American Society of Mechanical Engineers 2019–2020 Code Editions Incorporation by Reference Proposed Rule – Draft Regulatory Analysis

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Office of Nuclear Material Safety and Safeguards
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Abstract

The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to incorporate by reference the 2019 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Division 1, and Section XI, Division 1, with conditions; the 2020 Edition of Division 1 of the ASME Code for Operation and Maintenance of Nuclear Power Plants, with conditions; the 2011 Addenda to ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications," without conditions; and the 2012 and 2015 Editions of ASME NQA-1, with conditions.

The NRC has a well-established practice for approving these consensus standards through the rulemaking process and incorporating them by reference into the NRC's requirements in Title 10 of the *Code of Federal Regulations* 50.55a, "Codes and standards." This practice increases consistency across the industry and demonstrates the NRC's willingness to support the use of the most updated and technically sound techniques developed by ASME to adequately protect the public.

This document is a regulatory analysis for the proposed rule. To improve the credibility of the NRC's cost estimates for this regulatory action, the staff conducted an uncertainty analysis to consider the effects of input uncertainty on the cost estimate and a sensitivity analysis to identify the variables that most affect the cost estimate (i.e., the cost drivers). The NRC's analysis demonstrates that the proposed rule, if made into a final rule, would result in a net averted cost to the industry that ranges from $6.26 million using a 7-percent discount rate to $6.99 million using a 3-percent discount rate. Compared to the regulatory baseline, the NRC would realize a net averted cost that ranges from $0.30 million using a 7-percent discount rate to $0.37 million using a 3-percent discount rate.

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Executive Summary

The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to incorporate by reference the 2019 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section III, Division 1, and Section XI, Division 1, with conditions; the 2020 Edition of Division 1 of the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code), with conditions; the 2011 Addenda to ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications," without conditions; and the 2012 and 2015 Editions of ASME NQA-1, with conditions. A significant portion of the averted costs from this proposed rule result from the reduction in burden of plant-specific requests for alternatives because these provisions would be incorporated by reference.

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

- Proposed Rule Analysis. The proposed rule recommended by the staff would result in a cost-justified change based on a net (i.e., taking into account both costs and benefits) averted cost to the industry ranging from $6.26 million (7-percent net present value (NPV)) to $6.99 million (3-percent NPV). Relative to the regulatory baseline, the NRC would realize a net averted cost ranging from $0.49 million (7-percent NPV) to $0.57 million (3-percent NPV). Table ES-1 shows that the total costs and benefits of proceeding with the rule would result in net averted costs to the industry and the NRC ranging from $6.75 million (7-percent NPV) to $7.56 million (3-percent NPV).

Table ES-1 Total Costs and Benefits for Rulemaking (Alternative 2)

Attribute	Costs		
	Undiscounted	7% NPV	3% NPV
Total Industry Costs	$0	$0	$0
Total NRC Costs	($340,000)	($320,000)	($330,000)
Total Costs	($340,000)	($320,000)	($330,000)
Attribute	**Benefits**		
	Undiscounted	7% NPV	3% NPV
Total Industry Benefits	$7,650,000	$6,260,000	$6,990,000
Total NRC Benefits	$990,000	$810,000	$900,000
Total Benefits	$8,640,000	$7,070,000	$7,890,000
Attribute	**Net Benefits (Costs)**		
	Undiscounted	7% NPV	3% NPV
Industry	$7,650,000	$6,260,000	$6,990,000
NRC	$650,000	$490,000	$570,000
Total	$8,300,000	$6,750,000	$7,560,000

Note: Numbers rounded to the nearest ten thousand dollars. Totals throughout this document may differ because of rounding. All values are reported in 2020 dollars.

