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# **Regulatory Analysis for the Proposed Rule— Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning**

NRC-2015-0070; RIN 3150-AJ59

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**U.S. Nuclear Regulatory Commission**  
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## ABBREVIATIONS AND ACRONYMS

ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
AMP	aging management program
ANPR	advance notice of proposed rulemaking
BLS	Bureau of Labor Statistics
BWR	boiling-water reactor
CFH	certified fuel handler
CFR	<i>Code of Federal Regulations</i>
COL	combined license
CPI-U	Consumer Price Index for all urban consumers
CSP	cyber security plan
DBA	design-basis accident
DBT	design-basis threat
DCE	decommissioning cost estimate
DCSS	dry cask storage system
DOE	U.S. Department of Energy
DP	decommissioning plan
DTF	decommissioning trust fund
EA	environmental assessment
EAL	emergency action level
ECL	emergency classification level
EIS	environmental impact statement
EOS	Emergency Operations Facility
EP	emergency preparedness
EPA	U.S. Environmental Protection Agency
EPZ	emergency planning zones
ERDS	Emergency Response Data System
ERO	Emergency Response Organization
ETE	evacuation time estimate
FEMA	Federal Emergency Management Agency
FFD	fitness for duty
FR	<i>Federal Register</i>
FTE	full-time equivalent
GEIS	Generic Environmental Impact Statement
GL	generic letter
GWd	gigawatt-day

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HAB	hostile action-based
IFMP	Irradiated Fuel Management Plan
IMP	insider mitigation program
IOEP	independent spent fuel storage installation-only emergency plan
IP	inspection plan
ISFSI	independent spent fuel storage installation
IT	information technology
LAR	license amendment request
LLW	Low-Level Radioactive Wastes
LTP	License Termination Plan
MOU	memorandum of understanding
MTHM	metric ton of heavy metal
NAICS	North American Industry Classification System
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NLO	Non-Licensed Operator
NOUE	notification of unusual event
NPP	nuclear power plant
NPV	net present value
NRC	Nuclear Regulatory Commission
NUREG	NRC technical report
OMB	Office of Management and Budget
ORO	Offsite Response Organization
PA	Protected Area
PAA	Price-Anderson Act
PAGS	protective action guides
PAR	protective action recommendation
PDEP	permanently defueled emergency plan
PERT	program evaluation and review technique
PS	physical security
PSDAR	Post-Shutdown Decommissioning Activities Report
PSEP	Post-Shutdown Emergency Plan
PWR	pressurized-water reactor
QAP	Quality Assurance Program
RAI	Request for Additional Information
RB	Regulatory Basis

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RCS	reactor coolant system
REP	radiological emergency preparedness
RG	regulatory guide
SAE	site area emergency
SSC	structures, systems, and components
SSCE	site-specific cost estimate
SER	safety evaluation report
SFP	spent fuel pool
SNF	spent nuclear fuel
SOC	standard occupational classification (code)
SRM	staff requirements memorandum
STA	shift technical advisor
TSC	Technical Support Center
UA	Unescorted Access
UAA	Unescorted Access Authorization
VA	Vital Area

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## EXECUTIVE SUMMARY

The NRC is proposing to amend its regulations related to the decommissioning of production and utilization facilities. The Commission directed the NRC staff to proceed with an integrated rulemaking on power reactor decommissioning to address: a graded approach to emergency preparedness (EP); lessons learned from the plants that have already gone through (or are currently going through) the decommissioning process; the advisability of requiring a licensee's post-shutdown decommissioning activities report (PSDAR) to be approved by the NRC; maintaining the three existing options for decommissioning and the associated timeframes; the role of State and local governments and non-governmental stakeholders in the decommissioning process; and any other issues deemed relevant by the NRC staff.

Major provisions of the proposed rule include changes in the areas of: emergency preparedness, physical security, cyber security, drug and alcohol testing, certified fuel handler training, decommissioning funding assurance, offsite and onsite financial protection requirements and indemnity agreements, environmental considerations, records retention requirements, low-level waste transportation time, spent fuel management planning, NRC's backfit rule, foreign ownership, control, or domination, and scope of the license termination plan requirement.

In this regulatory analysis, the NRC presents the costs, benefits and other impacts to industry, government and society from the proposed rule. The regulatory analysis evaluated the economic impact of the proposed changes to the above areas of decommissioning and concludes that the proposed rule should be adopted because it would result in a cost benefit to the nuclear power industry, government, and society as summarized in Table 1 below.

Table 1 Decommissioning Areas under Proposed Rulemaking

Area of Decommissioning	Proposed Alternative	Total Net Benefit (Cost) <sup>a,b</sup> (2018 million dollars, 7% NPV <sup>c</sup> )
Emergency Preparedness	EP-2	\$7.74
Physical Security	PS-2	\$0.88
Cyber Security	CS-2	\$0.08
Drug and Alcohol Testing	DA-2	\$7.02
Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor	CFH/STA-2	\$0.37
Decommissioning Funding Assurance	DTF-2	\$1.18
Offsite and Onsite Financial Protection	FP-2	\$0.56
Environmental Considerations	ENV-2	(\$0.04)
Record Retention Requirements	R-2	\$0.24
Low-Level Waste Transportation Time	TR-2	\$0.16
Spent Fuel Management Planning	SFM-2	(\$0.30)
Backfit Rule	BF-2	(\$0.06)
Foreign Ownership, Control, or Domination	F-2	\$0.08
Total:		\$7.91

<sup>a</sup> These estimates are based on preliminary inputs and are subject to change.

<sup>b</sup> The total net benefit results are sensitive to the timing of when costs and benefits occur and to the discount rate for these decommissioning areas.

<sup>c</sup> NPV is defined as net present value.

## 1 INTRODUCTION

This document presents the regulatory analysis for the proposed rule, “Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning.” The NRC last amended its requirements for the decommissioning of nuclear power plants in 1996. Staff proposed improvements to the decommissioning requirements in 1999, but after the terrorist attacks of September 11, 2001, the NRC discontinued work on the decommissioning rulemaking and redirected resources toward higher priority work related to safeguards and security. Because no reactors were planning to shut down at that time, the NRC decided there was no immediate need to complete the rulemaking. However, in 2013, four power reactor units permanently shut down and defueled without significant advance notice or preplanning. These licensees and the associated shutdown reactors were: Duke Energy Florida for Crystal River Unit 3 Nuclear Generation Plant; Dominion Energy Kewaunee for Kewaunee Power Station; and Southern California Edison for San Onofre Nuclear Generating Station, Units 2 and 3. On December 29, 2014, Entergy Nuclear Operations, Inc., shut down Vermont Yankee Nuclear Power Station (Vermont Yankee), and on January 12, 2015, the licensee certified that Vermont Yankee had permanently ceased operation and removed fuel from the reactor vessel. In addition, the Omaha Public Power District board of directors shut down Fort Calhoun Station on October 24, 2016. Furthermore as of the time of this writing, the following operating nuclear power stations have announced plans to permanently shut down between 2018 and 2025: Oyster Creek Nuclear Generating Station plans to shut down by October 31, 2018; Pilgrim Nuclear Power Station plans to shut down by June 1, 2019; Three Mile Island Nuclear Station, Unit 1 is planning to shut down on or about September 30, 2019; Davis-Besse Nuclear Power Station, Unit 1 plans to shut down by May 31, 2020; Indian Point Nuclear Generating, Units 2 and 3 plans to shut down by April 30, 2021; Perry Nuclear Power Plant, Unit 1 plans to shut

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down by May 31, 2021; Beaver Valley Power Station, Units 1 and 2 plans to shut down by October 31, 2021; Palisades Nuclear Plant plans to shut down by spring of 2022; and Diablo Canyon Power Plant, Units 1 and 2 plans to shut down in 2025.

Both the decommissioning reactor licensees and the NRC expended substantial resources processing licensing actions for these power reactors during their transition period to a decommissioning status. These licensing actions come in the form of exemptions and amendments to reduce requirements no longer needed to protect public health and safety and the common defense and security for permanently shutdown reactors. To date, the NRC has not identified any safety or security concerns in the current regulatory framework for decommissioning power reactors. However, insights from the recent licensing activities associated with decommissioning power reactors indicate that the decommissioning process can be improved to be more efficient, predictable, and less costly by reducing the processing of individual licensing actions and revising the NRC regulations to achieve a long-term regulatory framework for decommissioning. Therefore, the NRC's goal is to take the appropriate approach for making regulatory changes that reduce the number of licensing actions needed during decommissioning, while still ensuring safety. Furthermore, as stated previously, the staff, consistent with Commission direction, has considered, as part of this rulemaking effort, other issues deemed relevant to decommissioning.

## **1.1 Background**

Detailed regulations for the decommissioning of nuclear power reactors were not included in the NRC rules before 1988. In that year, the NRC published a final rule in the *Federal Register* (FR) (Ref. 1), establishing decommissioning requirements for various types of licensees (53 FR 24018). By the early 1990s, the NRC recognized a need for more changes to the power reactor decommissioning regulations and published a proposed rule to amend its regulations for reactor decommissioning in 1995 (Ref. 2). In 1996, the NRC amended its regulations for reactor decommissioning to clarify ambiguities, make generically applicable procedures being used on a case-by-case basis, and allow for greater public participation in the decommissioning process (Ref. 3). However, as an increasing number of power reactor licensees began decommissioning their reactors in the 1990s, it became apparent that the NRC should consider conducting rulemaking on specific topics in order to improve the efficiency and effectiveness of the decommissioning process.

In a series of Commission papers issued between 1997 and 2001, the NRC staff provided options and recommendations to the Commission to address regulatory improvements related to power reactor decommissioning. In the staff requirements memorandum (SRM) to SECY-99-168, "Improving Decommissioning Regulations for Nuclear Power Plants" (Ref. 4), the Commission directed the NRC staff to proceed with a single, integrated, risk-informed decommissioning rule, addressing the areas of EP, insurance, safeguards, staffing and training, and backfitting. The objective of this rulemaking was to clarify and remove certain regulations for decommissioning power reactors as informed by the reduction in radiological risk to public health and safety and the common defense and security compared to the radiological risk of operating reactors.

During reactor decommissioning, the principal safety concern is the storage of spent fuel in the spent fuel pool (SFP) or an independent spent fuel storage installation (ISFSI). Based on NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants" (Ref. 5), the only accident that might lead to a significant radiological release at a decommissioning reactor is a zirconium fire from an SFP accident, within a few months after the

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reactor has been permanently shut down. The zirconium fire scenario is a postulated, but highly unlikely, beyond-design-basis accident that involves a major loss of water inventory from the SFP, resulting in a significant heatup of the spent fuel, thus leading to substantial zirconium cladding oxidation and fuel damage. The analyses of spent fuel heatup scenarios that might result in a zirconium fire take into consideration the decay heat of the irradiated fuel stored in the SFP and the exothermic reactions of the zirconium with oxygen, water, or both. Therefore, the probability of a zirconium fire scenario continues to decrease as a function of the time that the decommissioning reactor has been permanently shut down. With the permanent cessation of reactor operations and the permanent removal of the fuel from the reactor core, the risk of an accident at decommissioning plants and the number of events that can have significant offsite consequences are significantly reduced. As a result of the shutdown and removal of fuel from the reactor vessel, the reactor, reactor coolant system, and supporting systems no longer operate and, therefore, have no function. Hence, postulated accidents involving failure or malfunction of the reactor, reactor coolant system, or supporting systems are no longer applicable for a power reactor that has decommissioned.

On June 28, 2000, the NRC submitted SECY-00-0145 (Ref. 6) to the Commission, proposing an integrated decommissioning rulemaking plan that would amend regulations in the areas of emergency preparedness, insurance, safeguards, staffing and training, and backfitting for licensees who certified, pursuant to Title 10 of the *Code of Federal Regulations* (CFR) section 50.82(a) that they permanently ceased facility operation(s) and permanently removed fuel from the reactor vessel. The rulemaking plan was contingent on the completion of a zirconium fire risk study provided in NUREG-1738. NUREG-1738 could not completely rule out the possibility of a zirconium fire after extended spent fuel decay times. However, NUREG-1738 did demonstrate that storage of spent fuel in a high-density configuration in SFPs is safe, and that the risk of accidental release of a significant amount of radioactive material to the environment is extremely low.

Because of uncertainty in the NUREG-1738 conclusions about the risk of SFP fires, the NRC faced a challenge in developing a generic decommissioning rule for EP, physical security, and insurance. To seek additional Commission direction, on June 4, 2001, the NRC submitted to the Commission SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Fuel in Spent Fuel Pools" (Ref. 7). However, given the zirconium fire risk study in NUREG-1738 that showed the risk of a SFP fire to be extremely low, and the reactor security implications of the terrorist attacks of September 11, 2001, the NRC redirected its rulemaking priorities to focus on programmatic regulatory changes related to safeguards and security.

In the SRM for SECY-14-0118, "Request by Duke Energy Florida, Inc., for Exemptions from Certain Emergency Planning Requirements," dated December 30, 2014 (Ref. 8), the Commission directed the NRC to proceed with rulemaking on reactor decommissioning and set an objective of early 2019 for its completion. The Commission also stated that this rulemaking should address the following:

- Issues discussed in SECY-00-0145 such as the graded approach to EP.
- Lessons learned from the plants that have already (or are currently) going through the decommissioning process.
- The advisability of requiring a licensee's PSDAR to be approved by the NRC.
- Maintaining the three existing decommissioning options and the associated timeframes.
- The role of State and local governments and non-governmental stakeholders in the decommissioning process.



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- Any other issues deemed relevant by the NRC.

In SECY-15-0014, “Anticipated Schedule and Estimated Resources for a Power Reactor Decommissioning Rulemaking,” (Ref. 9), the NRC committed to proceed with a rulemaking on reactor decommissioning with the goal of submitting a final rule to the Commission by the end of fiscal year 2019. As a result, the NRC issued a draft regulatory basis (RB) on March 15, 2017 (Ref. 10) and the associated regulatory analysis (RA) for the draft RB on May 9, 2017 (Ref. 11) for public comments. Public comments were received by the NRC staff, which resulted in the issuance of the regulatory basis on November 27, 2017 (Ref. 12) in the *Federal Register* and the associated RA for the RB (Ref. 13), which form the basis for this regulatory analysis document for the proposed rule.

## **1.2 Statement of the Problem**

Once a licensee enters the decommissioning phase, certain regulations that applied during the operating phase might not be necessary during decommissioning due to the shutdown condition of the plant. During its review of the overall decommissioning regulations, the NRC identified areas where the existing regulations could be updated or clarified to be more consistent with, or more appropriately reflect, the requirements necessary to maintain reasonable assurance of adequate protection of public health and safety and the common defense and security at a decommissioning power reactor. These areas of decommissioning are discussed in more detail below with NRC recommendations to address the potential changes.

In developing the regulatory basis, the NRC explored multiple alternatives for each area of decommissioning, including developing guidance, pursuing rulemaking, and maintaining the status quo. Pursuant to 10 CFR 50.12, “Specific exemptions,” the Commission may grant exemptions from regulations if the Commission determines the exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security, and when special circumstances are present, such as when application of the regulation is not necessary to achieve the underlying purpose of the rule. Experience has demonstrated that licensees for decommissioning power reactors seek multiple exemptions and license amendments per site to establish a long-term licensing framework for decommissioning. By issuing a decommissioning rule, the NRC would be able to modify its regulations commensurate with the reduced risk associated with permanently shutdown and defueled reactors and maintain safety and security at sites transitioning to decommissioning, without the need to grant specific exemptions, approvals, or issue license amendments related to certain subject matters (e.g., EP, physical security, certified fuel handler training, decommissioning financial assurance, and onsite/offsite liability insurance).

## **1.3 Objectives**

The objectives for the decommissioning rulemaking include:

- Continue to provide assurance of adequate protection of public health and safety and the common defense and security at decommissioning power reactor sites.
- Ensure that the requirements for decommissioning power reactors are clear and appropriate.
- Codify those issues that are found to be generically applicable to all decommissioning power reactors and have resulted in the need for exemptions or license amendments.

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- Identify, define, and resolve additional areas of concern related to the regulation of decommissioning power reactors.

## **1.4 Sections in the Proposed Rulemaking**

The following list shows how each section of this regulatory analysis document corresponds to the technical areas discussed in the proposed rule, part IV, Scope of the Proposal.

- Section 4.1 corresponds to section A, "Emergency Preparedness"
- Section 4.2 corresponds to section B, "Physical Security"
- Section 4.3 corresponds to section C, "Cyber Security"
- Section 4.4 corresponds to section D, "Drug and Alcohol Testing"
- Section 4.5 corresponds to section E, "Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor"
- Section 4.6 corresponds to section F, "Decommissioning Funding Assurance"
- Section 4.7 corresponds to section G, "Offsite and Onsite Financial Protection Requirements and Indemnity Agreements"
- Section 4.8 corresponds to section H, "Environmental Considerations"
- Section 4.9 corresponds to section I, "Record Retention Requirements"
- Section 4.10 corresponds to section J, "Low-Level Waste Transportation"
- Section 4.11 corresponds to section K, "Spent Fuel Management Planning"
- Section 4.12 corresponds to section L, "Backfit Rule"
- Section 4.13 corresponds to section M, "Foreign Ownership, Control, or Domination"
- Section 4.14 corresponds to section N, "Clarification of Scope of License Termination Plan Requirement"

## **2 DECOMMISSIONING INPUTS**

The purpose of this section is to define the inputs that support the definition of the alternatives and cost-benefit analysis.

### **2.1 Decommissioning Levels**

The NRC is proposing to amend its regulations to provide an efficient regulatory framework during decommissioning using a graded approach for certain technical areas. This graded approach is commensurate with the reductions in radiological risk at four levels of decommissioning: (1) permanent cessation of operations and removal of all fuel from the reactor vessel, (2) sufficient decay of fuel in the SFP such that it would not reach ignition temperature within 10 hours under adiabatic heatup conditions, (3) transfer of all spent fuel to dry storage, and (4) removal of all fuel from the site. These levels are discussed further as follows:

#### **2.1.1 Level 1**

Level 1 commences after the NRC's docketing of the licensee's certifications of permanent cessation of operations and permanent removal of the fuel from the reactor vessel pursuant to 10 CFR 50.82, "Termination of license," or 10 CFR 52.110, "Termination of license." In this level, a decommissioning reactor is defueled and permanently shut down, but the spent fuel in the SFP is still susceptible to a zirconium fuel cladding fire within 10 hours under adiabatic

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heatup conditions if the SFP is unexpectedly drained. This configuration encompasses the period from immediately after the core is removed from the reactor to just before the decay heat of the hottest assemblies is low enough that no rapid zirconium oxidation would take place within 10 hours. The NRC staff has determined that a baseline decay time period of 10 months for a boiling-water reactor (BWR) or 16 months for a pressurized water reactor (PWR) conservatively bounds the anticipated decay time for the operating fleet at the time of this rulemaking. Therefore, the proposed rule establishes these two time periods as the default time licensees will remain in Level 1, for reactors operating using fuels with zirconium cladding at a burnup of less than or equal to 72 Gigawatt-days/Metric Ton of Heavy Metal (GWd/MTHM), averaged across the assembly. During these time periods, an appropriate level of EP must be maintained to respond to applicable design basis accidents and to ensure a prompt response to the low likelihood possibility that a rapid drain down of the SFP could cause a subsequent zirconium fire and release in less than 10 hours. Licensees have the ability to submit an analysis to support a shorter decay time period, just as in the regulatory baseline, and licensees would be required to submit this analysis if the burnup exceeds the above specified fuel characteristics.

This regulatory analysis discusses the regulatory change implementing these two decay time periods in further detail in the applicable sections below, for the areas of decommissioning that are impacted by the decay time periods.

### **2.1.2 Level 2**

In Level 2, the reactor is defueled and permanently shut down, and spent fuel in the SFP has decayed and cooled sufficiently that it cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions. In this configuration, the spent fuel can be stored long term in the SFP. The NRC anticipates that spent fuel in this decommissioning level will be stored in the pool for at least five years after the spent fuel is moved from the reactor vessel to the SFP. In addition, the site may possess a radioactive inventory of liquid radiological waste, radioactive reactor components, and contaminated structural materials. The radioactive inventory during this configuration may change, depending on the licensee's proposed shutdown activities and schedule.

### **2.1.3 Level 3**

In Level 3, the NRC anticipates that more than 5 years have elapsed since the reactor permanently ceased operation and was defueled and that all spent nuclear fuel is in dry cask storage (e.g., an ISFSI facility). The decision for a licensee to transfer all fuel to an ISFSI facility is based, in part, on such plant-specific factors as the timing and method of plant decommissioning, the preexistence of a licensed ISFSI, and the anticipated start of fuel shipments to a Federal high level waste repository or a monitored retrievable storage (MRS) facility. To evaluate the potential effects of alternatives considered in this analysis, the NRC assumed that the spent fuel is stored in an onsite ISFSI for 16 years before the spent fuel is transmitted to either an offsite ISFSI or a permanent geologic repository. This is based on a recently submitted decommissioning plan for transferring all the spent fuel to a U.S. Department of Energy (DOE) long-term storage repository (Ref. 14).

### **2.1.4 Level 4**

In Level 4, all spent nuclear fuel has been removed from the site. The site may possess a radioactive inventory of liquid radiological waste, radioactive reactor components, and

contaminated structural materials. The radioactive inventory during this configuration may change, depending on the licensee’s proposed decommissioning activities and schedule. There are no credible accident sequences that can result in significant offsite radiological consequences. As a result, the potential accidents that could occur during the decommissioning of a nuclear power reactor in Level 4 have negligible offsite and onsite consequences.

## **2.2 Decommissioning Experience of Recent Plants**

Between early 2013 and the end of 2014, the licensees of five power reactor units, as listed in Table 2, permanently ceased operation. It is the NRC’s understanding that economics associated with low wholesale electricity prices, the costs of capital improvements, or the costs of major facility repairs were the primary reasons leading to the decisions to permanently shut down these reactors. These were the first reactors to transition to decommissioning since 1998 – an interval of nearly 15 years without a power reactor permanently shutting down. These recent reactor shutdowns were unexpected and involved minimal preplanning.

During approximately a three-year period (2013-2016), over 70 decommissioning related licensing actions and other regulatory actions were processed for the five decommissioning reactor units. This period of increased licensing activity for plants shutting down is commonly referred to as the decommissioning transition process. These decommissioning transition licensing actions established a regulatory framework for decommissioning reactors, and are based, in large part, on the reduced risks to public health and safety and the common defense and security posed by the facility. For decommissioning reactors, the number of potential accidents is fewer and risks of radiological releases are reduced when compared to an operating reactor. Therefore, decommissioning licensees request certain amendments to their licenses and certain exemptions from the NRC’s operating regulations that reflect this reduction in risk.

Table 2 and Table 3 summarize the licensing activities associated with the five reactor units that recently went through the decommissioning transition process.

Table 2 Licensing Activity Summary for Recent Permanently Shutdown Reactors

<b>Site</b>	<b>Permanent Shutdown Date</b>	<b>Decommissioning Strategy <sup>a</sup></b>	<b>Public Meetings and Briefings</b>	<b>Licensing Actions</b>
Kewaunee	May 2013	SAFSTOR	3	22
Crystal River Unit 3	February 2013	SAFSTOR	3	16
SONGS, Units 2 and 3	June 2013	DECON	8	15
Vermont Yankee	December 2014	SAFSTOR	2	26
<b>Totals</b>			<b>16</b>	<b>79</b>

<sup>a</sup> Decommissioning strategies are discussed in Section 3.2 of this document.

Table 3 Licensing Actions Summary for Recent Permanently Shutdown Reactors

Site	Exemptions	Amendments	Order Rescissions	Other	Total
Kewaunee	9	4	3	6	22
Crystal River Unit 3	5	5	2	4	16
SONGS, Units 2 and 3	6	4	2	3	15
Vermont Yankee	9	7	4	6	26
<b>Totals</b>	<b>29</b>	<b>20</b>	<b>11</b>	<b>19</b>	<b>79</b>

### 3 IDENTIFICATION OF AFFECTED ATTRIBUTES

The NRC developed an inventory of impacted attributes that can be found in Chapter 5 of the NRC’s “Regulatory Analysis Technical Evaluation Handbook” (Ref. 15). These attributes are as follows:

- Industry Implementation: This attribute accounts for the one-time projected net economic effect on the affected licensees to implement the rulemaking objectives.
- Industry Operation: This attribute accounts for the projected net economic effect caused by routine and recurring activities that impact all affected licensees. The economic effect includes procedural and administrative activities to process license amendments and exemptions.
- NRC Implementation: This attribute accounts for the one-time projected net economic effect on the NRC to place the proposed alternative into operation.
- NRC Operation: This attribute accounts for the projected net economic effect on the NRC caused by routine and recurring activities after the proposed action is implemented. The economic effect includes procedural and administrative activities to process license amendments and exemptions.
- Other Government: This attribute is an impact which measures the net economic effect of the proposed action on the federal government (other than the NRC) and state and local governments resulting from the action's implementation or operation.
- General Public: This attribute accounts for out-of-pocket costs paid by members of the general public as a result of implementation or operation of proposed action.
- Environmental Considerations: This attribute accounts for environmental improvements resulting from the implementation of the proposed alternative relative to the regulatory baseline that have not been addressed through use of a generic or programmatic environmental impact statement or environmental assessment.
- Regulatory Efficiency: This attribute accounts for regulatory and compliance improvements resulting from the implementation of the proposed alternative relative to the regulatory baseline.

### 4 IDENTIFICATION AND ANALYSIS OF ALTERNATIVES FOR THE DECOMMISSIONING AREAS

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The NRC considered the following general approaches to address the regulatory problem identified in Section 1.2:

- Alternative 1: Take no action
- Alternative 2: Amend the decommissioning requirements through rulemaking

Fourteen areas of decommissioning are considered individually. Each area of decommissioning includes the above alternatives, the assumptions for the alternatives, and the impacted attributes.

#### **4.1 Emergency Preparedness**

The EP requirements in 10 CFR 50.47, “Emergency plans,” and Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities,” to 10 CFR Part 50 continue to apply to a nuclear power reactor after permanent cessation of operations and removal of fuel from the reactor vessel. Currently, no explicit regulatory provisions distinguish EP requirements for a power reactor that has permanently ceased operations from those for an operating power reactor. To establish a level of EP commensurate with the risk at a decommissioning site, licensees request exemptions from the regulatory EP requirements early in the decommissioning process, and the NRC thoroughly reviews each one on a case-by-case basis.

The NRC has previously approved exemptions from the emergency planning regulations in 10 CFR 50.47 and Appendix E to 10 CFR Part 50 at permanently shutdown and defueled power reactor sites. The agency granted these exemptions based, in part, on the NRC’s determination that the spent fuel at the decommissioning licensee’s facility had sufficiently decayed to eliminate applicable design-basis events that could result in an offsite radiological release exceeding the limits established by the U.S. Environmental Protection Agency’s (EPA’s) early phase protective action guides (PAGs) of 1 rem at the exclusion area boundary.

The NRC also relied on analyses that showed that a beyond-design-basis zirconium fire in the SFP is highly unlikely. This conclusion was based on the amount of time necessary before the spent fuel could reach the zirconium ignition temperature during a SFP draindown event. Based on reasonably conservative adiabatic heatup calculations, a minimum of 10 hours for the time to heatup to zirconium ignition temperature has been used as part of the basis to support the approval of exemptions from portions of the EP regulations. The 10-hour period allows for the licensee to take onsite mitigation measures or, if necessary, for offsite authorities to take appropriate response actions using an all-hazards approach emergency management plan.

Between 1987 and 1999, the NRC issued exemptions from EP requirements for ten licensees. In EP exemptions issued in 2014 and 2015 for four decommissioning licensees,<sup>1</sup> the NRC required the licensees to have sufficient trained personnel on shift, and equipment and procedures to implement their site-specific preplanned mitigation strategies within a 2-hour timeframe. These mitigation strategies are required by a license condition until the spent fuel is removed from the SFP. Licensees that have been granted EP exemptions must maintain an

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<sup>1</sup> The recent exemptions for emergency planning have been granted for Kewaunee Power Station (Ref. 18), Crystal River Unit 3 Nuclear Generating Plant (Ref. 19), San Onofre Nuclear Generating Station, Units 2 and 3 (Ref. 20), and Vermont Yankee Nuclear Power Station (Ref. 21).

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onsite emergency plan addressing the classification of an emergency, notification of emergencies to licensee personnel and offsite authorities, and coordination with designated offsite government officials following an event declaration so that, if needed, offsite authorities may implement appropriate response actions. The EP exemptions also relieve the licensee from the requirements of 10 CFR 50.47 and Appendix E to 10 CFR Part 50 as they pertain to offsite radiological emergency preparedness (REP), including the requirement to maintain the 10-mile plume exposure pathway and the 50-mile ingestion pathway emergency planning zones (EPZs).

In addition, licensees must pay fees to the Federal Emergency Management Agency (FEMA) and the participating states and localities to fund their activities that support the offsite radiological EP program. FEMA regulations in 44 CFR Part 350, "Review and Approval of State and Local Radiological Emergency Plans and Preparedness" (Ref. 16), address the review and approval of offsite response organizations' emergency plans and procedures for responding to radiological emergencies at commercial nuclear power plants. Under 44 CFR Part 354, "Fee for Services to Support FEMA's Offsite Radiological Emergency Preparedness Program" (Ref. 17), FEMA establishes the methodology to assess and collect user fees. The fees are to recover the obligated amounts for the radiological EP program. FEMA has established both site-specific and flat fees. The site-specific component is related to plume exposure pathway exercises (Ref. 22). Pursuant to 44 CFR 354.4(e), licensees are required to pay these fees until FEMA receives a copy from the NRC of its approval of exemptions from 10 CFR 50.54(q) requirements stating that offsite radiological emergency planning and preparedness are no longer required at the exemption-requesting licensee's nuclear power plant site. Following the receipt of these approved exemptions, FEMA will no longer assess a user fee for that site from the beginning of the next fiscal year.

Because there are no explicit regulatory provisions distinguishing EP requirements for a nuclear power reactor that has permanently ceased operations from those for an operating power reactor, the NRC is proposing to amend the EP requirements in 10 CFR Part 50, including 10 CFR 50.47, 10 CFR 50.54(q), (s), and (t), and Appendix E to 10 CFR Part 50, and add alternative requirements in new Section 10 CFR 50.200. The objectives of this rulemaking are to: (1) define the level of EP appropriate for a decommissioning nuclear power plant site from the time of permanent cessation of operations until such time that no EP would be required and (2) minimize the need for licensees to request, and the staff to review, exemptions from emergency preparedness regulations for relief from requirements that are no longer necessary.

#### **4.1.1 Alternative EP-1 (No-action alternative)**

Under the no-action alternative, the EP requirements in 10 CFR 50.47, 10 CFR 50.54(q) and Appendix E to 10 CFR Part 50 would remain unchanged and would continue to apply to a nuclear power reactor after permanent cessation of operations and removal of fuel from the reactor vessel. Every nuclear power reactor licensee must establish and maintain emergency plans and preparedness in accordance with these regulations. The regulations include standards for both onsite and offsite emergency response plans. These regulations and the planning basis for EP are based upon an anticipated prompt response to a wide spectrum of events. But for a decommissioning site, the number of accidents that can have significant offsite consequences is greatly reduced and dominated by the zirconium fire scenario. The current regulations do not address that there is considerably more time to respond to a postulated zirconium fire incident at a decommissioning site than for postulated operating reactor accidents.

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Because certain EP requirements designed for operating reactors impose regulatory burden on licensees undergoing decommissioning that is not necessary to protect the public health and safety, licensees generally request exemptions from these requirements. Under the current exemption process described in NSIR/DPR-ISG-02 (Ref. 23), exemptions to offsite EP requirements must be supported by a number of analyses, including a site-specific analysis demonstrating that fuel stored in the SFP would not reach the zirconium ignition temperature in less than 10 hours following a beyond-design-basis accident that involves a major loss of water inventory from the SFP. These exemption requests require extensive analysis by the licensee and review by the NRC for each application. The no-action alternative would not relieve the burden imposed on both licensees and the NRC resulting from this case-by-case EP exemption process. In addition, while the exemption process could be further enhanced, this process would not result in the efficiency gains possible through Alternative EP-2. By continuing to assess EP exemptions for individual licensees, licensees and the NRC would continue to expend resources to prepare and process exemption requests. The RG 1.184 “Decommissioning of Nuclear Power Reactors,” gives an overview of the current decommissioning process and illustrates that the majority of the administrative burden incurred by licensees and the NRC is in the first several years of decommissioning.

The NRC’s approval of the requests for exemption from certain requirements of 10 CFR 50.47 and Appendix E to 10 CFR Part 50 allows licensees to initiate the process of establishing a permanently defueled emergency plan (PDEP) and a permanently defueled emergency action level (EAL) scheme. A licensee could submit the PDEP to the NRC for prior review and approval and the NRC would document its determination on the PDEP in a safety evaluation report (SER). The NRC approval of the PDEP would document that the licensee has maintained reasonable assurance that adequate protective measures can and will be taken in a radiological emergency and would provide an approved emergency plan as a licensing basis against which future changes could be compared. Alternatively, a licensee could determine that the adoption of the PDEP would not constitute a reduction in effectiveness of the emergency plan per 10 CFR 50.54(q) because of the change in the licensing basis for the plant resulting from the granting of the exemption request, and as such, the licensee could opt to implement the change without prior NRC review and approval. With respect to the permanently defueled EAL scheme, its adoption is considered to be a scheme change, and per the requirements of Section IV.B.2 of Appendix E to 10 CFR Part 50, the licensee would submit it to the NRC for prior review and approval as a license amendment request pursuant to 10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit.”

#### **4.1.2 Alternative EP-2 (Rulemaking to amend regulations to provide a graded approach to emergency preparedness / emergency plan changes between levels with NRC approval)**

In this alternative, the NRC would propose a graded approach to EP that is commensurate with the reductions in radiological risk at the four levels of decommissioning discussed in Section 2.1. The levels and proposed areas of EP requirements are discussed below. This alternative differs from Alternative EP-1 because the reduction of EP requirements occurs in Alternative EP-1 only if exemptions are requested by the nuclear power plant licensees and approved by the NRC.

Under this alternative, the NRC and FEMA must establish a notification process that would replace the existing NRC/FEMA process for terminating the assessment of FEMA user fees following the receipt from the NRC of its approved exemptions from pertinent 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 requirements. The new notification process would inform



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FEMA that offsite radiological emergency planning and preparedness are no longer required at a particular commercial nuclear power plant site after the spent fuel has cooled for a period of 10 months for BWRs or 16 months for PWRs and the licensee has submitted its certifications required by 10 CFR 50.82(a)(1) or 10 CFR 52.110(a). This change also requires FEMA to perform a rulemaking to amend 44 CFR 354.4(e), "Discontinuation of charges," to reflect this new process.

#### Level 1: Post Shutdown Emergency Plan (PSEP)

Licensees would enter Level 1 after the NRC's docketing of the licensee's certifications of permanent cessation of operations and permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1) or 10 CFR 52.110(a). A PSEP provides a transition period from the EP requirements for an operating reactor to the requirements for a decommissioning reactor where the spent fuel has decayed for at least 10 months for a BWR or 16 months for a PWR. This transition would reduce the regulatory burden associated with EP requirements that are no longer necessary at a permanently shutdown and defueled power reactor facility. For this analysis, the NRC estimates that licensees will remain in Level 1 for a period of 10 months for BWRs or 16 months for PWRs from the date of permanent cessation of operations. As discussed in Section 2.1.1, these time periods are based on a burnup of less than or equal to 72 GWt/MTHM; a licensee that exceeded this burnup prior to decommissioning would have to calculate decay time using NRC guidance to determine the appropriate time period. This calculation is the same as that being performed under the regulatory baseline by licensees seeking to transition from Level 1 to Level 2 PDEP, and would apply to any such licensee with a higher burnup under the regulatory baseline. Therefore, there is no incremental cost due to this requirement in the proposed rule. Furthermore, by providing the limiting burnup value, the NRC could potentially avert costs for a licensee that may decide not to perform the calculation, but instead use the 10- or 16-month time periods in the proposed rule language, due to having a burnup that conforms with the limit. This benefit is considered qualitatively in this regulatory analysis.

The following discussion addresses current requirements that the NRC proposes to amend to support a transition from Level 1 to a Level 2 PDEP while still providing for adequate protection of the public health and safety during this transition period.

#### *PSEP Staffing and Emergency Response Organization*

In Level 1, the proposed rule would allow a licensee transitioning to a PSEP to revisit staffing levels and the staffing analysis performed under Section IV.A.9 of Appendix E to 10 CFR Part 50 for the Emergency Response Organization (ERO) in order to align staffing with the reduced spectrum of credible accidents for a permanently shutdown and defueled power reactor facility. The proposed amended requirement would acknowledge that the spectrum of credible accidents requiring a response from the ERO at a facility that is permanently shutdown and defueled is reduced as compared to an operating plant, and the principal public safety concern involves the potential radiological risks associated with the storage of spent fuel onsite in the SFP. The reactor, reactor coolant system (RCS), and reactor support systems are no longer in operation and have no function related to the storage of spent fuel. Therefore, postulated accidents involving a failure or malfunction of the reactor, RCS, or reactor support systems are no longer applicable. As such, certain ERO positions and emergency functions as detailed in NUREG-0654/FEMA-REP-1, Revision 1, Table B-1 (Ref. 24), may not be applicable or necessary in Level 1 under a PSEP. Commensurate with the reduced spectrum of credible accidents, the NRC is proposing changes to the guidance on ERO staffing levels for Level 1.

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The NRC has developed a draft of a new guidance document, DG-1346, "Emergency Planning for Decommissioning Nuclear Power Reactors," as part of this rulemaking.

#### *PSEP Emergency Action Levels*

Section IV.C of Appendix E to 10 CFR Part 50 requires licensees to develop a set of emergency action levels (EALs) based not only on onsite and offsite radiation monitoring information but also on readings from a number of sensors that indicate a potential emergency, such as the pressure in containment and the response of the emergency core cooling system. The proposed rule would allow licensees transitioning to a PSEP to revise EALs consistent with the profile of a permanently shutdown and defueled power reactor facility. Although there may be no credible event that could result in significant radiological release beyond the site boundary when a facility enters Level 1, the purpose of Level 1 is to ensure that adequate EP is in place to ensure a prompt response even if a highly-unlikely event should occur. To accompany the proposed rule, the NRC would prepare guidance, in DG-1346, for a permanently shutdown and defueled power reactor facility desiring to make an EAL scheme change.

#### *PSEP Evacuation Time Estimate Studies*

Section IV.3 of Appendix E to 10 CFR Part 50 requires licensees to use evacuation time estimates (ETEs) in the formulation of PARs and to provide the ETEs to State and local governmental authorities for use in developing offsite protective action strategies. Licensees must update ETEs on a periodic basis in accordance with the requirements in 10 CFR 50.47(b)(10) and Sections IV.4, IV.5, and IV.6 of Appendix E to 10 CFR Part 50. In the 2011 EP Final Rule (Ref. 25), the NRC amended its regulations regarding ETEs to require licensees to periodically assess changes to the EPZ population. As a result, licensees are required to update their ETE analysis after every decennial census and at any time during the decennial period if the EPZ permanent resident population increases such that it causes the longest ETE value for specific zones to increase by 25 percent or 30 minutes, whichever is less.

The NRC concludes that updates to the ETE during Level 1 would provide limited benefit for the enhancement of protective action strategies or offsite evacuation planning. Even if the criteria for updating the ETE analysis were met within the Level 1 timeframe, updating an ETE report may take several months of analysis. After the ETE is updated, the regulations in Section IV.6 of Appendix E to 10 CFR Part 50 require an additional 180 days before an updated ETE can be used to inform PARs and offsite protective action strategies. The additional time and effort needed to develop and implement a revised protective action strategy may exceed the time that a facility would spend in Level 1 and would also be counter to the purpose of Level 1 as a transition period during the decommissioning process. Additionally, based on the NRC's review of submitted ETEs, population changes within a period comparable to the Level 1 timeframe are unlikely to impact ETEs enough to affect the formulation of protective action strategies. Because formal offsite REP planning and pre-planned PARs for evacuations in response to a radiological emergency would not be requirements of Level 2 (see discussion below), updates to the ETE during Level 1 would provide almost no benefit. For these reasons, the NRC is proposing to amend 10 CFR Part 50, Appendix E, Section IV.4 to clarify that the ETE requirements of paragraphs 4, 5, and 6 of 10 CFR Part 50, Appendix E, Section IV would no longer be applicable to licensees after the NRC docket the certifications of permanent cessation of operations and permanent removal of fuel from the reactor vessel. Existing ETE analyses would remain effective within the emergency plan until no longer required with PDEPs (i.e., in Level 2).

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### *PSEP Annual Dissemination of Public Information*

Section IV.D.2 of Appendix E to 10 CFR Part 50 currently requires licensees to make annual dissemination of basic emergency planning information to the public within the plume exposure pathway EPZ. Several commenters stated that this requirement should no longer apply to decommissioning sites. Section II.G of NUREG-0654/FEMA-REP-1, Revision 1 (Ref. 26), contains criteria for the information that should be included in the annual dissemination of public information, including educational information on radiation, points of contact, protective measures, and information for special needs populations. During the period of plant operation, EPZ residents will have had adequate opportunity to become aware of this information and much of this information is likely to remain unchanged from year to year. Starting in Level 2, and consistent with the removal of requirements for formal offsite REP for decommissioning sites (including the removal of EPZ requirements), the NRC would not require annual dissemination of public information. However, for Level 1, the change in the plant's operating status and the ensuing changes to the EP program prompt the need to provide a final dissemination of information to the public. This final dissemination would explain the decommissioning process and the resultant changes to the onsite and offsite EP that are likely to occur over the next several years. Although, the NRC is not proposing regulatory changes related to disseminations of public information, the NRC is issuing DG-1346 for public comment in conjunction with this proposed rule that provides guidance on one method acceptable to the NRC for this final dissemination of information for licensees with PSEPs. This new guidance would be developed as part of Alternative EP-2.

### *PSEP Drill and Exercises*

Section IV.F of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(14) include requirements for periodic drills and exercises for licensees. Given the low probability of design-basis accidents (DBAs) or other highly unlikely events that could result in exceeding the EPA PAGs, as well as the available time to initiate mitigation measures consistent with plant conditions, the previously routine progression to a General Emergency in power reactor site scenarios is not applicable to a decommissioning site. Therefore, the licensee would not be expected to demonstrate response to as wide a spectrum of events as it was during its operating phase. Beginning in Level 1, exercise scenarios could be reduced commensurate with the permanent cessation of power reactor operations and removal of fuel from the reactor vessel to reflect a smaller suite of potential accident scenarios.

Section IV.F.2.c of Appendix E to 10 CFR Part 50 also requires that offsite REP plans for each site be exercised biennially with full participation by each offsite authority having a role under the radiological emergency plan. Depending upon when the licensee starts the decommissioning process, a full participation exercise could potentially be required during Level 1. As the risk of an accident resulting in a radiological release offsite is significantly reduced in Level 1 and because regulatory standards for offsite REP programs would not be a requirement of Level 2, there would be limited safety benefit to performing full-scale participation exercises simulating a release with offsite consequences during the time a licensee is in Level 1. The NRC anticipates that it will need to clarify further through regulation or guidance the timing and scope of full participation drills and exercises in relation to the licensee's 8-year exercise cycle and the timeline for decommissioning. The NRC will make any potential changes to the timing and scope of drill and exercise requirements in consultation with FEMA. This new regulation would be developed as part of Alternative EP-2.

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### *PSEP Emergency Response Data System*

Section VI of Appendix E to 10 CFR Part 50 outlines a set of system, testing, and implementation requirements for the Emergency Response Data System (ERDS). These systems transmit near real-time electronic data directly between the licensee's onsite computer system and the NRC Operations Center. Nuclear power facilities that are shut down permanently or indefinitely are currently not required to provide hardware to interface with the NRC receiving system under 10 CFR Part 50, Appendix E.

Under Alternative EP-2, the NRC is proposing to require licensees in Level 1 to maintain the capability to provide meteorological, radiological, and SFP data (e.g., level, flow, and temperature data) to the NRC within a reasonable timeframe. The NRC assumes in this regulatory analysis that this clarification does not represent a material change in how the ERDS is implemented for Alternative EP-1.

### *Hostile Action Requirements*

In the 2011 EP Final Rule, the NRC amended its regulations to include enhancements to EP in response to a hostile action event. In Appendix E to 10 CFR Part 50, Section IV.B.1 includes providing EALs for hostile action, Section IV.E.8.d includes alternative facilities for the staging of ERO personnel, Section IV.I provides for protective actions for onsite personnel, and Section IV.F.2.c.4 and Section IV.F.2.i include hostile action scenarios in drills and exercises. These EP requirements related to hostile action are separate and distinct from physical protection regulations in 10 CFR Part 73. As discussed below, hostile action requirements would not apply to decommissioning sites that have progressed to Level 2. The NRC has determined that maintaining provisions for hostile action within onsite and offsite radiological emergency plans is prudent given the condition of the facility in Level 1.

As such, the NRC is proposing to maintain EP requirements related to hostile action during Level 1. However, consistent with the above discussion on drill and exercise requirements, the NRC concludes that continuing with full-participation hostile-action-based (HAB) exercises would provide limited safety benefit to a facility that is decommissioning. Under Alternative EP-2, NRC proposes to amend the regulations to remove the HAB exercise requirement from the 8-year exercise cycle starting in Level 1, although security-based EALs would remain in place as potential initiating events for drills and exercises. The removal of the full-participation HAB exercise requirement would be performed as part of Alternative EP-2.

### Level 2: Permanently Defueled Emergency Plan

For plants that have permanently shut down and defueled (Level 1), the proposed EP approach is based primarily on conditions that: (1) a postulated radiological release would not exceed the EPA PAGs at the exclusion area boundary for DBAs applicable to a permanently shutdown and defueled reactor, and (2) sufficient time would exist to take prompt mitigative actions in response to a postulated zirconium fire accident scenario in the SFP and, if warranted, for offsite officials to take appropriate response actions to protect public health and safety. The NRC's analysis of spent fuel decay times provided information on fuel heatup time to 900°C as a function of cooling time for both PWR and BWR assemblies. The analysis also included sensitivities to the mass of the racks and the fuel configuration in the SFP. Based on this analysis, the NRC concludes that after a cooling period of 10 months for BWRs or 16 months for PWRs, the spent fuel cannot reasonably heat up to clad ignition temperature within 10 hours. The NRC proposes to amend the regulations to allow licensees to transition to a permanently

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defueled emergency plan, or PDEP (Level 2) after a specified time. Also, the proposed change would allow licensees to submit an analysis for NRC approval demonstrating that an alternate (e.g., shorter) spent fuel decay period would ensure that spent fuel would not heat up to 900°C in less than 10 hours under adiabatic conditions. Under the proposed rulemaking Alternative EP-2, licensees would be required to submit this analysis under 10 CFR 50.90 and the analysis would need to be approved by the NRC in order for a licensee to transition to a PDEP (Level 2) in less than 10 months (for a BWR) or 16 months (for a PWR). This analysis is the same as that being performed under the regulatory baseline by licensees seeking to transition from Level 1 to Level 2 PDEP. Therefore, there is no incremental cost due to this requirement in the proposed rule. Furthermore, by providing the limiting burnup value, the NRC could potentially avert costs for a licensee that may decide not to perform the calculation, but instead use the 10- or 16-month time periods in the proposed rule language, due to having a burnup that conforms with the limit. This benefit is considered qualitatively in this regulatory analysis. The NRC would issue DG-1346 for public comment in conjunction with this proposed rule that provides guidance on one method acceptable to the NRC for conducting the spent fuel heatup analysis.

