3.1 Identification of Affected Attributes

This section identifies the factors that the staff expects the ISG to affect. These factors are classified as attributes using the list of potential attributes in NUREG/BR-0058. Each attribute is quantified where possible. An uncertainty analysis is completed to report cost and benefit confidence levels and to identify those variables that most affect the variation in the results distribution.

The NRC staff evaluates the following attributes in this regulatory analysis.

- Industry Operation—Licensees could do the following:
 - Discuss how inventory is included in the DCE or whether the licensee was relying on an existing plan to move the inventory off site.
 - Discuss decommissioning events in the DFP or provide the supporting basis for why an event did not occur.
 - Discuss the surveys conducted to estimate the volume of radioactive contaminants in the DFP; if such surveys were not done, discuss the circumstances that prevented the surveys from being conducted.
- NRC Operation—For the ISG, the NRC would do the following:
 - Avert NRC costs to process RAIs because fewer RAIs would be necessary.
- Regulatory Efficiency—The ISG would provide clarity and transparency of the NRC's process to review licenses under 10 CFR Parts 30, 40, and 70, which require licensees to provide financial assurance for all decommissioning activities.

- Improvement in Knowledge—The licensees could gather, organize, and present information in their submittals of DCEs and DFPs and produce better quality documents, which may result in less NRC review and approval time, in part because the NRC staff would need to generate fewer RAIs.

3.2 Analytical Method

The staff developed this regulatory analysis following the guidance in NUREG/BR-0058. In this regulatory analysis, the NRC staff has identified all attributes related to the regulatory action and analyzed them quantitatively and qualitatively. This regulatory analysis evaluates the incremental costs and benefits of these attributes relative to a baseline that reflects anticipated behavior if the NRC does not undertake any regulatory action (Alternative 1). Alternative 1 is the no action alternative and serves as a baseline against which to evaluate Alternative 2. As part of the regulatory baseline used in this analysis, the NRC staff assumes compliance with existing NRC regulations. After performing the quantitative regulatory analysis, the NRC staff addressed attributes that could only be evaluated qualitatively.

To estimate the costs and benefits associated with Alternative 2, the staff deconstructed the economic impact of the quantifiable attributes into activities involving RAIs. The NRC staff estimated the required level of effort for these activities and labor rates for NRC personnel in order to develop cost estimates. The staff gathered data from the regional offices to develop these levels of effort and used professional knowledge and judgment to estimate the costs and benefits. The analysis evaluates industry and NRC operation on a quantitative basis and regulatory efficiency and improvement in knowledge on a qualitative basis.

To evaluate the effect of uncertainty in the analysis, the NRC staff employed Monte Carlo simulations, an approach to uncertainty analysis in which input variables are expressed as distributions. The staff ran the simulation 10,000 times and chose values at random from the distributions of the input variables (see Section 4.2 of this paper). The result is a distribution of values for the output variable of interest. With Monte Carlo simulations, it is also possible to determine the input variables that have the greatest effect on the net cost or benefit.

3.2.1 Affected Entities

The ISG is applicable to all materials facilities licensed under 10 CFR Parts 30, 40, and 70. Currently, the ISG would apply to about 205 such licensees.

3.2.1.1 Time Horizon

The NRC assumes that it will finalize the ISG in the beginning of calendar year 2019. The estimated applicability period for the affected facilities is 60 years (i.e., 2019 to 2079), which is the average time between the issuance of a license and termination of the license.

3.2.1.2 Sign Conventions

The sign convention used in this analysis is that all favorable consequences (benefits) are positive and all adverse consequences (costs) are negative. In terms of costs, benefits (e.g., cost savings) would result in positive costs, while adverse consequences (e.g., additional costs) would result in negative costs. Negative costs are shown using parentheses (e.g., negative \$500 is displayed as (\$500)).

3.2.1.3 Labor Rates

For regulatory analysis purposes, the staff determined the NRC labor rate to be \$129 per hour (fiscal year 2019 dollars).³ The staff used the NRC labor rate to determine the costs and benefits resulting from the ISG. This approach is consistent with guidance set forth in NUREG/CR-4627, "Generic Cost Estimates," issued February 1992 (Ref. 9), and general cost-benefit methodology.