- Nonquantified Benefits. Other benefits of the proposed rule include the NRC's continued ability to meet its goal of ensuring the protection of public health and safety and the environment through the agency's approval of new editions of the ASME BPV Code and ASME OM Code, which allow the use of the most current methods and technology. The proposed rule is consistent with the provisions of the National Technology Transfer and Advancement Act of 1995 and implementing guidance in Office of Management and Budget Circular A-119, "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities," dated January 27, 2016, which encourage Federal regulatory agencies to consider adopting voluntary consensus standards as an alternative to *de novo* agency development of standards affecting an industry. Finally, the ASME code consensus process is an important part of the regulatory framework.

- Uncertainty Analysis. This regulatory analysis contains a simulation analysis showing that the estimated mean benefit for this proposed rule is $6.75 million with 90-percent confidence that the total net benefit is between $5.68 million and $7.87 million (7-percent NPV). A reasonable inference from the uncertainty analysis is that proceeding with the proposed rule represents an efficient use of resources and averted costs to the NRC and the industry. The hours for alternative request preparation and submission by industry and the number of such alternative requests are the factors responsible for the largest variations in averted costs.

- Decision Rationale. Relative to the no-action baseline, the NRC concludes that the proposed rule is justified from a quantitative standpoint because its provisions would result in net averted costs (i.e., net benefits) to the NRC and the industry. In addition, the NRC concludes that the proposed rule is also justified because of the nonquantified benefits that would be incurred as a result of this rule.

Abbreviations and Acronyms

ADAMS	Agencywide Documents Access and Management System
ASME	American Society of Mechanical Engineers
ASME Codes	ASME BPV and OM Codes
ASME OM Committee	ASME Committee on Operation and Maintenance of Nuclear Power Plants
BLS	Bureau of Labor Statistics
BPV	boiler and pressure vessel
CFR	*Code of Federal Regulations*
CPI-U	Consumer Price Index for All Urban Consumers
CRGR	Committee To Review Generic Requirements
FR	*Federal Register*
GDC	general design criterion/criteria
IBR	incorporation by reference
ISI	inservice inspection
IST	inservice testing
NAICS	North American Industry Classification System Code
NDE	nondestructive examination
NPV	net present value
NQA	Nuclear Quality Assurance
NRC	U.S. Nuclear Regulatory Commission
NTTAA	National Technology Transfer and Advancement Act of 1995
OM	operation and maintenance
OM Code	(ASME) Code for Operation and Maintenance of Nuclear Power Plants
OMB	Office of Management and Budget
PERT	program evaluation and review technique

1. Introduction

This document presents the regulatory analysis for the proposed rule to incorporate by reference specific American Society of Mechanical Engineers (ASME) codes and Code Cases. The proposed rule incorporates by reference the following items into U.S. Nuclear Regulatory Commission (NRC) regulations:

- the 2019 Edition of the ASME Boiler and Pressure Vessel (BPV) Code, Section III, Division 1, and Section XI, Division 1, and delineation of NRC requirements for the use of this code, with conditions

- the 2020 Edition of Division 1 of the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) and delineation of NRC requirements for the use of this code, with conditions

- the 2011 Addenda to ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications" (ASME NQA-1b-2011), without conditions

- the 2012 and 2015 Editions of ASME NQA-1, with conditions

The NRC analyzed the ASME BPV and OM Code editions (together referred to as the ASME Codes) to determine whether they are (1) acceptable without conditions, (2) acceptable with conditions, or (3) not approved. Generally, when the NRC approves codes with conditions, licensees may experience additional regulatory burden to meet the conditioned requirements.

2. Statement of the Problem and Objective

ASME develops and publishes the ASME BPV Code, which contains requirements for design, construction, and inservice inspection (ISI) of nuclear power plant components, and the ASME OM Code, which contains requirements for operation and inservice testing (IST) of nuclear power plant components. Until 2012, ASME issued new editions of the BPV Code every 3 years and addenda to the editions annually, except in years when it issued a new edition. Similarly, ASME periodically published new editions of an addenda to the OM Code. Starting in 2012, ASME decided to issue editions of its BPV and OM Codes (no addenda) every 2 years, issuing the BPV Code in the odd years (e.g., 2013, 2015) and the OM Code in the even years[1] (e.g., 2012, 2014). The new editions and addenda typically revise provisions of the ASME Codes to broaden their applicability, add specific elements to current provisions, delete specific provisions, clarify them to narrow the applicability of the provision, or a combination of these. The editions of and addenda to the ASME Codes do not significantly change code philosophy or approach.