#### *PDEP Offsite Radiological Emergency Response Plans*

Under the proposed rule, NRC planning standards would no longer apply to offsite radiological emergency response plans in Level 2. The transition to a PDEP would be conditioned upon analyses performed by the NRC that the licensee is wholly capable of and responsible for mitigating the consequences of an event. In its review of several exemption requests, the NRC has concluded that as long as a period of at least 10 hours is available to initiate mitigation measures or to implement appropriate response actions offsite, formal offsite radiological emergency plans required under 10 CFR Part 50 are not necessary for permanently shutdown and defueled nuclear power reactor licensees with a PDEP.

For transition to a PDEP, site conditions would need to provide a period of at least 10 hours to initiate mitigation measures or to implement appropriate response actions off site. The NRC concludes that such time is ample to take appropriate actions without the extensive preplanning and other requirements of the EP framework for operating plants, and, therefore, regulatory standards for offsite radiological emergency plans would no longer be necessary for the adequate protection of public health and safety. Licensees with PDEPs would still maintain a variety of onsite capabilities that may be available to support OROs in EP and response, including radiological training; regular coordination with OROs; radiological assessment capabilities; memoranda of understanding for firefighting, law enforcement, and ambulance/medical services; and the ability to make PARs upon request. For licensees with PDEPs, no action would be expected or required from State or local government organizations in response to an event at a decommissioning site other than onsite firefighting, law enforcement, and ambulance/medical services. The NRC contends that this clarification to the offsite radiological emergency response plans does not represent a material change in how licensees meet the EP requirements from Alternative EP-1 after the NRC grants the exemption request.

#### *PDEP Staffing and Emergency Response Organization*

For licensees with PDEPs, the proposed rule would include staffing requirements similar to the current requirements in § 50.47(b)(1), § 50.47(b)(2), and paragraph IV.A of Appendix E to 10 CFR Part 50 with the exception of changes made to reflect the small staffing levels required to operate the facility and the removal of formal offsite radiological emergency response requirements for licensees with PDEPs. For example, licensees with PDEPs would not have to

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comply with the requirement under 10 CFR Part 50, Appendix E, Section IV.A.3 to augment the ERO with staff from licensee headquarters. Decommissioning sites typically have a level of emergency response that does not require response by headquarters personnel. Licensees would not have to identify State and/or local officials responsible for protective actions, as currently required under 10 CFR Part 50, Appendix E, Section IV.A.8 because offsite emergency measures are limited to onsite support provided by local police, fire departments, and ambulance and hospital services, as appropriate. The proposed rule would require licensees with PDEPs to include in their emergency plans plant staff emergency assignments.

In addition, the staffing analysis required under 10 CFR Part 50, Appendix E, Section IV.A.9 would no longer apply to licensees with PDEPs. In the 2011 EP Final Rule, the NRC concluded that the staffing analysis requirement was not necessary for non-power reactor licensees because of the small staffing levels required to operate the facility. For this same reason, licensees with PDEPs would no longer be required to perform this analysis under the proposed rule.

As licensees transition to a PSEP, staffing levels may be reduced but must remain commensurate with the need to safely store spent fuel at the facility in a manner that is protective of public health and safety. New guidance would be developed as part of Alternative EP-2 to provide one method acceptable to the NRC for ERO staffing during Level 2.

#### *PDEP Emergency Classification Levels and Emergency Action Levels*

Section IV.C.1 of Appendix E to 10 CFR Part 50 requires that emergency action levels are based, in part, on onsite and offsite radiation monitoring data. The proposed rule would require licensees with PDEPs to establish a standard emergency classification level (ECL) and EAL scheme, the bases of which include facility system and effluent parameters. The proposed EAL and ECL requirements for licensees with PDEPs would be analogous to 10 CFR Part 50, Appendix E, Sections IV.B and IV.C with the exceptions of the requirements to base EALs on offsite monitoring information and the 10 CFR Part 50, Appendix E, Section IV.B.1 requirement to include hostile action based EALs. For facilities with PDEPs, the proposed rule would specify that only the ECLs of Notification of Unusual Event and Alert would apply (and not the ECLs of Site Area Emergency and General Emergency that apply to operating reactors). The proposed requirements would be accompanied by new guidance as part of Alternative EP-2.

#### *PDEP Emergency Assessment, Classification, and Declaration*

Section IV.C.2 of Appendix E to 10 CFR Part 50 currently requires licensees to maintain the capability to assess, classify, and declare an emergency condition within 15 minutes. A decommissioning power reactor has a low likelihood of a credible accident resulting in radiological releases requiring offsite protective measures and the event progression is much slower compared to that for operating reactors. For these reasons under Alternative EP-2, the NRC proposes to amend the regulations so that licensees with PDEPs (in Level 2) would not be required to assess, classify, and declare an emergency condition within 15 minutes. Instead, the NRC is proposing that licensees with PDEPs must document and maintain the capability to assess, classify, and declare an emergency condition as soon as possible and within 60 minutes after the availability of indications that an EAL has been exceeded and must promptly declare the emergency condition as soon as possible following identification of the appropriate ECL. The NRC estimates in this analysis that this change in the reporting timing requirement from 15 minutes to as soon as possible and within 60 minutes would result in an

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inconsequential cost burden difference from Alternative EP-1 for the case that the licensee submits and the NRC grants an exemption request.

#### *PDEP Notification Requirement to State and Local Governmental Agencies*

Section IV.D.3 of Appendix E to 10 CFR Part 50 currently requires licensees to have the capability to notify OROs of an emergency declaration within 15 minutes. Under this alternative, licensees in Level 2 would be required to promptly notify OROs and to make this notification no later than 60 minutes after declaring an emergency. Because of the low probability of DBAs or other credible events that would be expected to exceed the EPA PAGs and the available time to initiate mitigation measures consistent with plant conditions or, if necessary, to implement protective actions, the NRC concludes that 60 minutes provides sufficient time for ORO notification in Level 2.

Under Alternative EP-2, the NRC proposes to amend the regulations to require licensees to promptly notify to State and local governmental agencies and to make this notification as soon as possible and within 60 minutes after declaring an emergency. The NRC estimates in this analysis that this change in the notification time requirement from 15 minutes to as soon as possible and within 60 minutes would result in an inconsequential cost burden difference from Alternative EP-1 for the case that the licensee submits and the NRC grants an exemption request.

#### *PDEP Public Alert and Notification Systems*

Section IV.D.3 of Appendix E to 10 CFR Part 50 currently requires licensees to demonstrate that appropriate governmental authorities have the capability to make a public alerting and notification decision promptly on being informed of an emergency condition. Because of the low probability of DBAs or other credible events that would be expected to exceed the limits of EPA PAGs offsite and the available time for event mitigation, the NRC concluded that the public alert and notification system would not be required for licensees in Level 2. Similarly, exercises of this system, as required under Section IV.F.2 of Appendix E to 10 CFR Part 50 would no longer be required for licensees with PDEPs (in Level 2).

Under Alternative EP-2, the NRC proposes to amend the regulations to provide a non-mandatory relaxation of this alert and notification system requirement. However, licensees in Level 2 would still be required to maintain the capability to notify responsible State and local governmental agencies within 60 minutes after declaring an emergency, and research has shown sufficient time would be available to inform the public and implement protective actions, if necessary. The NRC estimates in this analysis that the proposed change would result in an inconsequential cost burden difference in how the public alert and notification system is maintained and exercised from Alternative EP-1 for the case that the licensee submits and the NRC grants an exemption request.

#### *PDEP Emergency Planning Zones*

Emergency Planning Zones (EPZs) are defined as the areas for which planning is needed to assure prompt and effective actions can be taken to protect the public in the event of an incident. The requirements of 10 CFR Part 50 state that the EPZs associated with each nuclear power plant must be defined both for the shorter-term plume exposure pathway and the longer-term ingestion exposure pathway. Because of the low probability of DBAs or other credible events that would be expected to exceed the EPA PAGs offsite, and the available time

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to initiate mitigation measures consistent with plant conditions, the potential offsite consequences would not warrant maintaining the plume exposure pathway and ingestion exposure pathway EPZs in Level 2. If necessary, sufficient time would be available for OROs to implement appropriate response actions even for the worst-case severe accident.

Therefore, under Alternative EP-2, the NRC proposes to amend the regulations to clarify that the planning standards of 10 CFR 50.47(b) do not apply to offsite radiological emergency response plans if the licensee's emergency plan is not required to meet these planning standards or if the plume exposure pathway EPZ does not exceed the site area boundary. In addition to licensees with PDEPs (in Level 2), future licensees of small modular reactors or other nuclear technologies may be permitted to have a plume exposure pathway EPZ that does not exceed the site area boundary, and this proposed paragraph would clarify applicability of the 10 CFR 50.47(b) planning standards to these facilities as well.

#### *PDEP Offsite Radiological Protective Action Recommendations*

Licensees must develop a range of protective actions for the plume exposure pathway EPZ for emergency workers and the public and to give consideration to evacuation, sheltering, and the use of potassium iodide per the current requirements in 10 CFR 50.47(b). Also, licensees must develop and put in place guidelines for the choice of protective actions during an emergency and develop protective actions for the ingestion exposure pathway EPZ.

Under Alternative EP-2, licensees with PDEPs (in Level 2) would be required to continue to develop a range of protective actions for emergency workers and the public but, consistent with the removal of regulatory standards for offsite radiological EP for these licensees, would not reference specific offsite protective actions or pre-planned activities for the public in the EPZs. The proposed requirement would require preplanned PAR strategies for emergency workers who may have to respond to the decommissioning site for firefighting, law enforcement, and ambulance/medical services and members of the public present within the owner-controlled area during a radiological emergency. For licensees in Level 2, preplanned offsite protective actions to ensure a prompt response to a radiological emergency on site are not necessary given the time available for OROs to implement appropriate response actions. Although the likelihood is extremely low for events that would result in doses in excess of the EPA PAGs to the public beyond the owner-controlled area boundary based on the permanently shutdown and defueled status of the reactor, the NRC would require licensees in Level 2 to determine the magnitude of and continually assess the impact of a radiological release and, if a release is occurring, the licensee staff would be required to communicate that information to offsite authorities within 60 minutes for their consideration in taking appropriate response actions.

The NRC estimates in this analysis that the proposed change would result in an inconsequential cost burden difference in how the licensee maintains the range of protective actions for the plume exposure pathway EPZ for emergency workers and the public from Alternative EP-1 for the case that the licensee submits and the NRC grants an exemption request.

#### *PDEP Evacuation Time Estimate Studies*

Currently licensees are required to develop and update Evacuation Time Estimates (ETEs) in accordance with 10 CFR 50.47(b) and Section IV.3 of Appendix E to 10 CFR Part 50. Section IV.3 requires licensees to use ETEs in the formulation of protective action recommendations (PARs) and to provide ETEs to State and local governmental authorities for use in developing offsite protective actions strategies. Under Alternative EP-2 and consistent



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with the determination for EPZs and PARs, the NRC would not require licensee with PDEPs (in Level 2) to maintain ETEs.

#### *PDEP Emergency Facilities and Equipment*

Section IV.E of Appendix E to 10 CFR Part 50 requires licensees to maintain and describe adequate provisions for emergency facilities and equipment, including equipment at the site for personnel monitoring, equipment for radiological assessment, facilities and supplies for decontaminating onsite individuals, first aid facilities and medical supplies, arrangements for qualified medical service providers and the transportation of contaminated injured individuals, and arrangements for the treatment of individuals injured in support of licensed activities. Decommissioning licensees have not received exemptions or license amendments for these requirements to date and the NRC has determined that licensees with PSEPs (in Level 1) and PDEPs (in Level 2) would still need to maintain these capabilities. As a result, the NRC has not proposed an alternative for how the licensee maintains and describes adequate provisions for emergency facilities and equipment from Alternative EP-1.

#### *PDEP Hostile Action Requirements*

Part 50, Appendix E, Section IV.A.7 defines “hostile action” as an act directed toward a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidate the licensee to achieve an end, as it applies to the capability of implementing EP during such events. However, in the Statement of Considerations for the 2011 EP Final Rule, the NRC excluded nonpower reactors from the definition of “hostile action” because a nonpower reactor as defined in 10 CFR 50.2, “Definitions,” is not a nuclear power plant, and a regulatory basis had not been developed to support the inclusion of nonpower reactors in the definition of “hostile action.” A facility with a PDEP (in Level 2) would be similar to a nonpower reactor in that it has a small operating staff and a low likelihood of a credible accident resulting in radiological releases requiring response actions off site. As such, power reactor facilities transitioning to a PDEP do not fall within the scope of “hostile action,” and enhancements to EP in response to hostile action, such as alternative facilities for the staging of ERO personnel, protection of onsite personnel, and challenging drills and exercises involving hostile action, are not warranted. However, elements for security-based events would be maintained for these facilities, including EALs for security-based events. For physical security, the objective for these facilities relates to protection of the spent fuel against sabotage. A level of security commensurate with the consequences of a sabotage event is required and is evaluated on a site-specific basis. The severity of the consequences declines as fuel ages and thereby removes over time the underlying concern that a sabotage attack, under the current definition, could cause offsite radiological consequences.

Under Alternative EP-2, power reactor licensees transitioning to a PDEP (Level 2) would be required to identify ORO resources that would respond to a security event, and the assistance licensees expect from those resources would be maintained in PDEPs. The NRC estimates in this analysis that the treatment of hostile action requirements does not represent a change in burden from Alternative EP-1 after the NRC grants the exemption request.

#### *PDEP Drills and Exercise*

The proposed rule would require licensees with PDEPs to conduct periodic exercises to evaluate major portions of emergency response capabilities, conduct periodic drills to develop and maintain key skills, and correct deficiencies identified as a result of exercises and drills.

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The proposed requirements differ from the existing requirements under 10 CFR Part 50, Appendix E, Section IV.F to account for changes in principal functional areas, offsite radiological emergency response requirements, offsite PAR requirements, and the spectrum of accidents possible at a PDEP facilities. The regulatory analysis assumes that this will not represent a change in burden from Alternative EP-1 after the NRC grants an exemption request.

#### *PDEP Offsite Response Organization Participation in Drills and Exercises*

Section IV.F of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(14) include requirements for periodic EP drills and exercises for licensees. Paragraph IV.F.2.c of Appendix E to 10 CFR Part 50 requires offsite REP plans for each site to be exercised biennially with full participation by offsite authorities having a role under the radiological response plan. Under the proposed rule, because no action is required from State and local government organizations in response to an event other than onsite firefighting, law enforcement, and ambulance/medical services, the requirements related to ORO participation in radiological drills and exercises would no longer be relevant for licensees with PDEPs. Licensees with PDEPs would be required to enable any State or local government to participate in the licensee's drills when requested. The regulatory analysis assumes that relaxing ORO participation in radiological drills and exercises from mandatory participation to an opportunity to participate (i.e., voluntary participation) does not represent a change in burden from Alternative EP-1 after the NRC grants an exemption request.

#### Level 3: All Spent Fuel Transferred to an Independent Spent Fuel Storage Installation

A licensee with all of its spent fuel in dry cask storage that terminates its 10 CFR Part 50 or 10 CFR Part 52 license must first obtain a 10 CFR Part 72 specific license before transitioning to the EP requirements already provided in § 72.32(a). A licensee maintaining its 10 CFR Part 50 or 10 CFR Part 52 license, and thus its 10 CFR Part 72 general license authorized under § 72.210, "General license issued," may opt to change its EP program to align it with the requirements of § 72.32 once all spent fuel is transferred to dry cask storage. In addition, licensees with 10 CFR Part 72 general licenses would need to continue to comply with all applicable 10 CFR Part 50 and 10 CFR Part 52 requirements until the 10 CFR Part 50 or 10 CFR Part 52 license is terminated. The proposed rule would require that licensees with an independent spent fuel storage installation-only emergency plan (IOEP) must follow and maintain the effectiveness of an emergency plan that meets the requirements in § 72.32(a).

#### Level 4: All Spent Fuel Removed from Site

Once all spent fuel has been permanently removed from the site, a licensee can terminate its EP program because the site no longer poses any risk of a radiological release.

#### Additional Amendments for Emergency Preparedness

##### *Change to Emergency Plans*

Licensees are required by 10 CFR 50.54(q)(2) to follow and maintain the effectiveness of an emergency plan that meets the standards in 10 CFR 50.47(b) and the requirements in Appendix E to 10 CFR Part 50. In addition, 10 CFR 50.54(q) contains the conditions under which the licensee may make changes to its emergency plan without prior application to and approval by the NRC, provided that the changes do not reduce the effectiveness of the plan and

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that the plan, as changed, continues to meet the standards in 10 CFR 50.47(b) and the requirements in Appendix E to 10 CFR Part 50.

The proposed rule would add new requirements, similar to § 50.54(q)(2) and § 50.54(q)(3), referencing the requirements that emergency plans for decommissioning power reactors must meet and the process for making these changes. The proposed rule would establish the process for: (1) transitions between EP decommissioning levels (i.e., PSEP, PDEP, IOEP) and (2) changes to emergency plans within an EP decommissioning level. The NRC does not anticipate any EP-related changes to 10 CFR 50.59 as a result of this rulemaking alternative.

#### *Program Element Review under 10 CFR 50.54(t)*

Under 10 CFR 50.54(t), licensees must conduct reviews of EP program elements either: (1) at intervals not to exceed 12 months, or (2) as necessary, based on an assessment by the licensee against performance indicators, and as soon as reasonably practicable after a change occurs in personnel, procedures, equipment, or facilities that potentially could adversely affect EP. If a licensee chooses the second option, it must still review all program elements at least once every 24 months. The proposed rule would amend § 50.54(t) such that, starting after the NRC's docketing of certifications under § 50.82(a)(1) or § 52.110(a), licensees would be able to conduct program element reviews under § 50.54(t) at intervals not to exceed 24 months (rather than 12 months) without conducting an assessment against performance indicators. As a result, it is expected that licensees would conduct a program element review shortly after implementing a PDEP. With this proposed change, the NRC seeks to ensure that a licensee evaluates its EP program soon after it transitions to a PDEP.

#### *Reasonable Assurance and Offsite Radiological Emergency Preparedness*

Every 10 CFR Part 50 or 10 CFR Part 52 license includes as a condition of the license the requirements of 10 CFR 50.54(s)(2)(ii) and (s)(3), regarding findings and determinations of reasonable assurance. For decommissioning power reactors, the proposed rule would state that if regulatory standards for offsite radiological EP are not required, then findings and determinations by FEMA would not be needed in order for the NRC to make determinations regarding reasonable assurance under § 50.54(s)(2)(ii). Therefore, the proposed rule would clarify that FEMA findings and determinations are only necessary when the NRC's planning standards apply to offsite radiological emergency response plans. As a result, FEMA fees would no longer apply in these cases. The regulatory analysis did not identify any change in burden for this provision between that required for Alternative EP-1 after the NRC grants the exemption request and for Alternative EP-2.

#### Development of Regulatory Guides

Under Alternative EP-2, the NRC would develop a new EP-specific guidance document for decommissioning facilities that would be issued for public comment with the proposed rule.

### **4.1.3 Assumptions**

The regulatory analysis has made the following assumptions:

- In Alternative EP-1, all nuclear power plant licensees would file exemption requests and amendment requests from pertinent 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 requirements so that they may obtain the benefits described in Alternative EP-2 above.

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- For Alternative EP-2, each licensee would not submit a site-specific analysis, but instead would wait the pre-determined time, which will be specified by rulemaking, before transitioning from Level 1 to Level 2.
  - For Alternative EP-2, the regulatory analysis assumes that the notification requirements performed for Alternative EP-1 will be reflected in the proposed guidance.
  - For Alternative EP-2, the regulatory analysis assumes that staffing and emergency response organization requirements do not represent a material change in burden from Alternative EP-1 after the NRC grants the exemption requests.

#### **4.1.4 Affected Attributes**

Industry Implementation: Under Alternative EP-2, the number of requests for exemptions that licensees typically submit from EP requirements would be reduced, resulting in a one-time benefit (i.e., averted cost) to industry for plants that enter decommissioning after issuance of the rule. Additionally, the licensees would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Industry Operation: Under Alternative EP-2, licensees might avoid recurring FEMA fees due to the time period between when the fuel in the SFP has sufficiently decayed such that it would not reach ignition temperature within 10 hours under adiabatic heatup conditions and the finalization of the exemption from emergency preparedness.

NRC Implementation: To implement Alternative EP-2, the NRC incurs a one-time cost in order to develop the rule and the EP specific guidance. For Alternative EP-2, the number of exemptions from and amendments to 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 requirements would be reduced, which would result in a benefit (i.e., averted cost) to the NRC due to lack of reviewing these exemptions and amendments.

Other Government: To implement Alternative EP-2, the NRC and FEMA would establish a notification process that replaces the existing NRC/FEMA process for terminating the assessment of FEMA user fees. The FEMA would also incur one-time costs to develop and issue a final rule to amend 44 CFR 354.4(e) to reflect this new process. Under Alternative EP-2 the state, local governments and FEMA would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative EP-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

## **4.2 Physical Security**

Whether they hold a license under 10 CFR Part 50 or 10 CFR Part 52, nuclear power reactor licensees are subject to various security requirements in 10 CFR Part 73, "Physical Protection of Plants and Materials." Such requirements include those in Appendix B to Part 73, "General Criteria for Security Personnel," Appendix C to Part 73, "Safeguards Contingency Plans," 10 CFR 73.54, "Protection of digital computer and communication systems and networks, and 10 CFR 73.55, "Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage." If the power reactor site has an associated independent spent fuel storage installation (ISFSI) under the general license granted by 10 CFR

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72.210, “General license issued,” the licensee must protect the ISFSI in accordance with 10 CFR 72.212, “Conditions of general license issued under 10 CFR 72.210.”

Under the existing regulations, each nuclear power reactor licensed under 10 CFR Part 50 or 10 CFR Part 52, remains subject to the requirements in 10 CFR 73.55 to maintain a Commission-approved physical security plan, training and qualification plan, safeguards contingency plan, and cyber security plan. The regulations in 10 CFR 73.55(b)(3) require the physical protection program to be designed to prevent significant core damage and spent fuel sabotage. The regulations further require the licensee to have a physical protection program that ensures that the capabilities to detect, assess, interdict, and neutralize threats (up to and including the design-basis threat (DBT) of radiological sabotage, as stated in 10 CFR 73.1, “Purpose and scope,”) are maintained at all times. The regulations in 10 CFR 73.55(b)(3) also require that the licensee’s physical protection program provides defense in depth through the integration of systems, technologies, programs, equipment, supporting processes, and implementing procedures to ensure the program’s continued effectiveness.

During the initial transition from operation to decommissioning, the reactor is permanently shutdown and the spent fuel is permanently moved from the reactor vessel to an SFP. Although the potential adversary targets are fewer, and in fewer locations, the licensee is currently responsible for identifying and analyzing the “new” site-specific conditions to account for possible adversary approaches consistent with the changes in facility configuration. At this step in the process, licensees with reactors in the decommissioning process have submitted to the NRC various changes and requests for exemptions from the NRC security requirements under 10 CFR 73.5, “Specific Exemptions,” requests for license amendments under 10 CFR 50.90, and security plan changes under 10 CFR 50.54(p). In accordance with 10 CFR 50.54(p)(2), a licensee may make security plan changes that do not decrease the safeguards effectiveness of the security plan without prior NRC approval. Licensees must provide a report of the security plan change to the NRC within 2 months of the change.

Currently, there are no regulatory provisions distinguishing physical security requirements for a power reactor that has permanently ceased operation from those for an operating power reactor. As a result, decommissioning reactor licensees and the NRC have expended resources for processing security-related licensing actions, such as exemption and license amendment requests. Licensees that have transitioned to decommissioning have sought and received NRC approval of exemptions and amendments to reduce physical security requirements no longer needed or no longer relevant because the configuration of the site has changed, and the risk presented by a decommissioning plant is much less than when it was operating.

Additionally, licensee and NRC resources are also spent reviewing security plan changes to ensure all revisions either do not reflect a decrease in safeguards effectiveness or are submitted to the NRC for review and approval prior to implementation in accordance with 10 CFR 50.54(p). The lack of a regulatory definition for “a decrease in safeguards effectiveness” complicates this process, therefore the NRC is proposing to amend the current regulation to provide clarity for licensees and staff for security plan changes.

#### **4.2.1 Alternative PS-1 (No-action alternative)**

The no-action alternative would retain the current physical security regulatory structure for power reactor licensees during operation and decommissioning. Each nuclear power reactor licensed under 10 CFR Part 50 or 10 CFR Part 52 would continue to remain subject to the

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current requirements in 10 CFR 73.55 to maintain a Commission approved physical security plan, training and qualification plan, safeguards contingency plan, and cyber security plan. Under this alternative, the NRC would continue to process requests from licensee undergoing decommissioning for exemptions from certain requirements and to process license amendment for the security commitments in existing license conditions.

#### 4.2.2 Alternative PS-2 (Rulemaking)

Under this alternative, the NRC would streamline the decommissioning process by allowing licensees to make changes to NRC-required security programs during decommissioning that reflect the reduced number of target sets and therefore a reduction in risk without having to request either an exemption or amendment. These changes include commonly requested exemptions and amendments made by decommissioning licensees and typically approved by the NRC. Under this alternative, the NRC will continue to review security plan change reports submitted by licensees and will continue to provide oversight of licensee security programs at decommissioning power reactors through a security inspection program that verifies the licensees' compliance with applicable regulatory requirements.

In addition, this alternative would pursue rulemaking to implement proposed changes, which are discussed in detail below, to the physical security requirements for decommissioning power reactors. Once a licensee certifies under 10 CFR 50.82, "Termination of License," that it has: (1) permanently ceased operation and (2) permanently removed fuel from the reactor vessel, and these certifications have been docketed by the NRC, changes to the operations of the plant will support a step-down in the physical security requirements currently imposed on operating reactors through regulations and orders. The following areas of physical security will be considered for modification in the rulemaking:

- **Security Plans.** The NRC is proposing to revise § 50.54(p) to include definitions of the terms "change" and "decrease in safeguards effectiveness." The application of these definitions is limited to the revised § 50.54(p) and will apply to operating, decommissioning, and decommissioned reactor licensees. The term "change" would be defined in a new § 50.54(p)(1)(i) to mean an action that results in a modification of, addition to, or removal from, the licensee's security plans. The term "decrease in safeguards effectiveness" would be defined in a new § 50.54(p)(1)(ii) to mean a change or series of changes to an element or component of the security plans referenced in this section that reduces or eliminates the licensee's ability to perform or maintain the capabilities set forth in § 73.55(b)(3)(i) without compensating changes to other security plan elements or components.

The NRC is proposing that decommissioning and operating reactor licensees include in the required § 50.54(p)(2) report a summary of the supporting analysis for the licensee's determination that the change does not decrease safeguards effectiveness. The summary must be sufficient to demonstrate that the change does not decrease the safeguards effectiveness of the plan.

- **Dry Cask Storage.** Power reactor licensees that operate an ISFSI may hold either a general or specific license for the ISFSI. Under 10 CFR 72.212(b)(9), general license ISFSIs are subject to the same physical security requirements in 10 CFR 73.55 as power reactors, with some exceptions. By contrast, licensees that hold a specific license under 10 CFR Part 72 are subject to the physical security requirements of 10 CFR

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73.51, “Requirements for the physical protection for spent nuclear fuel and high-level radioactive waste,” which are less stringent than the 10 CFR 73.55 requirements.

During the decommissioning process, power reactor licensees with a general license ISFSI will transition to a phase when all the spent fuel has been removed from the SFP and placed in a dry cask storage system (DCSS). At this point, the security measures needed to protect the facility from radiological sabotage decrease significantly. Once the reactor ceases to operate, certain requirements in 10 CFR 73.55, (e.g., protection against significant core damage) are no longer necessary because there is no fuel in the reactor core. General ISFSI licensees must submit license amendments and requests for regulatory exemptions to obtain relief from the more stringent requirements. The NRC has previously exempted decommissioning licensees that have placed all fuel in a DCSS from the requirements of 10 CFR 73.55, and has allowed the licensees to commit to following the ISFSI-specific physical security requirements in 10 CFR 73.51 which reflect a level of physical protection significantly less than that required at operating power reactors and decommissioned facilities with fuel in the SFP.

The NRC is proposing that once all spent nuclear fuel (SNF) has been placed in dry cask storage, licensees may elect to follow the proposed § 72.212(b)(9)(vii) and protect a general license ISFSI in accordance with the physical security requirements in § 73.51. A licensee may use the process set forth in the revised and renumbered § 50.54(p)(3) to make this change and submit its revised physical security plan to the NRC. These security plans must continue to address the applicable security-related orders associated with an ISFSI that are conditions of the license. The NRC is also proposing conforming changes to § 72.13, “Applicability,” to reflect the requirements that would apply to a licensee that elects to follow the proposed § 72.212(b)(9)(vii).

- **Significant Core Damage.** Under 10 CFR 73.55(b)(3), a nuclear power reactor licensee’s physical protection program must be designed, in part, to prevent significant core damage. A nuclear power reactor that has permanently ceased operations no longer has fuel in the reactor vessel. Therefore, there is no potential for an emergency shutdown to prevent significant core damage or a radiological release because there is no core that would pose a radiological risk. Accordingly, licensees no longer need to protect against significant core damage once all fuel is in the SFP or in a DCSS. Training of security personnel for this condition is also no longer warranted. Therefore, the NRC is proposing that a licensee of a decommissioning nuclear power reactor no longer be required to meet the requirement in § 73.55(b)(3) to protect against significant core damage once the reactor has permanently ceased operating and all fuel has been removed from the reactor vessel. The requirement to protect against spent fuel sabotage would remain in place as long as spent fuel remains on the site.
- **Vital Areas.** Under 10 CFR 73.55(e)(9), licensees are required to protect the reactor control room as a vital area. A vital area is defined in 10 CFR 73.2 as any area which contains vital equipment; under 10 CFR 73.2, vital equipment means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. The NRC also considers the equipment or systems that would be required to function to protect public health and safety following such a failure, destruction, or release to be vital. The role of the reactor control room at an operating plant is described in 10 CFR Part 50, Appendix A, General Design Criterion 19. General Design Criterion 19 specifies that the control

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room must be a protected space from which actions can be taken to operate the nuclear power plant safely and without interruption under normal or accident conditions.

For a permanently shutdown and defueled facility, the vital equipment associated with operating the reactor vessel is no longer needed and the remaining vital equipment (e.g., associated with SFP cooling) may no longer be needed or may be relocated to a vital area separate from the control room. Once a reactor has permanently ceased operations, the need for a reactor control room is eliminated if all of the vital equipment is removed and if the area does not serve as the vital area boundary for other vital areas. The NRC is proposing to revise § 73.55(e)(9)(v) to provide that a licensee of a decommissioning nuclear power reactor would no longer need to designate the reactor control room as a vital area if it does not otherwise meet the definition of a vital area in § 73.2.

- **Communications.** Under 10 CFR 73.55(j)(4)(ii), the NRC requires that a system for continuous communication capabilities with the control room must terminate in the central and secondary alarm stations to ensure effective command and control during both normal and emergency conditions. One purpose of this requirement is to ensure that communications are maintained between security operations and reactor operators who are normally located in the control room. A nuclear power reactor that has permanently ceased operations and no longer has fuel in the reactor vessel may no longer have reactor operators or a control room; therefore, the NRC is proposing to amend § 73.55(j) to require continuous and redundant communications be maintained between the central alarm station and the certified fuel handler (CFH), as defined in 10 CFR 50.2, or senior on-shift licensee representative once the reactor has ceased operations and the licensee no longer has licensed senior operators in the control room. The intention of this change is to allow licensees flexibility in maintaining communications with one or both of these individuals.
- **Suspension of security measures.** The NRC is proposing to amend 10 CFR 73.55(p) to permit a CFH to approve the temporary suspension of security measures during certain emergency conditions or during severe weather at decommissioning nuclear power reactors whose 10 CFR 50.82(a) certifications have been docketed. Currently, the security requirements in 10 CFR 73.55(p)(1)(i) provide that a “licensee may suspend any security measures under this section in an emergency when this action is immediately needed to protect the public health and safety.... This suspension of security measures must be approved as a minimum by a licensed senior operator before taking this action.” Similarly, 10 CFR 73.55(p)(1)(ii) provides that a licensee may suspend security measures during “severe weather when the suspension of affected security measures is needed to protect the personal health and safety of security force personnel.... This suspension of security measures must be approved, as a minimum, by a licensed senior operator, with input from the security supervisor or manager, before taking this action.” The licensee for a nuclear power reactor that has permanently ceased operations and no longer has fuel in the reactor vessel may no longer employ or have on site a licensed senior operator. As currently written, these provisions are not clear as to whether the suspension of security measures to protect the public or the security personnel in the instance of severe weather could be accomplished at a decommissioning reactor without first requesting an exemption. The NRC proposes to modify the regulatory language to clarify that a licensed senior operator or CFH can make this decision.



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### 4.2.3 Assumptions

The regulatory analysis assumes the following for the cost-benefit analysis of Physical Security:

- All nuclear power plant licensees will file exemption and amendment requests to reduce their physical security requirements that are commensurate with the benefits for the recommended rulemaking.
- Docketing of the certifications submitted under 10 CFR 50.82 meets the requirements for stepping down the physical security requirements.

### 4.2.4 Affected Attributes

Industry Implementation: Under Alternative PS-2, licensees would not need to apply for exemptions and amendments for reducing their physical security requirements. This would result in a one-time benefit (i.e., averted cost) for industry. Under Alternative PS-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: To implement Alternative PS-2, the NRC would incur a one-time cost relative to the status quo for developing the rule. Under Alternative PS-2, licensees would not need to apply for exemptions and amendments to reduce their physical security requirements, which results in a benefit (i.e., averted cost) for the NRC due to lack of reviewing these exemptions and amendments.

Other Government: Under Alternative PS-2, the State and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternatives PS-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Regulatory Efficiency: The current regulatory process of removing certain 10 CFR Part 73 requirements through exemptions and the process of changing license conditions related to physical security by amendments introduces regulatory burden to licensees and the NRC. Under Alternative PS-2, licensees that proceed through decommissioning would no longer need to submit physical security exemption requests, license amendment requests, or order withdrawal requests to the NRC to receive certain relaxation from physical security requirements. This would allow licensees to complete their decommissioning operations without diverting resources to submit these requests.

## 4.3 Cyber Security

As stated in § 73.54, applicants and licensees must provide high assurance that their digital computer and communication systems and networks associated with safety and important-to-safety, security, and emergency preparedness functions are adequately protected against cyber attacks, up to and including the design basis threat described in § 73.1, "Purpose and scope." To accomplish this, each holder of a nuclear power reactor operating license under 10 CFR Part 50 has submitted a cyber security plan (CSP) to the NRC that has been approved by the NRC. Further, combined license (COL) applicants are required to submit their CSP as part of their COL application for review and approval. Approved CSPs are referenced as license conditions in each Part 50 license and continue to apply until the license is terminated or the license

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condition is removed by license amendment. A COL holder does not have an equivalent cyber security license condition.

The cyber security requirements in § 73.54 apply to licensees currently licensed to operate a nuclear power plant. Once the NRC has docketed a licensee's § 50.82(a)(1) or § 52.110(a) certifications, that licensee is no longer authorized to operate a nuclear power plant. Therefore, the requirements in § 73.54 would no longer apply to such a licensee. However, each Part 50 licensee has a license condition requiring the licensee to maintain its CSP, and this license condition remains in effect during decommissioning. A COL holder, without the license condition, is not required to maintain its CSP when it begins decommissioning.

#### **4.3.1 Alternative CS-1 (No-action alternative)**

Under the no-action alternative, the NRC would not change the current cyber security requirements set forth in 10 CFR 73.54. These requirements are applicable to 10 CFR Part 50 licensees and applicants, and to applicants and holders of COLs in accordance with 10 CFR 52.79(a)(36)(iii). Once a licensee has filed the certifications required by either 10 CFR 50.82(a)(1)(i) and (ii) or 10 CFR 52.110(a) and those certifications have been docketed by the NRC, the licensee is no longer authorized to operate a nuclear power reactor. Therefore, by its terms, 10 CFR 73.54 does not apply to such licensees, because they are no longer licensed to operate a nuclear power reactor.

Although the cyber security rule no longer applies to a licensee that has filed the certifications required by 10 CFR 50.82(a)(1)(i) and (ii) or 10 CFR 52.110(a) and those certifications have been docketed by the NRC, the license still incorporates the licensee's CSP as a license condition. As such, a licensee must abide by its CSP until the licensee submits a license amendment request to remove the CSP from its license. If a license amendment request is not submitted and approved, in whole or in part, the existing CSP would remain in force even after the submittal and docketing of the 10 CFR 50.82(a)(1) or 10 CFR 52.110(a) certifications. Under the no-action alternative, the NRC expects that licensees would continue to submit license amendment requests to have the CSP rescinded once the spent fuel has sufficiently decayed.

#### **4.3.2 Alternative CS-2 (Rulemaking to remove all cyber security requirements when spent fuel has sufficiently decayed)**

Under this alternative, the NRC is proposing to update cyber security requirements set forth in § 73.54, "Protection of digital computer and communication systems and networks" for nuclear power reactor licensees. This update would clarify the cyber security requirements applicable to a nuclear power reactor during each stage of the decommissioning process. In order to clarify the applicability of the cyber security rule to decommissioning nuclear power reactor licensees, the NRC is proposing to add two subsections to § 73.54. A new § 73.54(i) would state that the requirements of § 73.54 will remain in effect until: (1) the NRC has docketed the licensee's § 50.82(a)(1) or § 52.110(a) certifications, and (2) at least 10 months for a BWR or 16 months for a PWR have elapsed since the date of permanent cessation of operations or an NRC approved alternative to the 10 or 16 month spent fuel decay period, submitted under proposed § 50.54(q)(7)(ii)(A)–(B), has elapsed. As discussed in Section 2.1.1, these time periods are based on a burnup of less than or equal to 72 GWt/MTHM; a licensee that exceeded this burnup prior to decommissioning would have to calculate decay time using NRC guidance to determine the appropriate time period. This calculation is the same as that being performed under the regulatory baseline by licensees seeking to remove all cyber security requirements, and would

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apply to any such licensee with a higher burnup under the regulatory baseline. Therefore, there is no incremental cost due to this requirement in the proposed rule. Furthermore, by providing the limiting burnup value, the NRC could potentially avert costs for a licensee that decides not to perform the calculation, but instead use the 10- or 16-month time periods in the proposed rule language, due to having a burnup that conforms with the limit. This benefit is considered qualitatively in this regulatory analysis.

A new § 73.54(j) would state that, after both requirements of § 73.54(i) have been met, the licensee's license condition that requires implementation and maintenance of a cyber security plan would be removed from the license. The NRC is also proposing the removal of the first paragraph of § 73.54 and revising the language of § 73.54(a). This is a conforming change to clarify that the applicability of § 73.54 is not limited to "operating" reactors, i.e., that § 73.54 would still be applicable after the NRC has docketed a licensee's § 50.82(a)(1) or § 52.110(a) certifications, and to remove language that is no longer needed concerning the initial submission of cyber security plans by existing licensees. Further, the NRC is proposing a change to § 73.55(c)(6), which requires the licensee to establish, maintain, and implement a Cyber Security Plan. This is a conforming change to reflect the scenario in which a decommissioning power reactor licensee is no longer required to maintain a cyber security plan (i.e., the fuel in the SFP has sufficiently decayed), but is still required to comply with § 73.55(c). Extending the requirement to maintain a CSP during decommissioning would be a new requirement imposed on COL holders and so would constitute a violation of issue finality.

#### **4.3.3 Assumptions**

The regulatory analysis assumes that all future sites would submit license amendment requests to remove cyber security requirements during decommissioning.

#### **4.3.4 Affected Attributes**

Industry Implementation: Under this alternative, industry would not need to submit an amendment to remove their cyber security plans once the spent fuel has met the appropriate conditions when the spent fuel has sufficiently decayed per Alternative CS-2. Under Alternative CS-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Industry Operation: In Alternative CS-2, COL licensees would remain subject to cyber security protection requirements until the fuel in the spent fuel pool has sufficiently cooled (i.e., 10 months for BWRs and 16 months for PWRs). This alternative will result in additional costs to the COL licensees due to labor hours expended to implement the cyber security requirements for 10 or 16 months.

NRC Implementation: To implement Alternative CS-2 the NRC would incur a one-time cost relative to the status quo for developing the rule.

Other Government: Under Alternative CS-2, the State and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative CS-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

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## 4.4 Drug and Alcohol Testing

The requirement in 10 CFR 26.3(a) lists those licensees that are required to comply with designated subparts of 10 CFR Part 26, “Fitness for Duty Programs,” including “[l]icensees who are authorized to operate a nuclear power reactor under 10 CFR 50.57, “Issuance of operating license,” and holders of a COL under 10 CFR Part 52 after the Commission has made the finding under 10 CFR 52.103(g). . . .” In accordance with this language, 10 CFR Part 26 does not apply to a holder of a power reactor license issued under 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” that is no longer authorized to operate a nuclear power reactor because the NRC has docketed the certifications required under 10 CFR 50.82(a)(1) (i.e., a decommissioning Part 50 reactor licensee). However, 10 CFR Part 26 continues to apply to holders of COLs issued under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” throughout decommissioning. Therefore, 10 CFR Part 52 licensees are required to maintain a full fitness for duty (FFD) program during decommissioning, but 10 CFR Part 50 licensees are not subject to the same requirement. The NRC intends to resolve this inconsistency in the application of FFD requirements to Part 50 and Part 52 licensees during decommissioning by clarifying that 10 CFR Part 26 does not apply to 10 CFR Part 52 licensees once the NRC has docketed their 10 CFR 52.110(a) certifications.

Under 10 CFR 73.55(b)(9), nuclear power reactor licensees must implement an insider mitigation program (IMP) that incorporates elements of a 10 CFR Part 26 FFD program. However, 10 CFR 73.55(b)(9) does not specify what those elements are. The purpose of a licensee’s IMP is to help ensure that individuals granted unescorted access authorization (UAA) or unescorted access (UA) to the licensee’s protected area (PA) or vital area (VA) remain trustworthy and reliable and do not pose a threat to the facility. The NRC recognizes that the IMP requirements, including the appropriate elements of the 10 CFR Part 26 program, apply to all personnel granted UAA or UA to the PA or VA equally. This construct makes sense for operating facilities that contain many target sets of potential interest to an adversary. However, the risk associated with decommissioning facilities have significantly decreased in comparison to those associated with the operating facilities. The spent fuel pool and its safety systems become the primary focus of the licensee’s security mission to protect against the DBT as most (if not all) of the other target sets are no longer relevant when a nuclear power reactor is no longer operational. Therefore, the NRC intends to clarify the 10 CFR Part 73(b)(9) IMP rule language by establishing an appropriate set of FFD provisions to be incorporated into the IMP to provide reasonable assurance that individuals granted UAA or UA to the PA or VA are trustworthy and reliable (as demonstrated, in part, by the avoidance of substance abuse).

The NRC also notes that 10 CFR Part 73, Appendix B (section I.B.1.b.(4)) contains requirements addressing drug or alcohol addiction issues for security personnel. Section I.B.2.a of the same appendix requires that security personnel “demonstrate mental alertness and the capability to exercise good judgement.” Although not specifically used as the basis for this rulemaking, continuation of drug and alcohol testing will support the licensee’s continued adherence to these provisions of 10 CFR Part 73, Appendix B.

### 4.4.1 **Alternative DA-1 (No-action alternative)**

The no-action alternative would not address the inconsistency in the scope of 10 CFR Part 26 and its application to 10 CFR Part 50 and 10 CFR Part 52 licensees during decommissioning. Therefore, 10 CFR Part 26 would not apply to 10 CFR Part 50 licensees during decommissioning, but would continue to apply to 10 CFR Part 52 licensees during decommissioning. This alternative would also not clarify the appropriate 10 CFR Part 26 FFD

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elements to be incorporated into a licensee's IMP. Licensees would continue to determine which elements of their 10 CFR Part 26 program to include in their IMPs, as required by 10 CFR 73.55(b)(9)(ii)(B). The NRC has observed that recently decommissioned reactor licensees generally continue to implement all of the elements of 10 CFR Part 26, with the exception of Subparts I and K.

#### **4.4.2 Alternative DA-2 (Rulemaking to require Fitness for Duty program elements that support IMP for power reactors)**

Alternative DA-2 would propose rulemaking to amend 10 CFR 26.3 to correct the inconsistency in the application of 10 CFR Part 26 to 10 CFR Part 50 and 10 CFR Part 52 during decommissioning. This would ensure that similarly situated nuclear power reactor facilities are treated the same. The rulemaking would also clarify the FFD program elements under 10 CFR Part 26 that support a licensee's IMP. This clarification would apply to both 10 CFR Part 50 and 10 CFR Part 52 facilities, but becomes particularly important during decommissioning of 10 CFR Part 50 reactor facilities, as the 10 CFR Part 26 FFD program requirements are currently no longer applicable to these facilities.

Under this alternative, the inconsistency regarding application of 10 CFR Part 26 between 10 CFR Part 50 and Part 52 licensees during decommissioning would be corrected. In addition, the NRC would require that all nuclear power reactor licensees implement the same FFD program elements to support their IMP under the provisions of 10 CFR 73.55(b)(9)(ii)(B). The proposed rule would focus the applicability of the 10 CFR Part 26 elements on individuals who have security-related responsibilities or regular SFP area unescorted access at licensee sites. This approach reflects the reduced potential for insiders to affect radiological sabotage at decommissioning sites and the reduced hazard presented by the spent fuel. These changes would ensure that FFD program elements that are necessary to maintain reasonable assurance that individuals at reactor sites, particularly at decommissioning sites, remain trustworthy and reliable are implemented consistently throughout the industry. These changes will also reduce the number of individuals that are subjected to the FFD elements that satisfy the IMP requirements over the decommissioning time frame.

#### **4.4.3 Assumptions**

In the status quo, the regulatory analysis assumes that at decommissioning, licensees, will continue to implement a full FFD program, with the exception of Subparts I and K, in order to meet the requirements of 10 CFR 73.55(b)(9).

For Alternative DA-2, the NRC assumes that the staffing level at a nuclear power plant in the beginning of decommissioning is 25% of its full staffing level when fully operating. This is based on the fact that the decommissioning Vermont Yankee nuclear power plant has had 150 workers after the start of decommissioning (Ref. 27), whereas the Ginna nuclear power plant has had a peak staff level of 600 workers (Ref. 28).

For Alternative DA-2, the regulatory analysis assumes that 10 percent of the staffing level at a decommissioned nuclear power plant will have access to vital area.

For Alternative DA-2, the regulatory analysis assumes that 30 percent of the staffing level at a decommissioned nuclear power plant will have access to a protected area.

#### **4.4.4 Affected Attributes**

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Industry Implementation: To implement Alternative DA-2, industry would incur a one-time cost in making minor changes in their drug and alcohol testing procedures to account for the IMP requirements during decommissioning. Under Alternative DA-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Industry Operation: Alternative DA-2 will rework the structure of the IMP requirements to allow for an approach commensurate with the hazard and potential event consequences associated with a facility's decommissioning status. As a result, the number of individuals subject to random drug and alcohol testing under 10 CFR 26.31(c)(5) for an operating reactor will be reduced for certain segments of the site's decommissioning population. This will result in the industry's drug and alcohol testing program costs being reduced during decommissioning.

NRC Implementation: To implement Alternative DA-2, the NRC incurs a one-time cost relative to the status quo for the rulemaking process. These costs include the preparation of the proposed and final rule.

NRC Operation: Clarifying the regulations will reduce the burden on the NRC in the administration of reporting requirements for drug and alcohol testing under Alternative DA-2.

Other Government: Under Alternative DA-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative DA-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

#### **4.5 Certified Fuel Handler Definition and Elimination of Shift Technical Advisor**

The current regulations for operating reactors require specific staffing levels for licensed operators for each shift, as well as control room staffing requirements and commensurate training requirements for licensed operators. They do not address training requirements for a facility undergoing decommissioning. Licensees have been requesting amendments to their technical specifications to eliminate the need to maintain licensed operators on the staff during decommissioning. In place of the licensed operators, decommissioning plant licensees have required the presence of a CFH, a non-licensed operator (NLO) who has been qualified in accordance with a fuel handler training program approved by the Commission, and an additional NLO as the necessary staff for each shift. Furthermore, decommissioning plants are discontinuing the associated licensed operator training programs.