3.2.1.4 Base Year

The staff assumes it will finalize the ISG in the beginning of 2019, so the monetized costs and benefits in this analysis are expressed in base year 2019 dollars.

3.2.2 Assumptions

This section discusses the analysis of the costs associated with the ISG. The analysis employs the following assumptions and considerations:

- The ISG will be finalized in the beginning of 2019.
- All affected licensees will follow the processes detailed in the ISG and, hence, the net operation cost between Alternative 1 (no action) and Alternative 2 (issue ISG) for these licensees is negligible.
- Under Alternative 1 (no action), the NRC staff will continue to develop and transmit RAIs to licensees addressing DFP and DCE concerns that it deems necessary if the ISG is not issued.

3.2.3 Costs and Benefits of the Affected Entities

For purposes of this analysis, the costs and benefits incurred under the ISG are categorized as follows:

- operation costs and benefits for the industry and
- operation costs and benefits for the NRC

3.2.3.1 Industry Operation Costs and Benefits

Under Alternative 2 (issue ISG), the staff assumes that licensees under 10 CFR Parts 30, 40, and 70 will follow the processes detailed in the ISG for DCEs and DFPs, and that these licensees will incur costs to discuss inventory in their DCEs, discuss decommissioning events in their DFPs, and estimate the volume of radioactive contaminants (or provide reasons why these surveys were not conducted). Under Alternative 1 (no action), licensees would not have provided such detail in their DCEs, DFPs, and surveys and, as a result, would have to provide

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"). The NRC labor rates for fee recovery purposes are set for cost recovery of the services rendered and, as such, include nonincremental costs (e.g., overhead, administrative, and logistical support costs).

these details in response to NRC-issued RAIs. Thus, the staff assumes that the net operation costs for the licensees between Alternatives 1 and 2 are negligible.

3.2.3.2 NRC Operation Costs and Benefits

Over the past three years, the NRC has issued RAIs to 10 CFR Parts 30, 40, and 70 licensees in response to a lack of details (see Section 3.2.3.1 of this paper) in DCEs, DFPs, and surveys submitted by licensees. As a result, the NRC has incurred costs associated with processing these RAIs. Alternative 2 (issue ISG) would reduce the costs to the NRC from an expected reduction in the issuance of RAIs. This cost reduction would result from the clarity provided by the ISG. Table 1 details the benefits to the NRC for issuing the ISG.

Table 1 Estimated NRC Operation Costs and Benefits

Year	Activity	Total Hours	Hourly Rate	Net Benefit		
				Undiscounted	7% NPV	3% NPV
2019	Reduced RAIs	336	\$129	\$43,000	\$43,000	\$43,000
2020	Reduced RAIs	336	\$129	\$43,000	\$40,000	\$42,000
2021	Reduced RAIs	336	\$129	\$43,000	\$38,000	\$41,000
Total:				\$129,000	\$121,000	\$126,000

NPV = net present value.

3.2.4 Regulatory Efficiency

The ISG would provide clarity and transparency for how the licensees would implement the NRC’s radioactive materials licensing regulations in 10 CFR Parts 30, 40, and 70, which require that licensees provide financial assurance for all decommissioning activities. As a result, the NRC would issue fewer RAIs with respect to financial assurance, possibly resulting in fewer delays in processing DCEs and DFPs.

3.2.5 Improvements in Knowledge

The ISG would help materials licensees gather, organize, and present information in their DCEs and DFPs and produce better quality documents, which may result in less NRC review and approval time, in part because the NRC staff would need to generate fewer RAIs.

4 Evaluation of Costs and Benefits

This section organizes the analytical results into three sections. Section 4.1 presents results of the costs and benefits of the ISG as a whole, Section 4.2 identifies and evaluates the uncertainties that most affect the variation in the results, and Section 4.3 discusses disaggregation of the ISG.