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and standards," establishes requirements for the design, construction, operation, ISI, and IST of nuclear power plants. In 10 CFR 50.55a, the NRC approves or mandates the use of certain parts of ASME Code editions and addenda through the rulemaking process of incorporation by reference (IBR). Upon IBR of the ASME Codes into 10 CFR 50.55a, the provisions of the ASME Codes are legally binding NRC requirements, as delineated in 10 CFR 50.55a, subject to the conditions on certain specific ASME Code provisions specified in 10 CFR 50.55a. The NRC last incorporated

[1] The 2014 Edition of the ASME OM Code was delayed and was designated the 2015 Edition. Similarly, the 2016 Edition of the OM Code was delayed and was designated the 2017 Edition.

by reference editions of and addenda to the ASME Codes into the regulations in a final rule (Volume 82 of the *Federal Register*, page 32934 (82 FR 32934); July 18, 2017), subject to NRC conditions.

2.1 Background

Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic licensing of production and utilization facilities," provides the bases and requirements for the NRC's assessment of the use of generally recognized codes and standards and the potential for, and consequences of, degradation of the reactor coolant pressure boundary. As appropriate, similar requirements appear in the licensing basis for a reactor facility. The applicable general design criteria (GDC) include GDC 1, "Quality Standards and Records"; GDC 14, "Reactor Coolant Pressure Boundary"; and GDC 32, "Inspection of Reactor Coolant Pressure Boundary."

GDC 1 requires, in part, the following:

> Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function.

GDC 14 establishes the following:

> The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

Additionally, GDC 32 establishes the following:

> Components which are part of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leaktight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel.

The National Technology Transfer and Advancement Act of 1995 (Public Law 104-113, 1995) (NTTAA) mandates the following:

> All Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments.

In carrying out this legislation, Federal agencies are to consult with voluntary consensus standards bodies and participate with such bodies in developing technical standards when such participation is in the public interest and compatible with the agency mission, priorities, and budget resources. If the technical standards are inconsistent with applicable law or otherwise impractical, a Federal agency may choose to use technical standards that are not developed or adopted by voluntary consensus bodies.

Since 1971, provisions of the ASME BPV Code have been one part of the framework to establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety. Various technical interests (e.g., utility, manufacturing, insurance, regulatory) are represented on the ASME standards committees that develop, among other things, improved methods for the construction and ISI of nuclear power plant components categorized as ASME Class 1, 2, and 3; metal containment; and concrete containment. This broad spectrum of stakeholders helps to ensure that the various interests are considered.

A directive from the ASME Board on Nuclear Codes and Standards transferred responsibility for the development and maintenance of rules for the IST of pumps and valves from the ASME Section XI Subcommittee on Nuclear Inservice Inspection to the ASME Committee on Operation and Maintenance of Nuclear Power Plants (ASME OM Committee); this led to the development of the OM Code. In 1990, ASME published the initial edition of the OM Code, which provides rules for IST of pumps and valves. The ASME OM Committee continues to maintain the OM Code. ASME intended that the OM Code replace the ASME BPV Section XI rules for IST of pumps and valves. The ASME Section XI Committee no longer updates the Section XI rules for IST of pumps and valves, which were previously incorporated by reference into NRC regulations.