A CFH at a permanently shutdown and defueled nuclear power reactor undergoing decommissioning is an individual who has the requisite knowledge and experience to evaluate plant conditions and make judgments about what actions are necessary to protect the public health and safety. Because the CFH is defined as an NLO, the NRC has evaluated the CFH training program in accordance with 10 CFR 50.120, "Training and qualification of nuclear power plant personnel," which includes a requirement in 10 CFR 50.120(b)(2) that the training program must be derived from a systems approach to training, as defined in 10 CFR 55.4, and must provide for the training and qualification of certain categories of nuclear power plant personnel, including the NLO category. The NRC notes that, although the definition for a CFH in 10 CFR 50.2 indicates that a fuel handler training program requires Commission approval, the

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regulations do not have specific requirements that describe what constitutes an acceptable program besides those requirements in 10 CFR 50.120, which apply to all NLOs. Because a training program for an NLO subject to 10 CFR 50.120 does not require Commission approval, unless that NLO is a CFH, the NRC has determined that an acceptable fuel handler training program suitable to qualify a CFH should ensure that the trained individual: (1) has requisite knowledge and experience in the safe conduct of decommissioning activities, (2) has requisite knowledge and experience in the safe handling and storage of spent fuel, and (3) is capable of evaluating plant conditions and exercising prudent judgment for emergency action decisions.

Hence the NRC proposes revising the definition of a CFH in 10 CFR 50.2 to establish these three criteria for an acceptable fuel handler training program. This would eliminate the need for licensees to seek Commission approval of their training programs. Use of the criteria would be optional; licensees could still seek Commission approval for fuel handler training programs suitable to qualify a CFH. The NRC can inspect the implementation of training programs suitable to qualify NLOs and CFHs using existing inspection procedures, such as IP 41501 (Ref. 29).

#### **4.5.1 Alternative CFH/STA-1 (No-action alternative)**

This alternative would retain the current wording of CFH-related regulations. The regulations state, in part, that, “[t]he training program must be periodically evaluated and revised as appropriate to reflect ... changes to the facility, procedures and regulations.” The no-action alternative would not result in any significant additional cost or benefit and the NRC would continue to review, on a case-by-case basis, the training requirements proposed in the requests for approval submitted by the licensees. Additionally, the NRC would make no changes to the regulations regarding the Shift Technical Advisor (STA) position.

#### **4.5.2 Alternative CFH/STA-2 (Rulemaking regarding CFH definition and Shift Technical Advisor)**

Under this alternative, the NRC would propose rulemaking to clarify the requirements for the training of CFHs at decommissioning power reactors. This rulemaking would revise the definition of “certified fuel handler” in 10 CFR 50.2, which would retain the existing definition of the CFH and add an alternative to revise the definition of “certified fuel handler” that would eliminate the need for licensees to seek the Commission’s approval for fuel handler training programs.

Specifically, the NRC would codify current licensing practices by amending § 50.2 to add an alternative definition with three broad-scope objectives as responsibilities for which a CFH must be trained: (1) safe conduct of decommissioning activities; (2) safe handling and storage of spent fuel; and (3) appropriate response to plant emergencies. In addition, the CFH would have to qualify in accordance with a fuel handler training program that meets the same requirements as training programs for non-licensed operators required by § 50.120. Should a licensee not exercise the alternative definition, it would need to submit a request for approval of a fuel handler training program.

The NRC proposes to revise a footnote to the table titled “Minimum Requirements Per Shift for On-Site Staffing of Nuclear Power Units by Operators and Senior Operators Licensed Under 10 CFR Part 55” in § 50.54(m)(2)(i) to state that a STA is not required upon the NRC’s docketing of the license holder’s certifications required under §§ 50.82(a)(1) or 52.110(a). Additionally, the

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NRC will update RG 1.184, “Decommissioning of Nuclear Power Reactors” to provide guidance for the staffing requirements at a decommissioning power reactor site.

#### **4.5.3 Assumptions**

The regulatory analysis has made the following assumptions for the cost benefit analysis of CFH definition and elimination of the STA:

- The development of voluntary industry initiatives would require the same amount of time as the NRC would take to develop a new Regulatory Guide.
- The NRC would take one-half the time to review the industry initiatives as the industry would take to develop them.
- All licenses would choose to use the definition of a CFH that the proposed rulemaking alternative would provide when they establish their fuel handler training programs.

#### **4.5.4 Affected Attributes**

Industry Implementation: Under Alternative CFH/STA-2, licensees would still need to submit license amendment requests that would replace licensed operators with shift staffing consisting of CFHs and NLOs, for managing the spent fuel at a nuclear power site and conducting decommissioning activities. However, Alternative CFH/STA-2 would eliminate the need for a licensee to seek the Commission’s approval for fuel handler training programs suitable to qualify a CFH. The elimination of this approval process would result in a one-time benefit (i.e., averted cost) for industry. Additionally, a licensee would not need to submit an amendment to remove the Shift Technical Advisor. Under Alternative CFH/STA-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: To implement Alternative CFH/STA-2, the NRC incurs a one-time cost relative to the status quo for developing the rule. In addition, under Alternative CFH/STA-2, the NRC would no longer have to review fuel handler training programs for their suitability to qualify CFHs. However, the NRC will continue to review license amendment requests for changes to the section of licensees’ technical specifications titled, “Administrative Controls.”

Regulatory Efficiency: Under Alternative CFH/STA-2, licensees in decommissioning would not need to submit fuel handler training programs suitable to qualify CFHs for the Commission’s approval. This would provide licensees with flexibility to complete their decommissioning operations, in that resources will not be expended to process these types of licensing actions.

Other Government: Under Alternative CFH/STA-2, the State and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternatives CFH/STA-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.



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## 4.6 Decommissioning Funding Assurance

The NRC requires nuclear power plant licensees to provide reasonable assurance that funds will be available for plant radiological decommissioning. An element of this assurance is the requirement for licensees to provide a minimum decommissioning fund per the formula defined in 10 CFR 50.75(c). The table of minimum amounts formula (NRC minimum formula) was established in 1988 as a means to assure the bulk of funds needed for radiological decommissioning would be available. The requirement in 10 CFR 50.75(c) also defines a process for adjusting the formula to current-year dollars. The NRC uses the formula and adjustment factors to assess the adequacy of the decommissioning trust funds (DTFs) established by the nuclear power plant licensees every two years.

The NRC is proposing changes to address the use of DTFs. The changes would clarify that the DTF can be used to pay for both radiological decommissioning expenses under 10 CFR 50.2 and spent fuel management and 10 CFR Part 72 specific license ISFSI decommissioning, so long as sufficient funding remains for radiological decommissioning. The primary intent of these changes would be to reduce the need for regulatory exemptions with respect to use of the DTF by licensees while ensuring that sufficient funding is available for NRC-required radiological decommissioning. Overall, the NRC anticipates that the recommended changes would minimize the need for licensees to request exemptions from decommissioning funding regulations and that the changes would provide licensees with a greater degree of flexibility in the use of their DTFs.

Currently, DTF regulations do not address the costs associated with the unavailability of permanent spent fuel repositories. However, the lack of permanent spent fuel repositories requires licensees to provide long-term onsite storage of spent fuel in an ISFSI, incur spent fuel management expenses and, ultimately, decommission the ISFSIs. Pursuant to 10 CFR 72.6, licenses for the receipt, handling, storage, and transfer of spent fuel are of two types: general and specific. Licensees may provide financial assurance for the decommissioning of general license ISFSIs with funds in their 10 CFR Part 50 DTFs because general license ISFSI decommissioning falls under the definition of decommission in 10 CFR 50.2. However, licensees may not provide financial assurance for the decommissioning of specific license ISFSIs, as addressed in 10 CFR 72.30, with funds in their 10 CFR Part 50 DTFs without the NRC approval of a regulatory exemption.

When funds are commingled in the DTF and are not distinctly identified, the NRC does not have a mechanism to allow for the use of those funds for non-decommissioning purposes such as spent fuel management or for 10 CFR Part 72 specific license ISFSI decommissioning outside of the exemption process. Because of these issues, licensees have sought and been granted exemptions from 10 CFR 50.75, "Reporting and recordkeeping for decommissioning planning," requirements to allow the use of excess monies from the DTFs that are not needed for radiological decommissioning to pay for expenses associated with spent fuel management. The reliance on exemptions creates regulatory uncertainties as well as burdens on licensees and the NRC. A licensee must expend resources to prepare the documentation and analysis that is required to obtain approval of the exemption request. The NRC must also divert resources from other agency activities to evaluate each request in order to determine whether the exemption request should be granted.

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#### **4.6.1 Alternative DTF-1 (No-action alternative)**

Under the no-action alternative, the regulations to establish and use the DTF would remain unchanged. The regulation would not be amended to address commingling of funds in the DTF for spent fuel management, ISFSI decommissioning, or site restoration. In addition, DTF regulations would not be amended to address costs associated with the long-term onsite storage of spent fuel in an ISFSI, costs which stem from the unavailability of permanent spent fuel repositories. This being the case, licensees are likely to continue to request exemptions in order to address spent fuel management expenses and may also request exemptions to pay for ISFSI decommissioning and site restoration expenses on a case-by-case basis. For example, licensees could choose to submit an exemption request to allow the use of DTF funds for spent fuel management. The NRC would review the exemption request and grant the exemption on a finding of reasonable assurance that sufficient funding will remain available in the DTF to complete radiological decommissioning and upon a determination that the licensee meets the requirements in 10 CFR 50.12, "Specific exemptions."

#### **4.6.2 Alternative DTF-2 (Rulemaking to amend regulations to minimize exemptions and reduce the ambiguity in the decommissioning trust fund regulations)**

Under this alternative, the NRC proposes the following changes to current DTF regulations to minimize exemption requests and address the ambiguity in the DTF regulations:

- Amend the regulations at 10 CFR 50.82 to allow decommissioning funds collected and kept in an external trust as required in 10 CFR 50.75, to be used for spent fuel management as well as Part 50 and Part 72 specific license ISFSI decommissioning, so long as sufficient funding remains for radiological decommissioning. Specifically, the NRC proposes to add a new § 50.82(a)(8)(viii) to provide a licensee the option to use its DTF for spent fuel management and specific license ISFSI decommissioning costs only if: (1) the licensee has submitted, and the NRC has docketed, the certifications required under § 50.82(a)(1) or § 52.110(a) to permanently cease reactor operations and defuel the reactor; (2) 90 days have elapsed since the NRC received the licensee's PSDAR under § 50.82; and (3) the licensee has identified excess funds in the DTF. Such excess funds are funds in the DTF that are greater than those funds reasonably needed to maintain compliance with § 50.82(a)(8)(i)(B)-(C), complete radiological decommissioning, and terminate the license. Regardless of whether this option is exercised, a licensee would be required to continue with a series of steps, as specified in § 50.75(a), to comply with all decommissioning funding assurance regulations. A licensee would not be relieved of the responsibility to certify that there is reasonable assurance that decommissioning funding will be available.
- Amend the regulations to modify the reporting requirements in 10 CFR 50.75(f)(1) to be consistent with the reporting frequency for decommissioning funding assurance for ISFSIs in 10 CFR 72.30(c). Licensees would report the status of decommissioning funding on a triennial basis (every 3 years) instead of on a biennial frequency.
- Amend the regulation at 10 CFR 50.75(b) to further clarify that licensees shall maintain decommissioning funding assurance. Licensees would have to correct shortfalls in a timely manner and provide evidence to the NRC during the next reporting cycle under 10 CFR 50.75(f). Current guidance provides that licensees may remedy shortfalls by utilizing the methods described in 10 CFR 50.75(e)(1). Language would be added to address instances when the amount in the DTF falls below the regulatory amount

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required either by the NRC minimum formula as set forth in 10 CFR 50.75(c) or a licensee's site-specific cost estimate, thereby creating a "shortfall."<sup>2</sup> Conforming changes would be made to 10 CFR 50.82 as part of this rulemaking.

- Amend 10 CFR 50.75 (h)(1)(B)(iv) to be consistent with 10 CFR 50.4, "Written communications," with respect to written notice of intent to make a disbursement or payment from the DTF. This change would require all notice materials be sent to the Document Control Desk instead of the Office Director NRR, as licensees are now directed.
- Eliminate 10 CFR 50.75(f)(2) as it is duplicative of the language of 10 CFR 50.75(f)(1).
- The NRC is proposing to amend the regulations at 10 CFR 50.82(a)(8)(i)(A) and 10 CFR 52.110(h)(1)(i) to remove the term "legitimate." This term does not add any substance to the regulations and is potentially confusing. The intent of the regulation is to ensure that expenses fall within the NRC definition of decommission in 10 CFR 50.2. Whether an expense falls within the definition of decommission would continue to be determined on a case-by-case basis by the licensee when considering whether to make a withdrawal from the DTF. Since this term is non-substantive, its removal will not change any of the existing requirements regarding the use of decommissioning funds.
- The NRC proposes to revise § 52.110 to make the same changes proposed in § 50.82 for consistency. In addition, the NRC proposes to add paragraphs (h)(5) – (h)(7) with site-specific decommissioning cost estimate report requirements which are identical to the requirements in § 50.82(a)(8)(v) – (vii). A report on irradiated fuel should only be submitted if irradiated fuel is on site.
- The NRC proposes to revise § 72.30 so that that the resubmittals subsequent to the initial decommissioning funding plan for ISFSIs will no longer require NRC approval. This change would make the processes under § 72.30(c) more efficient and less burdensome to the licensee, while still maintaining reasonable assurance of adequate funding for the decommissioning of an ISFSI.

The objectives of these proposed changes are to: (1) provide licensees with options for using DTF monies and the flexibility to consider site-specific conditions in maintaining their DTF; (2) create consistent standards for NRC's use in determining whether licensees are compliant with the appropriate use of the DTF; and (3) minimize the need for licensees to submit exemption requests from decommissioning funding regulations.

### **4.6.3 Assumptions**

The assumptions used in the regulatory analysis for this decommissioning area are:

- For Alternative DTF-1, the regulatory analysis assumes that all operating nuclear power plant sites will submit exemption requests to use a portion of their DTFs for spent fuel management.

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<sup>2</sup> Shortfall is defined as the difference between the amount of financial assurance provided by the licensee and the amount of financial assurance required.

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#### **4.6.4 Affected Attributes**

Industry Implementation: Under Alternative DTF-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Industry Operation: Under Alternative DTF-2, licensees would report assurances for decommissioning against the funding in the DTF every 3 years instead every 2 years. This would result in costs averted from the lower frequency of reporting. In addition, licensees who report a shortfall pursuant to 10 CFR 50.75(f) would have to correct the shortfall in a timely manner.

NRC Implementation: To implement Alternative DTF-2, the NRC incurs a one-time cost relative to the status quo for developing the rule.

NRC Operation: Under Alternative DTF-2, the NRC would evaluate the submitted report of assurances for decommissioning against the funding in the DTF on a triennial basis instead of on a biennial basis. This would result in cost averted from the lower frequency of evaluating these reports.

Regulatory Efficiency: Under Alternative DTF-2, licensees would have sufficient internal controls, chart of accounts, and reporting tools to identify distinct funds in the DTF and the licensees' intention for their use would be identified and reflected in accounting practices. These controls and reporting mechanism leads to transparency regarding the intended use of decommissioning trust assets and establishes a clear and consistent regulatory structure. Under Alternative DTF-2, licensees would have more flexibility concerning funding of spent fuel management than currently exists with the status quo (Alternative DTF-1).

Other Government: Under Alternative DTF-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative DTF-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

#### **4.7 Offsite and Onsite Financial Protection Requirements and Indemnity Agreements**

To implement the requirements under the Price-Anderson Act (PAA), codified in Section 170 of the Atomic Energy Act of 1954, as amended (AEA), the NRC requires nuclear power plant licensees to comply with regulations for offsite financial protection and indemnity agreements. All nuclear reactors are required to have and maintain offsite financial protection as set forth in 10 CFR 140.11, "Amounts of financial protection for certain reactors." The amounts of insurance required for each large operating reactor (i.e., has a rated capacity of 100,000 electrical kilowatts or more) are set forth in 10 CFR 140.11(a)(4), which are: (1) primary financial protection in the amount of \$450 million; and (2) secondary financial protection consisting of funds from a nuclear industry retrospective rating plan. The Commission executes and issues agreements of indemnity for large operating reactors pursuant to 10 CFR 140.20, "Indemnity agreements and liens." The general form of indemnity agreement to be entered into by the Commission with large operating reactors is provided at 10 CFR 140.92, "Appendix B-Form of indemnity agreement with licensees furnishing insurance policies as proof of financial

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protection,” and 10 CFR 140.93, “Appendix C-Form of indemnity agreement with licensees furnishing proof of financial protection in the form of licensee’s resources.”

Apart from the PAA requirements, the NRC also requires nuclear power reactor licensees to maintain onsite property insurance. Specifically, 10 CFR 50.54(w) requires licensees to obtain property insurance for each reactor site in the amount of \$1.06 billion, or the maximum amount of coverage generally available from private sources, whichever is less, to stabilize and decontaminate the reactor and the reactor site in the event of an incident. Neither the PAA nor NRC’s implementing regulations for large operating reactors explicitly addresses the concept of decommissioning. Likewise, the NRC’s onsite insurance requirements do not address the status of facilities during the period of decommissioning or the reduction in risk that is presented by permanently shutdown reactors.

In SECY 93-127, “Financial Protection Required of Licensees of Large Nuclear Power Plants during Decommissioning,” (Ref. 30), the NRC staff concluded, “In the interim, exemptions could be granted for reductions in the amount of primary financial protection required to a level which would not prejudice the outcome of rulemaking. The staff believes that a level of \$100 million would be adequate.” In the Staff Requirements Memorandum (SRM) for SECY-93-127 (Ref. 31), the Commission authorized the staff to approve, through specific exemptions from the requirements of 10 CFR 140.11(a)(4), termination of participation in the retrospective rating plan and reduction in primary financial protection from \$450 million to \$100 million, after a cooling period adequate to support air cooling of the fuel in a completely drained pool. Similarly, under status quo, and pursuant to the requirements provided in 10 CFR 50.54(w), licensees must have and maintain a minimum coverage limit for each reactor site in the lesser amount of either: \$1.06 billion, or whatever amount of insurance is generally available from private sources. In SECY-96-256, “Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w)(1) and 10 CFR 140.11,” (Ref. 32), the NRC staff recommended changes to the power reactor insurance regulations that would allow licensees to lower onsite insurance levels to \$50 million upon demonstration that the fuel stored in the SFP can be air-cooled. In its SRM for SECY-96-256 (Ref. 33), the Commission supported the NRC’s recommendation that, among other things, would allow permanently shutdown power reactor licensees to reduce onsite financial protection coverage to \$50 million when the licensee was able to demonstrate that the spent fuel could be air-cooled if the spent fuel pool was drained of water. The NRC has issued several exemptions from the requirements of 10 CFR 50.54(w) on the basis that the reduced onsite insurance coverage value of \$50 million satisfies the underlying purpose of the rule in funding stabilization of site conditions and cleanup costs associated with decontamination following the hypothetical rupture of a large onsite liquid radioactive waste tank. With the spent fuel adequately cooled by air in a drained spent fuel pool, the potential for a significant release from the spent fuel was considered negligible.

#### **4.7.1 Alternative FP-1 (No-action alternative)**

Under the no-action alternative, licensees will continue to abide by regulations in 10 CFR 140.11(a)(4), which require each reactor that is licensed to operate and has a rated capacity for electrical generation exceeding 100,000 electrical kilowatts to have \$450 million in primary financial protection to remedy a potential offsite release of nuclear material and to participate in the industry retrospective rating plan. Under 10 CFR 50.54(w), licensees will also continue to maintain a minimum coverage limit for each reactor site in the lesser amount of either: \$1.06 billion, or whatever amount of insurance is generally available from private sources. Pursuant to 10 CFR 140.8, “Specific exemptions,” and 10 CFR 50.12, “Specific

exemptions,” the Commission may grant exemptions from this regulation that it determines are authorized by law and otherwise are in the public interest.

#### 4.7.2 Alternative FP-2 (Rulemaking to codify the current exemption process)

This rule change would allow the licensees of large operating reactors that have permanently shut down a reduction in both offsite and onsite financial protection without the need for licensees to submit requests for regulatory exemptions from financial protection requirements. The objectives of this rulemaking would be to: (1) provide a process that maintains an adequate level of financial protection during decommissioning, and (2) minimize the need for licensees to request exemptions from financial protection requirements that are no longer needed.

This alternative proposes to amend the offsite and onsite financial protection requirements based on the reduced risk of radiological release from the anticipated reactor configurations and adopts reductions in financial protection based on two levels (level one and two) described below. The amounts of financial protection provided in these two levels are consistent with exemptions that have been granted to decommissioned reactors in the past. The insurance amounts would be based on the estimated cost of recovery from limiting hypothetical events for specific level one and two reactor configurations. The below table provides a summary of Level 1 and Level 2, which are described below:

Table 4 Two-Step Graded Approach

Level	Reactor Site Description	Offsite Requirement	Onsite Requirement
1	Operating or Permanently Ceased Operations and Permanently Defueled	\$450 million; participation in the industry retrospective rating plan	\$1.06 billion
2	Sufficiently Decayed Fuel; $\geq 1,000$ gallons of radioactive waste	\$100 million; withdrawal from the rating plan	\$50 million

##### Description of Level 1: Permanently Ceased Operations and Permanently Defueled

Licensees in Level 1 include operating reactors and decommissioning reactors that have docketed certifications of permanent cessation of operations and permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82 or 10 CFR 52.110. In this level, a decommissioning reactor is defueled and permanently shut down, but the spent fuel in the SFP is still susceptible to a zirconium fuel cladding fire if the SFP is unexpectedly drained, although a very unlikely event. This configuration encompasses the period from immediately after the core is removed from the reactor to just before the decay heat of the hottest assemblies is low enough that no rapid zirconium oxidation will take place within 10 hours under adiabatic conditions. Licensees in Level 1 must maintain the full amounts of offsite and onsite insurance specified in 10 CFR 140.11(a)(4), and 10 CFR 50.54(w), respectively.

##### Description of Level 2: Sufficiently Decayed Fuel

In Level 2, the reactor is defueled and permanently shut down, and spent fuel in the SFP has decayed and cooled sufficiently that it cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions. In this configuration, the spent fuel can be stored long term in

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the SFP. In addition, the site may possess a radioactive inventory of liquid radiological waste, radioactive reactor components, and contaminated structural materials. The radioactive inventory during this configuration may change, depending on the licensee's proposed shutdown activities and schedule. The transition to Level 2 financial protection amounts could occur after a timeframe based on a site-specific analysis that demonstrates the fuel cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions. In Level 2, the offsite requirements would be reduced from \$450 million in primary financial protection and participation in the industry retrospective rating plan to \$100 million and withdrawal from the industry retrospective rating plan. The Commission determined that the \$100 million was sufficient to cover offsite liability claims such as those incurred as a result of Three Mile Island, Unit 2.

If significant sources of radioactive material remain on site, such that it is greater than or equal to 1,000 gallons of radioactive waste, licensees should be required to maintain an adequate level of onsite insurance coverage. In Level 2, onsite financial protection requirements would be reduced from \$1.06 billion to \$50 million. The \$50 million reflects the potential for a radiological incident resulting from the mobile sources of radioactivity at a permanently shutdown reactor site. A scenario involving the rupture of a large liquid radioactive waste storage tank (approximately 450,000 gallons) containing slightly radioactive water was selected as conceivable and a bounding scenario. For estimating cleanup costs, the limiting event considered costs associated with removal of soil contamination and potential contamination of the ground water table. That postulated event was estimated to result in an onsite waste cleanup cost of approximately \$50 million with negligible radiological consequences off site. In economic terms, it would surpass the cleanup costs associated with a fuel-handling incident, which has been taken into account in determining the upper-bound level of onsite insurance coverage required in Level 2.

Furthermore, the NRC proposes to amend its regulations at §140.81, "Scope and purpose," to clarify the applicability of the requirements for an Extraordinary Nuclear Occurrence (ENO) to reactors in decommissioning. Under Sections 11, "Definition," and 170 of the AEA, and NRC regulations at Subpart E, "Extraordinary Nuclear Occurrences," to 10 CFR Part 140, the Commission is authorized to make a determination as to whether an event at a production or utilization facility causing a discharge or dispersal of source, special nuclear, or byproduct material that has resulted or will result in substantial damages to offsite members of the public or property, is an ENO. An event will qualify as an ENO if the Commission determines that the criteria set forth in §§ 140.84, "Criterion I – Substantial discharge of radioactive material or substantial radiation levels offsite," and 140.85, "Criterion II – Substantial damages to persons offsite or property offsite," have been met. The NRC recognizes that the consequences resulting from an accident at a decommissioning reactor in Level 1 can be similar to an accident at an operating reactor. As presented in NUREG-1738, in the window beginning immediately after the reactor is defueled and the fuel placed in the SFP, the offsite consequences of a zirconium fire may be comparable to those from operating reactor postulated severe accidents. The existing potential consequences from a zirconium fire, until the fuel in the SFP has sufficiently decayed, provides the basis for the NRC's proposal to amend its regulations to include plants in decommissioning within the scope of §140.81

The NRC also proposes to amend § 50.54(w) to include a prompt notification to the Commission of any material change in proof of onsite property insurance filed with the Commission under Part 50. Specifically, the transition to Level 2 as proposed by the NRC will prompt the licensee to notify the NRC under § 50.54(w)(7) of a reduction in onsite property insurance from \$1.06 billion to \$50 million. This proposed amendment to § 50.54(w)(7) would be a conforming

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change, for consistency, with the offsite financial protection requirements under 10 CFR 140.15(e).

### **4.7.3 Assumptions**

The assumptions used in the regulatory analysis for this decommissioning area are:

- For Alternative FP-1, all nuclear reactor licensees will submit exemption requests for onsite and offsite financial protection should the rulemaking not go forward. These exemptions requests will be consistent with the reduction of offsite and onsite financial protection requirements described in levels one and two.
- For Alternative FP-2, the regulatory analysis assumes that each decommissioning licensee would not submit a site-specific analysis that demonstrates the spent fuel in a SFP cannot heat up to clad ignition temperature under adiabatic conditions since they would opt for a decay period of 10 or 16 months.
- For Alternative FP-2 the regulatory analysis assumes that nuclear power reactor sites that have decommissioned would reduce their onsite and offsite financial protection to the minimum requirements of level 2 once they meet the description of this level.
- For Alternative FP-2 the regulatory analysis assumes that the decommissioning financial protection and indemnity regulations will no longer apply following the site passing its confirmatory survey and the NRC terminates the plant license.

### **4.7.4 Affected Attributes**

Industry Implementation: Under Alternatives FP-2, licensees would not need to apply for exemptions from offsite and onsite financial protection regulations. This results in a one-time benefit (i.e., averted cost) for each licensee. Licensees would be required to submit a prompt notification to the Commission of any material change in proof of onsite or offsite property insurance filed with the Commission under proposed § 50.54(w)(6) or current § 140.15(e). The industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: To implement Alternatives FP-2, the NRC incurs a one-time cost relative to the status quo for developing the rule. Under these alternatives, exemptions would no longer be needed for licensees to receive approval for reduced financial protection. This results in the elimination of staff reviews for these exemption requests and leads to a benefit (i.e., averted cost) for the NRC.

Other Government: Under Alternatives FP-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternatives FP-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.



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## **4.8 Environmental Considerations**

In certain circumstances, licensees may be unable to satisfy the requirement that licensees conclude in the PSDAR that all environmental impacts associated with site-specific decommissioning activities will be bounded by previous environmental impact statements. NUREG-0586, Supplement 1, Volumes 1 and 2, "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors" (Decommissioning GEIS) (Ref. 34) identified two resource areas that were not generically resolved and thus require a site-specific analysis. Four other resource areas were also identified that may require a site-specific analysis. Therefore, if a licensee were unable to reach the conclusion in the PSDAR that all impacts will be bounded, the licensee would have to either change its planned decommissioning activities so that their impacts would be bounded or submit and have approved a license amendment request or an exemption request to satisfy § 50.82(a)(4)(i) or § 52.110(d)(1).

### **4.8.1 Alternative ENV-1 (No Action)**

The no-action alternative would retain the current decommissioning regulations regarding that licensees conclude in the PSDAR that all environmental impacts associated with site-specific decommissioning activities will be bounded by previous environmental impact statements.

### **4.8.2 Alternative ENV-2 (Rulemaking)**

In this alternative, the NRC proposes to change the PSDAR requirements in § 50.82(a)(4)(i) and § 52.110(d)(1) to require that licensees provide the basis for whether or not the environmental impacts from site-specific decommissioning activities are bounded by previous environmental reviews. This rulemaking change would clarify that licensees, at the PSDAR stage, are required to evaluate the environmental impacts and provide in the PSDAR the basis for whether or not the proposed decommissioning activities are bounded by appropriate federally issued environmental review documents. Licensees would no longer be required to make the definitive conclusion that impacts will be bounded. Instead, they would have the flexibility to address any unbounded environmental impacts closer to, but prior to, the decommissioning activity being undertaken that could cause the unbounded impact. If a licensee were to consider a proposed decommissioning activity that would otherwise be prohibited by § 50.82(a)(6)(ii) or § 52.110(f)(2), then prior to undertaking such activity, the licensee could submit a request for a license amendment or a regulatory exemption, decide not to perform the proposed activity, or modify the proposed activity so that the significant environmental impact does not occur. If the licensee chose to submit a license amendment or an exemption request, then the request would trigger NRC responsibilities under the applicable environmental statutes.

The NRC also proposes to change the § 50.82(a)(4)(i) and § 52.110(d)(1) regulations to allow licensees to use appropriate federally issued environmental review documents prepared in compliance with NEPA, ESA, NHPA, or other environmental statutes instead of only environmental impact statements. This change allows licensees to use a wider range of site-specific documents that address various resources. The NRC is also proposing to change the § 50.82(a)(6)(ii) and § 52.110(f)(2) regulations to clarify that the previous review of any potential significant environmental impact must be bounded by appropriate federally issued environmental review documents prepared in compliance with NEPA, ESA, NHPA, or other environmental statutes.

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### 4.8.3 Assumptions

The regulatory analysis has made the following assumption:

- For Alternative ENV-2, assume that industry will no longer make the effort that they would have taken in status quo to conclude in the PSDAR that all environmental impacts associated with site-specific decommissioning activities will be bounded by previous environmental impact statements.
- Assume that industry would spend three hours per page to conclude in the PSDAR that all environmental impacts associated with site-specific decommissioning activities will be bounded by previous environmental impact statements.

### 4.8.4 Affected Attributes

Industry Implementation: For Alternative ENV-2, industry would avert time that they would take to conclude in the PSDAR that all environmental impacts associated with site-specific decommissioning activities will be bounded by previous environmental impact statements. For Alternative ENV-2 the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: For Alternative ENV-2, the NRC would expend resources to implement the proposed and final rulemaking.

Other Government: For Alternative ENV-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: For Alternative ENV-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Environmental: Under Alternative ENV-2, one of the suggested changes would amend the rule language to state that at the PSDAR stage, licensees must evaluate the environmental impacts associated with site-specific decommissioning activities and determine whether they are bounded by previously issued federal environmental documents. This change would clarify the requirement that ensure that the licensee does not perform decommissioning activities that would result in significant impacts not previously reviewed. This regulatory change would have no impact on the NRC, and licensees could continue to resolve any unbounded impacts before the performance of the associated decommissioning activity by requesting a license amendment or an exemption, by not performing the activity, or by modifying the activity to avoid causing the significant environmental impact. Further, this change would more closely align the licensee's environmental analysis to the occurrence of the impact. This would reduce the burden on decommissioning licensees at the time of PSDAR submittal because they would no longer need to develop a statement concluding that all of the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements.

## 4.9 Record Retention Requirements

The following regulations contain the existing requirements for recordkeeping and record retention at operating nuclear power plants and ISFSIs:

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- General Design Criterion 1 of Appendix A to 10 CFR Part 50, “Quality Standards and Records,” requires licensees to retain certain records throughout the life of the unit.
  - Criterion XVII, “Quality Assurance Records,” of Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50, requires licensees to retain certain records consistent with regulatory requirements for a duration established by the licensees.
  - 10 CFR 50.59(d)(3) and 52.63(b)(2) require licensees to maintain certain records until termination of a license issued under 10 CFR Part 50 or 10 CFR Part 52.
  - 10 CFR 50.71(c) requires licensees to maintain certain records consistent with various elements of the NRC regulations, facility technical specifications, and other licensing bases documents.
  - 10 CFR 72.72(d) requires licensees to duplicate certain records of spent fuel and high-level radioactive waste and store them in a separate location sufficiently remote from the original records so that a single event would not destroy both sets.

Licensees that are transitioning to decommissioning frequently request exemptions from certain parts of these recordkeeping regulations that require the retention of records until termination of the license. Licensees that have previously been granted these exemptions used the justification that, when the associated structures, systems, and components (SSCs) are removed from the licensing basis documents, the SSCs will no longer serve any NRC-regulated function. Therefore, the need to retain the records will be eliminated.

In addition, several licensees have requested an exemption from the requirements of 10 CFR 72.72(d), which mandates that certain records of spent fuel and high-level radioactive waste in storage be kept in duplicate in a separate location sufficiently remote from the original records that a single event would not destroy both sets of records. Licensees seeking this exemption use the justification that they will store the ISFSI spent fuel records using the same procedures and processes used for the facility spent fuel (and other) records, which are typically stored in accordance with the NRC-approved quality assurance program (QAP).

#### **4.9.1 Alternative R-1 (No-Action)**

The no-action alternative would retain the status quo and all provisions of the current recordkeeping and record retention regulations found in 10 CFR 50.71(c); 10 CFR Part 50, Appendix A, General Design Criterion 1; 10 CFR Part 50, Appendix B, Criterion XVII; 10 CFR 50.59(d)(3), and 10 CFR 72.72(d). Under this alternative, decommissioning licensees would still need to apply for exemptions under 10 CFR 50.12 and 10 CFR 72.7 to remove the record retention requirements for SSCs that no longer serve any NRC-regulated function. The NRC would continue to review and approve these exemptions on a case-by-case basis.

#### **4.9.2 Alternative R-2 (Rulemaking to Decrease Record Retention Requirements during Decommissioning)**

Through this rulemaking effort, the NRC will seek to change the NRC regulations to minimize the need for regulatory exemptions related to recordkeeping and record retention requirements

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during decommissioning. Once the NRC receives notifications of permanent cessation of operation and permanent removal of fuel from the reactor vessel, under 10 CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii), it will allow decommissioning licensees to no longer retain records associated with SSCs that no longer serve any NRC-regulated function. The NRC will allow this change as long as appropriate change mechanisms, such as the 10 CFR 50.59 evaluation process or NRC-approved technical specification changes, are used to assess the removal of those records to determine that elimination of the records will have no adverse impact to public health and safety.

### **4.9.3 Assumptions**

The regulatory analysis assumes that a licensee will request exemptions from certain parts of record keeping regulations at the time it certifies under 10 CFR 50.82(a)(1) or 10 CFR 52.110(a) that it has: (1) permanently ceased operation and (2) permanently removed fuel from the reactor vessel. The NRC also assumes that in the future, the industry, the states and the general public will provide comments on Alternative R-2 during the proposed rulemaking stage.

### **4.9.4 Affected Attributes**

Industry Implementation: Under Alternative R-2, the exemptions that licensees typically submit from record keeping requirements would be reduced, resulting in a one-time benefit (i.e., averted cost) to industry for licensees that enter decommissioning after issuance of the rule. For Alternative R-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: For Alternative R-2, the NRC would incur a one-time cost in order to develop the rule. For Alternative R-2, the exemptions from record keeping requirements would be reduced, which would result in a benefit (i.e., averted cost) to the NRC due to lack of reviewing these exemption requests.

Other Government: Under Alternative R-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative R-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

## **4.10 Low-Level Waste Transportation**

10 CFR Part 20, "Standards for Protection Against Radiation," Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests," Section III.E, contains requirements for investigating rail shipments of low-level radioactive wastes (LLW) if the shipper has not received notification of receipt within 20 days after transfer. In addition, Section III.E requires licensees to report such missing shipments to the NRC. Licensees that are involved in the decommissioning process frequently request an exemption from certain parts of these requirements related to the 20-day receipt notification window. Licensees that have previously been granted these exemptions typically extended the investigation notification window to 45 days using the justification that operational experience indicates that while the 20-day receipt notification window is adequate for waste shipments by truck, rail shipments may take more than 20 days to reach their destination

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resulting from delays in the route that are outside the licensee's control (e.g., rail cars waiting in switchyards waiting to be included in a train to the disposal facility).

The NRC is proposing this rulemaking to minimize the need for licensees to seek exemptions from the investigation requirements for LLW by extending the receipt of notification period from 20 days to 45 days after transferring LLW from an operating or decommissioning facility by rail, as required by 10 CFR Part 20.

#### **4.10.1 Alternative TR-1 (No-Action)**

The no-action alternative would retain the status quo and all provisions of the current investigation requirements for LLW transportation in 10 CFR Part 20, Appendix G, Section III.E. Under this alternative, both operating and decommissioning licensees would still need to apply for exemptions under 10 CFR 20.2301 in order to extend the receipt notification window to 45 days after transferring LLW from decommissioning nuclear plants by rail. The NRC would continue to review and approve these exemptions on a case-by-case basis.

#### **4.10.2 Alternative TR-2 (Rulemaking to Change Low Level Waste Transportation Requirements)**

Through this rulemaking effort, the NRC will seek to change its regulations to minimize the need for regulatory exemptions related to investigation requirements for LLW transportation during both operation and decommissioning at all nuclear facilities under 10 CFR Part 20. Specifically, the NRC will allow these licensees to extend the receipt notification window to 45 days after transferring LLW from the nuclear facility by rail. This change will continue to meet the underlying purpose of 10 CFR Part 20, Appendix G, Section III.E, which requires licensees to investigate, trace, and report radioactive shipments that have not reached their destination, for unknown reasons.

#### **4.10.3 Assumptions**

The regulatory analysis assumes that a licensee will request exemptions from certain parts of transportation investigation requirements at the time it certifies under 10 CFR 50.82 that it has: (1) permanently ceased operation and (2) permanently removed fuel from the reactor vessel. The regulatory analysis also assumes that in the future, the industry, the states and the general public will provide comments on Alternative TR-2 during the proposed rulemaking stage.

#### **4.10.4 Affected Attributes**

Industry Implementation: Under Alternative TR-2, the exemptions that licensees typically submit from transportation investigation requirements would be reduced, resulting in a one-time benefit (i.e., averted cost) to industry for licensees that enter decommissioning after issuance of the rule. For Alternative TR-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: For Alternative TR-2, the NRC would incur a one-time cost in order to develop the rule. For Alternative TR-2, the exemptions from transportation investigation requirements would be reduced, which would result in a benefit (i.e., averted cost) to the NRC due to lack of reviewing these exemption requests.

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Other Government: Under Alternative TR-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative TR-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

#### **4.11 Spent Fuel Management Planning**

The regulation in § 72.218(a) states that the § 50.54(bb) spent fuel management program (i.e., the irradiated fuel management program or IFMP) must include a plan for removing from the reactor site the spent fuel stored under the 10 CFR Part 72 general license. The IFMP must show how the spent fuel will be managed before starting to decommission systems and components needed for moving, unloading, and shipping this spent fuel. Section 72.218(b) requires that an application for termination of a reactor operating license submitted under § 50.82 or § 52.110 must also describe how the spent fuel stored under the 10 CFR Part 72 general license will be removed from the reactor site. Although § 72.218 states what information the § 50.54(bb) IFMP, the § 50.82 and § 52.110 application for termination of a reactor operating license must include, the regulations in §§ 50.54(bb), 50.82, and 52.110 do not contain this information.

As §§ 50.54(bb), 50.82, and 52.110 do not reflect the provisions in § 72.218, this causes regulatory uncertainty. The NRC proposes to clarify and align the regulations in §§ 50.54(bb), 50.82, 52.110, and 72.218 to provide regulatory clarity and enhance overall regulatory transparency and openness regarding decommissioning and spent fuel management planning.

##### **4.11.1 Alternative SFM-1 (No-Action)**

The no-action alternative would retain the provisions of the current decommissioning regulations and guidance documents related to spent fuel management and handling capabilities during decommissioning, and would make no changes or clarifications to the requirements in 10 CFR 50.82, 10 CFR 50.54(bb), 10 CFR 52.110, or 10 CFR 72.218.

##### **4.11.2 Alternative SFM-2 (Rulemaking to clarify and update Spent Fuel Management Planning)**

In this alternative, the NRC would pursue rulemaking to clarify and update the regulations in 10 CFR 50.82, 10 CFR 50.54(bb), 10 CFR 52.110, and 10 CFR 72.218 as they relate to requirements for a licensee to consider or plan how it is going to manage and remove spent fuel at the site before it decommissions the SSCs that support moving, unloading, and shipping of spent fuel. Specifically, 10 CFR 50.54(bb) would be modified to make it clear that the IFMP must be submitted by the licensee and approved by the NRC before the licensee starts to decommission systems and components needed for moving, unloading, and shipping the spent fuel. In addition, the NRC would clarify the current IFMP approval process by requiring submittal of the IFMP as a license amendment request. The NRC would also delete the current notification requirement in 10 CFR 50.54(bb). The NRC would also delete the current provisions from 10 CFR 72.218 when it adds these spent fuel management planning requirements to 10 CFR Part 50. In addition, the NRC would revise 10 CFR 72.218 to address requirements related to termination of the 10 CFR Part 72 general license and clarify that the general license ISFSI is decommissioned consistent with the requirements in 50.82 or 52.110, and the general license is terminated upon termination of the 10 CFR Part 50 or 10 CFR Part 52

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license. The rulemaking changes would also include development of guidance documents per Alternative SFM-2.

### **4.11.3 Assumptions**

The regulatory analysis has made the following assumptions:

- Assume that no new regulatory guidance would be developed and that only guidance document RG 1.184 would be updated to account for spent fuel management requirements.

### **4.11.4 Affected Attributes**

Industry Implementation: Under Alternative SFM-2, licensees would commit additional resources to respond to the updates to RG 1.184, "Decommissioning of Nuclear Power Reactors." Under Alternative SFM-2, licensees would commit minor resources to include additional details regarding spent fuel management in the IFMP. For Alternative SFM-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

Industry Operation: Under Alternative SFM-2, licensees would spend less time on conference calls due to enhanced clarity in guidance and/or rulemaking.

NRC Implementation: Under Alternative SFM-2, the NRC would commit additional resources to update RG 1.184. For Alternative SFM-2, the NRC would expend resources to implement the rulemaking.

NRC Operation: Under Alternative SFM-2, the NRC would spend less time on conference calls due to enhanced clarity in guidance and/or rulemaking.

Other Government: Under Alternative SFM-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

General Public: Under Alternative SFM-2, the general public would commit additional resources to participate in the public meeting and comment period for the proposed rule.

## **4.12 Backfit Rule**

The NRC uses its backfitting process to decide whether to impose new or revised regulatory requirements or staff positions on nuclear power reactor licensees or certain nuclear materials licensees. To ensure that these proposed changes are adequately defined and justified, the NRC imposes the changes only after a formal and systematic assessment of the proposed imposition. The intended result of the backfitting process is to prevent the NRC, after issuing a license or other approval, from arbitrarily changing the terms and conditions for operating under the approval and the regulations that existed at the time the NRC issued the approval.

For nuclear power reactor licensees, this process is set forth in 10 CFR 50.109, "Backfitting," and in the issue finality provisions in 10 CFR Part 52 (hereinafter collectively referred to as the "Backfit Rule"). The language of the Backfit Rule clearly applies to a licensee designing,

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constructing, or operating a nuclear power facility. For example, 10 CFR 50.109(a)(1) defines “backfitting” as:

[T]he modification of or addition to systems, structures, components, or design of a facility; or the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct or operate a facility; any of which may result from a new or amended provision in the Commission’s regulations or the imposition of a regulatory staff position interpreting the Commission’s regulations that is either new or different from a previously applicable staff position.

The application of the Backfit Rule to decommissioning plants is not as clear. In SECY-98-253, “Applicability of Plant-Specific Backfit Requirements to Plants Undergoing Decommissioning” (ADAMS Accession No. ML992870107), the NRC presented the Commission with a list of reasons underlying this uncertainty:

- The Backfit Rule has no end point when the rule no longer applies, “thereby implying that backfit protection continues into decommissioning and up to the point of license termination.”
- The term “operate” could reasonably be interpreted as including activities to decommission the reactor.
- The Backfit Rule was developed when the decommissioning of plants was not an active area of regulatory concern.
- The Backfit Rule’s definition of “backfitting” uses terms associated with the design, construction and operation of a facility, rather than its decommissioning, although the staff noted in SECY-98-253 that “prior to the 1996 decommissioning rule, the Commission regarded decommissioning as a phase of the plant’s life cycle which is different from the operational phase.”
- Two of the factors used in evaluating a backfit—costs of construction delay/facility downtime, and changes in plant/operational complexity – are targeted to power operation and “conceptually inappropriate in evaluating the impacts of a backfit on a decommissioning plant.”
- The statement of considerations for the 1970<sup>3</sup>, 1985<sup>4</sup>, and 1988<sup>5</sup> final Backfit Rules did not discuss any aspect of decommissioning, focusing instead on construction and operation.
- Proposed changes to decommissioning requirements usually focused on relaxing requirements or on whether a requirement applicable to an operating reactor continued to be applicable to a decommissioning plant. Thus, “the notion of a ‘substantial increase’ in protection to public health and safety from a backfit does not appear to be particularly useful [in decommissioning].”

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<sup>3</sup> 35 FR 5317, March 31, 1970

<sup>4</sup> 50 FR 38097, September 20, 1985

<sup>5</sup> 53 FR 20603, June 6, 1988



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- The 1996 decommissioning final rule<sup>6</sup> did not directly respond to questions from the public on the applicability of the Backfit Rule to a decommissioning plant.

In SECY-98-253, the NRC staff requested Commission approval to amend, among other regulations, 10 CFR 50.109, so that the Backfit Rule would clearly apply to licensees in decommissioning. In this paper, the NRC staff also proposed that, until the rulemaking was finished, the staff would apply the Backfit Rule to plants undergoing decommissioning “to the extent practical.” In the February 12, 1999 SRM for SECY-98-253 (ADAMS Accession No. ML003753746), the Commission approved development of a Backfit Rule for plants undergoing decommissioning. The Commission directed the NRC staff to continue to apply the then-current Backfit Rule to plants undergoing decommissioning until issuance of the final rule.

The NRC recognizes that certain provisions of the Backfit Rule do not apply to power reactor licensees in decommissioning as discussed in the proposed rule *Federal Register* notice. Currently, the Backfit Rule guidance in Management Directive 8.4, “Management of Facility-Specific Backfitting and Information Collection,” (Ref. 35) provides only that the Backfit Rule applies to decommissioning plants. However, because of the lack of clarity for backfitting in the decommissioning phase of a power reactor, the NRC is proposing rulemaking.

#### **4.12.1 Alternative B-1 (No-action alternative)**

The NRC would continue to apply the Backfit Rule to licensees in decommissioning “to the extent practical.” This means that the NRC would not use the provisions of the Backfit Rule that concern reactors that are being designed, constructed, or operated because those provisions cannot be applied to a licensee of a reactor that has already terminated the design, construction, and operation phases of its reactor’s life. These provisions are, in part or in whole, the following sections of 10 CFR 50.109:

- 10 CFR 50.109(c)(5): Installation and continuing costs associated with the backfit, including the cost of facility downtime or the cost of construction delay;
- 10 CFR 50.109(c)(6): The potential safety impact of changes in plant or operational complexity, including the relationship to proposed and existing regulatory requirements; and
- Other references to reactor design, construction, or operation in 10 CFR 50.109.