4.1 Costs and Benefits of the Interim Staff Guidance

Table 2 summarizes the incremental costs and benefits of the ISG, compared to the regulatory baseline, from both quantitative and qualitative perspectives. The ISG (Alternative 2) would result in an estimated benefit of between \$121 thousand at a 7-percent discount rate and \$126 thousand at a 3-percent discount rate. These benefits are associated with NRC

operations and are based on the anticipated reduction of RAIs that the NRC staff would process over the next three years due to the lack of this ISG. The table also presents the qualitative benefits for the regulatory efficiency and improvement in knowledge.

Table 2 Summary of Overall Costs and Benefits (Quantitative and Qualitative)

	Net Quantitative Benefits (or Costs)	Qualitative Benefits
Alternative 2: Issue ISG	<ul style="list-style-type: none"> • \$121,000 using a 7% discount rate • \$126,000 using a 3% discount rate 	<ul style="list-style-type: none"> • Reduction in RAIs. • Improvements in regulatory efficiency by providing clarity and transparency for how licensees would implement the NRC's regulations in 10 CFR Parts 30, 40, and 70. • Better quality DCEs and DFPs submitted by the licensees.

4.2 Uncertainty Analysis

4.2.1 Uncertainty Analysis Description

To determine the robustness of the costs resulting from the ISG, the NRC staff examined how the industry and the NRC costs change as a result of the uncertainties associated with the NRC staff's analytical assumptions and input data. The NRC used Monte Carlo simulations performed using the @RISK® software program⁴ to examine the impact of uncertainty on the estimated net costs of the ISG.

Monte Carlo simulations forecast uncertainty by replacing the point estimates of the input variables for the costs with probability distributions. Defining input variables as probability distributions, as opposed to point estimates, allows for modeling the effect of uncertainty on the results of the analysis (i.e., the net costs).

The probability distributions chosen to represent the different input variables in the analysis were bounded by the range of referenced input, which the NRC staff determined based on its professional judgment. When defining the probability distributions in the Monte Carlo simulation, summary statistics are needed to characterize the distributions. These summary statistics include the minimum, most likely, and maximum values of a program evaluation and review technique (PERT) distribution.⁵ The staff used the PERT distribution to reflect the relative spread and skewness of the distribution defined by the three estimates.

Table 3 identifies the data elements, the distribution, and the summary statistics used in the uncertainty analysis.

⁴ Information about this software is available at <http://www.palisade.com>.

⁵ A PERT distribution is a special form of the beta distribution with a minimum, most likely, and maximum value specified. The PERT distribution is a special case of a beta distribution and can generally be considered to be superior to the triangular distribution when the parameters result in a skewed distribution, as the smooth shape of the PERT places less emphasis in the direction of skew.

Table 3 Uncertainty Analysis Variables

Uncertainty Analysis Variables						
Data Element	Value	Distribution	Low	Best	High	Source or Basis of Estimate
Number of Request for Additional Information (RAIs) per year	30	Program Evaluation Review Technique (PERT)	24	30	36	NRC Staff
Number of NRC hours spent on each RAI	11.2	PERT	0.2	1.8	60.0	

4.2.2 Uncertainty Analysis Results

The staff performed the Monte Carlo simulation by repeatedly calculating the net costs 10,000 times. For each iteration, the values identified in Appendix A were chosen randomly from the probability distributions that define the input variables. The value of the output variables was recorded for each iteration, and these resulting output variable values were used to define the resultant probability distribution.

Each figure below represents 10,000 Monte Carlo simulations in which the input variables were changed to assess the effect on costs. The cost distributions illustrated in the figures represent the incremental costs from the regulatory baseline (Alternative 1) and provide descriptive statistics on the uncertainty distribution. The 5-percent and the 95-percent values that appear as vertical lines with a numerical value at the top, as shown in Figure 1, illustrate the 5-percent and 95-percent monetary values, respectively.