In 10 CFR 50.55a, the NRC requires that nuclear power plant owners construct Class 1, 2, and 3 components in accordance with the ASME BPV Code, Section III, Division 1. Regulations in 10 CFR 50.55a also require that owners perform ISI of Class 1, 2, 3, metal containment, and concrete containment components in accordance with ASME BPV Code, Section XI, Division 1, and that they perform IST of safety-related pumps and valves within the scope of the ASME OM Code in accordance with the ASME OM Code. ASME develops Code Cases to gain experience with new technology before incorporating it into the ASME Codes; permit licensees to use advances in ISI and IST; offer alternative examinations for older plants; respond expeditiously to user needs; and provide a limited, clearly focused alternative to specific ASME Code provisions.

2.2 Statement of the Problem

In this regulatory action, the NRC is conditioning the use of the 2019 Edition of the ASME BPV Code, Section III, Division 1, and ASME BPV Code, Section XI, Division 1. If the NRC did not conditionally accept ASME Code editions (or addenda and Code Cases), the NRC would disapprove these provisions entirely. One outcome of this action might be that licensees and applicants would submit a petition for rulemaking, requesting the NRC to incorporate by reference the full scope of the ASME Code editions and addenda that would otherwise be approved through rulemaking (i.e., the request would not be simply for approval of a specific ASME Code provision with conditions). Alternatively, licensees and applicants could submit a larger number of requests for the use of alternatives under 10 CFR 50.55a(z) or requests for exemptions under 10 CFR 50.12 or 10 CFR 52.7, both entitled “Specific exemptions.” These alternative or exemption requests could also include similar broad-scope requests for approval to use the full scope of the ASME Code editions and addenda. These requests would pose an unnecessary additional burden on both the licensee and the NRC, inasmuch as the NRC has already determined that the ASME Codes and Code Cases that are the subject of this regulatory action are acceptable for use (in some cases with conditions).

2.3 Objective

The objective of this regulatory action is to incorporate by reference the 2019 Edition of the ASME BPV Code, Section III, Division 1, and ASME BPV Code, Section XI, Division 1, with conditions; the 2020 Edition of Division 1 of the ASME OM Code, with conditions; ASME NQA-1b-2011, without conditions; and the 2012 and 2015 Editions of ASME NQA-1, with conditions.

3. Identification and Preliminary Analysis of Alternative Approaches

This section analyzes the alternatives that the NRC considered for conditioning the use of certain provisions of the ASME Codes. The NRC identified two alternatives:

(1) the no-action alternative (i.e., regulatory baseline)

(2) the IBR of the 2019 Edition of the ASME BPV Code, Section III, Division 1, and ASME BPV Code, Section XI, Division 1, with conditions; the IBR of the 2020 Edition of Division 1 of the ASME OM Code, with conditions; the IBR of ASME NQA-1b-2011, without conditions; and the IBR of the 2012 and 2015 Editions of ASME NQA-1, with conditions

3.1 Alternative 1—No Action

The no-action alternative is a non-rulemaking alternative. This alternative would not revise the NRC's regulations.

The no-action alternative would require licensees and applicants that want to use the many provisions of the ASME Code editions above to request and receive NRC approval for the use of alternatives under 10 CFR 50.55a(z).

3.2 Alternative 2—Incorporate by Reference the ASME Codes with Conditions

In Alternative 2, a rulemaking alternative, the NRC proposes to incorporate by reference the following in the *Code of Federal Regulations*:

- the 2019 Edition of the ASME BPV Code, Section III, including Subsection NCA, and Division 1, Subsections NB through NG and appendices
- the 2019 Edition of the ASME BPV Code, Section XI, Division 1, with conditions
- the 2020 Edition of Division 1 of the ASME OM Code, with conditions
- ASME NQA-1b-2011, without conditions
- the 2012 and 2015 Editions of ASME NQA-1, with conditions

As a result, the provisions of the ASME Codes would be legally binding NRC requirements, as delineated in 10 CFR 50.55a, and subject to the conditions on specific ASME Code provisions in 10 CFR 50.55a.