This approach would require the NRC to refrain from applying certain provisions of the Backfit Rule to licensees in decommissioning if the NRC determines that the provisions cannot be practically applied to those licensees. The NRC would employ this process on a case-by-case basis, given the specific circumstances at a particular licensee’s site. This approach could undermine the Backfit Rule’s predictability and stability policies because of its case-by-case nature and resultant uncertainty in terms of applicability.

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<sup>6</sup> 61 FR 39278, July 29, 1996

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#### **4.12.2 Alternative B-2 (Conduct rulemaking to clarify how the NRC applies the Backfit Rule to licensees in decommissioning)**

The NRC proposes to amend 10 CFR 50.109 so that power reactor licensees, which have had their § 50.82(a)(1) or § 52.110(a) certifications docketed by the NRC, are the subject of similar backfitting provisions as they were during their operating phase. A new backfitting provision for licensees in decommissioning would eliminate any confusion with the meaning of the words, “operate a facility,” in 10 CFR 50.109(a)(1) as compared to other uses of the term “operate” in 10 CFR Chapter I. The current 10 CFR 50.109(a) would be limited to licensees operating reactors, and the new provision would be limited to licensees in decommissioning.

#### **4.12.3 Affected Attributes**

Industry Implementation: To implement Alternative B-2, industry would participate in the development of the rulemaking. These would result in a one-time cost to industry for time spent on the reviews and participation in public meetings. For Alternative B-2, the industry would commit additional resources to participate in the public meeting and comment period for the proposed rule.

NRC Implementation: To implement Alternative B-3, the NRC incurs a one-time cost relative to the status quo for developing and finalizing the rule.

Other Government: Under Alternative B-2, the state and local governments would commit additional resources to participate in the public meeting and comment period for the proposed rule.

#### **4.13 Foreign Ownership, Control, or Domination (FOCD)**

The NRC’s regulations in Parts 50 and 52 provide for the issuance of a Part 50 license for a utilization or a production facility and a Part 52 license for a utilization facility, respectively. The NRC is proposing to amend its regulations to address the circumstances when a facility licensed under Part 50 or 52 no longer meets the definition of a utilization facility or a production facility, yet the NRC still maintains its regulatory authority over the licensee. The AEA has certain requirements specific to utilization or production facilities. By clarifying when a Part 50 or 52 licensed facility is no longer a utilization or a production facility, the NRC can then specify whether these AEA requirements still apply to the licensee for that facility.

The NRC has identified that 10 CFR 50.38 should not apply to a facility that is no longer a utilization or a production facility. Specifically, the AEA prohibits the issuance of a license for a utilization or a production facility to an entity that the Commission knows or has reason to believe is foreign owned, controlled, or dominated. However, the Commission’s regulations that implement this prohibition in § 50.38 are unclear as to whether the prohibition also applies to the acquisition of a Part 50 or 52 license for a facility that is no longer a utilization or a production facility.

#### **4.13.1 Alternative F-1 (No Action)**

The no-action alternative would retain the NRC’s current regulations regarding utilization and production facilities.

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The no-action alternative would also retain the provisions of the current decommissioning regulations with regard to the NRC's prohibition on transferring a license to an entity that the Commission knows or has reason to believe is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

#### **4.13.2 Alternative F-2 (Rulemaking to specify FOCD)**

In this alternative, the NRC proposes to add to its regulations language to establish the criteria for when a facility licensed under Part 50 or 52 no longer meets the statutory or regulatory definition of a utilization or a production facility (i.e., is no longer capable of making use of special nuclear material or of the production of special nuclear material, separation of the isotopes of plutonium, or processing of irradiated materials containing special nuclear material, respectively). The first criterion is that the facility must not be legally capable of operating. The second criterion is the physical modification of the licensed facility to be incapable of making use of special nuclear material or of the production of special nuclear material, separation of the isotopes of plutonium, or processing of irradiated materials containing special nuclear material, without significant facility alterations necessary to restore the capability to make use of special nuclear material or produce special nuclear material, separate the isotopes of plutonium, or process irradiated materials containing special nuclear material, respectively. When a utilization facility is physically modified to be incapable of making use of special nuclear material, it is no longer designed or used to sustain nuclear fission in a self-supporting chain reaction.

Sections 50.82(a)(2) and 52.110(b) already provide for the first criterion for power reactor licensees. Sections 50.82(a)(2) and 52.110(b) state, respectively, that a Part 50 or 52 license no longer authorize operation of the reactor or emplacement or retention of fuel into the reactor vessel once the NRC has docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, or when a final legally effective order to permanently cease operations has come into effect. The NRC would amend these regulations to add the second criterion that the facility licensed under Part 50 or 52 is no longer a utilization facility once the licensee modifies the facility to be incapable of making use of special nuclear material without significant facility alterations.

Because the NRC's regulations do not state when a non-power production or utilization facility (NPUF) licensee is no longer authorized to operate (other than at license termination), the NRC proposes to amend § 50.82(b) to add the criteria for when an NPUF is no longer a production or utilization facility. The NRC would renumber current paragraph (b)(6) in 10 CFR 50.82 as paragraph (b)(8) and add new paragraphs (b)(6) and (b)(7). Paragraph (b)(6) would provide that an NPUF or fuel reprocessing plant is not legally capable of operating when the NRC removes the licensee's authority to operate the facility through a license amendment. Licensees typically request a possession-only license amendment first and then submit a decommissioning plan (via a second license amendment request). This proposed rule would offer licensees the option to request only one licensing action—the decommissioning plan license amendment—that also would address the licensee's operating authority, rendering a "possession-only license amendment" unnecessary. The NRC would add new § 50.82(b)(7) and amend § 50.82(a)(2) and § 52.110(b) to affirm the continuation of the NRC's statutory authority over the existing Part 50 or 52 license after the performance of decommissioning activities that lead to the licensed facility no longer meeting the definition of a utilization or a production facility.

The NRC is also proposing to amend § 50.38, "Ineligibility of certain applicants," such that its prohibition on transferring a license to an entity that the Commission knows or has reason to

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believe is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government, is not applicable if the license is a Part 50 or 52 license for a facility that no longer meets the definition of a utilization or a production facility.

#### **4.13.3 Assumptions**

For Alternative F-2 (Rulemaking to specify FOCD) the NRC assumes in this regulatory analysis that one-third of all future nuclear power reactor sites that decommission will submit an exemption from § 50.38 if the proposed rule does not go forward. This assumption is based on historical data on past decommissioning sites that did submit an exemption from § 50.38 (Ref. 36).

#### **4.13.4 Affected Attributes**

Industry Implementation: Under Alternative F-2, the exemptions that licensees submit from § 50.38 would be eliminated, resulting in a one-time benefit (i.e., averted cost) to industry for licensees that enter decommissioning after issuance of the rule. Also, under Alternative F-2, the proposed rule would offer an NPUF the option to request only one licensing action—the decommissioning plan license amendment—that also would address the licensee’s operating authority, rendering a “possession-only license amendment” unnecessary, resulting in a one-time cost benefit for not having to prepare this amendment.

NRC Implementation: For Alternative F-2, the NRC would incur a one-time cost in order to develop the rule. For Alternative F-2, the exemptions from § 50.38 would be eliminated, which would result in a benefit (i.e., averted cost) to the NRC due to lack of reviewing these exemption requests. Under Alternative F-2, the proposed rule would offer the NPUFs the option to request only one licensing action—the decommissioning plan license amendment—that also would address the licensee’s operating authority, rendering a “possession-only license amendment” unnecessary, resulting in a one-time cost benefit to the NRC for not having to review these amendments.

### **4.14 Clarification of Scope of License Termination Plan Requirement**

The Commission’s “Policy Statement on Deferred Plants” (Ref. 37) addresses holders of construction permits who defer or terminate plant construction. Certain COL holders have cited the Policy Statement for authority to request NRC approval to withdraw their combined licenses. The Policy Statement provides that a permit holder can request to withdraw its permit and does not cite to the license termination provisions in 10 CFR Part 50. The Policy Statement was issued prior to the promulgation of 10 CFR Part 52 and has not been updated since, but there is nothing to prevent holders of a combined license from following the applicable parts of the Policy Statement while continuing to comply with the Commission’s regulations and the terms and conditions of the combined license. The requirement for a license termination plan in § 52.110(i) does not apply to plants that have not begun operating. While § 52.110(i) does refer to “[a]ll power reactor licensees,” the regulatory history and context indicates that § 52.110 as a whole applies only to plants that have started operation

#### **4.14.1 Alternative T-1 (No-Action)**

The no-action alternative would retain the provisions of the current decommissioning regulations with regard to the requirement for a license termination plan in § 50.82(a)(9) and § 52.110(i).

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#### **4.14.2 Alternative T-2 (Rulemaking to clarify license termination plan)**

The NRC is proposing to amend its regulations to clarify that the requirement for a license termination plan in § 50.82(a)(9) and § 52.110(i) applies only to power reactor licensees that commenced operation. This clarification is being proposed in response to apparent confusion among combined license holders who seek to surrender their licenses before operation. However, to avoid confusion over the license termination plan requirement, the NRC proposes to amend § 52.110(i) so that it explicitly applies only to “power reactor licensees that commenced operation.” As stated in the “Final Procedures for Conducting Hearings on Conformance With the Acceptance Criteria in Combined Licenses” (Ref. 38), the NRC has historically understood operation as beginning with the loading of fuel into the reactor. Therefore, § 52.110(i) would apply to 10 CFR Part 52 power reactor licensees that have, at a minimum, begun to load fuel into the reactor. Section 50.82(a)(9) would apply to 10 CFR Part 50 power reactor licensees that, at a minimum, have begun to load fuel into the reactor.

#### **4.14.3 Assumptions**

For Alternative T-2 (Rulemaking to clarify license termination plan) this clarification is administrative and does not present a significant change in the costs and benefits for the industry, NRC, State and local governments and the general public.

### **5 EVALUATION OF COSTS AND BENEFITS FOR AREAS OF DECOMMISSIONING CONSIDERED FOR RULEMAKING**

This section examines the costs and benefits expected to result from the alternatives of the decommissioning areas relative to the regulatory baseline (i.e., the no-action alternative). All costs and benefits are monetized, when possible. The total of costs and benefits are then summed to determine whether the difference between the costs and benefits results in a positive net benefit. Costs and benefits, which are not monetized because of the lack of data, are qualitatively described.

#### **5.1 Analytical Methodology**

This section describes the process used to evaluate costs and benefits associated with the alternatives, consistent with the guidance provided in NUREG/BR-0058, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” Revision 5 (Ref. 39). The benefits include desirable changes in affected attributes (e.g., monetary savings, reduced burden on licensees, streamlined process), while the costs include any undesirable changes in affected attributes (e.g., monetary costs).

This regulatory analysis evaluates eight attributes on a quantitative basis: industry implementation, industry operation, NRC implementation, NRC operation, other government, general public, environmental considerations and regulatory efficiency. Quantitative analysis requires a baseline characterization of the affected universe, including characterization of factors such as the number of affected entities, the areas of decommissioning, and the administrative processes and procedures that licensees or applicants would implement, or no longer implement, because of the alternatives under consideration. Costs to complete and process exemptions and amendments for decommissioning proceeding to preparing the proposed rule in 2018 are sunk costs and are not considered in this regulatory analysis.

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### 5.1.1 Regulatory Baseline

This regulatory analysis measures the incremental impacts of the recommended rulemaking relative to a baseline that reflects anticipated behavior in the event NRC undertakes no additional regulatory actions (the no-action alternatives). As part of the regulatory baseline used in this analysis, the staff assumes full licensee compliance with existing NRC regulations.

### 5.1.2 Discount Rates

In accordance with guidance from the Office of Management and Budget (OMB) Circular No. A-4, "Regulatory Analysis" (Ref. 40), and NUREG/BR-0058, Revision 5, net present worth calculations are used 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 present worth values, costs and benefits, regardless of when the cost or benefit is incurred in time, are valued to a reference year for comparison. Based on OMB Circular No. A-4 and consistent with NRC past practice and guidance, present worth calculations are presented using 3-percent and 7-percent real discount rates.<sup>7</sup> 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 to reflect reliance on a social rate of time preference discounting concept. A 7-percent discount rate approximates the marginal pretax real rate of return on an average investment in the private sector, and is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. A 7-percent rate is consistent with an opportunity cost of capital<sup>8</sup> concept to reflect the time value of resources directed to meet regulatory requirements.

### 5.1.3 Cost/Benefit Inflaters

To evaluate the costs and benefits consistently, the analysis inputs are inflated into 2018 dollars. The most common inflator is the Consumer Price Index for all urban consumers (CPI-U), developed by the U.S. Department of Labor, Bureau of Labor Statistics (BLS). The formula to determine the amount in 2018 dollars is as follows:

$$\frac{\text{CPIU}_{2018}}{\text{CPIU}_{\text{Value Year}}} * \text{Value}_{\text{Value Year}} = \text{Value}_{2018}$$

Values of CPI-U used in this cost-benefit analysis are summarized in Table 5.

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<sup>7</sup> The rates presented in Appendix C to OMB Circular No. A-94 (Ref. 41) do not apply to regulatory analysis or cost-benefit analysis of public investment. These rates are used for lease-purchase and cost-effectiveness analysis, as specified in the Circular.

<sup>8</sup> Opportunity cost is the value of the next best alternative to a particular activity or resource. An analyst does not need to assess opportunity cost in monetary terms. Opportunity cost can be assessed in terms of anything that is of value.

Table 5 Consumer Price Index—All Urban Consumers, U.S. City Average

Base Year	CPI-U Annual Average <sup>a</sup>	Forecast Percent Change of CPI-U from Previous Year <sup>b</sup>
2017	245.120	
2018	250.758	2.30%
2019	256.776	2.40%

<sup>a</sup> United States Bureau of Labor Statistics, “Table 24, Historical Consumer Price Index for All Urban Consumers (CPI-U): U.S. City Average, All-Items,” <https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201802.pdf> (Ref. 42).

<sup>b</sup> United States Congressional Budget Office, “The Budget and Economic Outlook: 2017 to 2027.” Table 2-1, “CBO’s Economic Projections for Calendar Years 2017 to 2027,” January 2017, <https://www.cbo.gov/publication/52370> (Ref. 43).

### 5.1.4 Labor Rates

For regulatory analysis purposes, labor rates are developed, and this approach is consistent with guidance set forth in NUREG/CR-4627, “Generic Cost Estimates” (Ref. 44), and general cost-benefit methodology. The NRC labor rate for fiscal year 2018 is \$131 per hour.<sup>9</sup>

The estimated mean industry labor rate is \$141 per hour. The NRC derived these labor rates according to data provided by BLS. The NRC used the 2016 occupational employment and wages data, which provided labor categories and the mean hourly wage rate by job type and used the inflator discussed in Section 5.1.3 to inflate these labor rate data to 2018 dollars. The industry labor rates used in the analysis reflect total compensation, which includes health and retirement benefits (using a burden factor of 2.0). The NRC used the BLS data tables to select appropriate hourly labor rates for performing the estimated procedural, licensing, and utility-related work necessary during and following implementation of the proposed alternatives. In establishing this labor rate, wages paid for the individuals performing the work plus the associated fringe benefit component of labor cost (i.e., the time for plant management over and above those directly expensed) are considered expenses and are included. The NRC also verified that these labor rates are consistent with wage rates submitted by industry in recent severe accident mitigation alternatives cost estimates. Appendix A of this regulatory analysis provides a breakdown of the labor categories considered that may be required to implement rulemaking. The NRC performed an uncertainty analysis, which is discussed in Section 6.10.

### 5.1.5 Affected Entities

The following describes the nuclear power reactors that are affected by the decommissioning rule:

<sup>9</sup> 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 non-incremental costs (e.g., overhead, administrative, and logistical support costs).

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Operating reactor sites: The NRC models 66 U.S. light-water nuclear power reactors sites in this analysis.<sup>10</sup> Note that in 2013 three of these sites had permanently shut down without significant advance notice or preplanning. These sites are Crystal River Nuclear Generation Plant, Kewaunee Nuclear Power Station and San Onofre Nuclear Generating Station. On December 29, 2014, Entergy Nuclear Operations, Inc., shut down Vermont Yankee Nuclear Power Station. Furthermore, the Omaha Public Power District board of directors shut down Fort Calhoun Station on October 24, 2016 (Ref. 45).

The following licensees have announced plans to shut down their operation power reactor sites between 2018 and 2025:

- Oyster Creek – by October 31, 2018 (originally by December 31, 2019)
- Pilgrim – by June 1, 2019
- Three Mile Island Unit 1 – on or about September 30, 2019
- Davis-Besse – by May 31, 2020
- Indian Point – by April 30, 2021
- Perry – by May 31, 2021
- Beaver Valley– by October 31, 2021
- Palisades – by spring 2022 (originally planned to shut down in 2018)
- Diablo Canyon – in 2025

These licensees who have identified their intention to permanently cease operations in the near future have indicated that they plan to continue to use the current transition process (i.e., establishing a decommissioning regulatory framework by requesting exemptions, license amendments, and rescinding orders, as needed). The NRC assumes that these licensees will not wait for the outcome of the decommissioning rulemaking before formulating their decommissioning licensing activities.

- Future operating reactor units: The NRC assumes that there are two future operating light-water nuclear power reactors that would be affected by the recommended rule and are considered in this analysis. The future nuclear power reactor units are Vogtle Electric Generating Plant, Units 3 and 4, assumed to begin operations in 2021 and 2022, respectively.<sup>11</sup>
- Non-power production or utilization facility (NPUF): The proposed rule will affect all NPUFs with respect to the definition of a production or utilization facility. Here the NRC would amend regulations to add the first criterion for NPUFs and fuel reprocessing plants (i.e., the licensee is no longer authorized to operate) and the second criterion for all production or utilization facilities that the facility licensed under Part 50 or 52 is no longer a utilization facility once the licensee modifies the facility to be incapable of making use of special nuclear material without significant facility alterations. The NRC is also proposing to amend § 50.38 such that its prohibition on transferring a license to an entity that the Commission knows or has reason to believe is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government, is not applicable if

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<sup>10</sup> Based on information obtained from NUREG-1350, Volume 29, "Information Digest: 2017–2018," Appendix G, "U.S. Commercial Nuclear Power Reactor Operating Licenses—Expiration by Year, 2013–2049," issued August 2017.

<sup>11</sup> Fermi Unit 3, Levy County Units 1 and 2, South Texas Project Units 3 and 4 and William State Lee III Units 1 and 2 are not included in this analysis because as of 11/1/2016, the NRC issued a COL for these proposed new reactors, but the licensees have no immediate plans to begin construction. If the construction plans change during this rulemaking, the regulatory analysis will be revised.



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the license is a Part 50 or 52 license for a facility that no longer meets the definition of a utilization or a production facility.

Other potential new reactors licensed under 10 CFR Part 52 and small modular reactors are not included in this analysis. In the case that additional 10 CFR Part 52 applicants are issued licenses and are under construction, the regulatory analysis for the final rule will reflect that change.

### **5.1.6 Sign Conventions**

The sign conventions used in this analysis for all favorable consequences for the alternatives are positive and all adverse consequences for the alternatives are negative. For example, additional costs above the regulatory baseline are shown as negative values, and benefits and averted costs are shown as positive values. Negative values are shown using parentheses (e.g., negative \$500 is displayed as (\$500)).

### **5.1.7 Base Year**

The rulemaking is expected to be issued and effective in 2020. The monetized benefits and costs in this analysis are expressed in year 2018 dollars. Rulemaking-related implementation costs are assumed to be incurred in years 2018 and 2019. Non-rulemaking implementation costs are assumed to be incurred in year 2020. Ongoing and annual costs of operation related to the alternatives are assumed to begin in year 2021 unless otherwise stated and continue until no additional costs or benefits are incurred. These monetized future costs and benefits are then discounted back into year 2018 dollars.

### **5.1.8 Time Period of Analysis**

To define the period of analysis covered by this regulatory analysis (i.e., the period over which costs and benefits would be incurred), the NRC used the remaining license term for each operating and COL licensees. These remaining license terms were obtained from NUREG-1350 (Ref. 46). The license terms consist of an operating period and can be followed by a 60-year period for SAFSTOR or a 12.5-year period for DECON decommissioning. The NRC assumes that each operating site that has not renewed its license will apply for and receives one 20-year license renewal beyond the original 40-year license term. At the end of the operating period, the NRC assumes that each site would enter the decommissioning phase, and would in turn incur decommissioning site costs. There are two new reactors included in the analysis - Vogtle Units 3 and 4. The NRC assumes that both new reactors will apply for and receive one 20-year license renewal in addition to the original 40-year license. Based on these assumptions, the Vogtle nuclear site would incur costs associated with the final rule from 2020 through 2082.

### **5.1.9 Cost Estimation**

In order to estimate the costs associated with the evaluated alternatives, the NRC used a work breakdown structure approach to deconstruct each alternative into requirements that would need to be met. These requirements include avoidance of exemptions and/or amendments, additional processes that licensees would be required to complete (e.g., additional materials and drug testing) and other additional penalties (e.g., spent fuel management fees). Additionally, licensee input on reduced staffing during decommissioning and extrapolation

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techniques (i.e., utilization of cost factors) was used to estimate the costs and benefits of each alternative.

The NRC gathered data from several sources (e.g., BLS, internal databases, publications, and periodicals) and professional opinion. This data was used to estimate activities such as the levels of effort required to prepare and submit exemption requests and license amendments, to review and process the exemptions and license amendments, to manage and track spent fuel management costs, and to complete materials tests. NRC working group members were also consulted to obtain expert opinion on the levels of effort (labor hours and staffing) to complete decommissioning activities. This expert opinion is based on NRC experience with oversight of operating and decommissioning power reactors and forms the basis for the many assumptions used to derive the cost estimates. In addition, the NRC used historical cost data to estimate the future cost of some requirements (e.g., drug and alcohol testing) using cost factors. For instance, to calculate the estimated averted costs of requests for exemptions and amendments and the preparation of the final rule, it was necessary for the NRC to extrapolate the labor hours responsible for the work based on past data. For steps in the regulatory alternatives with no or incomplete data, the staff based its cost estimates on similar steps for which data are available.

To incorporate uncertainty into the model, the staff employed a Monte Carlo simulation, which is an approach to uncertainty analysis where input variables are expressed as distributions. The simulation was run 10,000 times, and values used in simulations were chosen randomly from the distributions of the input variables provided in Appendix B to this document. The result was a distribution of values for the output variable of interest. Using Monte Carlo simulation, it is also possible to determine the input variables that have the greatest effect on the value of the output variable. Section 6.10 of this analysis provides a description of the Monte Carlo simulation methods and a presentation of the uncertainty analysis.

## **6 PRESENTATION OF RESULTS FOR AREAS OF DECOMMISSIONING CONSIDERED FOR RULEMAKING**

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 a negative algebraic sign, depending on whether the alternative has a favorable or adverse effect relative to the regulatory baseline (Alternative 1). A discussion is provided for those attributes that could not be represented in monetary values. Although this *ex-ante* cost-benefit analysis<sup>12</sup> provides useful information that can be used when deciding whether to select an alternative, the analysis is based on estimates of the future costs and benefits. Whether the estimates hold in the future, the process of conducting regulatory analyses has value in that it helps decision makers think in depth about specific alternatives and their associated results.

### **6.1 Industry Implementation**

The NRC estimates that amending some of the requirements in 10 CFR Part 50 that were mentioned previously (e.g., EP, physical security) would allow licensees to avert one-time costs because they would submit fewer exemptions and license amendment requests. However, the NRC had introduced new requirements for licensees which would result in additional costs.

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<sup>12</sup> 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 resources should be allocated to that alternative.

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Discussion of both the averted and additional costs of each area of decommissioning is presented in the next two sections.

### **6.1.1 Averted Industry Implementation Costs**

The licensee submittal of an exemption or amendment request to the NRC can be expensive. In order to be exempt from, or to change how a licensee complies with the NRC's requirements (e.g., maintaining offsite emergency preparedness, using DTFs for spent fuel management, etc.) during its reactor's decommissioning phase, the licensee must submit an exemption request or a license amendment request to the NRC for review and approval. This analysis evaluates the alternatives for proposed rulemaking in multiple areas of decommissioning, which will eliminate the need for decommissioning-related exemption and license amendment requests. These alternatives and areas of decommissioning are as follows:

- Under Alternative EP-2, exemptions from EP requirements and amendments to licensees regarding changes to the emergency plans would be reduced. This would result in a one-time benefit (i.e., averted cost) to industry from writing fewer exemption and amendment requests.
- Under Alternative PS-2, licensees would not need to apply for exemptions from the physical security requirements for suspension of security measures for the control room and ISFSI. This would result in a one-time benefit to industry from writing fewer exemptions.
- Under Alternative CS-2, industry would not need to submit an amendment to remove their cyber security plans once the spent fuel has sufficiently decayed.
- Under Alternative CFH-3, licensees would not need to submit for Commission approval fuel handler training programs suitable to qualify CFHs. This would result in a one-time cost benefit to industry.
- Under Alternatives FP-2, the exemptions for offsite and onsite financial protection requirements would be fewer due to the reductions in financial protection based on the level of decommissioning. This would result in a one-time benefit (i.e., averted cost) to industry from writing fewer exemptions.
- Under Alternative R-2, exemptions from the recordkeeping and record retention requirements would be reduced. This would result in a one-time benefit (i.e., averted cost) to industry for having to write fewer exemptions pertaining to these requirements.
- Under Alternative TR-2, exemptions related to LLW transportation investigation requirements during both operating and decommissioning at nuclear facilities covered by the requirements of 10 CFR Part 20 would be reduced. This would result in a one-time benefit (i.e., averted cost) to industry for having to write fewer of these exemptions.
- Under Alternative F-2, exemptions that licensees submit from § 50.38 would be eliminated, resulting in a one-time benefit (i.e., averted cost) to industry for licensees that enter decommissioning after issuance of the rule. The proposed rule would offer the NPUFs the option to request only one licensing action—the decommissioning plan license amendment—that also would address the licensee's operating authority,

rendering a “possession-only license amendment” unnecessary, resulting in a one-time benefit to NPUFs for not having to prepare these amendments.

Table 6 presents the averted implementation costs for all alternatives under proposed rulemaking relative to the no-action alternatives (status quo). Note that the licensees that have already entered decommissioning (i.e., Crystal River, Vermont Yankee, San Onofre, Kewaunee and Fort Calhoun), and those that have submitted an intent to decommission before year 2020 (e.g., Oyster Creek) will not receive the full benefits from the avoidance of the exemption and amendment process during the decommissioning transition phase. This is because these licensees likely will have already submitted exemption or amendment requests to the NRC for processing before the final rulemaking becomes effective in year 2020.

Table 6 Averted Industry Implementation Costs

Areas of Decommissioning	Alternatives	Averted Industry Implementation Costs		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ 19,855,000	\$ 5,488,000	\$ 10,554,000
Physical Security	PS-2	\$ 3,353,000	\$ 927,000	\$ 1,783,000
Cybersecurity	CS-2	\$ 621,000	\$ 155,000	\$ 299,000
Certified Fuel Handler Training	CFH/STA-2	\$ 657,000	\$ 159,000	\$ 329,000
Decommissioning Funding Assurance	DTF-2	\$ -	\$ -	\$ -
Offsite & Onsite Financial Protection	FP-2	\$ 1,718,000	\$ 475,000	\$ 913,000
Record Retention Requirements	R-2	\$ 754,000	\$ 209,000	\$ 401,000
Low Level Waste Transportation	TR-2	\$ 567,000	\$ 157,000	\$ 302,000
Foreign Ownership, Control, or Domination	F-2	\$ 204,000	\$ 56,000	\$ 109,000

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

\*\*\* NPV = net present value.

### 6.1.2 Additional Industry Implementation Costs

Additional one-time costs to the licensees would result for the following alternatives under proposed rulemaking:

- For Alternative EP-2, licensees would incur an additional one-time cost to participate in the public meeting and comment period for the proposed rule.
- For Alternative PS-2, licensees would incur an additional one-time cost to participate in the public meeting and comment period for the proposed rule.
- For Alternative CS-2, licensees would incur an additional one-time cost to participate in the public meeting and comment period for the proposed rule.
- For Alternative DA-2, licensees would incur an additional one-time cost because licensees would have to modify the drug and alcohol testing procedures in order to comply with the amended regulation. In addition, licensees would incur additional costs by participating in the public meetings and submitting comments on proposed alternatives.
- For Alternative CFH/STA-2, licensees would incur an additional one-time cost to participate in the public meeting and comment period for the proposed rule.

- For Alternative DTF-2 may result in additional costs to those licensees not under rate-setting regulations who report a shortfall in its DTF and are required to report compliance in the next decommissioning report. The cost impacts of the recommend change to make up the shortfall within a timely manner was not modeled at this time. In addition, licensees would incur additional costs by participating in the public meetings and submitting comments on the proposed alternatives.
- For Alternative FP-2, licensees would incur an additional one-time cost to participate in the public meeting and comment period for the proposed rule. Licensees would also incur an additional one-time cost to submit a prompt notification to the Commission of any material change in proof of onsite property insurance filed with the Commission under Part 50 and offsite insurance under Part 140.
- For Alternative ENV-2, licensees would commit additional resources to participate in the public meetings and write comments on the alternatives.
- For Alternative SFM-2, licensees would incur additional costs by participating in the public meetings and submitting comments on the proposed alternatives. Under Alternative SFM-2, licensees would commit additional resources to include the spent fuel management summary in the PSDAR.

Table 7 presents the additional implementation costs for all alternatives under proposed rulemaking relative to the no-action alternatives (status quo). The costs for industry to write and submit comments are included as well for each of the alternatives presented.

Table 7 Additional Industry Implementation Costs

Areas of Decommissioning	Alternatives	Additional Industry Implementation Costs		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ (25,000)	\$ (25,000)	\$ (25,000)
Physical Security	PS-2	\$ (13,000)	\$ (13,000)	\$ (13,000)
Cybersecurity	CS-2	\$ (4,000)	\$ (4,000)	\$ (4,000)
Drugs and Alcohol Testing	DA-2	\$ (4,000)	\$ (4,000)	\$ (4,000)
Certified Fuel Handler Training	CFH/STA-2	\$ (5,000)	\$ (5,000)	\$ (5,000)
Decommissioning Funding Assurance	DTF-2	\$ (20,000)	\$ (20,000)	\$ (20,000)
Offsite & Onsite Financial Protection	FP-2	\$ (13,000)	\$ (8,000)	\$ (10,000)
Environmental Considerations	ENV-2	\$ (11,000)	\$ (11,000)	\$ (11,000)
Spent Fuel Management Planning	SFM-2	\$ (12,000)	\$ (6,000)	\$ (8,000)
Backfit Rule	B-2	\$ (13,000)	\$ (13,000)	\$ (13,000)

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

## 6.2 Industry Operation

This attribute accounts for the projected economic effect caused by routine and recurring activities in the alternatives on affected licensees. The staff estimates that by amending some of the NRC's requirements that were mentioned previously (e.g., EP, physical security, etc.), licensees would be able to avert costs on a recurring basis (annually) during the decommissioning phase. However, the NRC has found that as a result of these changes to the NRC's regulations, licensees for power reactors would also be incurring costs annually during the decommissioning phase. The averted and additional costs that result on a recurring basis, annually or otherwise, are the operation costs. Discussion of the operation costs for each area of decommissioning is presented in the next two sections.

## 6.2.1 Averted and Additional Industry Recurring Costs

Recurring averted costs would result for the following alternatives under proposed rulemaking:

- Under Alternative DA-2, the licensee’s drug and alcohol testing program cost would be reduced for the length of the program during decommissioning due to the reduction individuals subject to the FFD elements necessary to satisfy IMP requirements.
- Under Alternative DTF-2, licensees would expend fewer resources to process decommissioning funding assurance reports because the annual reporting frequencies would be extended from every two years to every three years. The licensees would also avert costs because resubmittals subsequent to the initial decommissioning funding plan for ISFSIs will no longer require NRC approval.
- Under Alternative SFM-2, the proposed rule would result in reduced licensee time in teleconference calls with the NRC due to the clarity in how licensees should manage the spent fuel.
- Under Alternative CS-2, the proposed rule would result in recurring costs to COL licensees because they would be expending additional labor hours to implement the cyber security requirements for 10 months for BWRs and 16 months for PWRs, after the last reactor permanently defuels.

Table 8 presents the averted and additional industry operation costs for all affected areas of decommissioning relative to the no-action alternatives (status quo). Note that only 57 nuclear power plant sites are accounted for in this attribute, because five sites (i.e., Crystal River, Kewaunee, San Onofre, Vermont Yankee and Ft. Calhoun) have already entered decommissioning and three sites (i.e., Oyster Creek, Pilgrim, and Three Mile Island) will plan to decommission before the rulemaking takes effect. The Bellefonte site is not accounted for in this regulatory analysis due to the fact that construction of this site has ceased, and its future remains uncertain.

Table 8 Averted and Additional Industry Operation Costs

Areas of Decommissioning	Alternatives	Averted Industry Operation Costs		
		Undiscounted	7% NPV	3% NPV
Drugs and Alcohol Testing	DA-2	\$ 26,214,000	\$ 6,531,000	\$ 13,211,000
Decommissioning Funding Assurance	DTF-2	\$ 2,020,000	\$ 1,044,000	\$ 1,493,000
Spent Fuel Management Planning	SFM-2	\$ 52,000	\$ 14,000	\$ 28,000
Areas of Decommissioning	Alternatives	Additional Industry Operation Costs		
		Undiscounted	7% NPV	3% NPV
Cybersecurity	CS-2	\$ (1,050,000)	\$ (18,000)	\$ (178,000)

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars

## 6.3 NRC Implementation

By amending the NRC’s requirements that were mentioned previously, the NRC believes that licensees would be able to avert costs expended to apply for exemptions and amendments. As a result, the NRC would avert the cost to process these exemption and amendment requests. However, to achieve these savings, the NRC would incur a cost to develop the final rule and the

associated RGs. The following sections discuss the averted and incurred NRC implementation costs for rulemaking and guidance development.

### 6.3.1 Averted NRC Implementation Costs

When the NRC processes an exemption or license amendment request, resources are expended to perform the review, resolve technical issues, document the evaluation, and respond to the licensee. As a result of this rulemaking, the licensees would submit fewer exemption and license amendment requests and as a result the NRC would avert the time to process these submittals. This would lead to averted costs for the NRC and result in a one-time benefit. Exemption and license amendment requests that were submitted and processed (e.g., Crystal River, Vermont Yankee, San Onofre, and Kewaunee) and those that are expected to be submitted and processed before the effective date of the rule are not included in this analysis. Table 9 displays the NRC averted implementation costs for processing exemption and license amendment requests.

Table 9 Averted NRC Implementation Costs

Areas of Decommissioning	Alternatives	Averted NRC Implementation Costs		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ 10,726,000	\$ 2,965,000	\$ 5,702,000
Physical Security	PS-2	\$ 2,256,000	\$ 624,000	\$ 1,199,000
Cybersecurity	CS-2	\$ 328,000	\$ 82,000	\$ 158,000
Certified Fuel Handler Training	CFH/STA-2	\$ 1,413,000	\$ 341,000	\$ 708,000
Decommissioning Funding Assurance	DTF-2	\$ -	\$ -	\$ -
Offsite & Onsite Financial Protection	FP-2	\$ 977,000	\$ 270,000	\$ 519,000
Record Retention Requirements	R-2	\$ 406,000	\$ 112,000	\$ 216,000
Low Level Waste Transportation	TR-2	\$ 305,000	\$ 84,000	\$ 162,000
Foreign Ownership, Control, or Domination	F-2	\$ 110,000	\$ 30,000	\$ 58,000

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

### 6.3.2 Additional NRC Implementation Costs

The decommissioning final rule would impose implementation costs on the NRC. These costs include procedural and administrative activities, responding to public comments, developing the proposed rule and draft guidance documents, and developing and issuing the final rule and guidance documents. These one-time costs include updating NUREG documents and begin in 2018 with the proposed rulemaking and are assumed to end in 2020 with the development and issuance of the final rule. The regulatory analysis does not include estimates to perform ongoing decommissioning licensing activities. Table 10 shows the estimated cost for developing and issuing the proposed rule and associated RGs and NUREGs for each area of decommissioning.

Table 10 Additional NRC Implementation Costs

Areas of Decommissioning	Alternatives	Additional NRC Implementation Costs		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ (679,000)	\$ (657,000)	\$ (669,000)
Physical Security	PS-2	\$ (679,000)	\$ (657,000)	\$ (669,000)
Cybersecurity	CS-2	\$ (137,000)	\$ (132,000)	\$ (135,000)
Drugs and Alcohol Testing	DA-2	\$ (116,000)	\$ (112,000)	\$ (114,000)
Certified Fuel Handler Training	CFH/STA-2	\$ (126,000)	\$ (122,000)	\$ (124,000)
Decommissioning Funding Assurance	DTF-2	\$ (525,000)	\$ (508,000)	\$ (518,000)
Offsite & Onsite Financial Protection	FP-2	\$ (174,000)	\$ (169,000)	\$ (172,000)
Environmental Considerations	ENV-2	\$ (82,000)	\$ (79,000)	\$ (81,000)
Record Retention Requirements	R-2	\$ (82,000)	\$ (79,000)	\$ (81,000)
Low Level Waste Transportation	TR-2	\$ (82,000)	\$ (79,000)	\$ (81,000)
Spent Fuel Management Planning	SFM-2	\$ (338,000)	\$ (311,000)	\$ (326,000)
Backfit Rule	B-2	\$ (46,000)	\$ (45,000)	\$ (46,000)
Foreign Ownership, Control, or Domination	F-2	\$ (11,000)	\$ (11,000)	\$ (11,000)

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars

## 6.4 NRC Operation

This attribute accounts for the projected economic effect caused by routine and recurring activities in the proposed alternatives by the NRC. The NRC estimates that by improving the regulations governing decommissioning power reactors, there would be additional and averted costs on an annual basis. Costs that are incurred annually are due to the expense of NRC resources to provide oversight. The following areas of decommissioning are affected under proposed rulemaking, where the NRC could avert or save costs on a recurring basis.

- Under Alternative DA-2, the NRC would avert costs for the administration of reporting requirements due to the applicability of drug and alcohol testing on a reduced population at a decommissioning plant.
- Under Alternative DTF-2, the NRC would avert costs due to the review of the decommissioning funding assurance reporting requirements being on a triennial frequency (every 3 years) instead of on a biennial frequency. The NRC would also avert costs because resubmittals subsequent to the initial decommissioning funding plan for ISFSIs will no longer require NRC approval
- Under Alternative SFM-2, the proposed rule would result in reduced NRC time in teleconference calls with the licensees due to the clarity in how licensees should manage the spent fuel.

Table 11 Averted NRC Operation Costs

Areas of Decommissioning	Alternatives	Averted NRC Operation Costs		
		Undiscounted	7% NPV	3% NPV
Drugs and Alcohol Testing	DA-2	\$ 509,000	\$ 127,000	\$ 257,000
Decommissioning Funding Assurance	DTF-2	\$ 1,324,000	\$ 677,000	\$ 973,000
Spent Fuel Management Planning	SFM-2	\$ 28,000	\$ 8,000	\$ 15,000

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars



## 6.5 Regulatory Efficiency

The proposed rulemaking alternatives relative to the regulatory baseline would increase regulatory efficiency for the following areas of decommissioning: Emergency Preparedness, Physical Security, Decommissioning Funding Assurance, and Offsite and Onsite Financial Protection Requirements and Indemnity Agreements. This is because these changes would significantly reduce the number of license amendment and exemption requests that the licensees would need to prepare and submit during the decommissioning transition phase. This would significantly reduce the labor hours required by the licensees to develop and submit the amendment and/or exemption requests to the NRC and by the NRC to review these requests. For all areas of decommissioning, the proposed rulemaking alternatives would add clarity to what licensees can and cannot do during decommissioning and, as a result, would enable the NRC to better maintain and administer regulatory activities over the decommissioning process.

## 6.6 Other Government

All areas of decommissioning considered in this analysis would result in additional burden to other Federal, State and local government agencies because these agencies would commit additional resources to participate in public meetings and submit comments on documents published for public comment.

In Alternative EP-2, Rulemaking to amend regulations to provide a graded approach to emergency preparedness, FEMA must establish a notification process that would replace the existing NRC/FEMA process for terminating the assessment of FEMA user fees following the receipt from the NRC of its approved exemptions from pertinent 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 requirements. These exemptions would state that offsite radiological emergency planning and preparedness are no longer required at a particular commercial nuclear power plant site after the spent fuel has cooled for a period of 10 months for BWRs or 16 months for PWRs. This change also requires FEMA to perform a rulemaking to amend 44 CFR 354.4(e) to reflect this new process. The following table shows the estimates costs to other government entities.

Table 12 Costs to Other Government Agencies

Areas of Decommissioning	Alternatives	Total Costs (Other Government)		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ (30,000)	\$ (30,000)	\$ (30,000)
Physical Security	PS-2	\$ (5,000)	\$ (5,000)	\$ (5,000)
Decommissioning Funding Assurance	DTF-2	\$ (12,000)	\$ (12,000)	\$ (12,000)
Offsite & Onsite Financial Protection	FP-2	\$ (4,000)	\$ (4,000)	\$ (4,000)
Environmental Considerations	ENV-2	\$ (11,000)	\$ (11,000)	\$ (11,000)
Spent Fuel Management Planning	SFM-2	\$ (3,000)	\$ (3,000)	\$ (3,000)
Backfit Rule	B-2	\$ (3,000)	\$ (3,000)	\$ (3,000)

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars

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## 6.7 General Public

Some areas of decommissioning considered in this analysis will result in additional burden to the general public because they would commit additional time to participate in public meetings and provide comments during the commenting periods for the proposed rulemaking stage.

Table 13 Costs to the General Public

Areas of Decommissioning	Alternatives	Total Costs (General Public)		
		Undiscounted	7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ (2,000)	\$ (2,000)	\$ (2,000)
Decommissioning Funding Assurance	DTF-2	\$ (3,000)	\$ (3,000)	\$ (3,000)
Environmental Considerations	ENV-2	\$ (3,000)	\$ (3,000)	\$ (3,000)
Spent Fuel Management Planning	SFM-2	\$ (1,000)	\$ (1,000)	\$ (1,000)

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars

## 6.8 Environmental Considerations

Under Alternative ENV-2, guidance related to PSDARs would be revised to recommend that licensees provide information on how they would comply with all Federal, State, and local regulations in effect during decommissioning, such as those on nonradiological effluent releases, waste management, and environmental monitoring, in support of the PSDAR's discussion of environmental impacts. The environmental analyses that would bound the environmental impacts associated with site specific decommissioning activities generally assumed compliance with State and Federal regulations. Therefore, in determining if a decommissioning activity is bounded by previous analyses that relied on compliance with State and Federal regulations, the licensee should state whether it will continue to comply with applicable State and Federal regulations, which would strengthen the basis for determining whether environmental impacts are bounded. These updates to guidance documents under Alternative ENV-2 will result in additional time spent by the NRC, Industry, Other Government and the General Public to contribute to the updates.

Additionally, Alternative ENV-2 proposes to modify the rule language in 10 CFR 50.82(a)(4) to clarify that licensees no longer must conclude in the PSDAR that the environmental impacts of all planned decommissioning activities are bounded by appropriate previously issued environmental impact statements, but rather must evaluate whether the planned decommissioning activities will or will not be bounded by appropriate federally issued environmental review documents. If unbounded impacts are identified, then, consistent with 10 CFR 50.82(a)(6)(ii) and 10 CFR 52.110(f)(2), the licensee can address those impacts before the associated activity occurs instead of being required to address those impacts at the PSDAR stage.

## 6.9 Disaggregation

The NRC completed a screening review in accordance with the guidance in Section 4.3.2, "Criteria for the Treatment of Individual Requirements," of NUREG/BR-0058, for the areas of decommissioning containing an alternative that includes rulemaking:

- Emergency Preparedness

- 
- Physical Security
  - Cyber Security
  - FFD – Drug & Alcohol
  - Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor
  - Decommissioning Funding Assurance
  - Offsite and Onsite Financial Protection Requirements and Indemnity Agreements
  - Environmental Considerations
  - Record Retention Requirements
  - Low-Level Waste Transportation Time
  - Spent Fuel Management Requirements
  - Backfit Rule
  - Foreign Ownership, Control, or Domination (FOCD)
  - Clarification of Scope of License Termination Plan Requirement

In the screening review, the analysis evaluated each requirement of each area of decommissioning and found that the requirements considered separately would not mask the inclusion of other unnecessary requirements.

## **6.10 Uncertainty Analysis**

To determine the robustness of the costs and net benefits contained within this document, the NRC examined how the values estimated for benefits and costs change due to uncertainties associated with the staff's analytical assumptions and input data. The NRC used Monte Carlo simulations to examine the impact of uncertainty on the estimated costs and benefits of each area of decommissioning and performed the simulations using the @Risk software package by Palisade Corporation.<sup>13</sup>

Monte Carlo simulations involve introducing uncertainty into the analysis by replacing the point estimates of the variables used to estimate costs and benefits with probability distributions. By defining input variables as probability distributions as opposed to point estimates, the effect of uncertainty on the results of the analysis (i.e., the benefits and costs) can be modeled. The probability distributions were chosen to represent the different variables in the analysis and are defined by a bounded range of estimates. These bounded ranges of estimates were determined from data collected via the Agencywide Documents Access and Management System (ADAMS) and the NRC staff's professional judgment.

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<sup>13</sup> Information about this software is available online at [www.palisade.com](http://www.palisade.com).

The probability distributions are also defined by summary statistics. These summary statistics include the minimum and maximum of program evaluation and review technique (PERT)<sup>14</sup> and uniform distributions. For these distributions, the NRC used collected input to set the minimum and maximum values of the PERT and uniform distributions. Lastly, the NRC selected the output variables for the Monte Carlo simulations, which are the estimated monetary costs and benefits. The Monte Carlo simulations included 10,000 iterations and resulted in a monetary range of costs and benefits for each alternative of each area of decommissioning under consideration in proposed rulemaking. Additionally, @Risk was used to generate a tornado chart via the Monte Carlo simulations. The tornado chart identifies the input factors (cost drivers) that are ranked by effect on total cost. The results of the uncertainty analysis for the costing of each area of decommissioning are presented.