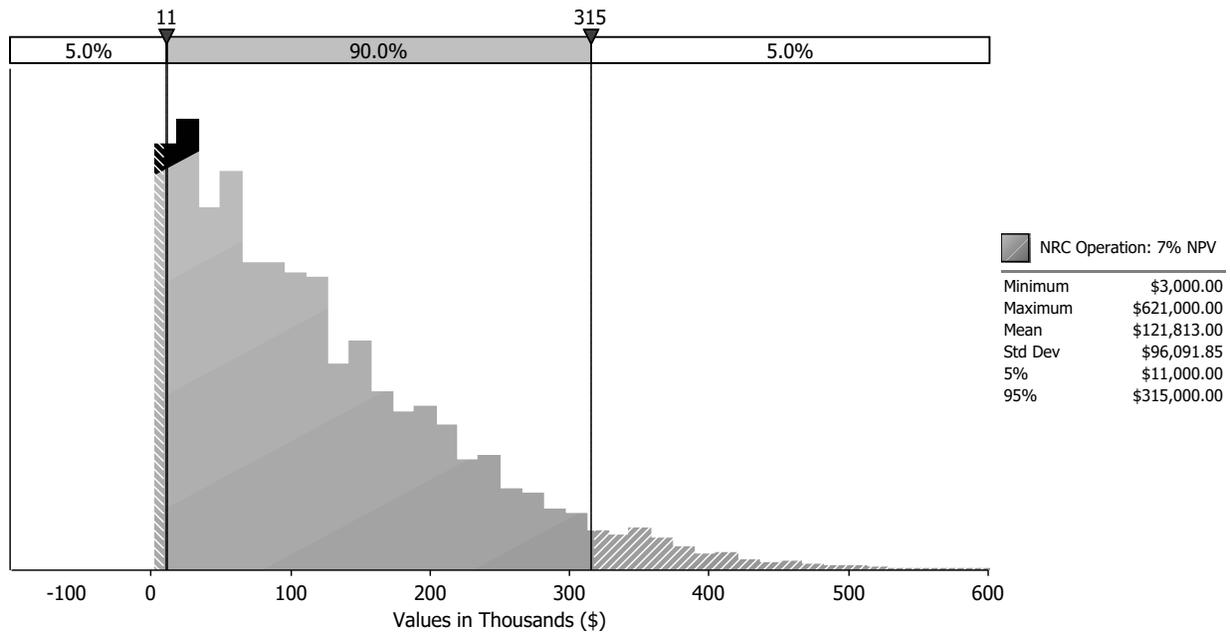


Figure 1 NRC Operation Costs (7-percent discount rate)

To estimate the effect of each uncertain variable on the net costs, the staff performed a regression with the net costs modeled as the dependent variable and the inputs as the independent variables. The result of this regression, known as a tornado diagram, represents in vertical order the variables with the greatest influence on the net cost. The tornado diagram also displays the resulting impact on the calculated net cost for each of the input variables. **Error! Reference source not found.** presents the tornado diagram for the net cost of the ISG using a 7-percent discount rate. From the tornado diagram, the averted number of hours spent by the NRC for each RAI due to this ISG, has the greatest influence on the total averted cost (i.e. net benefit), compared to the averted number of RAIs and the NRC labor rate.