The NRC recommends this rulemaking alternative for the following reasons:

- This alternative reduces the regulatory burden on applicants and licensees of nuclear power plants by eliminating the need to submit plant-specific requests for alternatives in accordance with 10 CFR 50.55a(z) and the need for the NRC to review those submittals.

- This alternative meets the NRC's goal of ensuring the protection of public health and safety and the environment by continuing to provide NRC approval of new ASME Code editions that allow the use of the most current methods and technology.

- This alternative supports the NRC's goal of maintaining an open regulatory process by informing the public about the process and by giving the public the opportunity to participate in it.

- This alternative supports the NRC's commitment to participating in the national consensus standard process through the approval of these ASME Code editions, and it conforms to NTTAA requirements.

- The initial burden on the NRC to update the regulations by incorporating by reference the editions of and addenda to the ASME Codes cited here is more than offset by the reduction in the number of plant-specific alternative requests that the NRC would otherwise evaluate. Section 5 of this analysis discusses the costs and benefits of this alternative compared to the regulatory baseline (Alternative 1).

4. Estimation and Evaluation of Costs and Benefits

This section describes the process for evaluating the costs and benefits expected to result from each alternative relative to the regulatory baseline (Alternative 1). All costs and benefits are monetized, when possible. The total costs and benefits are then summed to determine whether the difference between the costs and benefits results in a positive benefit. In some cases, costs and benefits are not monetized because meaningful quantification is not possible.

4.1 Identification of Affected Attributes

This section identifies the components of the public and private sectors, commonly referred to as "attributes," that are expected to be affected by the alternatives identified in Section 3. The alternatives would apply to licensees and applicants for nuclear power plants and nuclear power plant design certifications. The NRC believes that nuclear power plant licensees would be the primary beneficiaries. The NRC developed an inventory of the impacted attributes using NUREG/BR-0058, Draft Final Revision 5, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," dated February 13, 2020 (NRC, 2020).

The rule would affect the following attributes:

- <u>Public Health (Accident)</u>. This attribute accounts for expected changes in radiation exposure to the public caused by changes in accident frequencies or accident consequences associated with the alternative (i.e., delta risk). A decrease in public radiological exposure is a decrease in risk (i.e., benefit); an increase in public exposure is an increase in risk (i.e., cost).

- Occupational Health (Accident). This attribute measures immediate and long-term health effects on site workers because of changes in accident frequency or accident consequences associated with the alternative (i.e., delta risk). A decrease in worker radiological exposure is a decrease in risk (i.e., benefit); an increase in worker exposure is an increase in risk (i.e., cost).

- Occupational Health (Routine). This attribute accounts for radiological exposure to workers during normal facility operations (i.e., non-accident situations). An action could result in an increase in worker exposure. Sometimes this will be a one-time effect (e.g., installation or modification of equipment in a hot area); sometimes it will be an ongoing effect (e.g., routine surveillance or maintenance of contaminated equipment or equipment in a radiation area).

- Industry Implementation. This attribute accounts for the projected net economic effect on the affected licensees of implementing the mandated changes. Additional costs above the regulatory baseline are considered negative, and cost savings and averted costs are considered positive.

- Industry Operation. This attribute accounts for the projected net economic effect caused by routine and recurring activities required by the alternative on all affected licensees. For example, an alternative that would allow a nuclear power plant licensee to use the latest edition of the ASME BPV Code without submitting an alternative request would provide a net benefit (i.e., averted cost) to the licensee.

- NRC Implementation. This attribute accounts for the projected net economic effect on the NRC of placing the alternative into operation. It includes NRC implementation costs and benefits incurred in addition to those expected under the regulatory baseline.