### 6.10.1 Emergency Preparedness

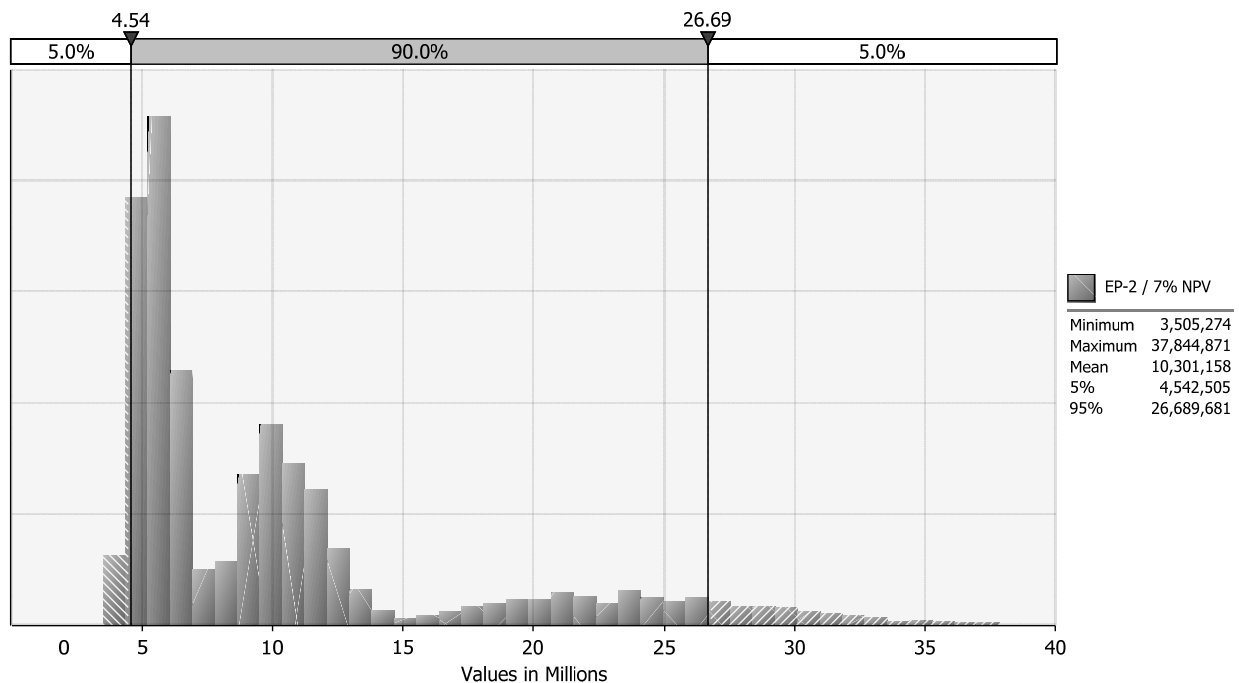


Figure 1 Variation of industry cost due to the uncertainty in the Emergency Preparedness cost drivers (Alternative EP-2)

<sup>14</sup> A PERT distribution is a special form of the beta distribution with a minimum and maximum value specified. 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. It can generally be considered as superior to the triangular distribution when the parameters result in a skewed distribution, as 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 modelling purposes where it is desired to capture tail or extreme events.

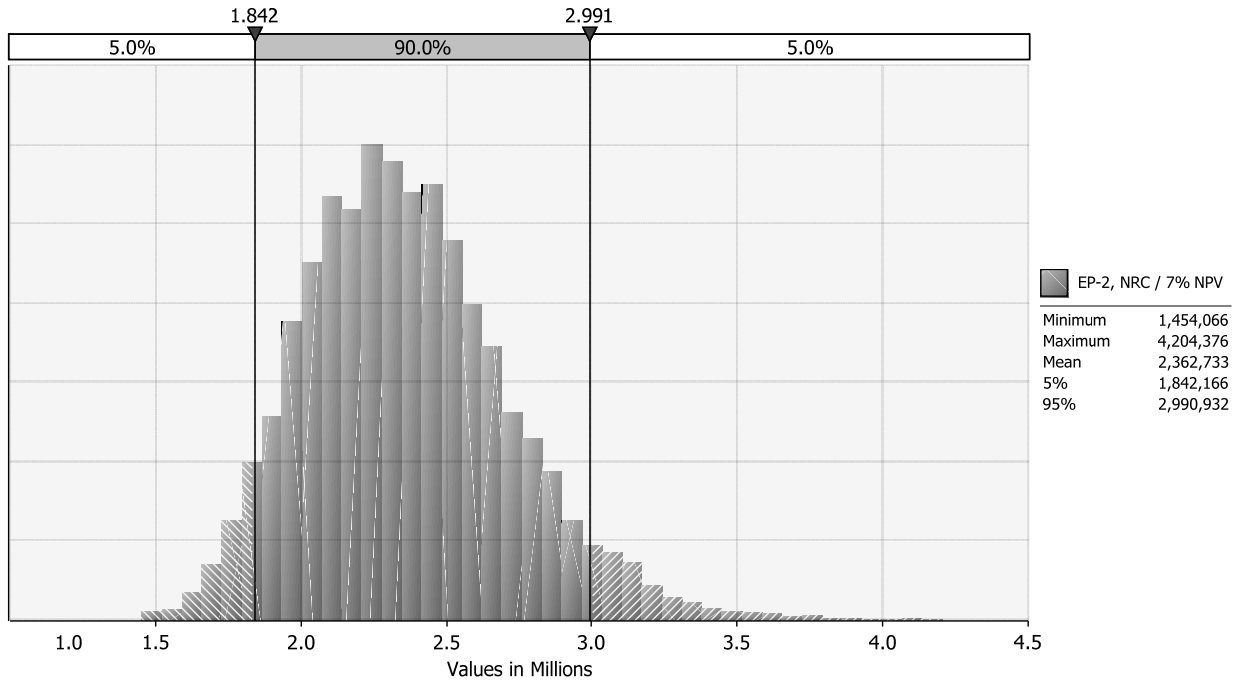


Figure 2 Variation of NRC cost due to the uncertainty in the Emergency Preparedness cost drivers (Alternative EP-2)

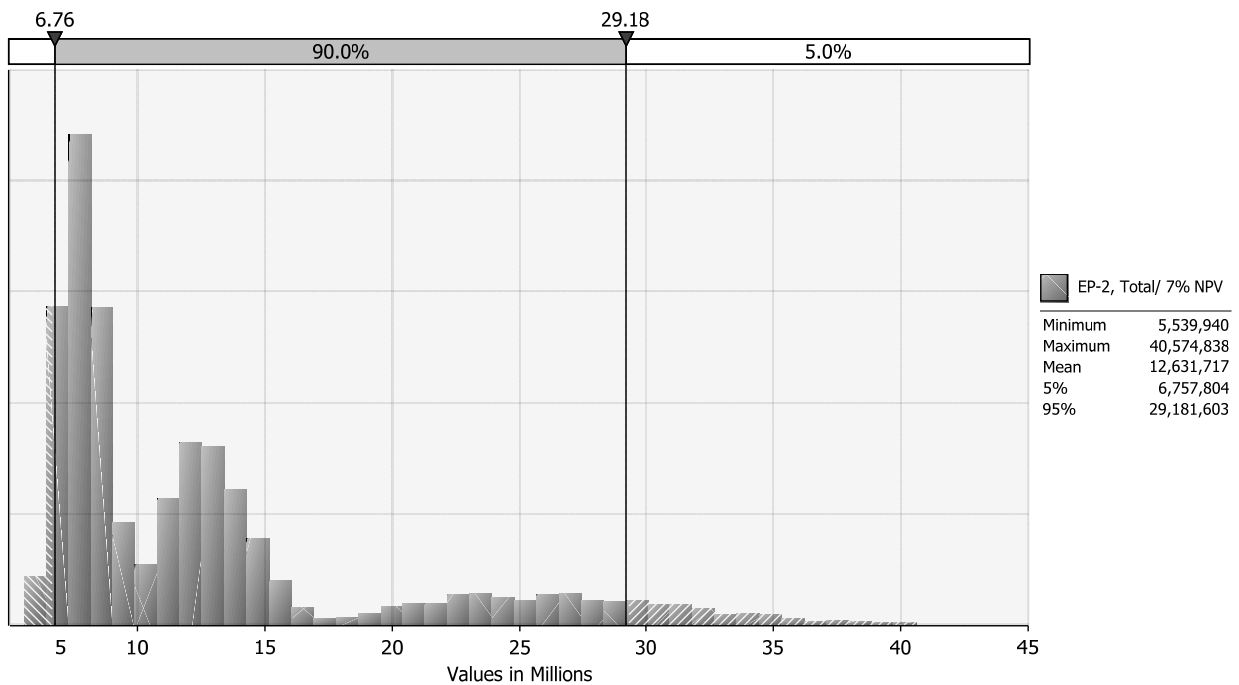


Figure 3 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the Emergency Preparedness cost drivers (Alternative EP-2)

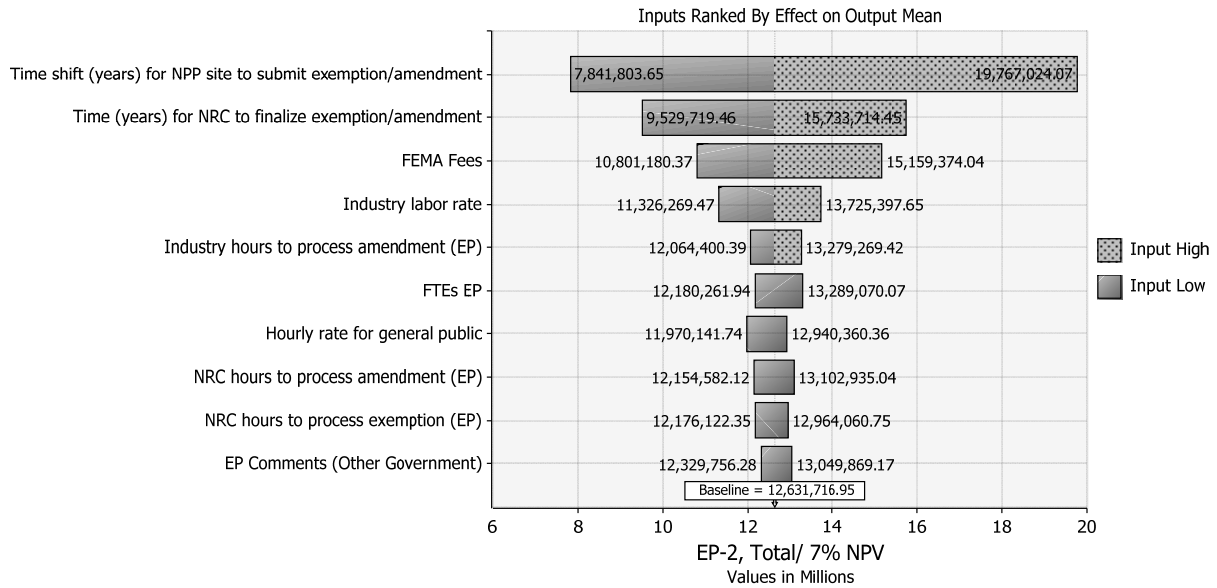


Figure 4 Tornado chart showing the variation of total cost due to each Emergency Preparedness cost driver (Alternative EP-2)

The regulatory changes to the Emergency Preparedness area of decommissioning for EP-2 would result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$5.5 million to \$40.6 million (7 percent NPV). The cost drivers that have the greatest influence are the time at which the licensee submits an exemption or amendment to the NRC for processing (i.e., 1 year before, during, or 1 year after decommissioning) and the time it takes the NRC to finalize the exemption or amendment. Note that the time at which an exemption from offsite emergency preparedness is submitted to the NRC may or may not lead to averted FEMA fees after Level 2. This depends on whether or not the exemption is submitted at or before the starting time of decommissioning. Nevertheless, this possible averted cost is represented by the uncertainty analysis.

## 6.10.2 Physical Security

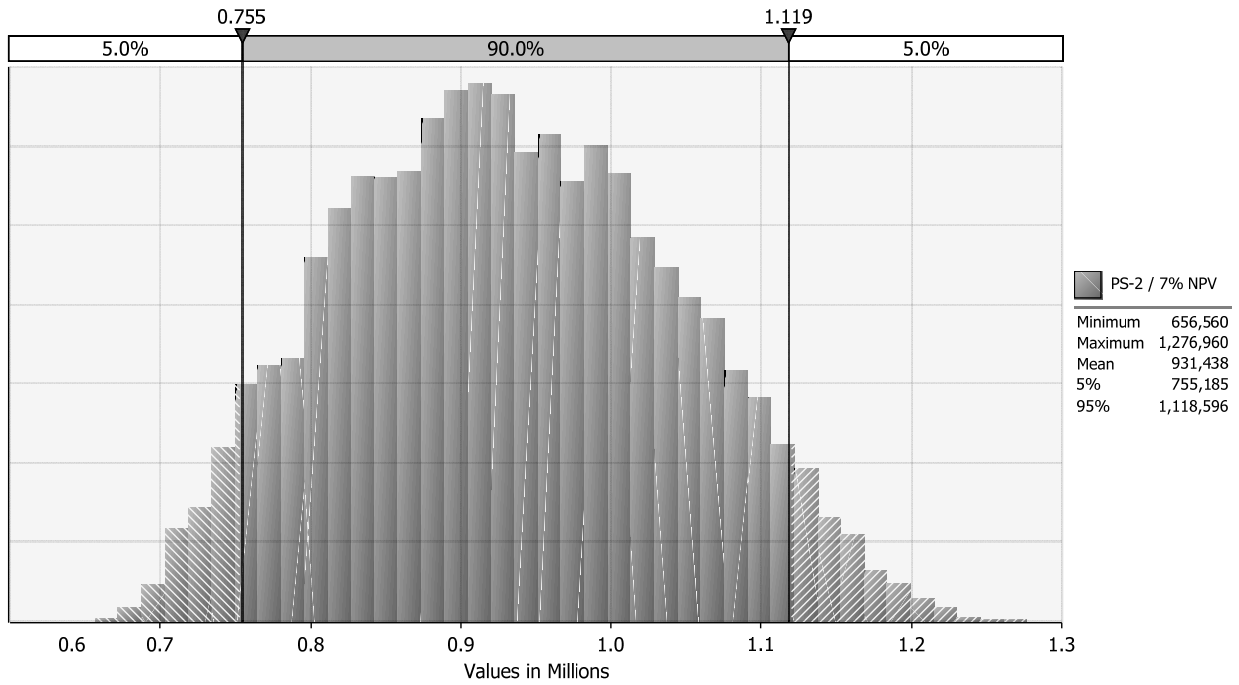


Figure 5 Variation of industry cost due to the uncertainty in the Physical Security cost drivers (Alternative PS-2)

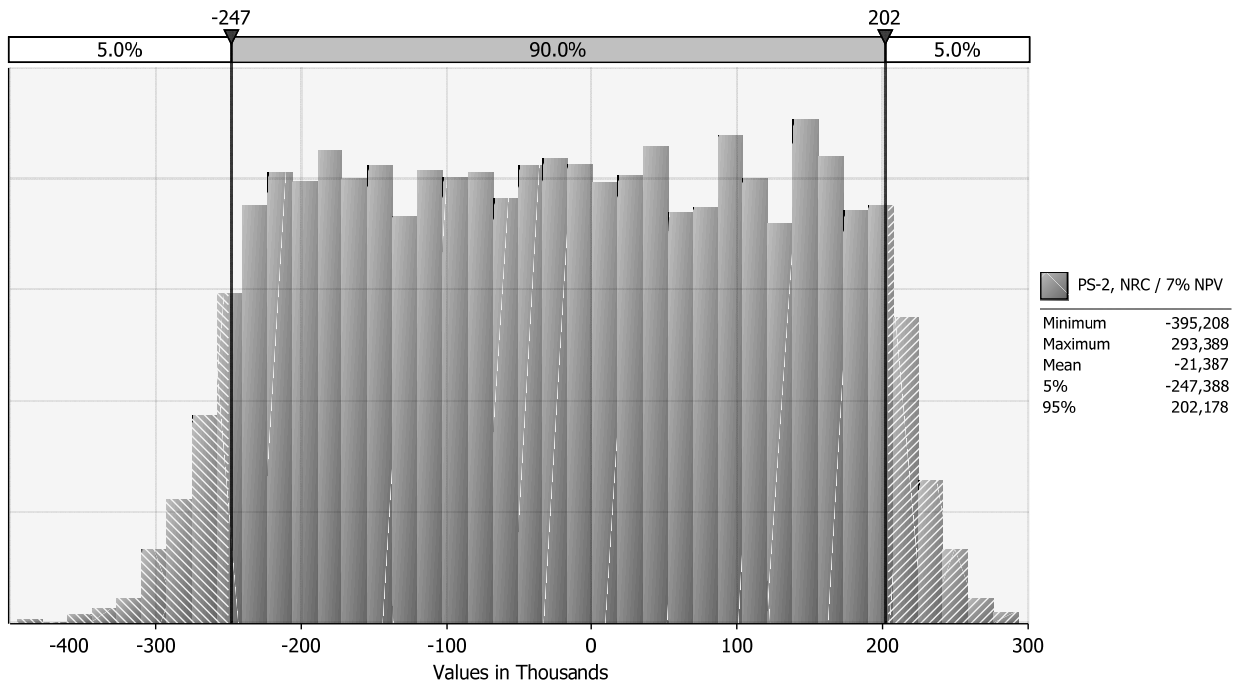


Figure 6 Variation of NRC cost due to the uncertainty in the Physical Security cost drivers (Alternative PS-2)

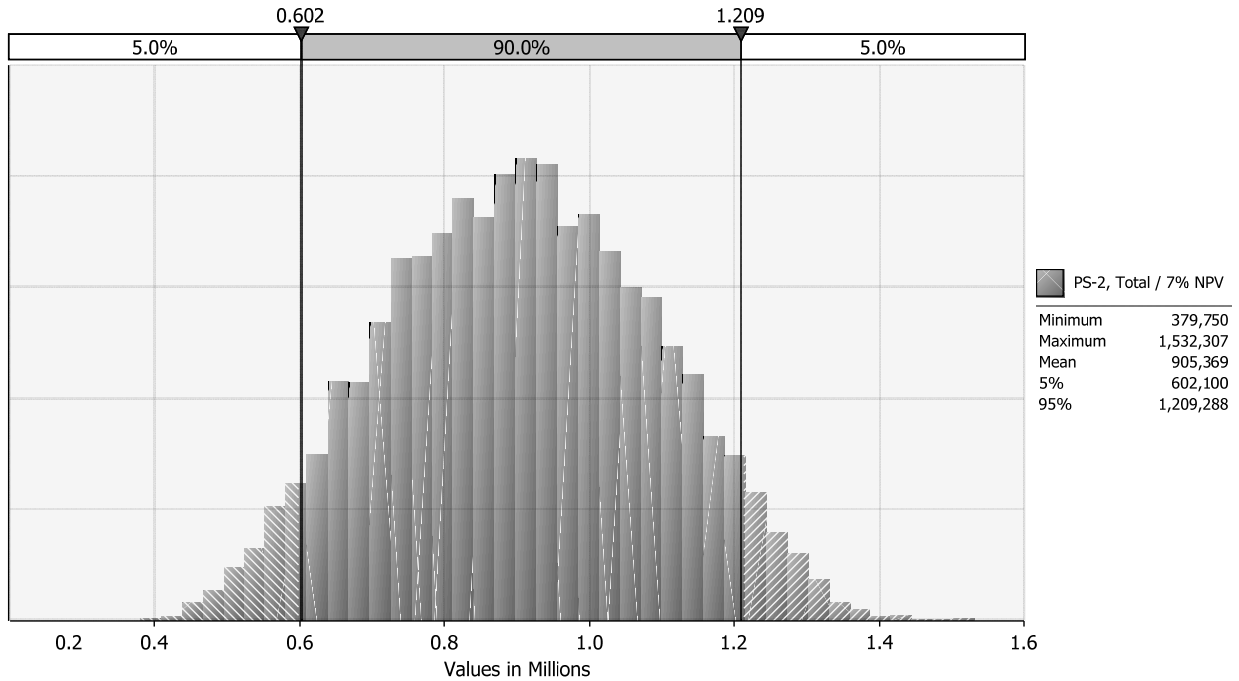


Figure 7 Variation of total cost industry, NRC, State and local governments and general public) due to the uncertainty in the Physical Security cost drivers (Alternative PS-2)

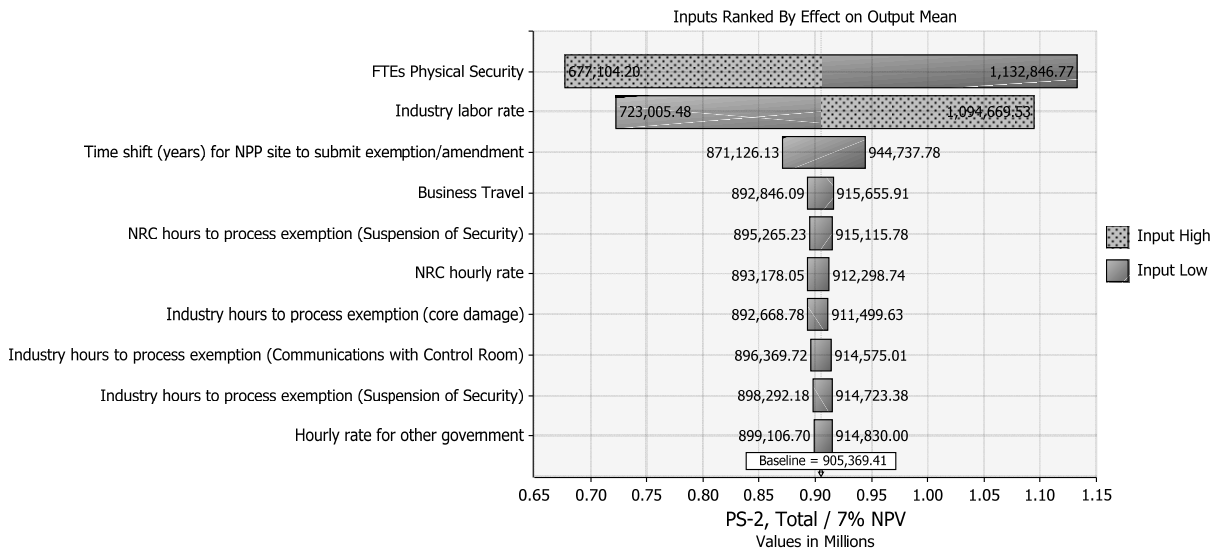


Figure 8 Tornado chart showing the variation of total cost due to each Physical Security cost driver (Alternative PS-2)

The regulatory changes to the Physical Security area of decommissioning will result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$380,000 to \$1.5 million (7 percent NPV). The cost drivers that have the greatest influence are the number of NRC full-time equivalents (FTEs) to implement rulemaking for this area of decommissioning and the nuclear power industry labor rate for hours averted to process exemptions and amendments.



### 6.10.3 Cyber Security

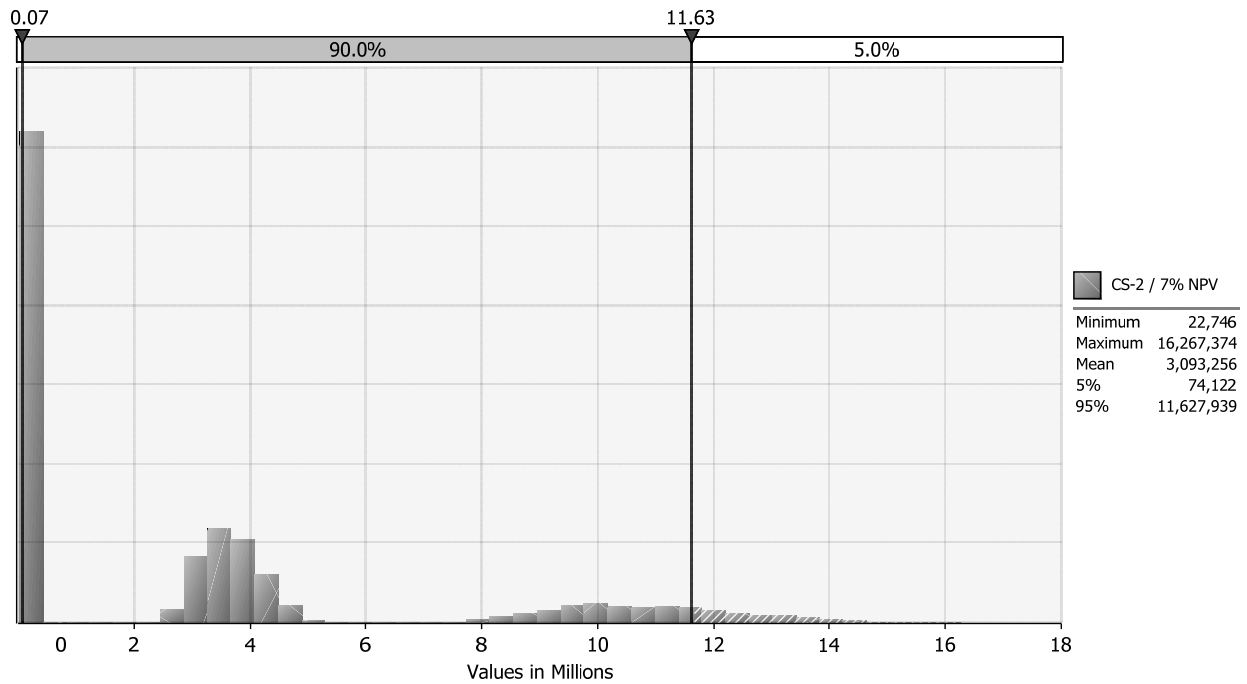


Figure 9 Variation of industry cost due to the uncertainty in the cyber security cost drivers (Alternative CS-2)

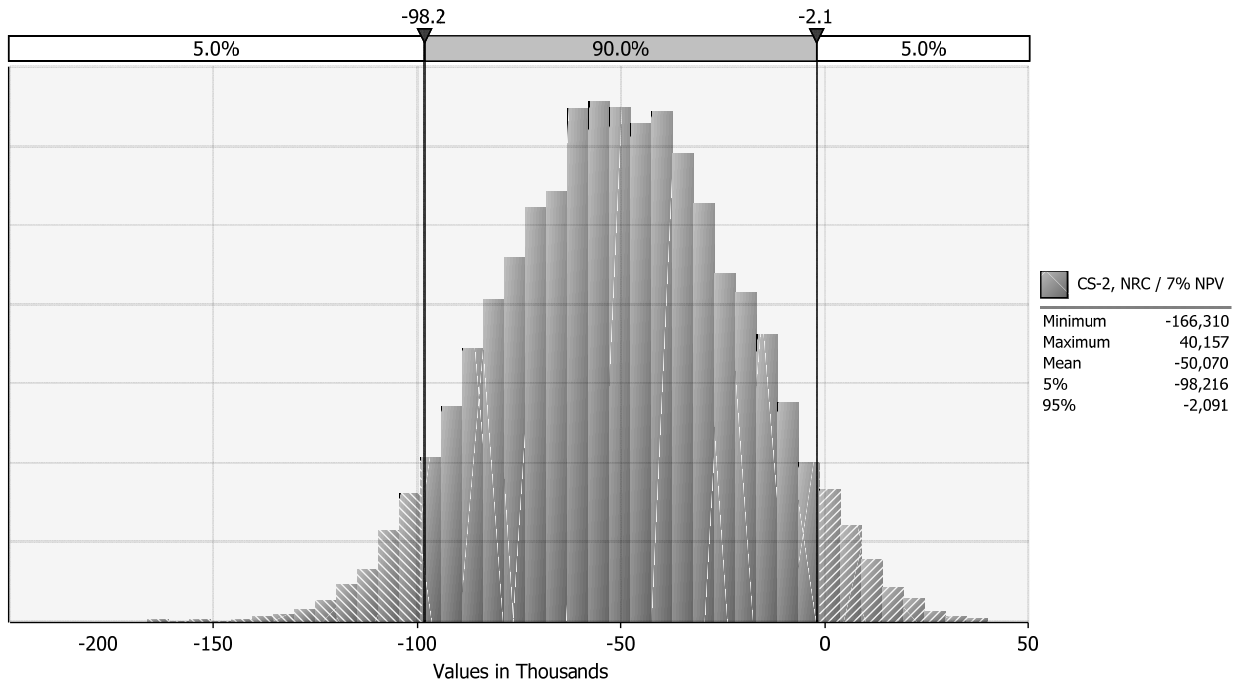


Figure 10 Variation of NRC cost due to the uncertainty in the cyber security cost drivers (Alternative CS-2)

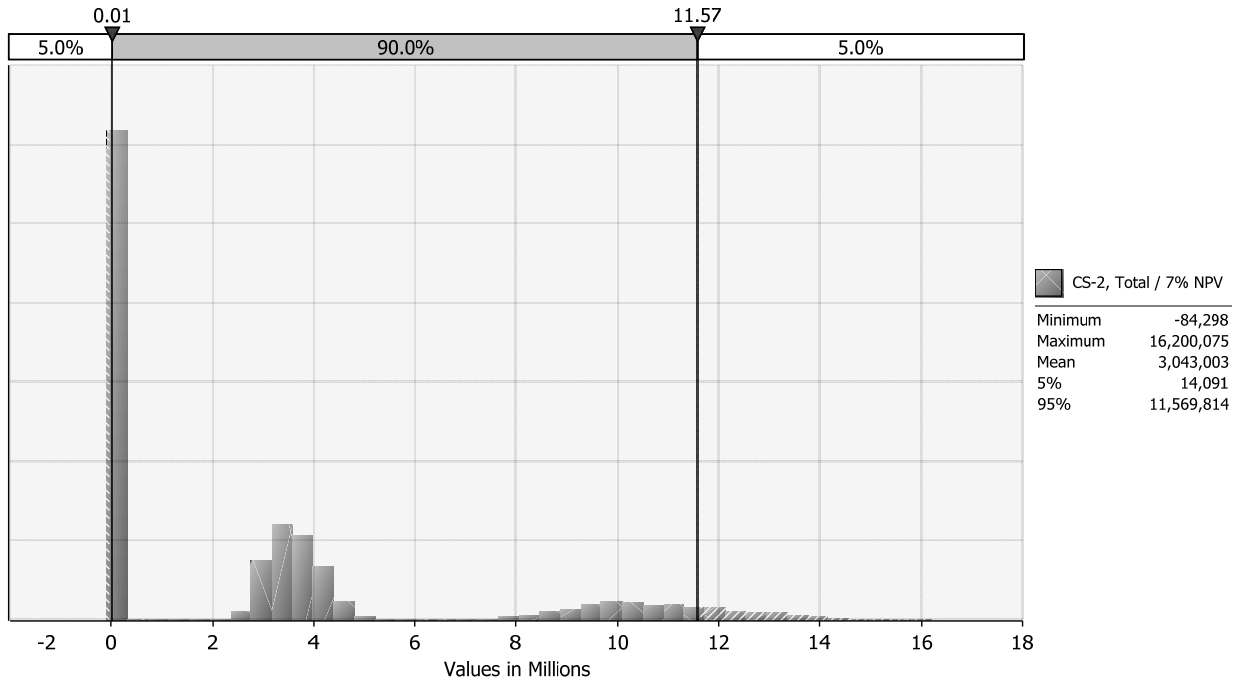


Figure 11 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the cyber security cost drivers (Alternative CS-2)

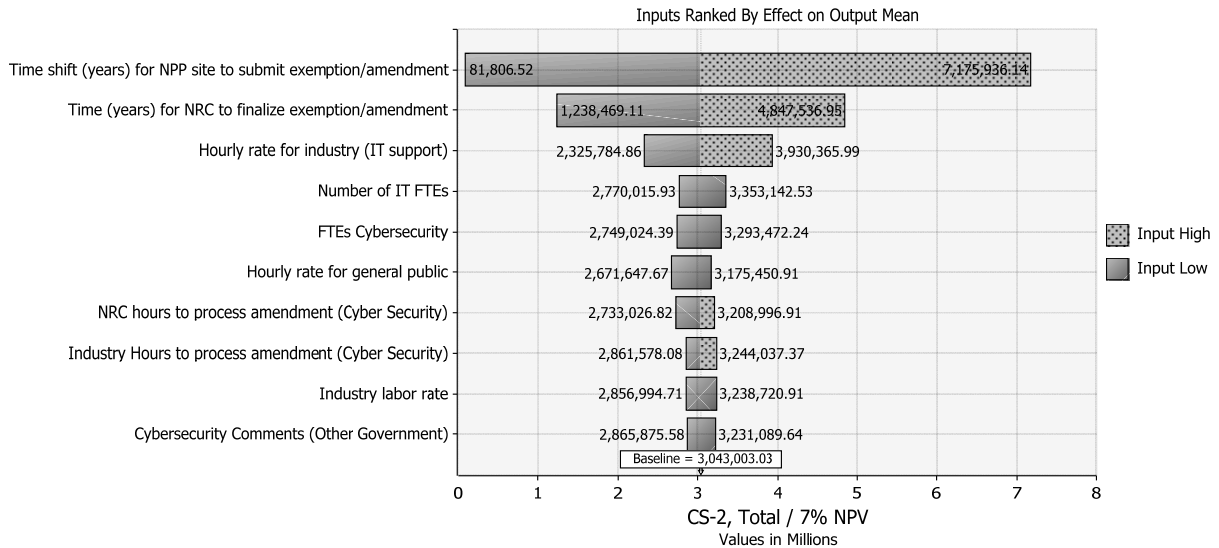


Figure 12 Tornado chart showing the variation of total cost due to each cyber security cost driver (Alternative CS-2)

The recommended regulatory changes to the cyber security area of decommissioning (Alternative CS-2) will result in additional or averted costs to industry, NRC, State and local governments and general public over the decommissioning period in the range of (\$84,000) to 16.2 million at 7 percent NPV. The cost drivers that have the greatest influence are the time at which the licensee submits an exemption or amendment to the NRC for processing (i.e., 1 year before, during, or 1 year after decommissioning) and the time it takes the NRC to finalize the exemption or amendment.

### 6.10.4 Drug and Alcohol Testing

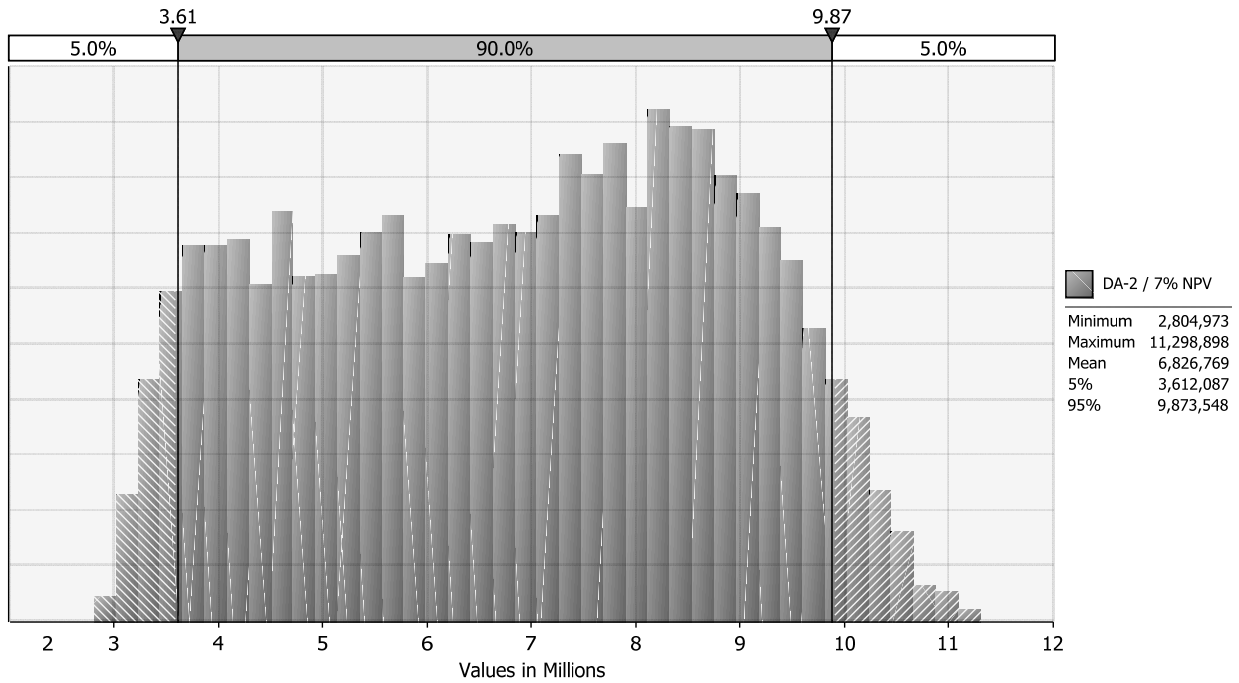


Figure 13 Variation of industry cost due to the uncertainty in the Drug and Alcohol Testing cost drivers (Alternative DA-2)

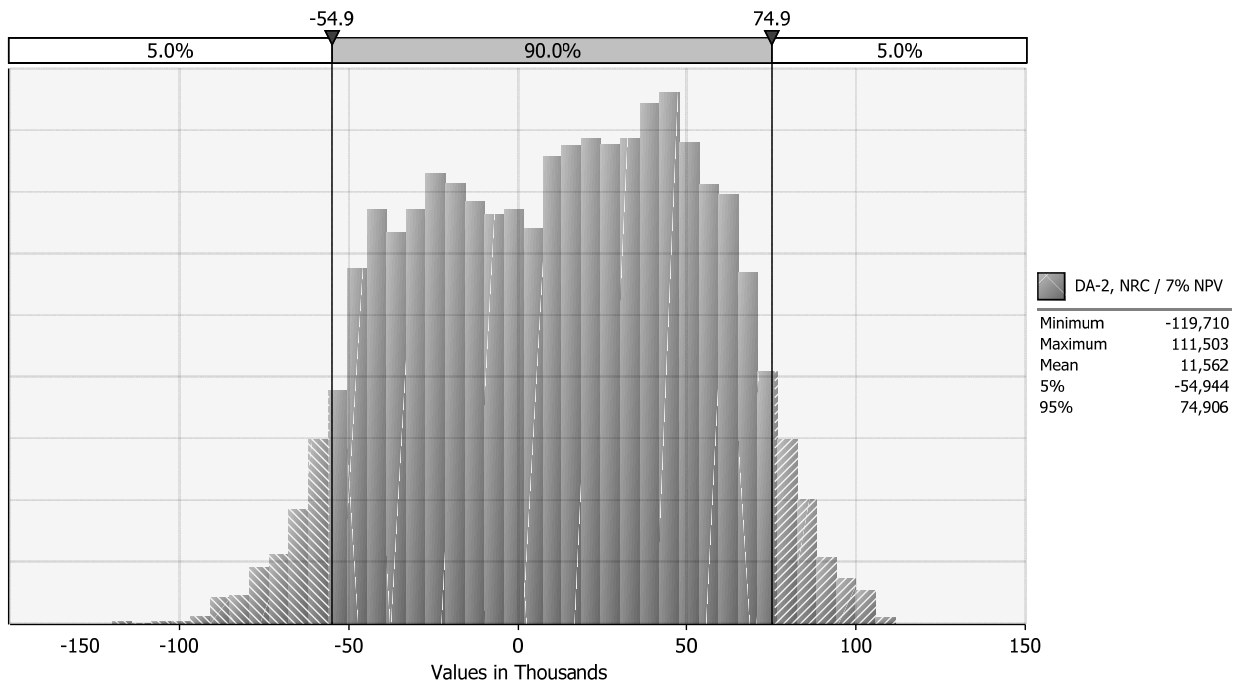


Figure 14 Variation of NRC cost due to the uncertainty in the Drug and Alcohol Testing cost drivers (Alternative DA-2)

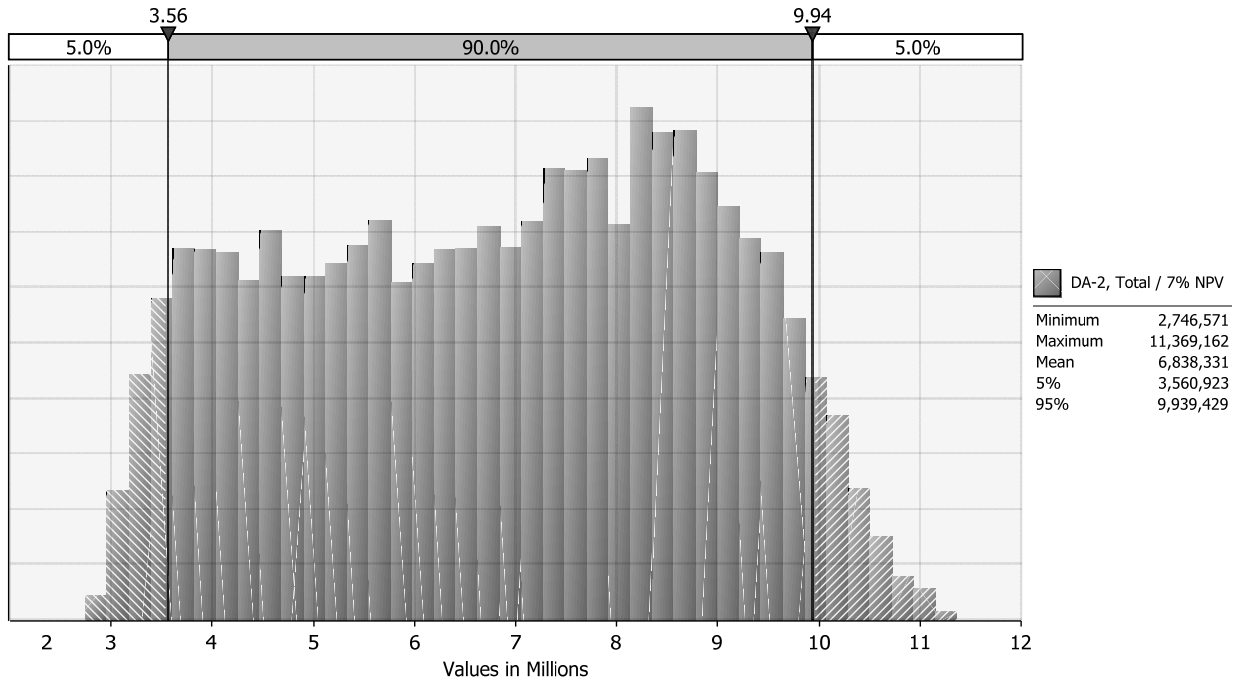


Figure 15 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the Drug and Alcohol Testing cost drivers (Alternative DA-2)

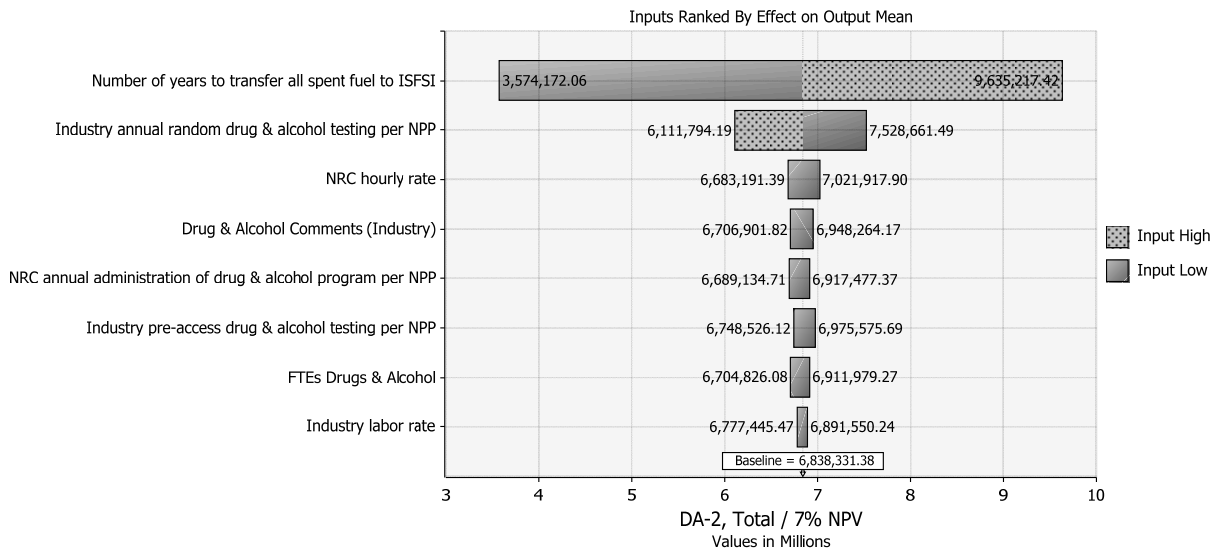


Figure 16 Tornado chart showing the variation of total cost due to each Drug and Alcohol Testing cost driver (Alternative DA-2)

The regulatory changes to the FFD-Drug and Alcohol Testing area of decommissioning (Alternative DA-2) will result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$2.7 million to \$11.4 million using a 7 percent NPV. The cost drivers that have the greatest influence on total cost are the number of years to transfer all spent fuel to ISFSI and the random drug and alcohol testing.