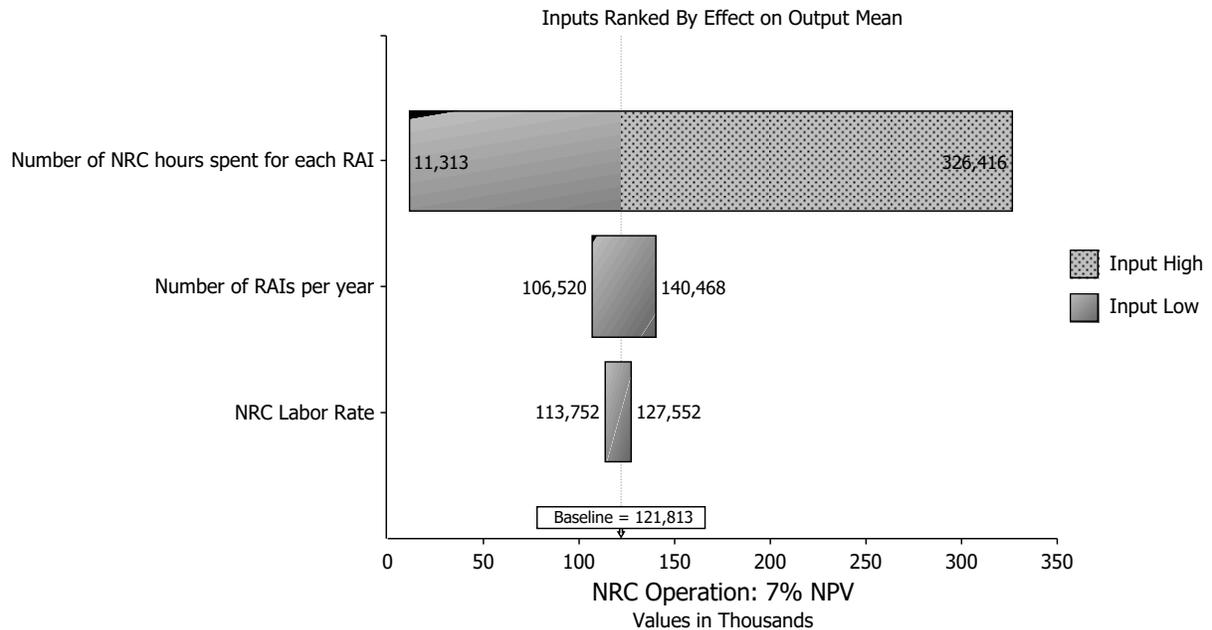


Figure 2 ISG Cost Drivers (7-percent discount rate)

4.3 Disaggregation

The NRC performed a screening review to determine whether any provisions would be unnecessary to achieve the regulatory objectives. The staff did not identify any unnecessary or unrelated provisions; therefore, it did not perform a disaggregation for this regulatory analysis.

5 Decision Rationale for Selection of the Proposed Action

This analysis is based on the quantification of the benefits where possible and relies on qualitative consideration of the benefits for implementing the ISG where quantification is not practical. These qualitative benefits are related to regulatory efficiency (i.e., the ISG would provide clarity and transparency for how the licensees would implement the NRC’s licensing regulations in 10 CFR Parts 30, 40, and 70) and improvement in knowledge (i.e., where the ISG would help materials licensees gather, organize, and present information in their submittals of DCEs and DFPs to provide better quality documents to the NRC for review). Considering these benefits, as well as a net monetary savings for the reduction of RAIs, the NRC staff recommends Alternative 2, issuing the ISG.

6 References

1. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material."
2. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 40, "Domestic Licensing of Source Material."
3. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, "Domestic Licensing of Special Nuclear Material."
4. NUREG-1757, "Consolidated Decommissioning Guidance," Volume 3, "Financial Assurance, Recordkeeping, and Timeliness," Revision 1, issued February 2012 (ADAMS Accession No. ML 12048A683).
5. "Decommissioning Planning Rule," published June 17, 2011, in Volume 76 of the *Federal Register*, page 35512 (76 FR 35512).
6. NRC Regulatory Guide (RG) 4.22, "Decommissioning Planning during Operations," (ADAMS Accession No. ML 12158A361)
7. U.S. Nuclear Regulatory Commission (NRC), "Required Updates to Decommissioning Funding Plans," from John Tappert, NRC, to Janet Schlueter, Nuclear Energy Institute, January 25, 2017 (ADAMS Accession No. ML16307A014).
8. NRC, NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," draft Revision 5, Washington, DC, March 28, 2018 (ADAMS Accession No. ML17221A005).
9. NRC, NUREG/CR-4627, "Generic Cost Estimates, Abstracts From Generic Studies for Use in Preparing Regulatory Impact Analyses," Revision 2, prepared by F. Sciacca, Science and Engineering Associates, Inc., Albuquerque, NM, February 1992 (ADAMS Accession No. ML13137A259).