- NRC Operation. This attribute accounts for the projected net economic effect caused by routine and recurring activities on the NRC after the rule is implemented. If the NRC does not approve changes to licensee design, fabrication, construction, testing, and inspection practices because the licensee or applicant wants to use an unapproved ASME Code, the licensee or applicant must request, under 10 CFR 50.55a(z), permission to use a more recent ASME Code by submitting a request to apply the updated edition or addenda as an alternative to the ASME Code provisions. This submittal requires additional staff time to evaluate the ASME Code to determine its acceptability and whether any limitations or modifications should apply. Under the proposed rule (Alternative 2), these alternative requests would not be necessary, which would result in a net benefit (i.e., averted cost) for the NRC. Licensees wishing to update early to all or part of a new edition would still need to request NRC approval for that early update.

- Improvements in Knowledge. This attribute accounts for improvements in knowledge acquired as the industry and the staff gain experience with new technology before its incorporation into the ASME Codes and by permitting licensees to use advances in ISI and IST. Improved ISI and IST may also result in the earlier identification of material degradation that, if undetected, could lead to further degradation that eventually causes a plant transient.

- Regulatory Efficiency. This attribute accounts for regulatory and compliance improvements resulting from the implementation of Alternative 2 relative to the regulatory baseline. Alternative 2 would continue the best practice of aligning NRC regulations with ASME Code standards, thereby providing the industry with the regulatory provisions for which it has sought permission via alternative requests. This rulemaking would reduce the effort the industry expends generating these requests and considering alternative means to accomplish the goals of these provisions.

- Other Considerations. This attribute accounts for considerations not captured in the preceding attributes. Specifically, this attribute accounts for how Alternative 2 meets specific requirements of the Commission, helps achieve NRC policy, and provides other advantages or detriments.

- Attributes with No Effects. Attributes not expected to be affected under any of the alternatives include considerations of public health (routine), offsite property, onsite property, other governments, the general public, safeguards and security, and the environment.

4.2 Analytical Methodology

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

Of the 10 affected attributes, the analysis evaluates four—industry implementation, industry operation, NRC implementation, and NRC operation—on a quantitative basis. Quantitative analysis requires a baseline characterization of the affected society, including factors such as the number of affected power plants, the nature of the activities currently performed, and the types of systems and procedures that licensees or applicants would implement, or would no longer implement, because of the alternatives. The staff calculated costs for these four attributes using three-point estimates to quantify the uncertainty in these estimates. The detailed cost tables used in this regulatory analysis are included in the individual sections for each of the provisions. The NRC evaluated the remaining six attributes on a qualitative basis because some benefits relating to consistent policy application and improvements in ISI and IST techniques are not quantifiable or because the data necessary to quantify and monetize the impacts on these attributes are not available. The staff documents its assumptions throughout this regulatory analysis. For reader convenience, Appendix A to this analysis summarizes the major assumptions and input data.

4.2.1 Regulatory Baseline

This regulatory analysis identifies the incremental impacts of the proposed rule compared to a baseline that reflects anticipated behavior if the NRC does not undertake regulatory or nonregulatory action. The regulatory baseline assumes full compliance with existing NRC requirements, including current regulations and relevant orders. This is consistent with NUREG/BR-0058, Draft Final Revision 5 (NRC, 2020), which states the following:

> In establishing the baseline case, the analyst should assume that all existing NRC and Agreement State requirements and written licensee commitments are already being implemented and that the costs and benefits associated with these

requirements are not part of the incremental estimates prepared for the regulatory analysis.

Section 5 of this regulatory analysis presents the estimated incremental costs and benefits of the alternatives compared to this baseline.

4.2.2 Affected Entities

This proposed rule will affect all operating light-water nuclear power plants. The analysis considers 57 plant sites containing one or more operating U.S. light-water nuclear power reactor units in 2020, 55 plant sites in 2021, and 54 plant sites in 2022 through 2024.

4.2.3 Base Year

All monetized costs are expressed in 2020 dollars, the planned year in which the proposed rule was to be published in the *Federal Register*. Ongoing costs of operation related to Alternative 2 are assumed to begin no earlier than 30 days after publication of the final rule in the *Code of Federal Regulations* unless otherwise stated, and they are modeled on an annual cost basis. Estimates are made for one-time NRC implementation costs. The NRC assumes that these costs will be incurred in year 2021. Estimates are made for recurring annual operating expenses. The values for annual operating expenses are modeled as a constant expense for each year of the analysis horizon. The staff performed a discounted cash flow calculation to discount these annual expenses to 2020 dollar values.