### 6.10.5 Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor

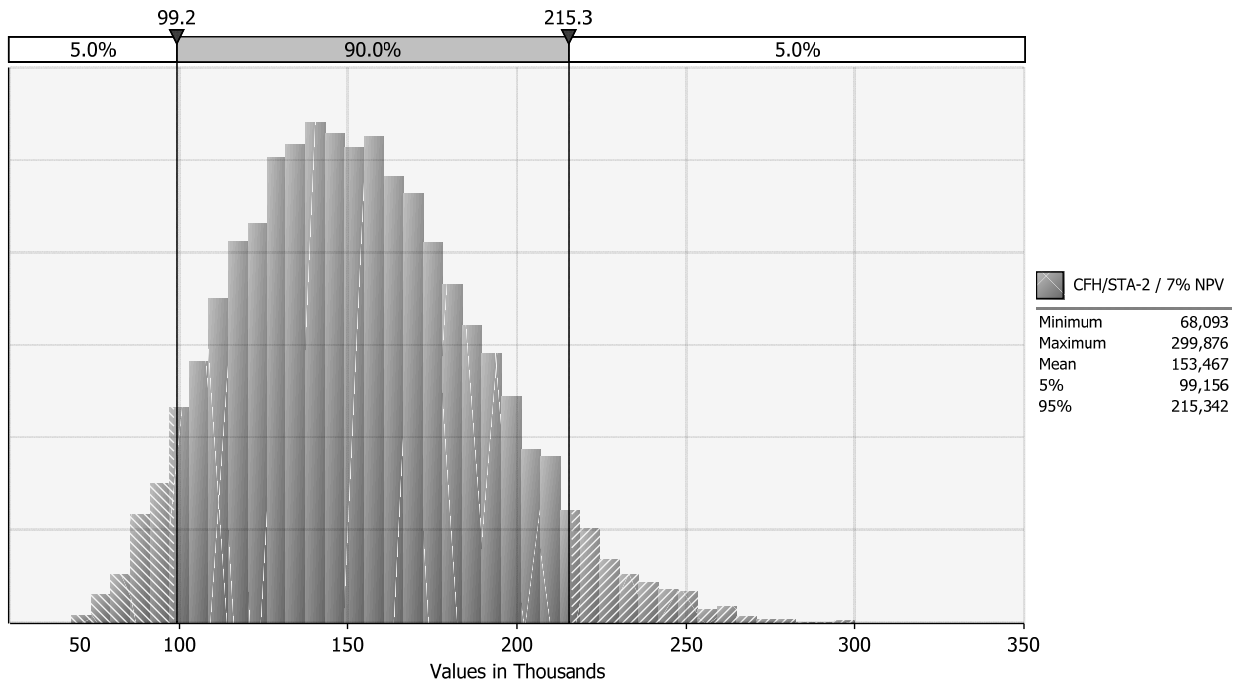


Figure 17 Variation of industry cost due to the uncertainty in the Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor cost drivers (Alternative CFH/STA-2)

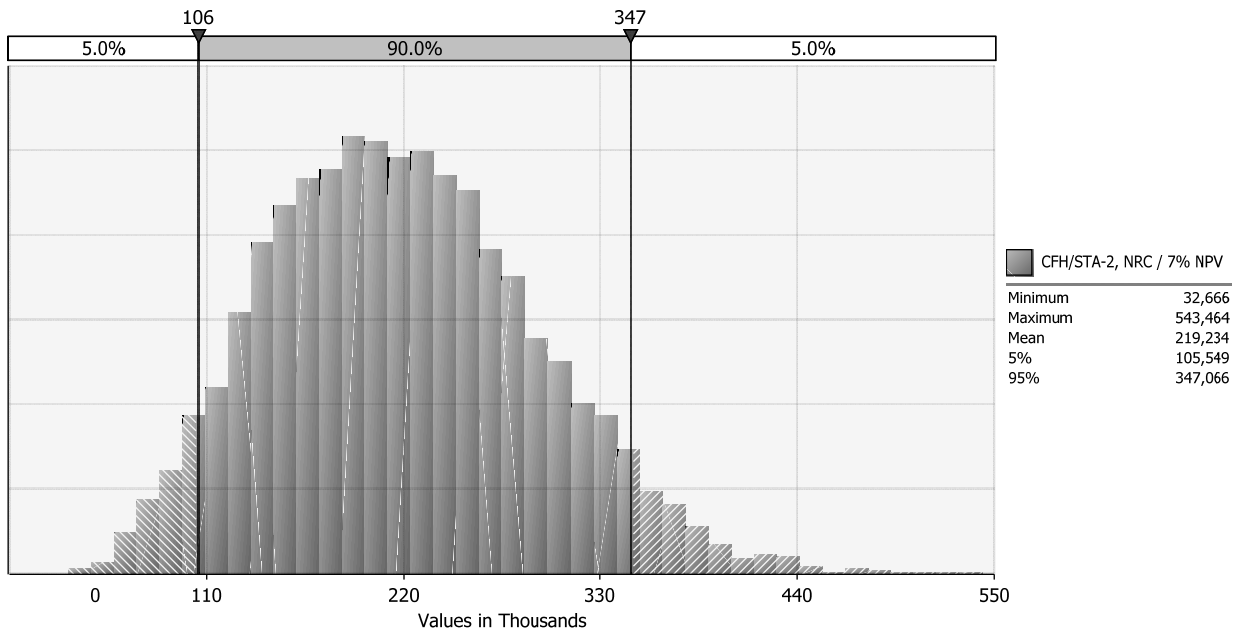


Figure 18 Variation of NRC cost due to the uncertainty in the Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor cost drivers (Alternative CFH/STA-2)

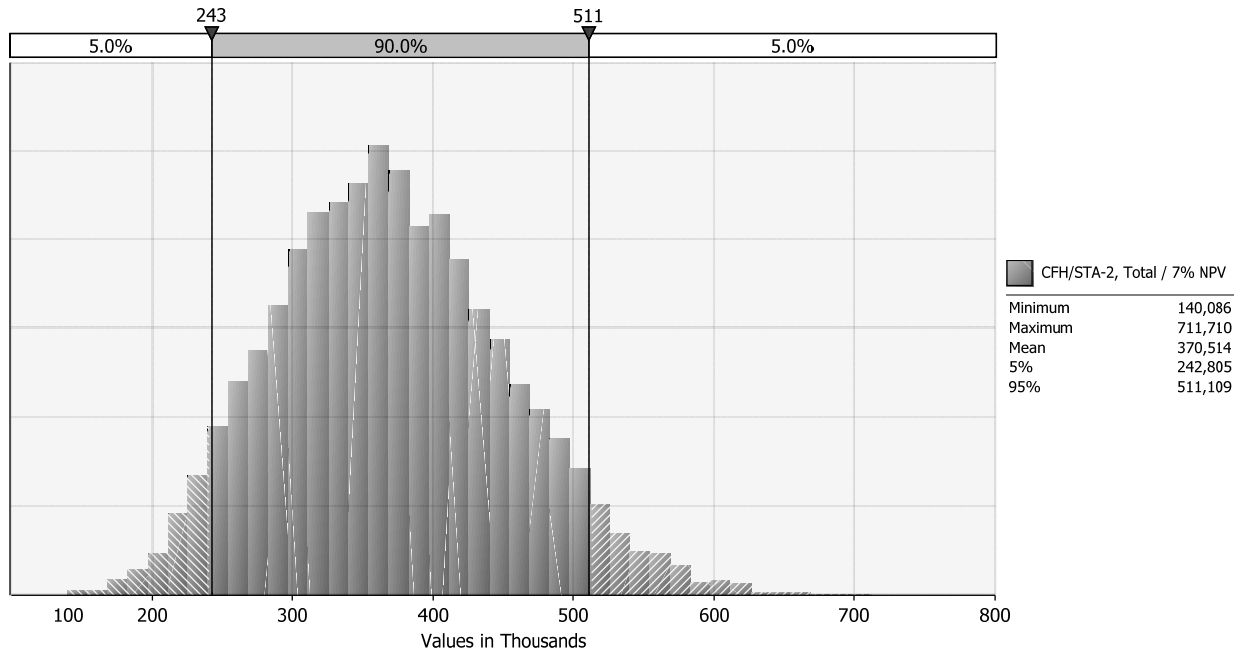


Figure 19 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor cost drivers (Alternative CFH/STA-2)

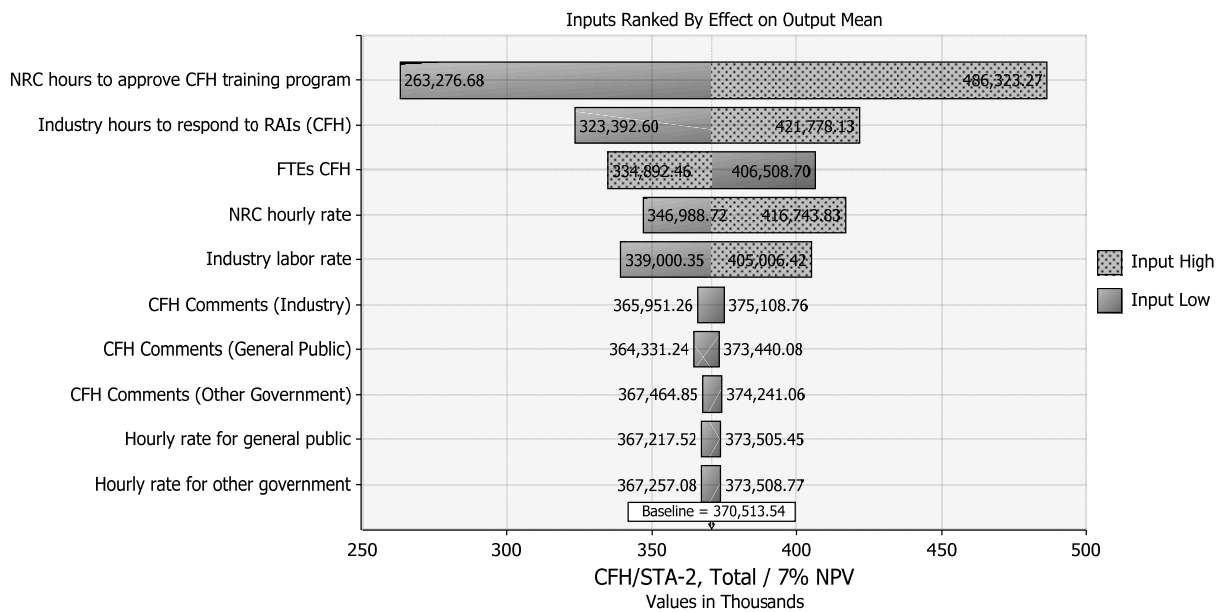


Figure 20 Tornado chart showing the variation of total cost due to each Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor cost driver (Alternative CFH/STA-2)

The regulatory changes to the training requirements for the Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor area of decommissioning (Alternative CFH/STA-2) will result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$140,000 to \$712,000 using a 7 percent NPV.

The cost driver that has the greatest influence on total cost for this area of decommissioning is the number of hours for NRC to approve a CFH training program.

### 6.10.6 Decommissioning Funding Assurance

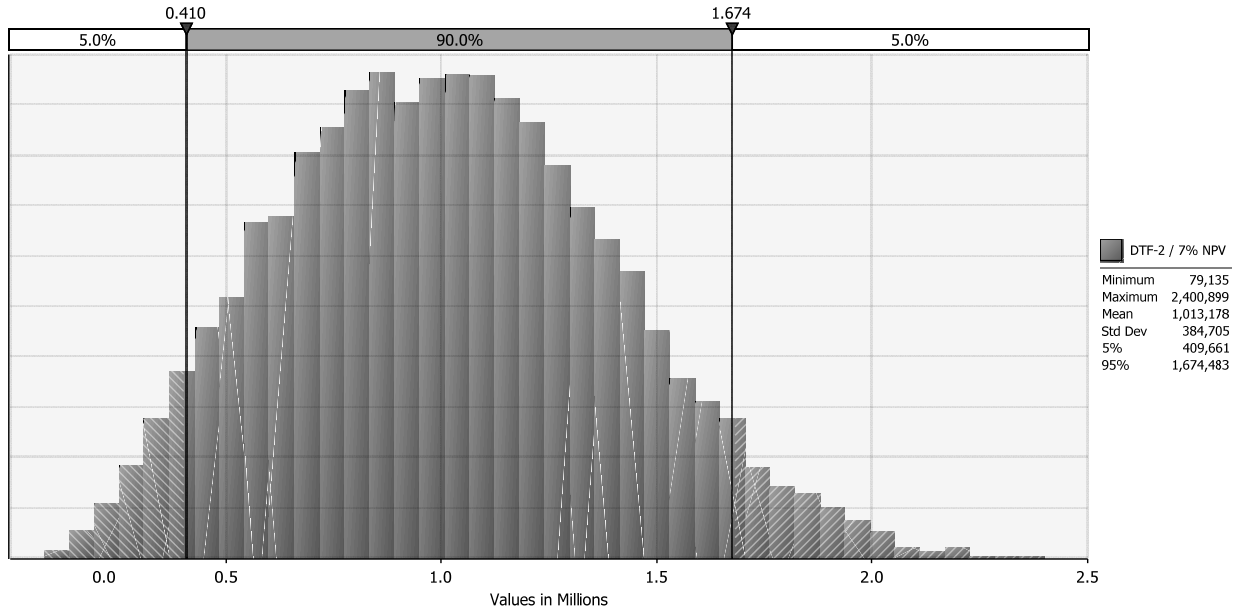


Figure 21 Variation of industry cost due to the uncertainty in the Decommissioning Funding Assurance cost drivers (Alternative DTF-2)

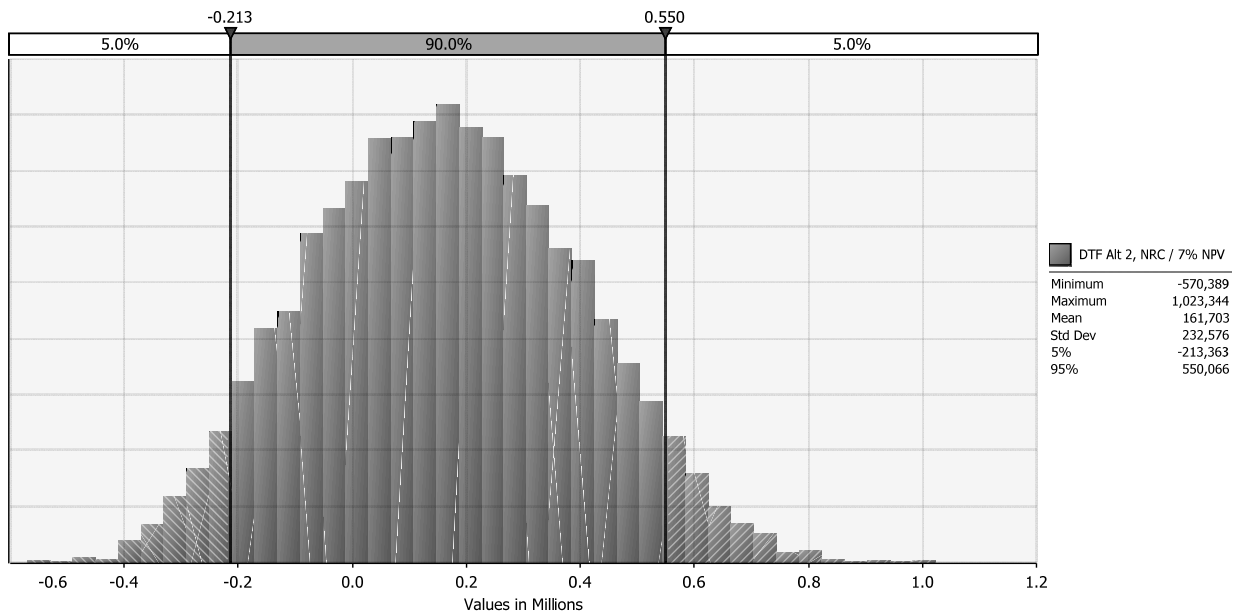


Figure 22 Variation of NRC cost due to the uncertainty in the Decommissioning Funding Assurance cost drivers (Alternative DTF-2)

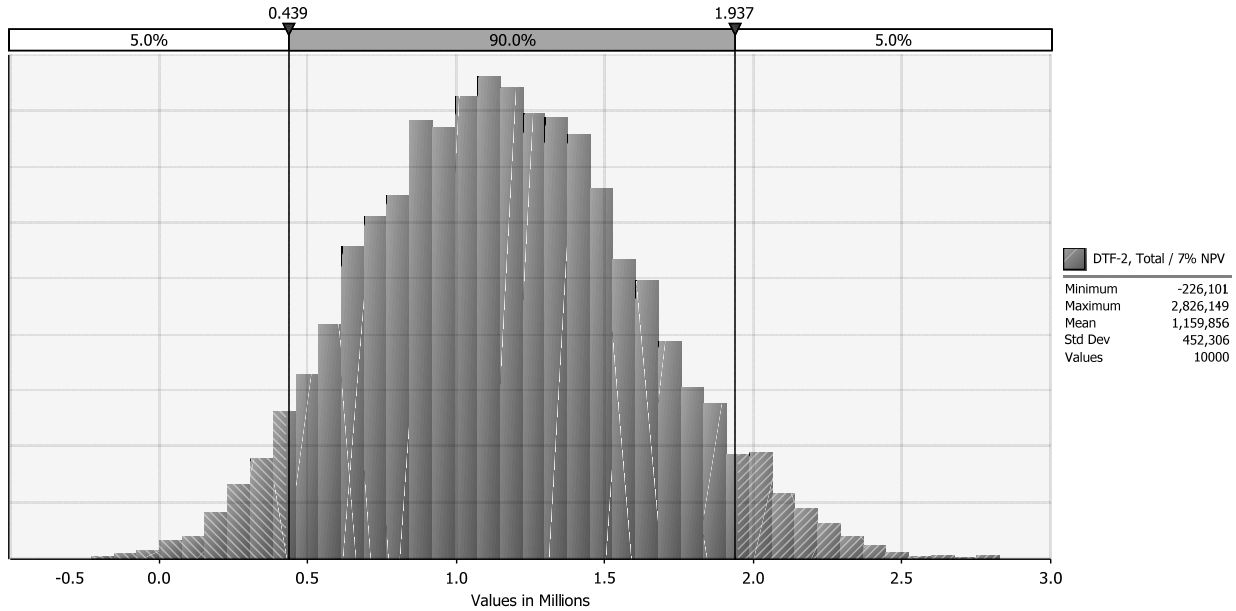


Figure 23 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the Decommissioning Funding Assurance cost drivers (Alternative DTF-2)

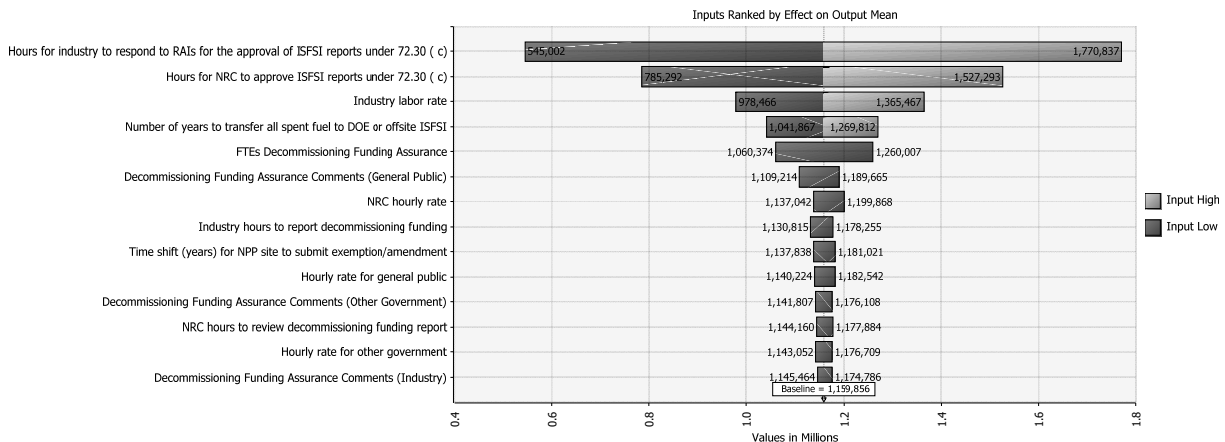


Figure 24 Tornado chart showing the variation of total cost due to each Decommissioning Funding Assurance cost driver (Alternative DTF-2)

The regulatory changes to this area of decommissioning (Alternative DTF-2) will result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$439,000 to \$1.94 million using a 7 percent NPV at a 90 percent confidence interval. The cost drivers that have the greatest influence on total cost are the number of hours the industry and the NRC would take to go through the approval process for ISFSI reports under 72.30 (c).



## 6.10.7 Offsite and Onsite Financial Protection Requirements and Indemnity Agreements

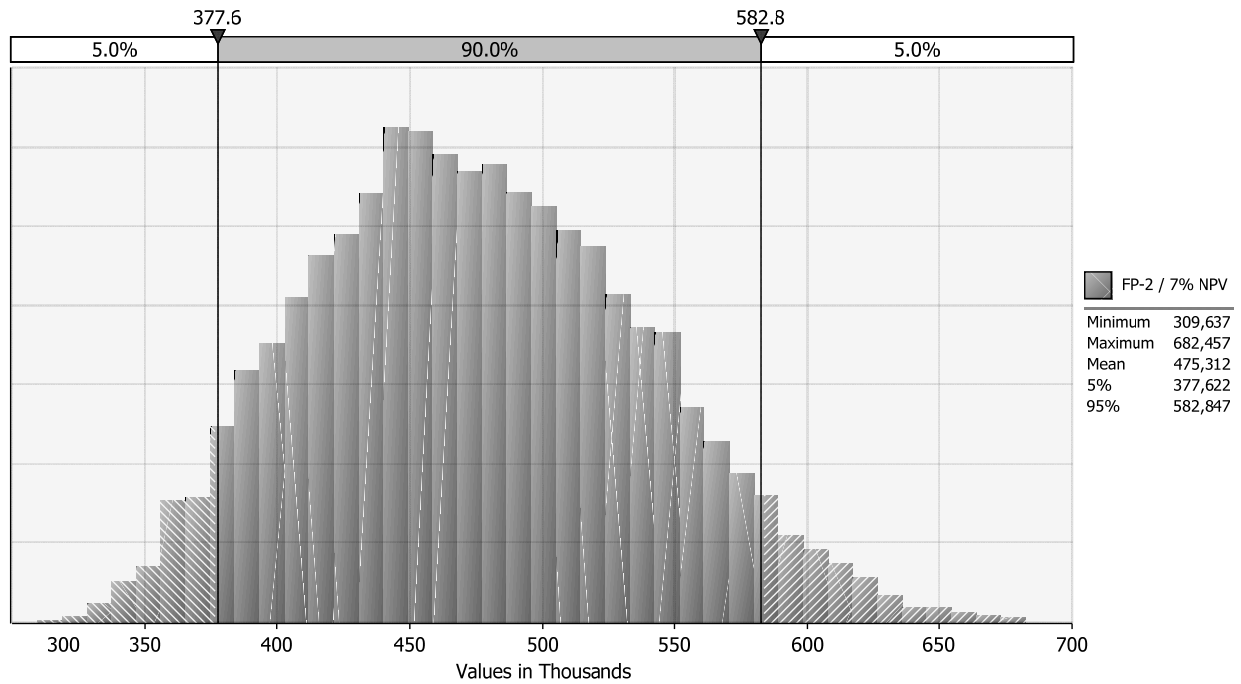


Figure 25 Variation of industry cost due to the uncertainty in the Financial Protection cost drivers (Alternative FP-2)

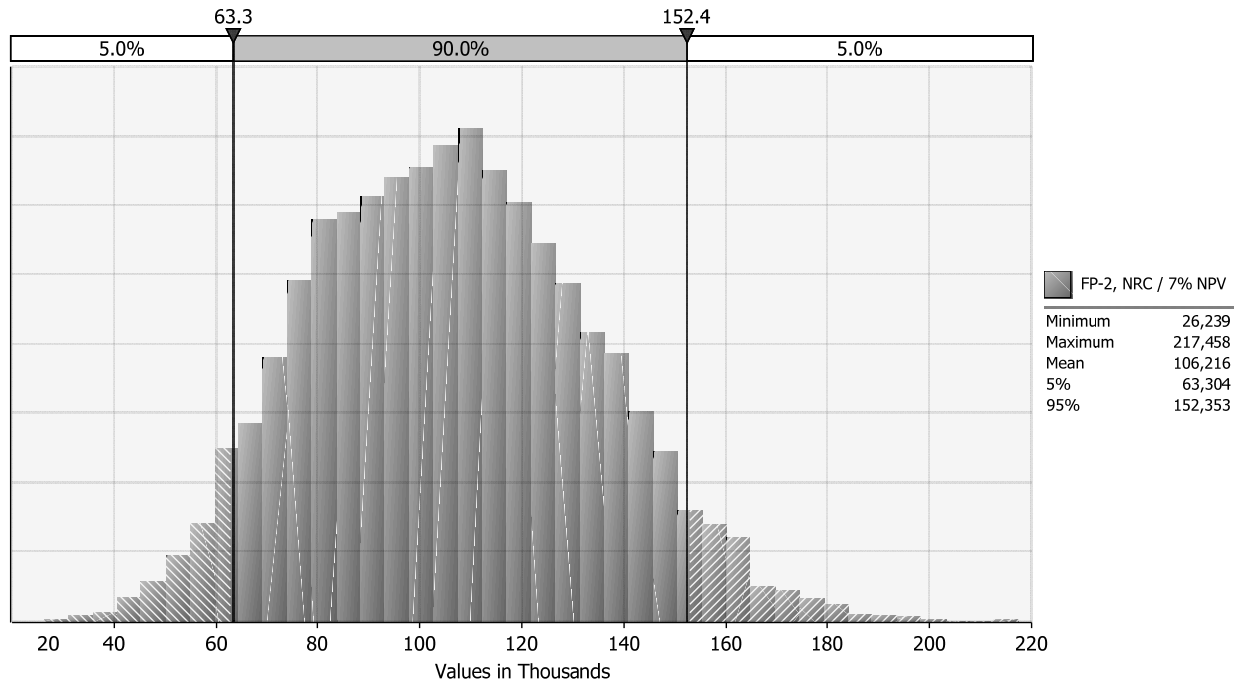


Figure 26 Variation of NRC cost due to the uncertainty in the Financial Protection cost drivers (Alternative FP-2)

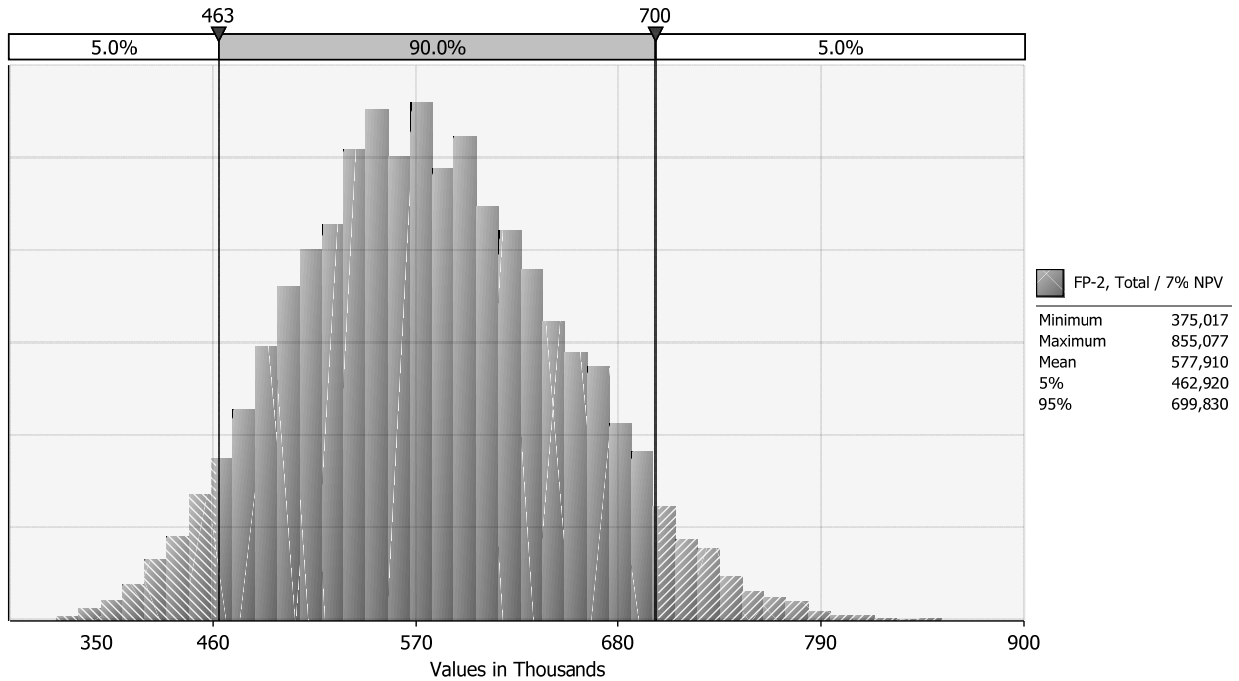


Figure 27 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the Financial Protection cost drivers (Alternative FP-2)

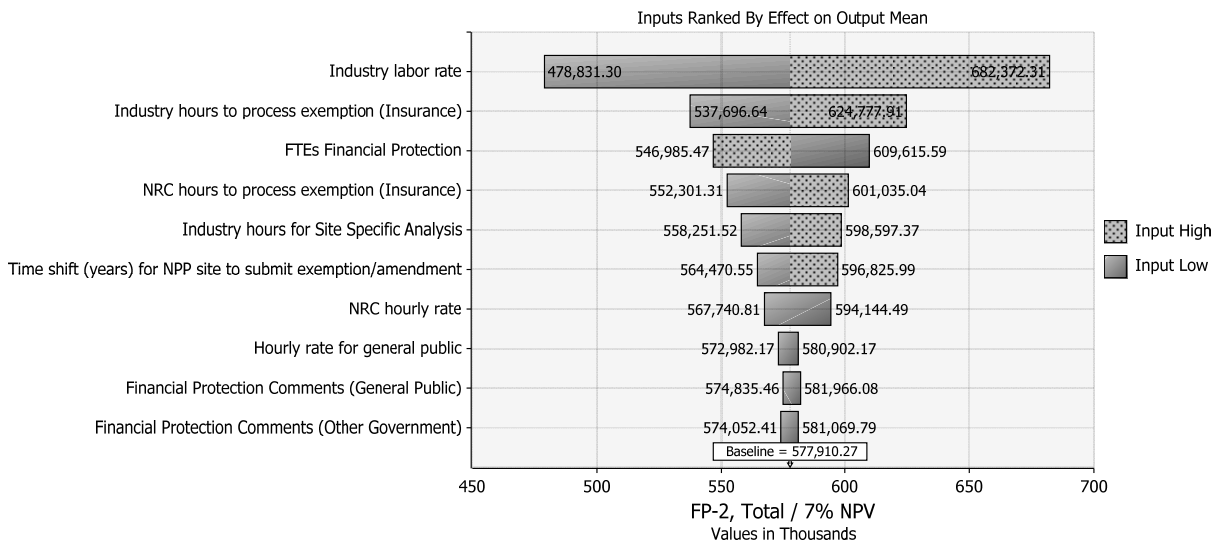


Figure 28 Tornado Chart showing the variation of total cost due to each Financial Protection cost driver (Alternative FP-2)

The regulatory changes to the Offsite and Onsite Financial Protection area of decommissioning (Alternative FP-2) will result in averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of \$375,000 to \$855,000 using a 7 percent NPV. The cost drivers that have the greatest influence on total cost are the nuclear power industry labor rate and the hours for a licensee to process an exemption for insurance.

### 6.10.8 Environmental Considerations

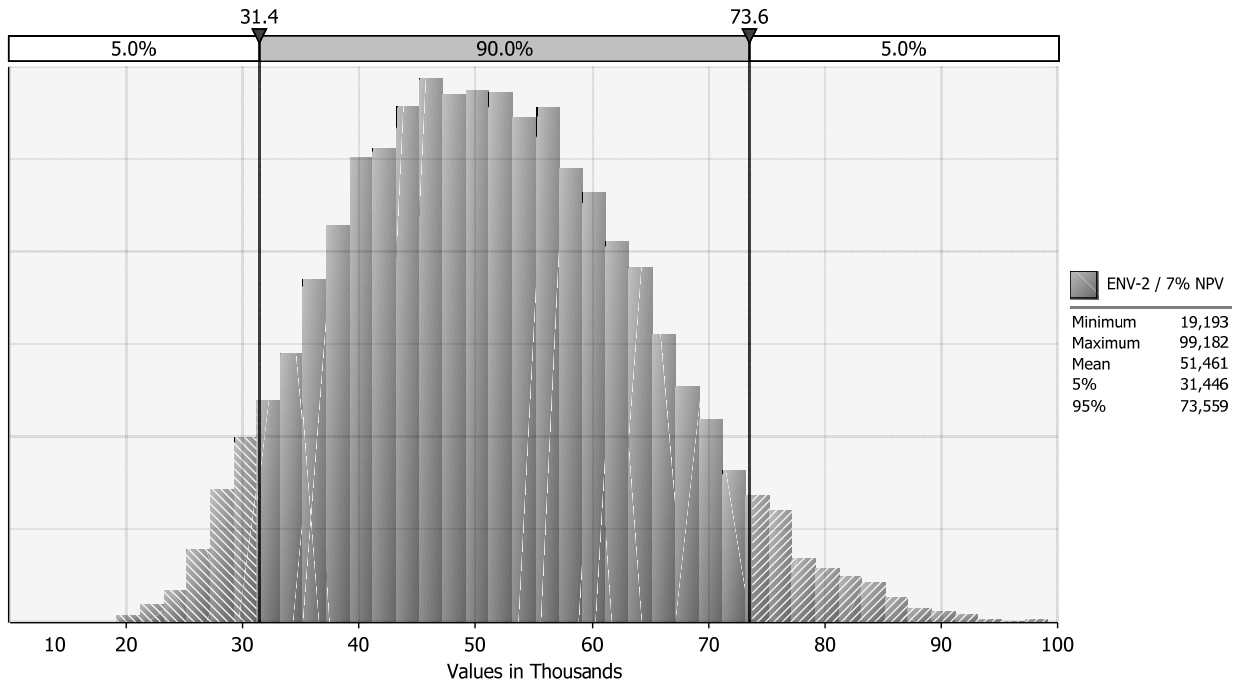


Figure 29 Variation of industry cost due to the uncertainty in the cost input variables (Alternative ENV-2)

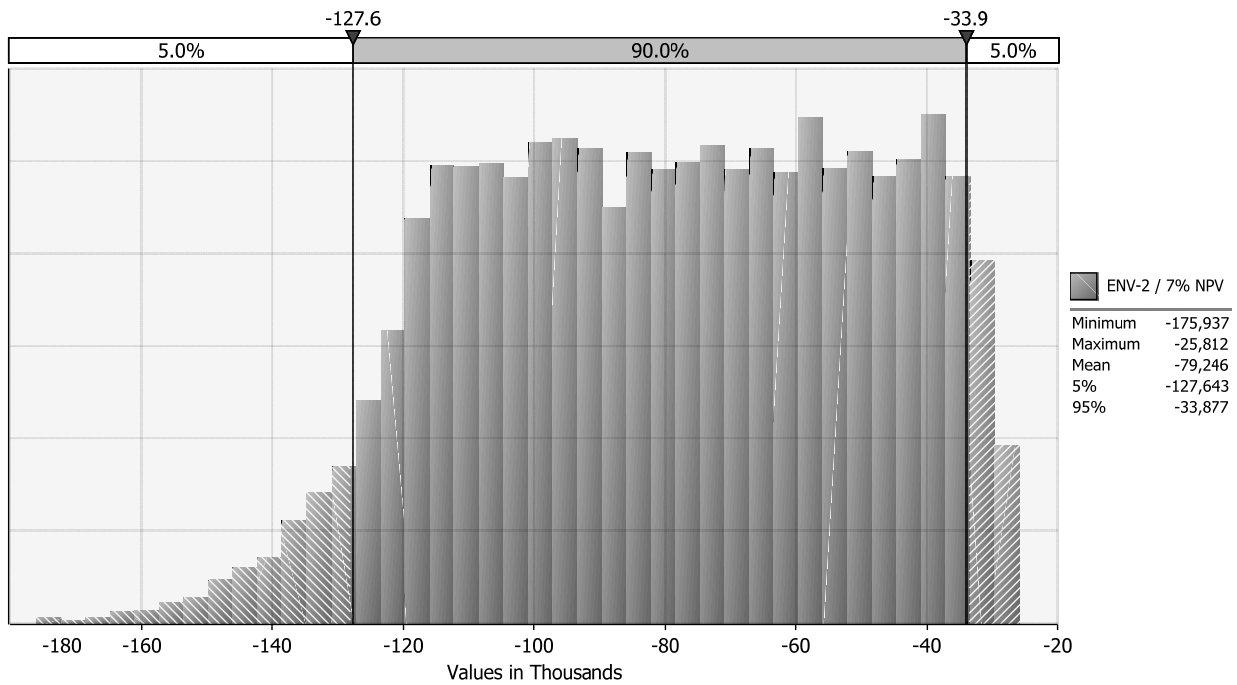


Figure 30 Variation of NRC cost due to the uncertainty in the cost input variables (Alternative ENV-2)

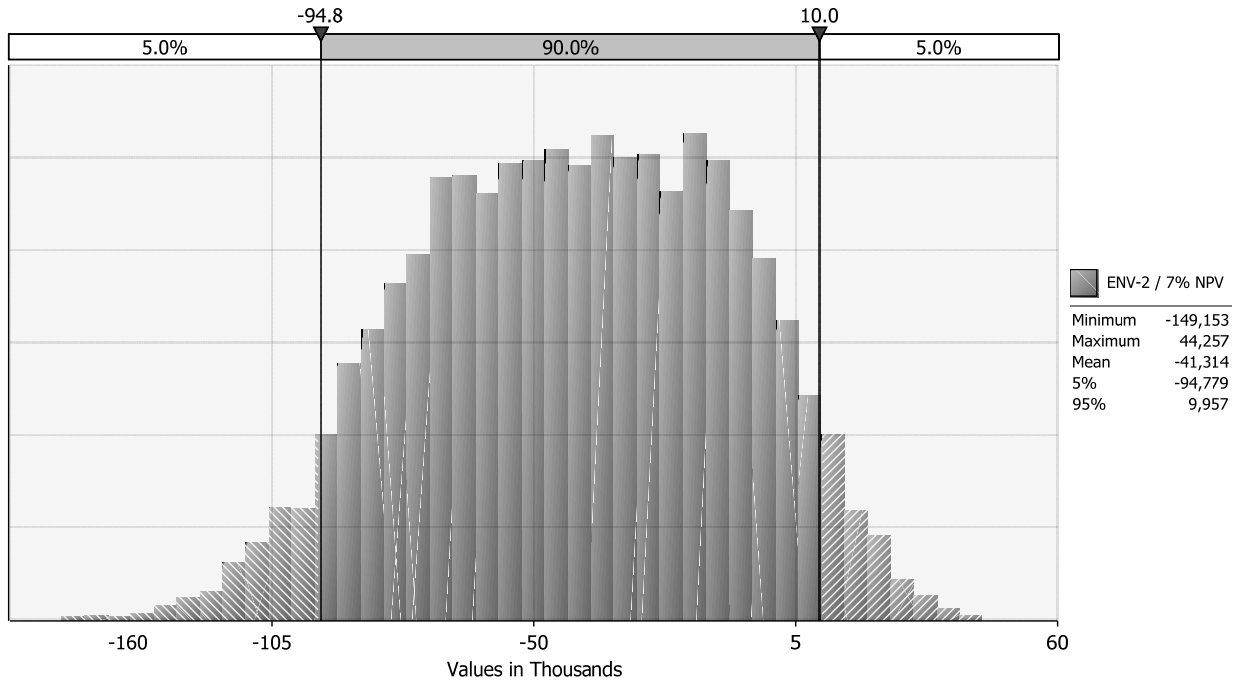


Figure 31 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the cost input variables (Alternative ENV-2)

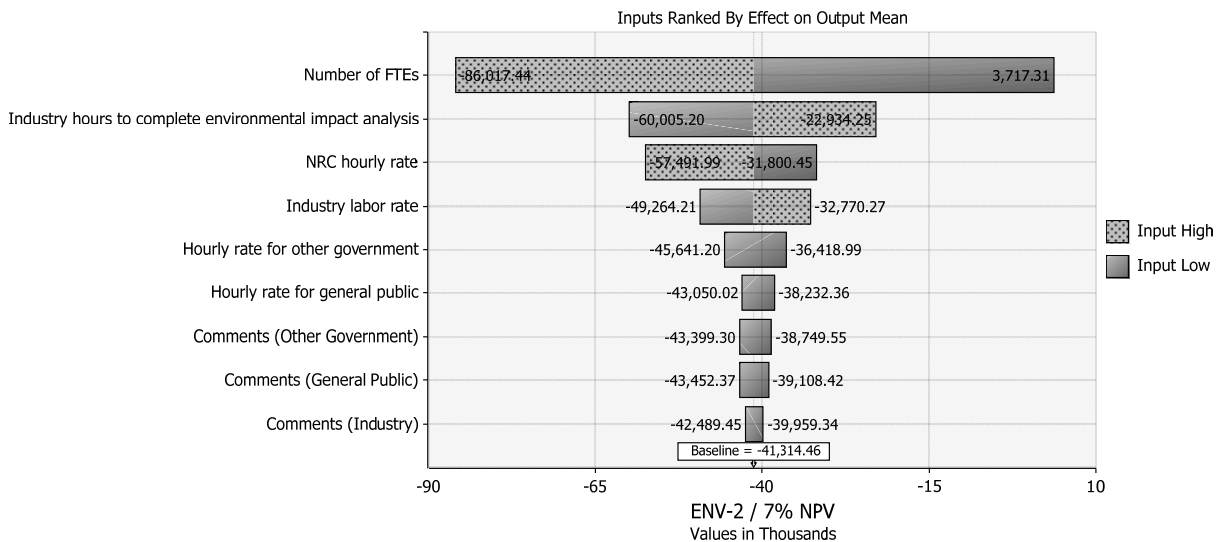


Figure 32 Tornado chart showing the variation of total cost due to each cost driver (Alternative ENV-2)

The regulatory changes to the Environmental Considerations area of decommissioning (Alternative ENV-2) will result in additional or averted costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of (\$149,000) to \$44,000 at 7 percent NPV. The cost driver that has the greatest influence on total cost for this alternative is the number of NRC FTEs to implement the rulemaking.

### 6.10.9 Record Retention Requirements

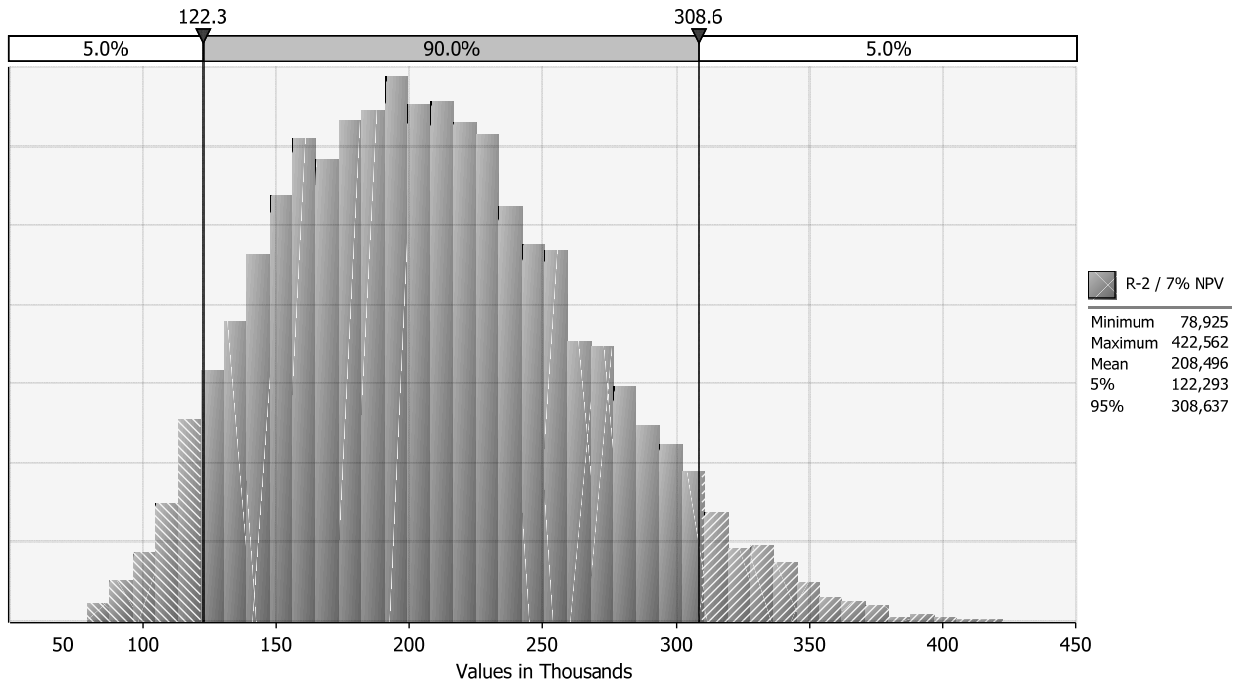


Figure 33 Variation of industry cost due to the uncertainty in the cost input variables (Alternative R-2)

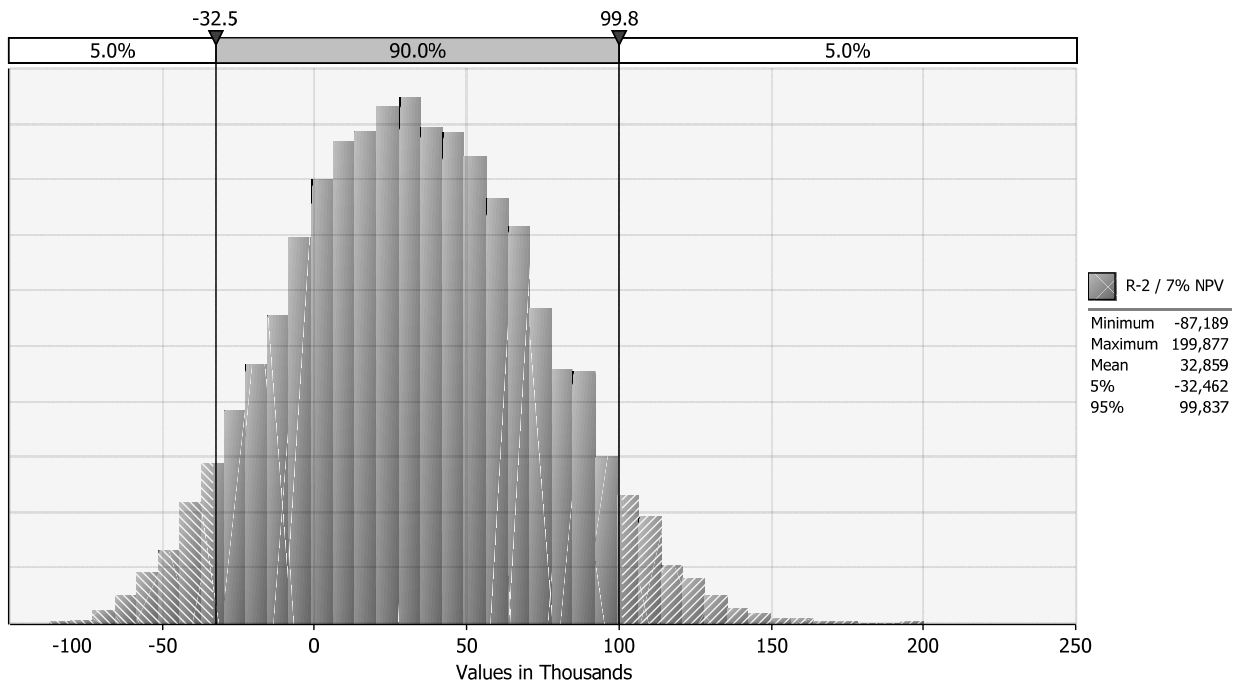


Figure 34 Variation of NRC cost due to the uncertainty in the cost input variables (Alternative R-2)

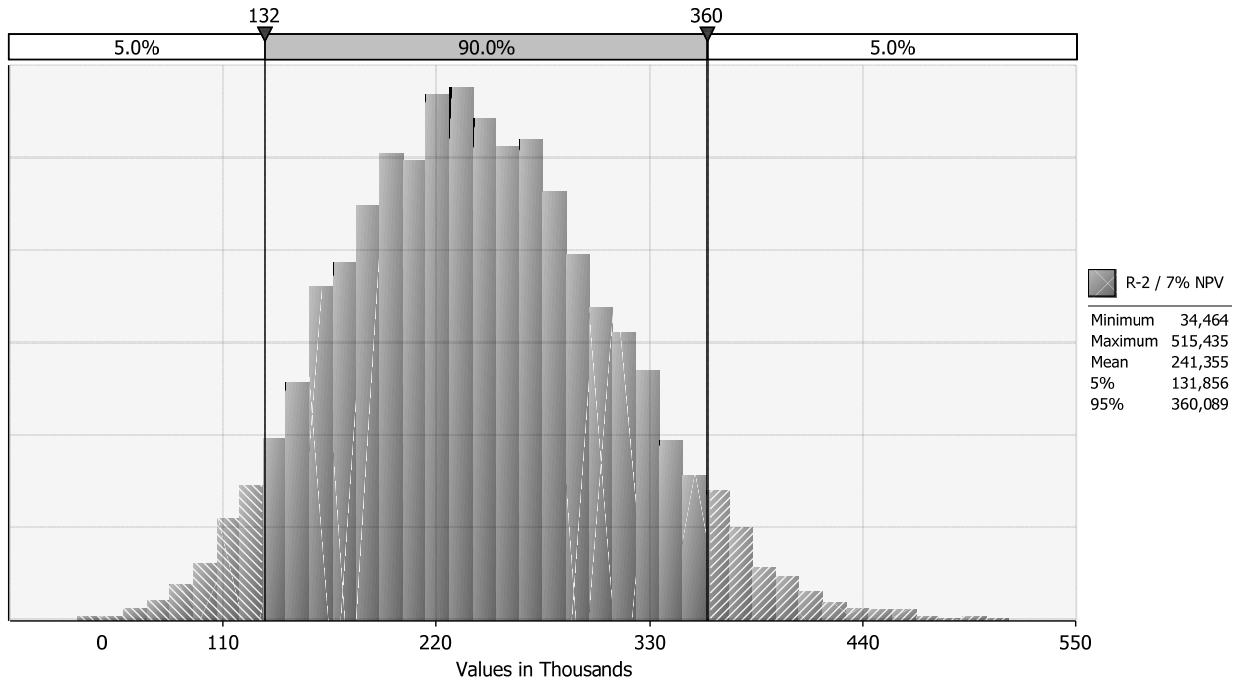


Figure 35 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the cost input variables (Alternative R-2)

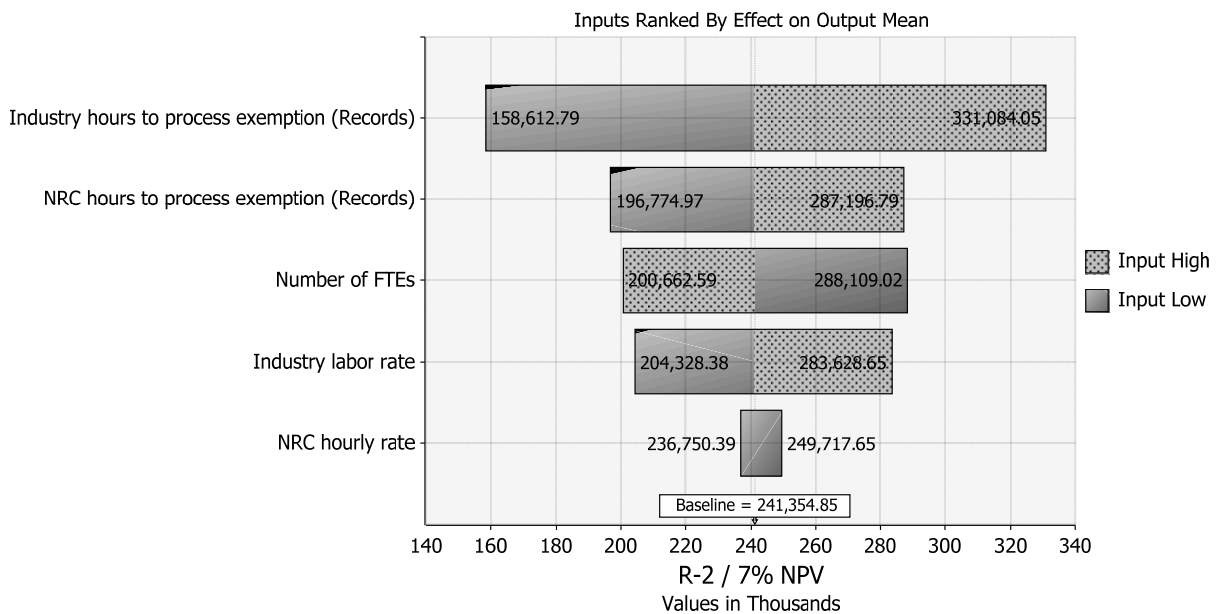


Figure 36 Tornado chart showing the variation of total cost due to each cost driver (Alternative R-2)

The regulatory changes to Alternative R-2 will result in cost savings to the industry and NRC over the decommissioning period in the range of \$34,000 to \$515,000 at 7 percent NPV. The cost drivers that have the greatest influence on total cost for this alternative are the number of industry and NRC hours to process exemptions from record keeping.

**6.10.10 Low-Level Waste Transportation**

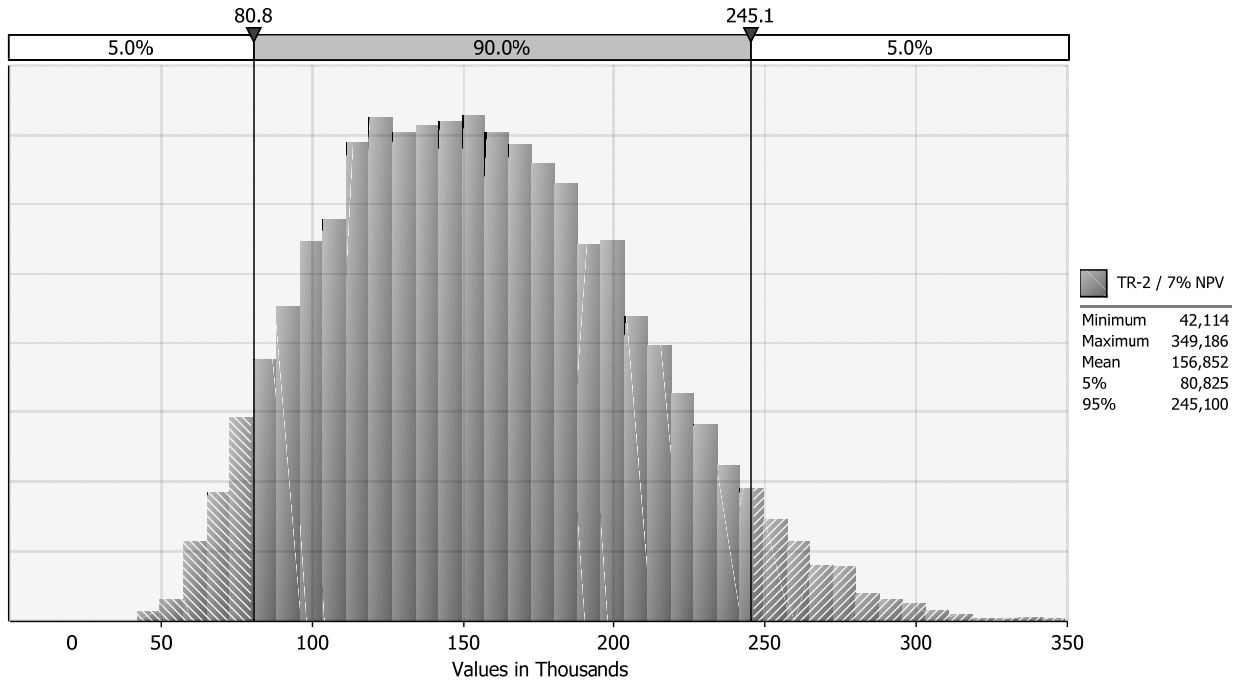


Figure 37 Variation of industry cost due to the uncertainty in the cost input variables (Alternative TR-2)

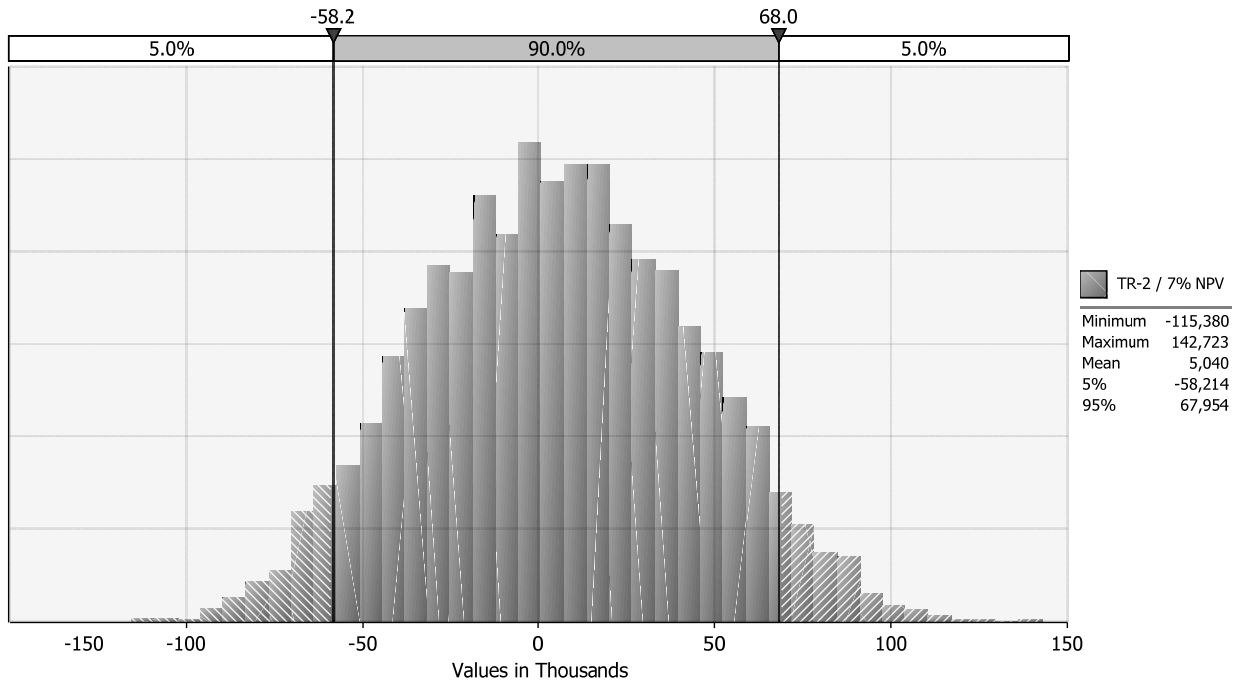


Figure 38 Variation of NRC cost due to the uncertainty in the cost input variables (Alternative TR-2)

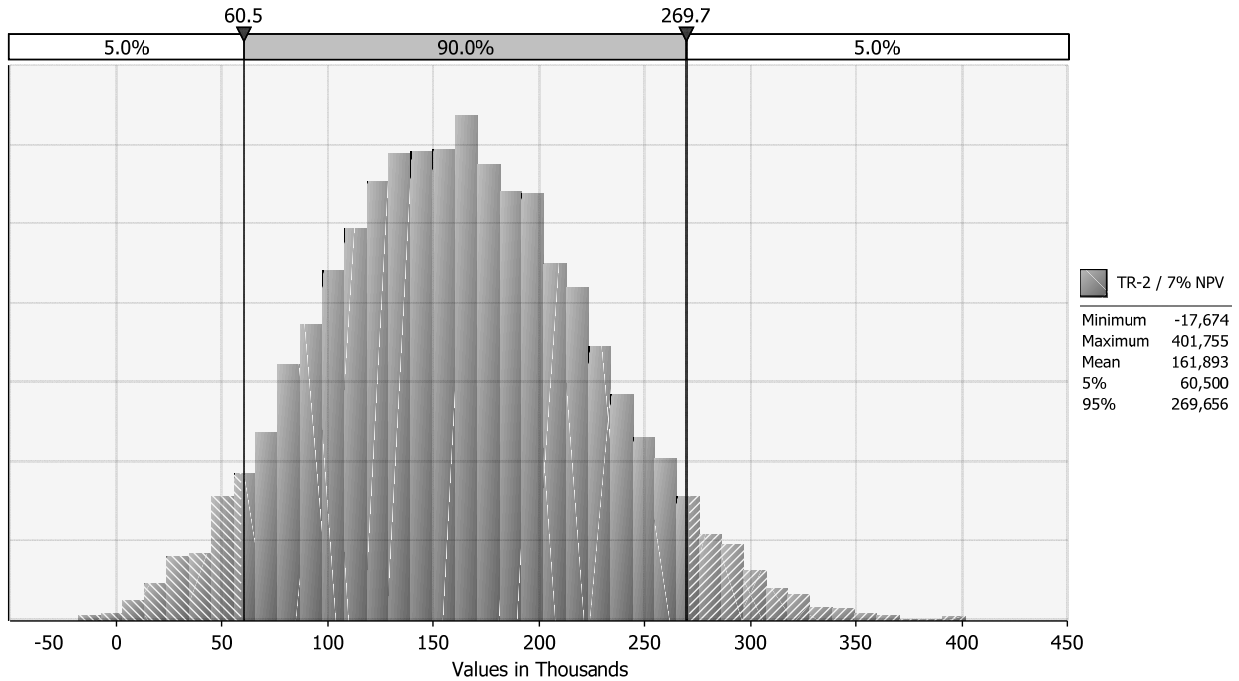


Figure 39 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the cost input variables (Alternative TR-2)

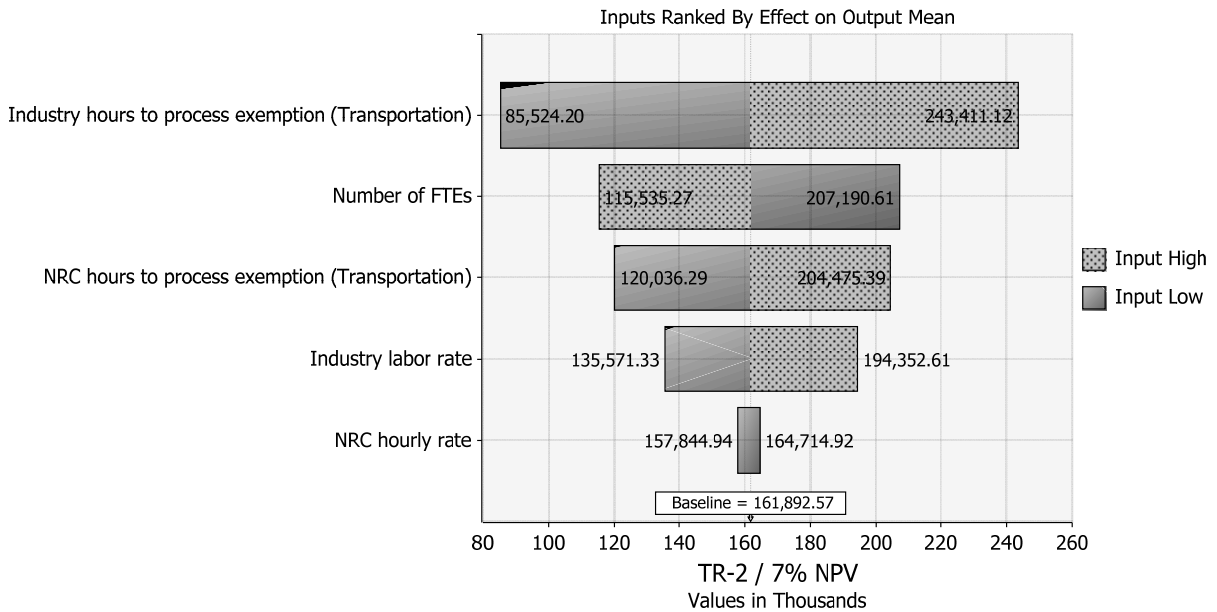


Figure 40 Tornado chart showing the variation of total cost due to each cost driver (Alternative TR-2)

The regulatory changes to Alternative TR-2 will result in cost savings to the industry and NRC over the decommissioning period in the range of (\$18,000) to \$402,000 at 7 percent NPV. The cost drivers that have the greatest influence on total cost for this alternative are the number of industry hours to process exemptions for transportation of low-level waste and the number of NRC FTEs to implement the rulemaking.



**6.10.11 Spent Fuel Management Planning**

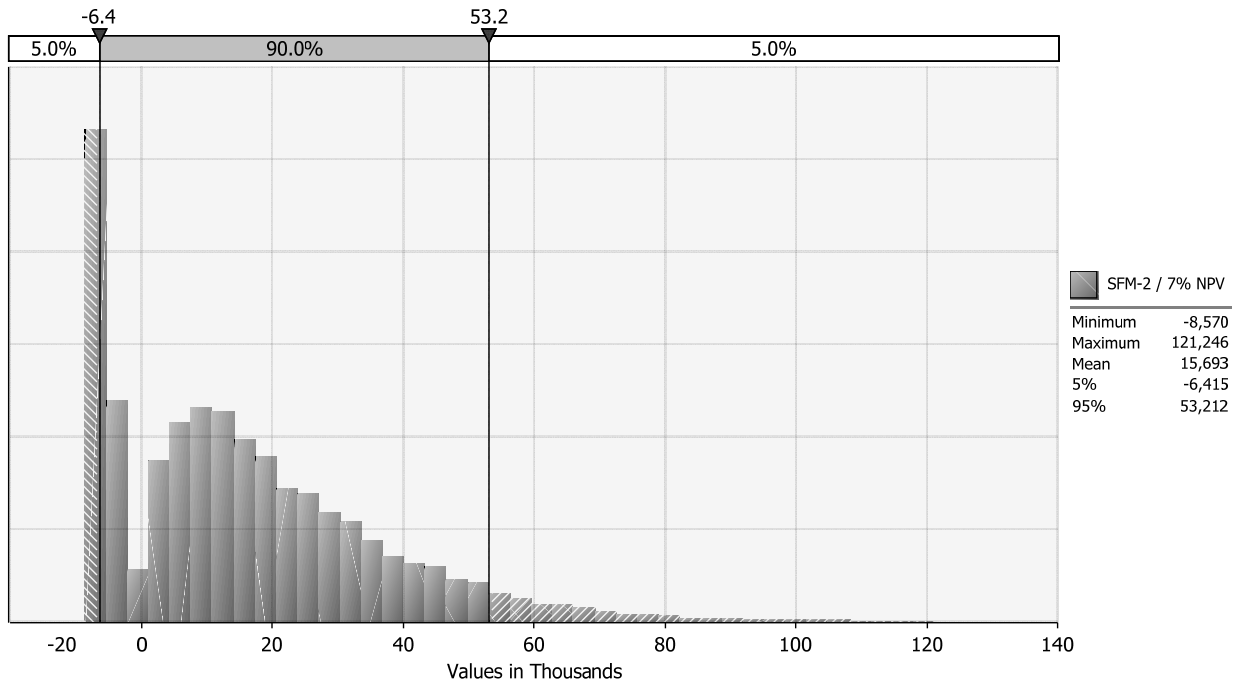


Figure 41 Variation of industry cost due to the uncertainty in the cost input variables (Alternative SFM-2)

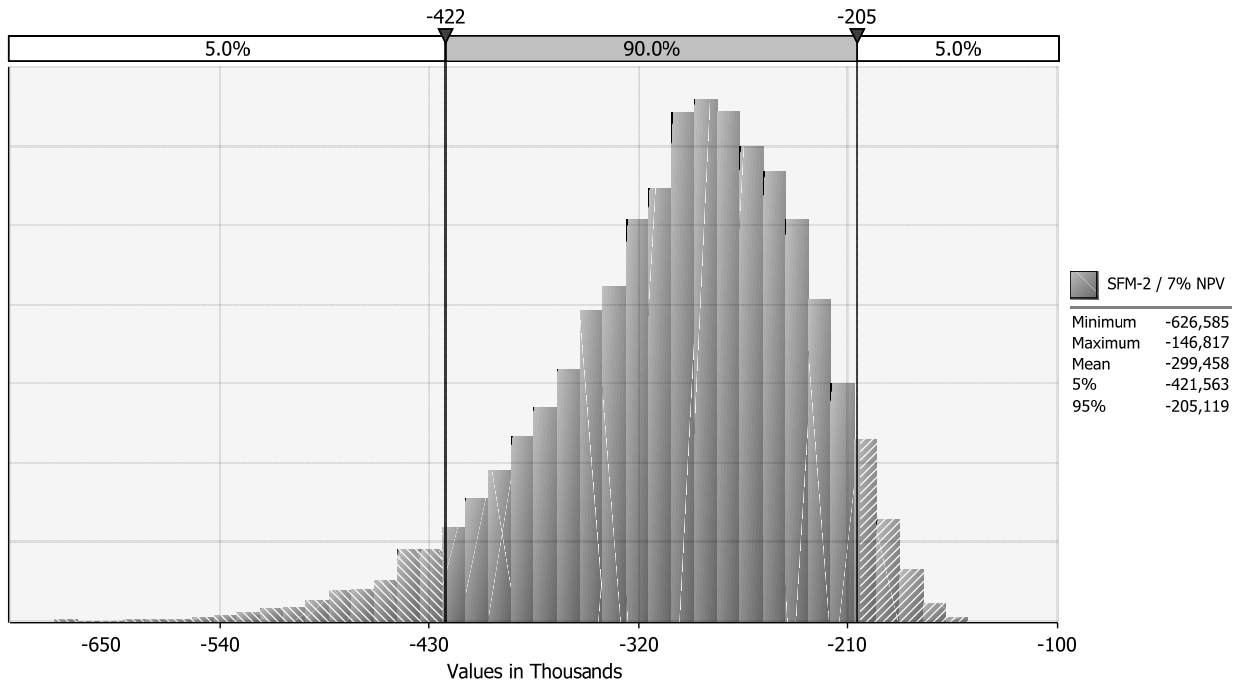


Figure 42 Variation of NRC cost due to the uncertainty in the cost input variables (Alternative SFM-2)

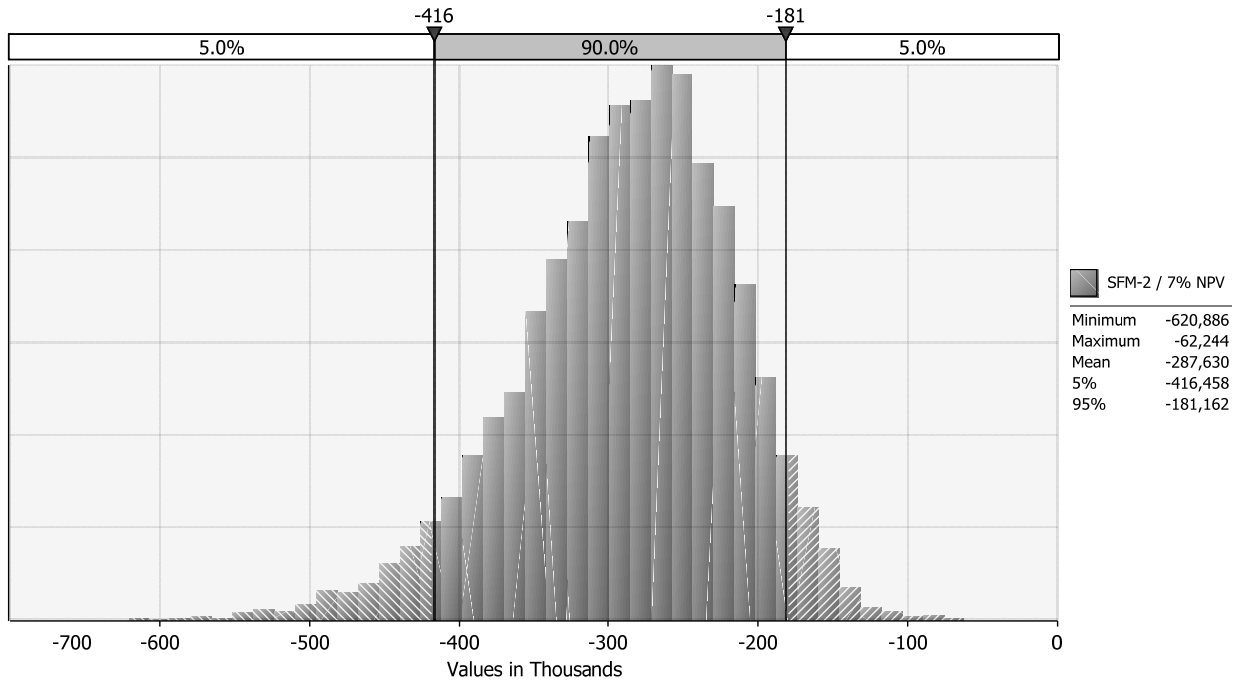


Figure 43 Variation of total cost (industry, NRC, State and local governments and general public) due to the uncertainty in the cost input variables (Alternative SFM-2)

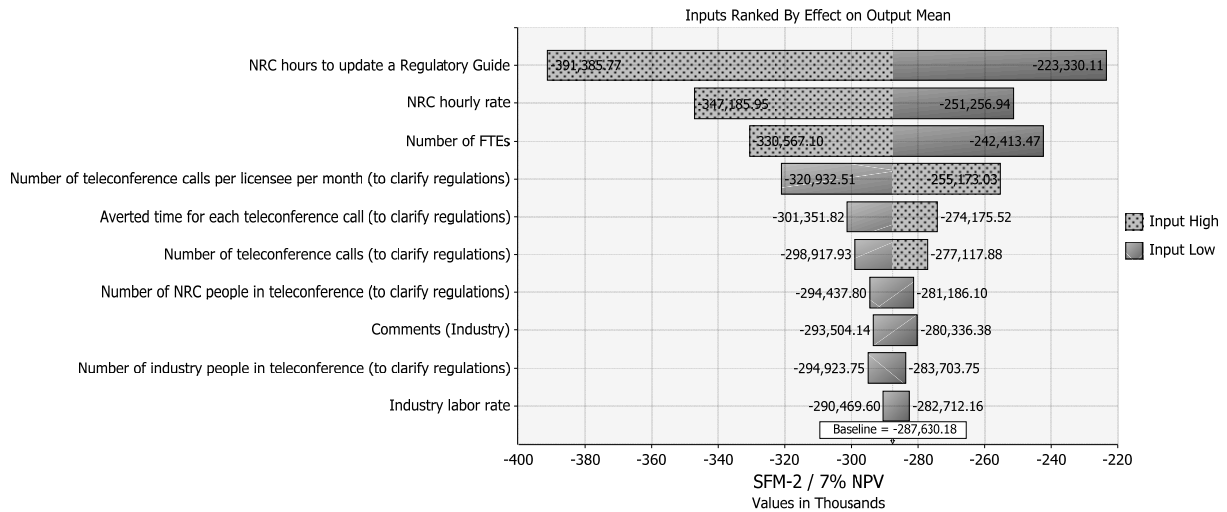


Figure 44 Tornado chart showing the variation of total cost due to each cost driver (Alternative SFM-2)

The regulatory changes to Alternative SFM-2 will result in costs to the industry, NRC, State and local governments and general public over the decommissioning period in the range of (\$621,000) to (\$62,000) at 7 percent NPV. The cost drivers that have the greatest influence on total cost for this alternative are the number of NRC hours to update the regulatory guides pertaining to this area and the NRC labor rate.

**6.10.12 Backfit Rule**

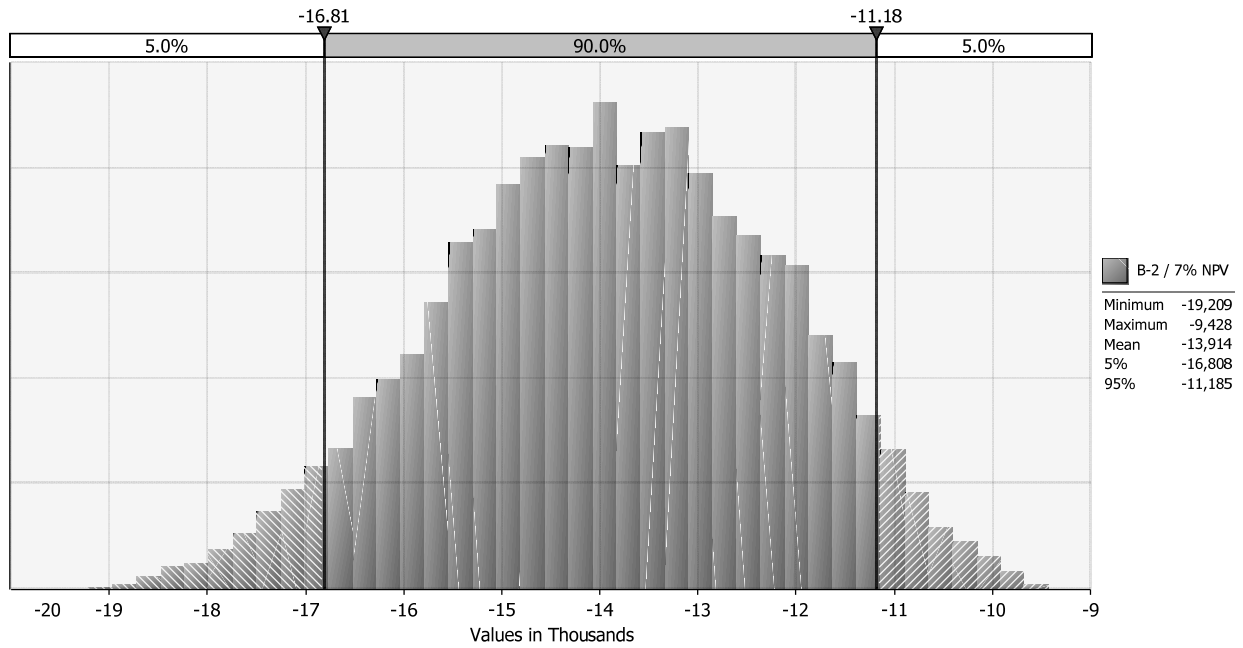


Figure 45 Variation of industry cost due to the uncertainty in the Backfit Rule cost drivers (Alternative B-2)

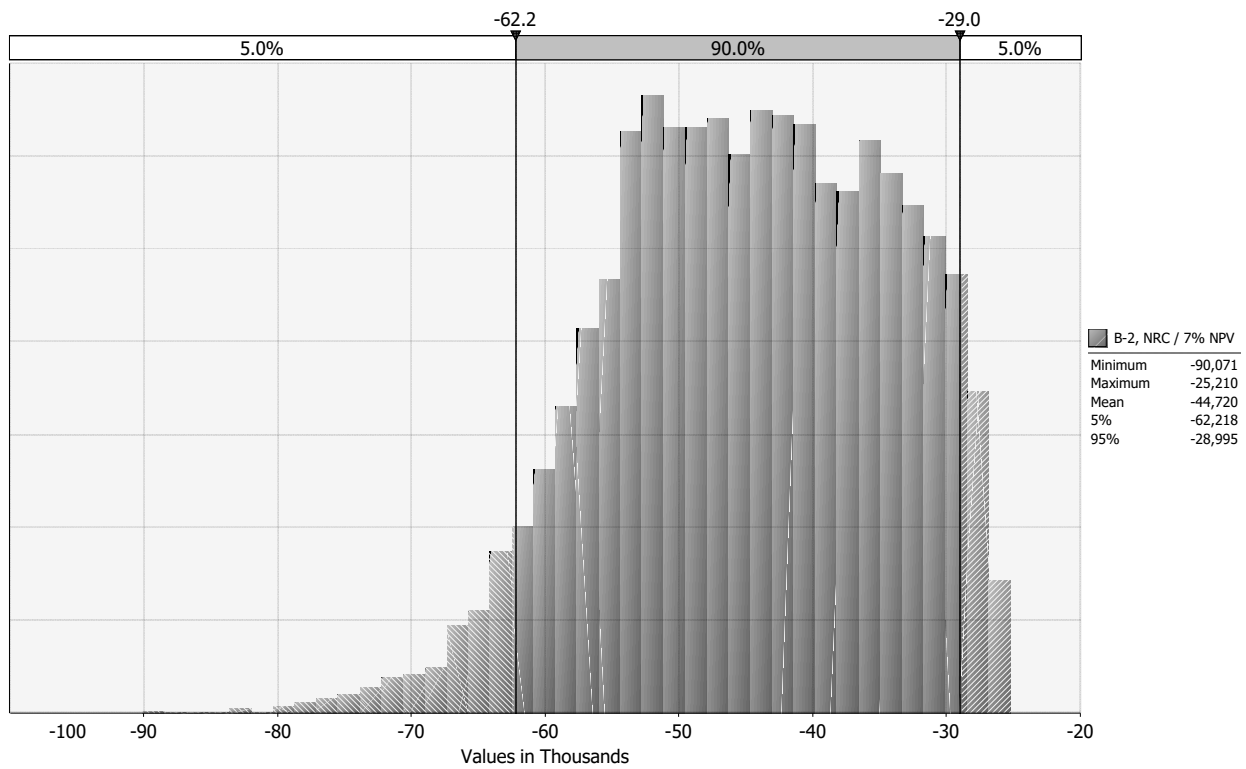


Figure 46 Variation of NRC cost due to the uncertainty in the Backfit Rule cost drivers (Alternative B-2)

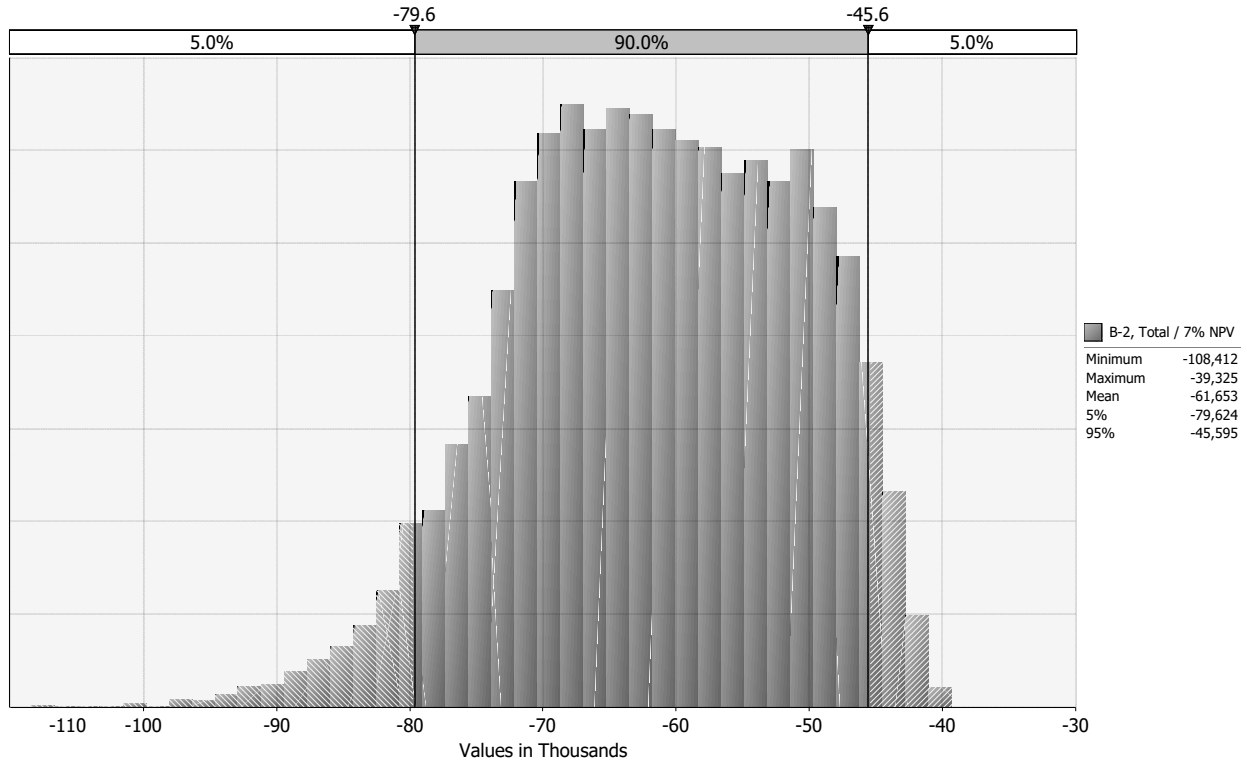


Figure 47 Variation of total cost due to the uncertainty in the Backfit Rule cost drivers (Alternative B-2)

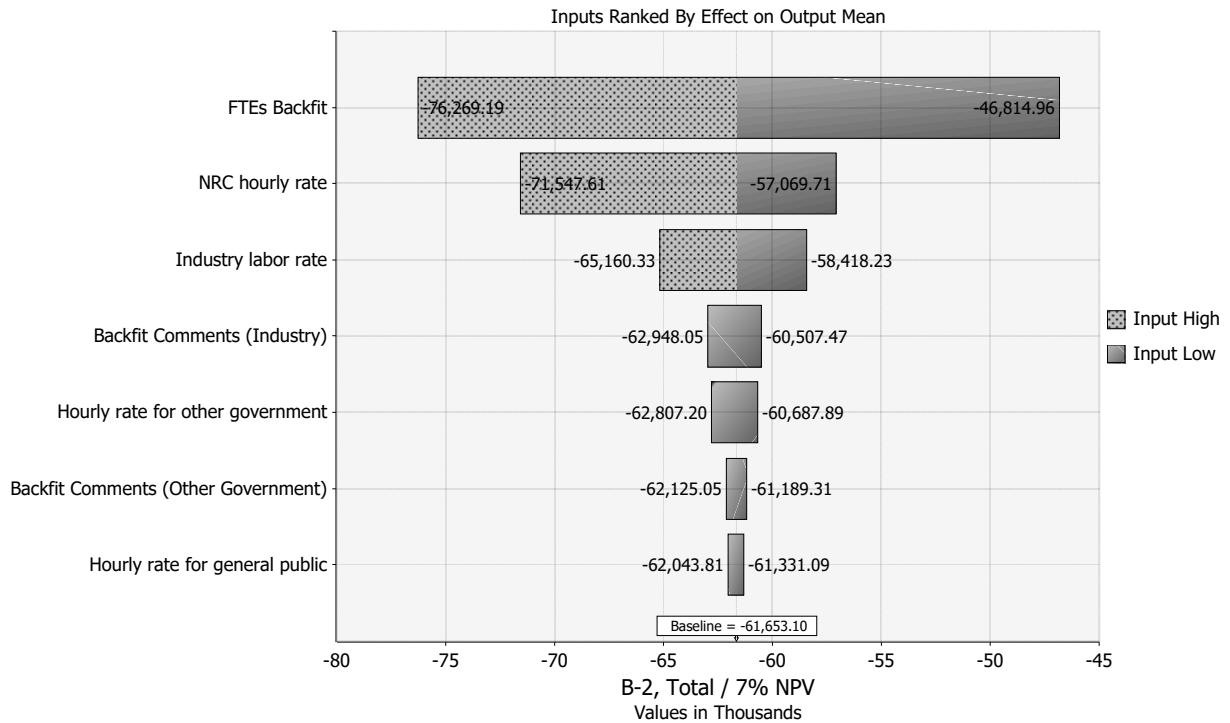


Figure 48 Tornado Chart showing the variation of total cost due to each Backfit Rule cost driver (Alternative B-2)

The regulatory changes to the Backfit Rule area of decommissioning (Alternative B-2) will result in costs to the industry, NRC, State and local governments and general public that is in the range of (\$315,000) to (\$128,000) using a 7 percent NPV. The cost drivers that have the greatest influence for Alternative B-2 are the number of hours it takes for the NRC to complete the rule and the NRC hourly labor rate.

### 6.10.13 Foreign Ownership, Control, or Domination (FOCD)

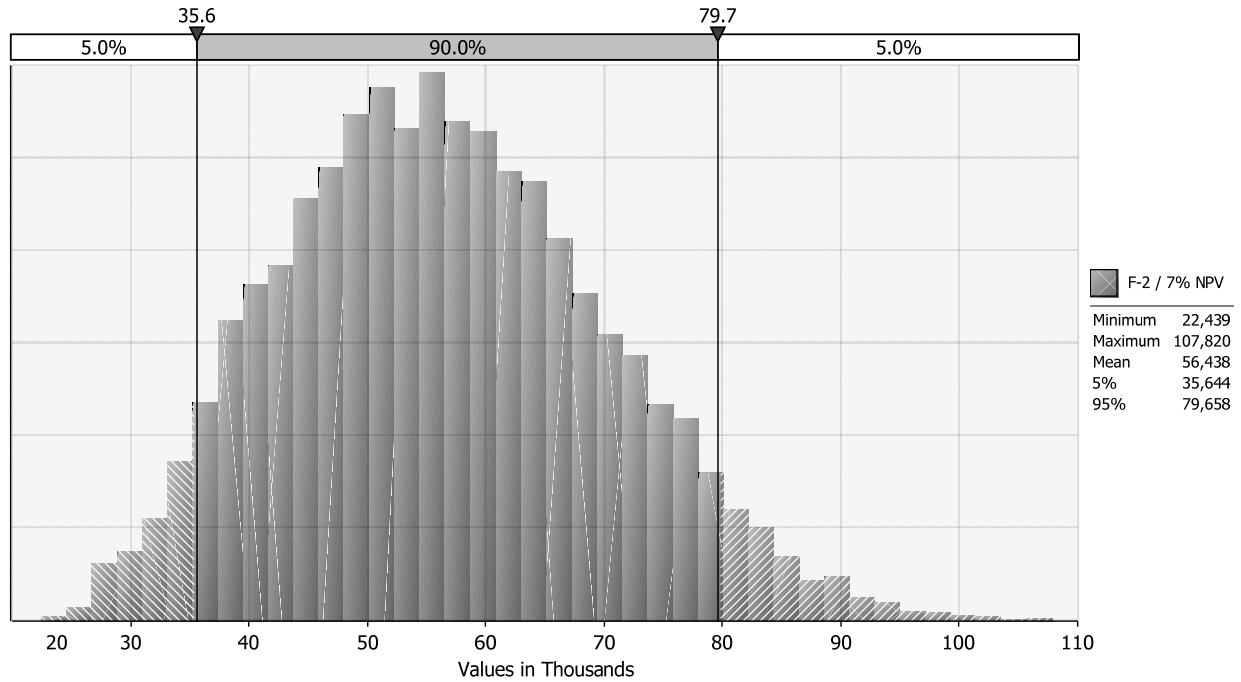


Figure 49 Variation of industry cost due to the uncertainty in the FOCD cost drivers (Alternative F-2)

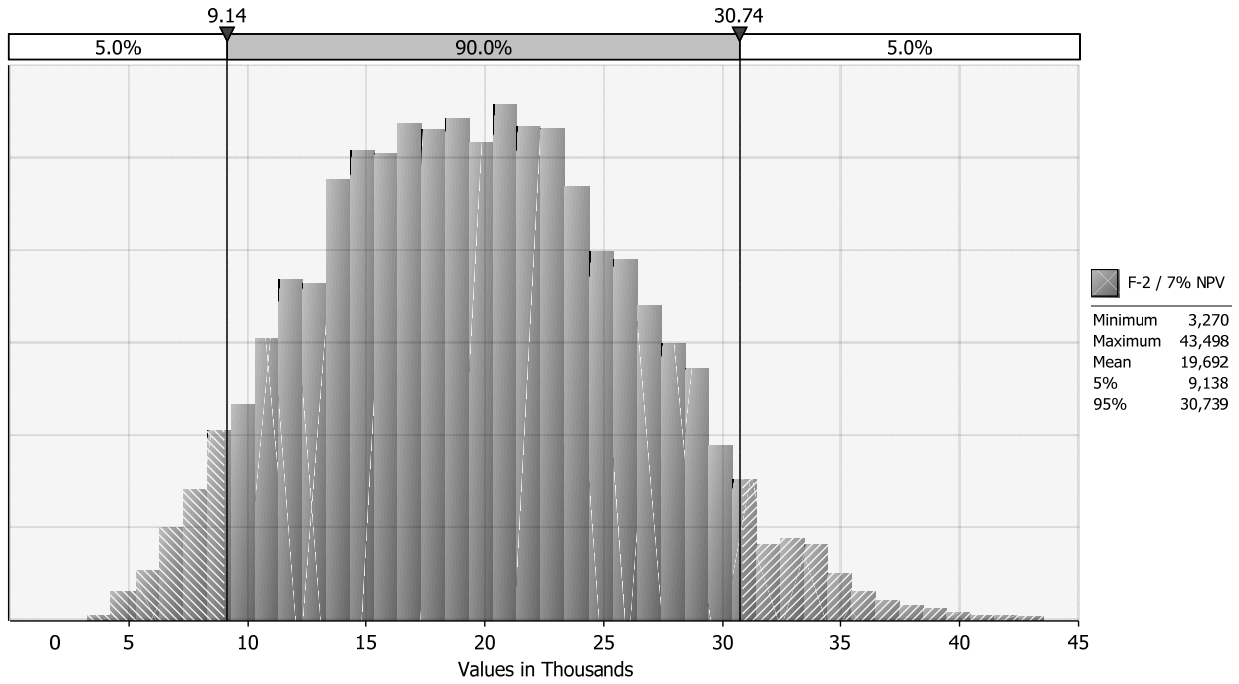


Figure 50 Variation of NRC cost due to the uncertainty in the FOCD cost drivers (Alternative F-2)

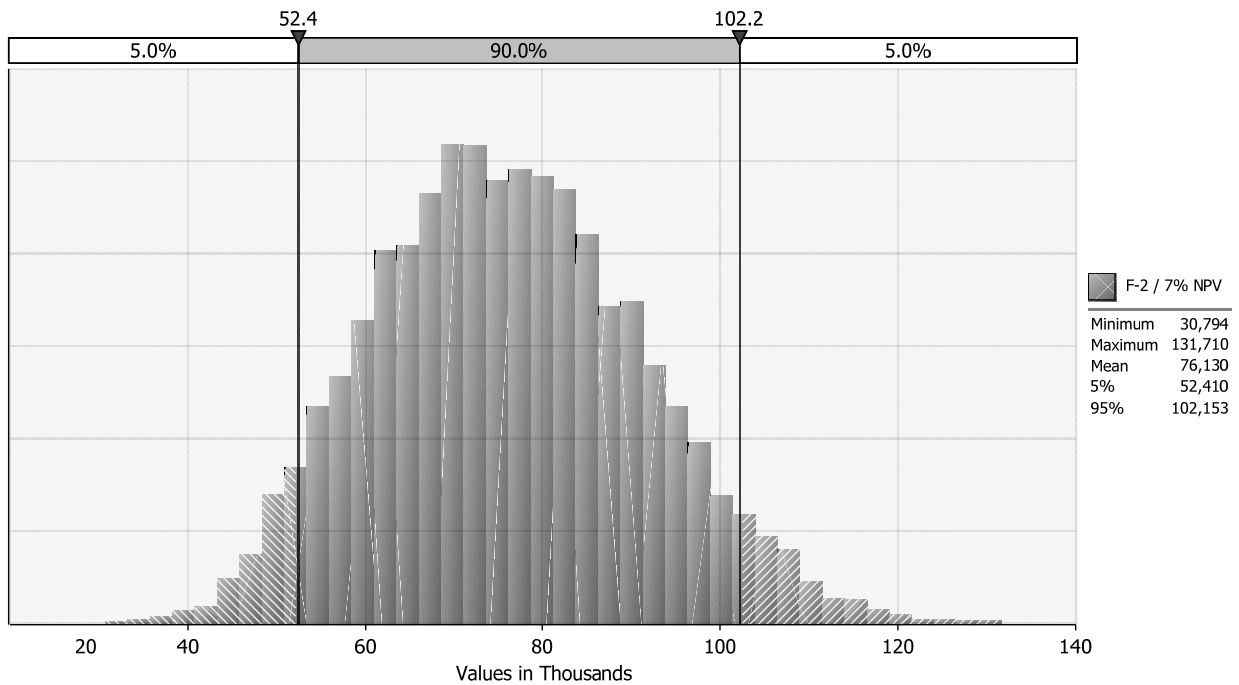


Figure 51 Variation of total cost due to the uncertainty in the FOCD cost drivers (Alternative F-2)

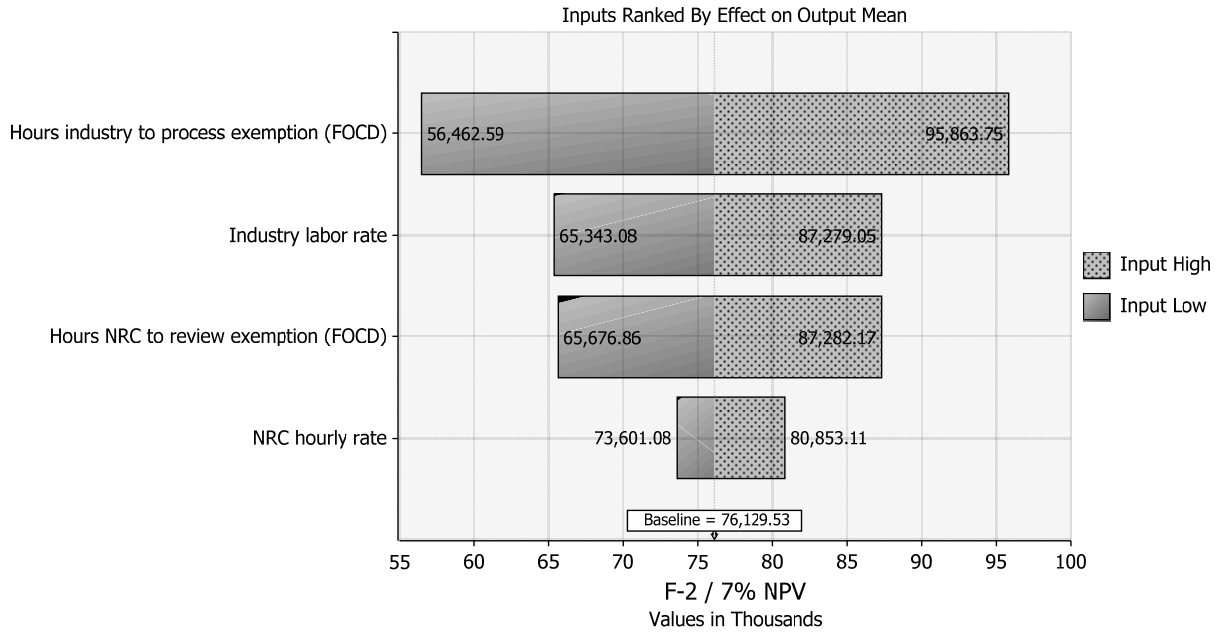


Figure 52 Tornado Chart showing the variation of total cost due to each FOCD cost driver (Alternative F-2)

The regulatory changes to the FOCD area of decommissioning (Alternative F-2) will result in cost savings to the industry and NRC that is in the range of \$31,000 to \$132,000 using a 7 percent NPV. The cost driver that has the greatest influence for Alternative F-2 is the number of hours it takes for the industry to process exemption requests.

## 6.11 Summary

This regulatory analysis identifies and integrates costs and benefits that will emerge from implementing the areas of decommissioning that contain rulemaking and guidance alternatives.

### 6.11.1 Quantified Net Benefit

The following tables show the estimated total net cost for the alternatives relative to the regulatory baseline (no-action alternatives) for each area of decommissioning.

Table 14 Cost and Benefits for Industry

Alternatives	Industry Costs and Benefits		
	Undiscounted	7% NPV	3% NPV
EP-2	\$ 19,830,000	\$ 5,463,000	\$ 10,530,000
PS-2	\$ 3,341,000	\$ 914,000	\$ 1,770,000
CS-2	\$ (433,000)	\$ 133,000	\$ 116,000
DA-2	\$ 27,926,000	\$ 7,010,000	\$ 14,135,000
CFH/STA-2	\$ 652,000	\$ 153,000	\$ 324,000
DTF-2	\$ 2,000,000	\$ 1,024,000	\$ 1,472,000
FP-2	\$ 1,705,000	\$ 467,000	\$ 903,000
ENV-2	\$ 216,000	\$ 51,000	\$ 110,000
R-2	\$ 754,000	\$ 209,000	\$ 401,000
TR-2	\$ 567,000	\$ 157,000	\$ 302,000
SFM-2	\$ 40,000	\$ 9,000	\$ 20,000
B-2	\$ (13,000)	\$ (13,000)	\$ (13,000)
F-2	\$ 204,000	\$ 56,000	\$ 109,000

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

Table 15 Cost and Benefits for NRC

Alternatives	NRC Costs and Benefits		
	Undiscounted	7% NPV	3% NPV
EP-2	\$ 10,047,000	\$ 2,308,000	\$ 5,033,000
PS-2	\$ 1,577,000	\$ (33,000)	\$ 530,000
CS-2	\$ 192,000	\$ (50,000)	\$ 23,000
DA-2	\$ 393,000	\$ 15,000	\$ 143,000
CFH/STA-2	\$ 1,287,000	\$ 219,000	\$ 584,000
DTF-2	\$ 798,000	\$ 168,000	\$ 455,000
FP-2	\$ 802,000	\$ 101,000	\$ 347,000
ENV-2	\$ (82,000)	\$ (79,000)	\$ (81,000)
R-2	\$ 324,000	\$ 33,000	\$ 135,000
TR-2	\$ 223,000	\$ 5,000	\$ 81,000
SFM-2	\$ (311,000)	\$ (303,000)	\$ (311,000)
B-2	\$ (46,000)	\$ (45,000)	\$ (46,000)
F-2	\$ 99,000	\$ 20,000	\$ 48,000

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

### 6.11.2 Qualitative Costs and Benefits

In addition to regulatory efficiency the alternatives provide additional costs and benefits as described below. These costs and benefits have not yet been quantified into monetary values:

*Emergency Preparedness:*



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Alternative EP-2: The NRC and FEMA would establish a notification process that would replace the current NRC/FEMA process for terminating the assessment of FEMA user fees following the receipt from the NRC of approved exemptions from pertinent 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 requirements stating that offsite radiological emergency planning and preparedness are no longer required at a particular commercial nuclear power plant site. The FEMA would also incur one-time costs to develop and issue a final rule to amend 44 CFR 354.4(e) to reflect this new process.

*Decommissioning Funding Assurance:*

Under Alternative DTF-2, licensees who report a shortfall pursuant to 10 CFR 50.75(f) would be required to make up the shortfall (from the minimum regulatory required amount as set forth in 10 CFR 50.75(c) or by the licensee's site-specific decommissioning cost estimate) before the next report is due. This requirement for making up DTF shortfalls would affect individual licensees differently, depending on the amount and cause of the DTF shortfall and the time period that the licensee would otherwise have had to make up the shortfall under the current regulatory framework. The greater the amount of money that must be funded to overcome the shortfall, the more significant the impact will be on the licensee. The combination of these two requirements could aggravate the licensee's financial condition if the licensee is unable to recover decommissioning costs through electrical generation rates and fees or through reductions in their operating plant budget. If the funding period were too short, licensees not under rate-setting regulations who report a shortfall would be placed at a competitive disadvantage, potentially leading to insolvency and premature shutdown of plants. The premature shutdown of a plant could result in a dramatic shortfall between the funds needed to decommission the plant and the funds that have been collected. Other possible effects of accelerated shortfall funding are interference with licensees' business planning or negative tax consequences.

## **6.12 Safety Goal Evaluation**

Safety goal evaluations are applicable to regulatory initiatives considered to be generic safety enhancement backfits subject to the substantial additional protection standard in 10 CFR 50.109(a)(3). A safety goal evaluation is designed to determine whether a regulatory requirement should not be imposed generically on nuclear power plants because the residual risk is already acceptably low.

This proposed rule would amend certain regulations affecting decommissioning production and utilization facilities. These amendments would reduce the number of exemption and license amendment requests submitted by licensees during the transition to decommissioning. The proposed rule would not enhance the safety of decommissioning facilities for the following areas of decommissioning: emergency preparedness, physical security, drug and alcohol testing, CFH/STA, decommissioning funding assurance, offsite and onsite financial protection and indemnity agreements, environmental considerations, record retention, low-level waste transportation, spent fuel management planning, backfit rule, FOCD, and clarification of the scope of license termination. Hence, a safety goal evaluation is not applicable to these areas of decommissioning.

Finally, as part of this proposed rule the NRC is proposing a modification to the cyber security requirement in 10 CFR 73.54. Every 10 CFR Part 50 license for an operating nuclear power reactor contains a license condition to have and maintain a Commission-approved cyber security plan (CSP). This license condition remains effective until the license is amended or

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terminated. The proposed rule provides a reduction in burden for these 10 CFR Part 50 licensees by removing the license condition after sufficient time has passed such that the spent fuel cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions. Because this proposed requirement results in a reduction in burden while maintaining an equivalent level of adequate protection of the public health and safety and common defense and security, a safety goal evaluation is not appropriate for this rule provision.

Holders of a 10 CFR Part 52 combined license are currently required to maintain a cyber security program only as long as 10 CFR 73.54 is applicable to them. Because 10 CFR 73.54 no longer applies to the licensee once it is not authorized to operate a nuclear power reactor, and a power reactor licensee is not authorized to operate a nuclear power reactor during decommissioning, COL holders are not required to maintain their CSP during decommissioning. This proposed rule would require licensees to maintain their cyber security program for 10 months (BWR) or 16 months (PWR) beyond the date of permanent cessation of operations and permanent removal of fuel from the reactor vessel, for burnups less than 72 GWd/MTHM and zirconium-clad fuel, unless an alternative spent fuel decay period is proposed by the licensee and approved by the NRC. For fuel with burnups greater than 72 GWd/MTHM or non-zirconium cladding, an alternative spent fuel decay period would be proposed by the licensee for approval by the NRC under § 50.54(q)(7)(ii). This could extend the duration over which a COL holder would be required to maintain a cyber security program. That extension would constitute a new or changed requirement for that licensee. Although the risk of a potential spent fuel radiological release is not quantified, the NRC has identified two qualitative benefits to the common defense and security and public health and safety that would be realized if the proposed violation of issue finality is implemented. Specifically, the NRC finds that extending the duration over which the licensee must maintain cyber security requirements would:

- Constitute a substantial increase in protection to common defense and security by ensuring that a compromise of digital systems cannot adversely impact the effective operation of licensees' physical security programs; and
- Constitute a substantial increase in public health and safety by ensuring that a compromise of digital systems cannot adversely impact the effective operation of emergency preparedness systems in the event of a zirconium fire scenario.

These two qualitative arguments satisfy the intent of the safety goal evaluation for the proposed changes to the cyber security requirements and demonstrate that the substantial additional protection standard in 10 CFR 50.109(a)(3) is met.

## **7 DECISION RATIONALE FOR THE AREAS OF DECOMMISSIONING**

This section discusses the proposed rulemaking alternative for each area of decommissioning that would be the most cost beneficial to the nuclear power industry, local, state, and US governments and general public. The NRC has established a decision rationale for each area of decommissioning with respect to the proposed rulemaking and this section will present these decision rationales, their costs, and their benefits.

For all areas that are being considered in the proposed decommissioning rulemaking, a quantitative cost benefit analysis was completed to inform the staff of those alternatives that provide the most cost-beneficial solutions. The following subsections present the decision rationales for each of the areas that are being considered in the proposed rulemaking, along with a quantitative and qualitative description of the alternatives.

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The regulatory analysis finds that there is a quantitative and qualitative basis for pursuing the decommissioning rulemaking based on the following:

Emergency Preparedness:

- The proposed rule provides the opportunity for significant averted costs over Alternative EP-1, the no-action alternative.
- Regulatory burden on nuclear power plant licensees would be reduced by eliminating the need to submit requests for exemptions and license amendments for EP requirements that pertain to operating reactors. This also reduces the need for the NRC to review these exemption and amendment submittals.

Physical Security:

- The proposed rule provides the opportunity for significant averted costs over Alternative PS-1, the no-action alternative.
- Regulatory burden on nuclear power plant licensees would be reduced by eliminating the need to submit security-related exemption and license amendment requests for nuclear power reactors during their transition period to a decommissioning status. This also reduces the need for the NRC to review these exemptions and amendment submittals.

Cyber Security:

- The proposed rule would clarify the cyber security requirements applicable to a nuclear power reactor during each stage of the decommissioning process. Additionally, fewer license amendment requests regarding reduction or elimination of cyber security requirements in 10 CFR 73.54 would be submitted by the licensees as a result of this proposed rule.

Fitness for Duty - Drug and Alcohol Testing:

- The proposed rule would clarify which elements of the FFD program defined in Part 26 would be applicable to an operating or decommissioning power reactor through the licensee's insider mitigation program. As a result, the number of personnel that undergo drug and alcohol testing at a decommissioning site would be reduced, resulting in cost savings to the nuclear power industry.

Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor:

- The proposed rule would provide consistency in the regulatory treatment of the training programs for NLOs (which do not require Commission approval) and training programs to qualify a NLO as a CFH (which do require Commission approval). The second change would clarify that an STA is not required for decommissioning reactors. These changes would provide clarity to the CFH's responsibilities and functions and eliminate the role of an STA by codifying current licensing practices.

Decommissioning Funding Assurance:

- These changes to the regulatory framework would align with the current decommissioning environment where commingling of funds in the DTF is allowed under guidance but silent in regulation.
- Regulatory efficiency would be improved through minimizing uncertainty associated with estimating decommissioning costs such that a licensee would be required to plan for, and provide assurances for, funding decommissioning to a site-specific cost

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estimate earlier in the facility's lifecycle. Shortfalls would be addressed in a timely manner by licensees with greater transparency on these actions.

- Provides greater transparency of a licensee's decommissioning costs and plans for funding at licensing, and throughout operations and decommissioning, while also providing a measure of flexibility for the use of funds in the DTF.

Offsite and Onsite Financial Protection Requirements and Indemnity Agreements:

- Regulatory burden on nuclear reactor licensees would be reduced by eliminating the need to submit requests for exemptions for reductions in onsite and offsite financial protection. This would also reduce the need for the NRC to review these exemption submittals.

Environmental Considerations:

- The proposed rule would clarify that licensees, at the PSDAR stage, are required to evaluate the environmental impacts and provide in the PSDAR the basis for whether or not the proposed decommissioning activities are bounded by previously issued, site-specific environmental reviews. Licensees would no longer be required to make the definitive conclusion that impacts will be bounded. Instead, they would have the flexibility to address any unbounded environmental impacts closer to, but prior to, the decommissioning activity being undertaken that could cause the unbounded impact.

Record Retention Requirements:

- The proposed rule would decrease the burden associated with long term record storage and increase the overall efficiency of the decommissioning process.

Low Level Waste Transportation:

- The proposed rule would eliminate the need for exemption requests pertaining to the 20-day receipt notification of transfer of low-level radioactive waste.

Spent Fuel Management Planning:

- The proposed rule would improve the efficiency of the NRC's oversight of the decommissioning process, by reducing the NRC staff's time in engaging with the licensee to clarify what reactor SSCs are needed for managing spent fuel and responding to frequent stakeholder inquiries in this area.

Backfit Rule:

- The proposed rule would clarify how the Backfit Rule applies to licensees in decommissioning. This would lead to less time spent on a generic or plant specific backfit analysis that pertains to decommissioning.

Foreign Ownership, Control, or Domination (FOCD):

- The proposed rule would make it clear that the regulations in Part 50, and similar regulations in Part 52, provide not only for the licensing of utilization and production facilities, but also for decommissioning and the termination of their associated licenses. The proposed rule would also identify those requirements needed for a Part 50 or Part 52 licensed facility that does not meet the definition of a utilization or production facility, such that it could be transferred to a foreign entity.

Clarification of Scope of License Termination Plan Requirement:

- The proposed rule would clarify that the requirement for a license termination plan in § 50.82(a)(9) and § 52.110(i) applies only to power reactor licensees that

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commenced operation and eliminate the apparent confusion among combined license holders who seek to surrender their licenses before operation.

Relative to the regulatory baseline, the NRC would realize additional costs to implement the proposed rulemaking, however this regulatory analysis shows that the above areas will result in quantitative and qualitative benefits as discussed below. In addition, the rulemaking alternatives would help ensure that the NRC's actions are effective, efficient, realistic, and timely by eliminating the need for the NRC review of exemption and amendment requests that are submitted for those licensees that are transitioning from operations to decommissioning.

### **7.1 Emergency Preparedness**

The NRC is proposing rulemaking Alternative EP-2 over the no-action alternative (status quo) because it would provide regulatory certainty for emergency preparedness requirements for permanently shutdown and defueled facilities. Also, in status quo, decommissioning power reactor licensees would need to submit exemption and amendment requests in order to reduce their emergency preparedness requirements throughout the decommissioning process. This would result in regulatory burden and costs to the licensees and the NRC during the decommissioning process from resources being expended to process the exemption and amendment requests. Additionally, Alternative EP-2 would provide a graded approach to reduce emergency preparedness requirements at decommissioning sites. Finally, the cost benefit analysis shows that this alternative is cost beneficial. The final recommendation, however, will be informed by public comments received on the proposed rule. The NRC proposes that an amendment of the regulations to provide a graded approach to EP, Alternative EP-2 as the best course of action. This alternative would provide a regulatory process for licensees to reduce their EP requirements corresponding to the licensee's level of decommissioning without the need to consider whether the change is a reduction in effectiveness.

### **7.2 Physical Security**

The NRC is proposing rulemaking Alternative PS-2 over the no-action alternative (status quo) because the risk of offsite consequences due to accidents is reduced at a decommissioning reactor when compared to that at an operating reactor. Given the reduced risk of offsite consequences, the NRC has concluded that existing physical security requirements can be stepped down commensurate with the reduced level of risk. Also, regulatory burden on nuclear power plant licensees would be reduced by eliminating the need to submit requests for exemptions and license amendments for reducing their physical security-related requirements during decommissioning. This alternative will also reduce the need for the NRC to review these exemptions and amendment requests and is shown to be cost beneficial.

### **7.3 Cyber Security**

The NRC is proposing rulemaking Alternative CS-2. Under this alternative, the NRC would undertake a rulemaking to only allow the removal of cyber security requirements from a power reactor licensee's license once spent fuel in the SFP has sufficiently decayed. This change to existing regulation would provide clarity as to the degree of cyber security that needs to be maintained during each stage of the decommissioning process, while ensuring that safety concerns (e.g., a postulated zirconium fire scenario) are properly addressed in a manner that

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provides reasonable assurance of adequate protection of public health and safety, and the common defense and security.

#### **7.4 Drug and Alcohol Testing**

The NRC is proposing rulemaking Alternative DA-2. The cost benefit analysis shows that rulemaking Alternative DA-2 results in cost savings to industry and NRC as detailed in Table 16. The benefit derived from pursuing this alternative is regulatory clarity on which elements of the FFD program defined in Part 26 would be applicable to a decommissioning power reactor through the licensee's insider mitigation program.

#### **7.5 Certified Fuel Handler Definition and Elimination of the Shift Technical Advisor**

The NRC is proposing rulemaking Alternative CFH/STA-2. The cost-benefit analysis shows that Alternative CFH/STA-2 results in a benefit to both industry and the NRC. The benefit derived from pursuing rulemaking Alternative CFH/STA-2 is the elimination of the need for a licensee to seek Commission approval for the CFH training program for a decommissioning reactor. This rulemaking alternative would reduce resources expended by both the licensee and the NRC regarding Commission approval of CFH training programs. Therefore, the NRC proposes proceeding with the rulemaking Alternative CFH/STA-2. This is also consistent with feedback received from the public on the regulatory basis.

#### **7.6 Decommissioning Funding Assurance**

The NRC is proposing rulemaking Alternative DTF-2. Alternative DTF-2 has the following benefits over the no-action alternative (status quo):

- The reporting requirements for decommissioning funding assurance under 10 CFR 50.75(f)(1) and (f)(2) would be changed from a biennial to a triennial reporting period to be consistent with the reporting requirements for ISFSIs in 10 CFR 72.30(c). This would reduce the burden on the licensees for reporting.
- Rulemaking would allow for greater transparency of a licensee's decommissioning costs and plans for funding at licensing, and throughout operations and decommissioning, while also providing a measure of flexibility for the use of funds in the DTF. This would minimize the uncertainty associated with estimating decommissioning costs such that a licensee would be able to plan for, and provide assurances for, funding decommissioning earlier in the facility's lifecycle. Shortfalls would be addressed in a timely manner by licensees with greater transparency on these actions.

As detailed in Table 16, Alternative DTF-2 presents a cost benefit at 7 percent NPV and at 3 percent NPV. The NRC therefore proposes to proceed with the rulemaking Alternative DTF-2.

#### **7.7 Offsite and Onsite Financial Protection Requirements and Indemnity Agreements**

The NRC is proposing rulemaking Alternative FP-2 over the no-action alternative (status quo) because the risk of offsite and onsite consequences due to a potential nuclear occurrence is

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reduced at a decommissioning reactor when compared to that at an operating reactor and the amounts of financial protection provided in Levels 1 and 2 are consistent with exemptions that have been granted to reactors that have decommissioned. Given the reduced risk of offsite and onsite consequences, the NRC has concluded that existing insurance requirements can be stepped down commensurate with the reduced level of risk and graded to emergency preparedness. Also, regulatory burden on nuclear reactor licensees is reduced by eliminating the need to submit exemptions for reduction to onsite and offsite financial protection. This will also reduce the need for the NRC to review these exemption requests.

## **7.8 Environmental Considerations**

The NRC is proposing rulemaking Alternative ENV-2, given the NRC's desire to reduce unnecessary regulatory burden and improve the regulatory process for decommissioning nuclear power plants. Implementation of ENV-2 would allow the NRC and stakeholders to access more detailed information in the PSDARs for those licensees choosing to follow the enhanced guidance. This would not reduce the flexibility provided by the use of a PSDAR instead of a decommissioning plan for decommissioning nuclear power plants or impose unnecessary burdens on licensees and the NRC to create and review additional documents that do not have any net positive impact on public health and safety.

Alternative ENV-2, would clarify, through rulemaking, that licensees must evaluate the environmental impacts associated with site-specific decommissioning activities and determine whether such impacts are bounded by appropriate previously issued environmental impact statements, rather than being required to make a definitive conclusion that all such impacts are bounded by appropriate previously issued environmental impact statements in the PSDAR. The 10 CFR 50.82(a)(6)(ii) and 10 CFR 52.110(f)(2) prohibitions against conducting a decommissioning activity that would result in a significant environmental impact not previously reviewed remains in place although clarifying language is added (under the proposed rule, the prohibition applies to a decommissioning activity not bounded by federally issued environmental review documents).

## **7.9 Record Retention Requirements**

The NRC is proposing rulemaking Alternative R-2, based on the preliminary assessment of the costs and benefits for changing decommissioning recordkeeping and record retention requirements. Under this alternative, decommissioning licensees would have a decreased burden resulting from not having to develop and submit exemptions and would achieve greater record storage efficiency throughout the decommissioning process. While some NRC resources would need to be expended in the near term to revise the regulations, the reduction in recordkeeping and record retention exemption requests would reduce the NRC's time necessary to process and review these exemptions during decommissioning in the long term. Although these changes would not directly affect public health and safety, the increased clarity of the requirements associated with recordkeeping and record retention during decommissioning would increase the overall transparency of the decommissioning process.

## **7.10 Low-Level Waste Transportation**

The NRC is proposing rulemaking Alternative TR-2, given the NRC's desire to maintain safety, reduce unnecessary regulatory burden, and improve efficiency and effectiveness in the regulatory process for decommissioning nuclear power plants. Under this alternative, licensees

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would have a decreased burden resulting from not having to develop and submit the subject exemption requests and would achieve greater efficiency throughout the LLW transportation process. While some NRC resources would need to be expended in the near term to revise the 10 CFR Part 20, Appendix G regulation, the reduction in requests for exemptions from the LLW transportation investigation, tracing, and reporting requirements would reduce the NRC's time necessary to process and review these exemptions. Although these changes would not directly affect public health and safety, the reduction in administrative burden associated with the LLW transportation investigation, tracing, and reporting requirements, during both facility operation and decommissioning, would increase the overall efficiency of the regulatory process.

### **7.11 Spent Fuel Management Planning**

The NRC is proposing rulemaking Alternative SFM-2, where the NRC would amend 10 CFR 50.82, 10 CFR 50.54(bb), 10 CFR 52.110, and 10 CFR 72.218 to clarify and update the regulations as previously described, as well as to enhance overall regulatory transparency and openness. The NRC estimates that this change would have a small impact on both licensees and the NRC since it would only require the NRC to promulgate rule language that is already present in other sections of 10 CFR Chapter I and simply move it into the appropriate portions of 10 CFR 50.82, 10 CFR 50.54(bb), and 10 CFR 52.110. In addition, decommissioning licensees would need to expend a relatively small amount of time and effort to provide the additional level of detail and information suggested under the adjusted requirements for spent fuel management and handling capabilities during decommissioning since most of these considerations are already being taken into account at decommissioning facilities.

With these regulation changes detailed in Alternative SFM-2 above, the NRC concludes that both the NRC and licensees would save resources in the future since the clarified regulations and additional detail in the guidance would reduce or potentially eliminate the NRC's need to engage in site-specific interactions with the licensee to clarify information regarding the management of spent fuel during decommissioning. It would also improve the efficiency of NRC communications with various stakeholders who have questions and concerns in this area. Additionally, Alternative SFM-2 would enhance the opportunity for public involvement in the decommissioning process, as well as expanding overall regulatory transparency and openness. Furthermore, Alternative SFM-2 resolves the identified inconsistencies within the regulations. Hence the NRC proposes Alternative SFM-2 to clarify the spent fuel management requirements.

### **7.12 Backfit Rule**

The NRC is proposing rulemaking Alternative B-2 over Alternative B-1 (status quo). The cost benefit analysis however shows that Alternative B-2 results in costs to both industry and the NRC due solely to the development of the rule. The benefit derived from pursuing rulemaking Alternative B-2 is regulatory clarity for how the backfit rule would apply to decommissioning plants. This may lead to less time spent by industry and the NRC for determining what regulatory action applied to a decommissioning licensee is or is not a backfit. Here the scope of activities and approvals that would continue from the operations phase into a decommissioning phase would be determined.

### **7.13 Foreign Ownership, Control, or Domination (FOCD)**

The NRC is proposing rulemaking Alternative F-2 over Alternative F-1 (status quo) in order to clarify that the regulations in Part 50, and the similar regulations in Part 52, provide not only



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for the licensing of utilization and production facilities, but also for their decommissioning and the termination of their associated licenses. The proposed rule will also allow foreign entities to directly invest in Part 50 and Part 52 licensees consistent with maintaining the common defense and security and the public health and safety. This will reduce the number of exemptions from § 50.38 for facilities that no longer meet the definition of a utilization or production facility, thus resulting in cost savings to the nuclear power industry and NRC. Additionally, the proposed rule would offer the NPUFs the option to request only one licensing action—the decommissioning plan license amendment—that also would address the licensee’s operating authority, rendering a “possession-only license amendment” unnecessary and resulting in cost savings to NPUFs and the NRC from lack of processing these amendments.

#### **7.14 Clarification of Scope of License Termination Plan Requirement**

The NRC is proposing rulemaking Alternative T-2 over Alternative T-1 (status quo) in order to clarify that combined license holders who seek to surrender their licenses before operation do not need to submit a license termination plan to the NRC for approval. Since the rulemaking alternative is a clarification in the language of § 50.82(a)(9) and § 52.110(i), there would not be a significant change in the costs and benefits to the industry, NRC, State and local governments and the general public due to this rulemaking alternative.

### **8 NRC PROPOSED RULE**

The following table summarizes the NRC alternatives for the proposed rule along with their incremental costs. The total incremental cost for the alternatives under proposed rule is also displayed. The following table provides the quantified and non-quantified costs and benefits for each proposed alternative in each area of decommissioning for specific decommissioning topics. These costs include burden to the Federal, State, local governments and the General Public due to public commenting periods.

Table 16 Summary of Total Costs and Benefits for the Recommended Alternatives

Areas of Decommissioning	Alternatives	Total Costs and Benefits	
		7% NPV	3% NPV
Emergency Preparedness	EP-2	\$ 7,740,000	\$ 15,530,000
Physical Security	PS-2	\$ 877,000	\$ 2,296,000
Cybersecurity	CS-2	\$ 83,000	\$ 140,000
Drugs and Alcohol Testing	DA-2	\$ 7,025,000	\$ 14,278,000
Certified Fuel Handler Training	CFH/STA-2	\$ 370,000	\$ 906,000
Decommissioning Funding Assurance	DTF-2	\$ 1,177,000	\$ 1,912,000
Offsite & Onsite Financial Protection	FP-2	\$ 564,000	\$ 1,247,000
Environmental Considerations	ENV-2	\$ (41,000)	\$ 15,000
Record Retention Requirements	R-2	\$ 241,000	\$ 536,000
Low Level Waste Transportation	TR-2	\$ 162,000	\$ 383,000
Spent Fuel Management Planning	SFM-2	\$ (299,000)	\$ (296,000)
Backfit Protection	B-2	\$ (61,000)	\$ (62,000)
Foreign Ownership, Control, or Domination	F-2	\$ 76,000	\$ 156,000
<b>Total:</b>		\$ 17,914,000	\$ 37,041,000
<b>Nonmonetary Benefits</b>			
<b>Regulatory Efficiency:</b> These alternatives would enable the NRC to better maintain and administer regulatory activities over the decommissioning process and ensure that the requirements for decommissioning power reactors are clear and appropriate.			
<b>Safety and Common Defense:</b> These alternatives would continue to provide reasonable assurance of adequate protection of the public health, safety, and common defense and security at nuclear power reactor sites that have started decommissioning.			

\* There may be discrepancies in calculations due to rounding.

\*\* All values are in 2018 dollars.

Should the alternatives result in a final rule, the cost benefit analysis shows that these alternatives are overall cost beneficial to the nuclear power industry, Federal, State and local governments and the general public and that the revised requirements would result in a net averted cost from \$17.9 million (7-percent NPV) to \$37.0 million (3-percent NPV). Most of the cost savings are attributable to the relief of exemptions and amendments that licensees would typically submit to the NRC for review and approval during decommissioning. The additional costs would be primarily due to efforts to conduct the rulemaking, update documents associated with the rulemaking (i.e., regulatory guidance and NUREGs) and to manage the response to public comments.

## 9 GUIDANCE DOCUMENTS

The NRC is currently revising the following guidance documents for the proposed rule:

- RG 1.159, “Assuring the Availability of Funds for Decommissioning Nuclear Reactors”
- RG 1.184, “Decommissioning of Nuclear Power Reactors”
- RG 1.185, “Standard Format and Content for Post-Shutdown Decommissioning Activities Report (PSDAR)”

During the course of the rulemaking, the NRC will draft a new regulatory guide, Draft Guide (DG)-1346, “Emergency Planning for Decommissioning Nuclear Power Reactors.”

The NRC has identified that the following guidance documents are subject to revision based on decisions made to pursue regulatory actions, including rulemaking:

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- RG 1.219, “Guidance on Making Changes to Emergency Plans for Nuclear Power Reactors”
  - RG 1.179, “Standard Content and Format of License Termination Plans for Nuclear Power Reactors”
  - RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning”
  - RG 4.22, “Decommissioning Planning During Operations”
  - RG 5.71, “Cyber Security Programs for Nuclear Facilities”
  - RG 5.66, “Access Authorization for Nuclear Power Plants”
  - RG 5.77, “Insider Mitigation Program”
  - NUREG-0586, “Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities”
  - NUREG-1022, “Event Reporting Guidelines 10 CFR 50.72 and 50.73”
  - NUREG-1496, “Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities”
  - NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants”
  - NUREG-1628, “Staff Responses to Frequently Asked Questions Concerning Decommissioning of Nuclear Power Plants”
  - NUREG-1700, “Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans”
  - NUREG-1727, “NMSS Decommissioning Standard Review Plan”
  - NUREG-1757, “Consolidated Decommissioning Guidance”
  - NSIR/DPR-ISG-01, “Interim Staff Guidance: Emergency Planning for Nuclear Power Plants”
  - Inspection Procedure 82501, “Decommissioning Emergency Preparedness Program Evaluation”
  - Inspection Procedure 82401, “Decommissioning Emergency Preparedness Scenario Review and Exercise Evaluation”

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**APPENDIX A: INDUSTRY LABOR RATES**

**Utilities (Sector 22)—Industry: Electric Power Generation, Transmission and Distribution  
(NAICS code 221100)**

<b>Position Title</b>	<b>Occupation (SOC Code)</b>	<b>Hourly Mean Wage (2017 dollars)</b>	<b>Hourly 10th Percentile Wage (2017 dollars)</b>	<b>Hourly 90th Percentile Wage (2017 dollars)</b>	<b>Source</b>
Executive	Top Executives (111000)	\$82.90	\$55.33	\$107.77	<a href="http://www.bls.gov/oes/current/oes111011.htm">http://www.bls.gov/oes/current/oes111011.htm</a>
	Chief Executives (111011)	\$107.38	\$73.99	\$139.59	<a href="http://www.bls.gov/oes/current/oes_nat.htm#11-0000">http://www.bls.gov/oes/current/oes_nat.htm#11-0000</a>
	<b>Average</b>	<b>\$95.14</b>	<b>\$64.66</b>	<b>\$123.68</b>	
Managers	First-Line Supervisors of Production and Operating Workers (511011)	\$44.49	\$31.65	\$64.36	<a href="http://www.bls.gov/oes/current/oes511011.htm">http://www.bls.gov/oes/current/oes511011.htm</a>
	First-Line Supervisors of Mechanics Installers and Repairers (491011)	\$43.89	\$36.29	\$60.57	<a href="http://www.bls.gov/oes/current/oes491011.htm">http://www.bls.gov/oes/current/oes491011.htm</a>
	Industrial Production Managers (113051)	\$61.67	\$47.10	\$90.44	<a href="http://www.bls.gov/oes/current/oes113051.htm">http://www.bls.gov/oes/current/oes113051.htm</a>
	General and Operations Managers (111021)	\$68.24	\$48.81	\$88.71	<a href="http://www.bls.gov/oes/current/oes111021.htm">http://www.bls.gov/oes/current/oes111021.htm</a>
	<b>Average</b>	<b>\$54.57</b>	<b>\$40.96</b>	<b>\$76.02</b>	
Technical Staff	Nuclear Engineers (172161)	\$51.46	\$42.46	\$71.60	<a href="http://www.bls.gov/oes/current/oes172161.htm">http://www.bls.gov/oes/current/oes172161.htm</a>
	Computer Support Specialists (151150)	\$33.54	\$24.84	\$50.12	<a href="http://www.bls.gov/oes/">http://www.bls.gov/oes/</a>
	Nuclear Technicians (194051)	\$40.87	\$32.38	\$56.36	<a href="http://www.bls.gov/oes/current/oes194051.htm">http://www.bls.gov/oes/current/oes194051.htm</a>
	Nuclear Power Reactor Operators (518011)	\$46.22	\$39.45	\$61.37	<a href="http://www.bls.gov/oes/current/oes518011.htm">http://www.bls.gov/oes/current/oes518011.htm</a>
	Industrial Machinery Mechanics (499041)	\$33.94	\$26.58	\$47.61	<a href="http://www.bls.gov/oes/current/oes499041.htm">http://www.bls.gov/oes/current/oes499041.htm</a>
	<b>Average</b>	<b>\$41.21</b>	<b>\$33.14</b>	<b>\$57.41</b>	
Admin Staff	Office and Administrative Support Occupations (430000)	\$25.35	\$18.21	\$38.85	<a href="http://www.bls.gov/oes/current/naics4_221100.htm#43-0000">http://www.bls.gov/oes/current/naics4_221100.htm#43-0000</a>
	First-Line Supervisors of Office and Administrative Support Workers (431011)	\$37.12	\$28.45	\$54.93	<a href="http://www.bls.gov/oes/current/oes431011.htm">http://www.bls.gov/oes/current/oes431011.htm</a>
	Office Clerks General (439061)	\$21.40	\$15.29	\$31.85	<a href="http://www.bls.gov/oes/current/oes439061.htm">http://www.bls.gov/oes/current/oes439061.htm</a>
	<b>Average</b>	<b>\$27.96</b>	<b>\$20.65</b>	<b>\$41.88</b>	
Licensing Staff	Paralegals and Legal Assistants (232011)	\$33.00	\$26.86	\$46.75	<a href="http://www.bls.gov/oes/current/oes232011.htm">http://www.bls.gov/oes/current/oes232011.htm</a>



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Position Title	Occupation (SOC Code)	Hourly Mean Wage (2017 dollars)	Hourly 10th Percentile Wage (2017 dollars)	Hourly 90th Percentile Wage (2017 dollars)	Source
	Lawyers (231011)	\$81.86	\$56.92	\$106.42	<a href="http://www.bls.gov/oes/current/oes231011.htm">http://www.bls.gov/oes/current/oes231011.htm</a>
	<b>Average</b>	<b>\$57.43</b>	<b>\$41.89</b>	<b>\$76.58</b>	
Total	<b>Average</b>	<b>\$55.26</b>	<b>\$40.26</b>	<b>\$75.12</b>	
	<b>Burdened labor rate</b>	<b>\$132.63</b>	<b>\$96.63</b>	<b>\$180.28</b>	
	<b>Burdened labor rate (2018 Dollars)</b>	<b>\$135.68</b>	<b>\$98.85</b>	<b>\$184.42</b>	

- (1) For this analysis, the NRC estimated that the 90th percentile is approximately 30 percent greater than the mean.
- (2) The North American Industry Classification System (NAICS) uses a production-oriented conceptual framework to group establishments into industries based on the activity in which they are primarily engaged. Further details about the NAICS framework are provided on the BLS web pages (Ref. 48).
- (3) The Standard Occupational Classification (SOC) system is used by Federal agencies to classify workers into occupational categories. Further details about the SOC system are provided on the BLS web pages (Ref. 49).
- (4) Data was extracted using a custom query function accessible at <https://www.bls.gov/oes/>. The query selected used multiple occupations for one industry. The industry sector selected was Sector 22, utilities and the industry was Industry 221100 - Electric Power Generation, Transmission and Distribution.

## APPENDIX B: UNCERTAINTY ANALYSIS VARIABLES

Values of low, most likely and high were derived from similar historical cost data and expert opinion of the NRC staff.

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
<b>2018 Hourly Rate for industry</b>	\$139.22	PERT	\$100.70	\$138.70	\$179.81
<b>2018 Hourly Rate for industry (IT Support)</b>	\$98.93	PERT	\$80.63	\$98.80	\$117.76
<b>2018 NRC Labor Rate</b>	\$148.00	PERT	\$130.00	\$131.00	\$234.00
<b>2018 Other Government Labor Rate</b>	\$78.62	PERT	\$24.50	\$79.91	\$127.57
<b>2018 General Public Labor Rate</b>	\$61.32	PERT	\$27.53	\$57.36	\$110.96
Industry Effort Comments	Mean value	Distribution Type	Low	Most Likely (Base)	High
<b>EP hours:</b>	180.2	PERT	154.5	180.2	205.9
<b>Physical security hours:</b>	91.7	PERT	78.6	91.7	104.8
<b>Cyber security hours:</b>	28.5	PERT	24.4	28.5	32.5
<b>Drug and alcohol testing hours:</b>	28.5	PERT	24.4	28.5	32.5
<b>CFH training hours:</b>	37.9	PERT	32.5	37.9	43.4
<b>Decommissioning financial assurance hours:</b>	148.6	PERT	127.4	148.6	169.8
<b>Offsite and onsite financial protection portion hours:</b>	47.4	PERT	40.6	47.4	54.2
<b>Backfit hours:</b>	98.0	PERT	84.0	98.0	112.0
<b>Environmental considerations, record retention requirements, and low-level waste transportation hours:</b>	237.1	PERT	203.2	237.1	271.0
Other Govt. Effort Comments	Mean value	Distribution Type	Low	Most Likely (Base)	High
<b>EP hours:</b>	378.3	PERT	324.2	378.3	432.3
<b>Physical security hours:</b>	57.6	PERT	49.4	57.6	65.8
<b>Cyber security hours:</b>	5.0	PERT	4.3	5.0	5.7
<b>Drug and alcohol testing hours:</b>	2.5	PERT	2.1	2.5	2.9
<b>CFH training hours:</b>	27.6	PERT	23.6	27.6	31.5
<b>Decommissioning financial assurance hours:</b>	147.8	PERT	126.7	147.8	168.9
<b>Offsite and onsite financial protection portion hours:</b>	45.1	PERT	38.6	45.1	51.5
<b>Backfit hours:</b>	37.6	PERT	32.2	37.6	42.9
<b>Environmental considerations, record retention requirements, and low-level waste transportation hours:</b>	390.8	PERT	335.0	390.8	446.6

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
<b>Gen Public Effort Comments</b>	<b>Mean value</b>	<b>Distribution Type</b>	<b>Low</b>	<b>Most Likely (Base)</b>	<b>High</b>
EP hours:	29.2	PERT	4.1	29.2	54.3
Physical security hours:	4.6	PERT	0.6	4.6	8.6
Cyber security hours:	1.5	PERT	0.2	1.5	2.9
Drug and alcohol testing hours:	1.5	PERT	0.2	1.5	2.9
CFH training hours:	1.5	PERT	0.2	1.5	2.9
Decommissioning financial assurance hours:	50.7	PERT	7.1	50.7	94.3
Offsite and onsite financial protection hours:	3.1	PERT	0.4	3.1	5.7
Backfit hours:	0.0	PERT	0.0	0.0	0.0
Environmental considerations, record retention requirements, and low-level waste transportation hours:	116.7	PERT	16.3	116.7	217.1
<b>Number of years remaining to implement rulemaking</b>					
<b>Number of years remaining to implement rulemaking</b>	3	NONE			
<b>NRC rulemaking contract support</b>	\$(150,000)	NONE			
<b>NRC cost (rulemaking)</b>	\$(6,060,439)	NONE			
<b>NRC cost (rulemaking) per year</b>	\$(2,020,146)	NONE			
<b>Number of NRC hours per year spent on this rulemaking effort</b>	13312	RISK UNIFORM	8606		18018
<b>Number of NRC hours per year spent on EP portion of rulemaking</b>	2293	RISK UNIFORM	1420		3167
<b>Number of NRC hours per year spent on physical security portion of rulemaking</b>	2293	RISK UNIFORM	1420		3167
<b>Number of NRC hours per year spent on cyber security portion of rulemaking</b>	462	RISK UNIFORM	355		568
<b>Number of NRC hours per year spent on drug and alcohol testing portion of rulemaking</b>	391	RISK UNIFORM	355		426
<b>Number of NRC hours per year spent on CFH training portion of rulemaking</b>	426	RISK UNIFORM	284		568
<b>Number of NRC hours per year spent on decommissioning</b>	1775	RISK UNIFORM	1420		2130

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
<b>financial assurance portion of rulemaking</b>					
<b>Number of NRC hours per year spent on offsite and onsite financial protection portion of rulemaking</b>	589	RISK UNIFORM	469		710
<b>Number of NRC hours per year spent on backfit portion of rulemaking</b>	156	RISK UNIFORM	99		213
<b>Number of NRC hours per year spent on environmental considerations, record retention requirements, and low-level waste transportation portions of rulemaking</b>	1938	RISK UNIFORM	710		3167
<b>Number of NRC hours per year for others (PRMB, RES, OGC, DORL (lessons learned)) spent on this rulemaking</b>	2442	RISK UNIFORM	1710		3175
<b>Number of nuclear power plant (NPP) sites that will enter the decommissioning transition phase after the rulemaking becomes effective</b>	58	NONE			
<b>Number of years from start of decommissioning, to transfer all spent fuel to dry cask storage in ISFSI</b>	10	INTEGER UNIFORM	5	10	16
<b>Number of years from start of decommissioning when all SF is transferred to DOE</b>	26	INTEGER UNIFORM	21	26	32
<b>Number of years from start of decommissioning to site dismantlement (SAFSTOR/ENTOMB method)</b>	50	INTEGER UNIFORM	40	50	60
<b>Number of years for site to decommission (DECON method)</b>	12	INTEGER UNIFORM	8	12	16
<b>Number of years for site to decommission (DECON or SAFSTOR/ENTOMB method)</b>	34	INTEGER UNIFORM	8	34	60
<b>Number of years for spent fuel management</b>	21	INTEGER UNIFORM	4	27	33
<b>IT staff personnel required to implement cyber security protection</b>	3.3	INTEGER UNIFORM	3	3	4
<b>Cost Impact to develop site specific cost estimate for DTF</b>	\$(333,333)	PERT	\$(300,000)	\$(300,000)	\$(500,000)
<b>Hours industry to process exemption (EP)</b>	1428.6	PERT	1246.8	1419.7	1646.2

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
Hours NRC to process exemption (EP)	714.3	PERT	623.4	709.8	823.1
Hours industry to process amendment (EP)	1043.6	PERT	632.2	1039.0	1473.6
Hours NRC to process amendment (EP)	521.8	PERT	316.1	519.5	736.8
Hours industry to process exemption (suspension of security)	20.0	PERT	18.2	20.0	21.8
Hours NRC to process exemption (suspension of security)	10.0	PERT	9.1	10.0	10.9
Hours industry to process exemption (core damage)	20.0	PERT	18.2	20.0	21.8
Hours NRC to process exemption (core damage)	10.0	PERT	9.1	10.0	10.9
Hours industry to process exemption (communications with control room)	40.0	PERT	36.4	40.0	43.6
Hours NRC to process exemption (communications with control room)	16.0	PERT	14.6	16.0	17.4
Hours industry to process amendment (reduction of control room)	100.0	PERT	93.0	100	107.0
Hours NRC to process amendment (reduction of control room)	40.0	PERT	37.2	40	42.8
Hours industry to process amendment (applying Part 72 to ISFSI)	300.0	PERT	279.0	300	321.0
Hours NRC to process amendment (applying Part 72 to ISFSI)	150.0	PERT	139.5	150	160.5
Hours industry to process amendment (cyber security)	70.5	PERT	24.0	68.3	126.0
Hours NRC to process amendment (cyber security)	34.7	PERT	12.0	33.3	63.0
Number of hours for NRC to update a regulatory guide	866.7	PERT	600	700	1800
Hours for industry to respond to RAI CFH training program	82.3	PERT	45.0	79.7	130.0

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
Hours NRC to approve CFH training program	164.6	PERT	90.0	159.4	260.0
Hours industry to process exemption (DTF)	260.6	PERT	107.0	243.7	482.2
Hours NRC to process exemption (DTF)	130.3	PERT	53.5	121.8	241.1
Hours for industry to update site specific cost estimate	7.0	PERT	4.0	7.0	10.0
Hours for NRC to review update to site specific cost estimate	7.0	PERT	4.0	7.0	10.0
Hours for industry to report decommissioning funding assurance per report	6.7	PERT	4.0	7.0	8.0
Hours for NRC to review single report on decommissioning funding assurance	6.7	PERT	4.0	7.0	8.0
Hours for industry to respond to RAIs for the approval of ISFSI reports under 72.30 ( c )	14.4	PERT	0.0	14.4	28.8
Hours for NRC to approve ISFSI reports under 72.30 ( c )	8.2	PERT	0.0	8.2	16.4
Hours industry to process exemption (Insurance)	200.7	PERT	171.8	199.4	234.6
Hours NRC to process exemption (Insurance)	100.3	PERT	85.9	99.7	117.3
Hours for industry to submit cover letter in compliance with 50.54 (w)(7)	0.8	PERT	0.5	0.8	1.0
Hours for industry to complete site-specific analysis for the adiabatic heatup of fuel assembly	14.5	PERT	8.7	13.9	22.3
Hours for NRC to review site specific analysis for the adiabatic heatup of fuel assembly	7.2	PERT	4.4	7.0	11.1
Hours for industry to update PSDAR	160.0	PERT	80.0	160.0	240.0
Hours for NRC to review update of the PSDAR	80.0	PERT	40.0	80.0	120.0
Hours for industry to complete full environmental analysis for decommissioning	1500.0	PERT	1000.0	1500.0	2000.0

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
Hours for NRC to complete NEPA analysis	1500.0	PERT	1000.0	1500.0	2000.0
Hours for industry to prepare and submit PSDAR amendment	4000.0	PERT	3000.0	4000.0	5000.0
Hours for NRC to review PSDAR amendment	2000.0	PERT	1500.0	2000.0	2500.0
Hours for industry to summarize the spent fuel management and put this summary in the PSDAR	1.1	PERT	0.8	1.1	1.5
Hours industry to process exemption (Records)	94.5	PERT	38.7	91.6	162.0
Hours NRC to process exemption (Records)	47.2	PERT	19.4	45.8	81.0
Hours industry to process exemption (Transportation)	77.5	PERT	35.0	77.5	120.0
Hours NRC to process exemption (Transportation)	38.8	PERT	17.5	38.8	60.0
Hours industry to process exemption (FOCD)	71.1	PERT	22.0	67.6	134.0
Hours NRC to process exemption (FOCD)	35.5	PERT	11.0	33.8	67.0
Averted time for teleconference calls (environmental considerations, record retention requirements, and low-level waste transportation areas) in hours	0.3	PERT	0.1	0.3	0.5
Number of teleconference calls per licensee per month for status updates and to resolve issues (environmental considerations, record retention requirements, and low-level waste transportation areas)	1.0	DUNIFORM	1.0		3.0

Parameter	Mean value	Distribution Type	Low	Most Likely (Base)	High
Number of industry people in the teleconference calls (environmental considerations, record retention requirements, and low-level waste transportation areas)	8.0	DUNIFORM	6.0		10.0
Number of NRC people in the teleconference calls (environmental considerations, record retention requirements, and low-level waste transportation areas)	4.0	DUNIFORM	2.0		6.0
Number of months for the teleconference calls	3.0	DUNIFORM	2.0		4.0
<b>FEMA fees averted</b>	\$1,036,815	PERT	\$514,005	\$946,665	\$1,917,863
<b>Average cost of business travel per week:</b>	\$950	PERT	\$600	\$950	\$1,300
<b>Industry one-time cost (pre-access drug &amp; alcohol testing) per NPP</b>	\$(168,628)	PERT	\$(202,353)	\$(168,628)	\$(134,902)
<b>Industry annual cost (manage drug &amp; alcohol testing) per NPP</b>	\$(345,479)	PERT	\$(414,575)	\$(345,479)	\$(276,383)
<b>NRC annual cost (administration drug &amp; alcohol Testing) per NPP</b>	\$(6,556)	PERT	\$(7,867)	\$(6,556)	\$(5,245)
<b>Time (in years) for NPP site to submit exemptions/amendments with respect to shutdown date</b>	0	DISCRETE UNIFORM	-1	0	1
<b>Time (in years) for NRC to finalize exemptions/amendments with respect to shutdown date</b>	1	DISCRETE UNIFORM	1	2	