4.2.4 Discount Rates

In accordance with guidance from Office of Management and Budget (OMB) Circular A-4, “Regulatory Analysis,” issued October 2003 (OMB, 2003), and NUREG/BR-0058, Draft Final Revision 5 (NRC, 2020), net present value (NPV) 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 NPVs, costs and benefits, regardless of when the cost or benefit is incurred, are valued to a reference year for comparison. The choice of a discount rate and its associated conceptual basis is a topic of ongoing discussion within the Federal Government. Based on OMB Circular A-4 and consistent with NRC past practice and guidance, present-worth calculations in this analysis use 3-percent and 7-percent real discount rates. A 3-percent discount rate approximates the real rate of return on long-term Government debt, which serves as a proxy for the real rate of return on savings to reflect reliance on the discounting concept of social rate of time preference.[2] A 7-percent discount rate approximates the marginal pretax real rate of return on an average investment in the private sector, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. A 7-percent rate is consistent with an opportunity cost[3] of capital concept to reflect the time value of resources directed to meet regulatory requirements.

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

[3] “Opportunity cost” represents what is foregone by undertaking a given action. If the licensee personnel were not engaged in revising procedures, they would be occupied by other work activities. Throughout the analysis, the NRC estimates the opportunity cost of performing these incremental tasks as the industry personnel’s pay for the designated unit of time.

4.2.5 Cost-Benefit Inflators

The NRC estimated the analysis inputs for some attributes based on the values published in the sources referenced, which are provided in prior-year dollars. To evaluate the costs and benefits consistently, these inputs are put into 2020 base-year 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). Using the CPI-U, the prior-year dollars are converted to 2020 dollars. The NRC used the following formula to determine the amount in 2020 base-year dollars from 2019:

$$\frac{CPI - U_{2020}}{CPI - U_{2019}} \, x \, Value_{2020} = Value_{2020}$$

Table **1** summarizes the values of CPI-U used in this regulatory analysis.

Table 1 CPI-U Inflator

Base Year	CPI-U Annual Average[a]	Percent Change from Previous Year
2019	255.657	
2020	260.289	1.81%

a For year 2020, the CPI-U annual average is the average value for the first 4 months.
Source: BLS, 2020

4.2.6 Labor Rates

For the purposes of this regulatory analysis, the NRC developed labor rates that include only labor and material costs that are directly related to the implementation, operation, and maintenance of the proposed rule requirements. This approach is consistent with the guidance in NUREG/CR-3568, "A Handbook for Value-Impact Assessment," issued December 1983 (NRC, 1983), and general cost-benefit methodology. The NRC incremental labor rate is $131 per hour in 2020 dollars.[4]

The NRC used the 2019 BLS Occupational Employment and Wages data (BLS, 2019) for the nuclear electric power generation industry (North American Industry Classification System (NAICS) Code 221113), which provide labor categories and the mean hourly wage rate by job type, and used the inflator discussed above to inflate these labor rate data to 2020 dollars. The labor rates used in the analysis reflect total hourly compensation, which includes wages and nonwage benefits (using a burden factor of 2.4, applicable for contract labor and conservative for regular utility employees). 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 alternative. In establishing this labor rate, wages paid to 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 incremental expenses and are included.

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4 These NRC labor rates differ from those developed under the NRC's license fee recovery program (10 CFR Part 170, "Fees for facilities, materials, import and export licenses, and other regulatory services under the Atomic Energy Act of 1954, as amended"). NRC labor rates for fee recovery purposes are appropriately designed for full-cost recovery of the services rendered and thus include nonincremental costs (e.g., overhead, administrative, and logistical support costs).

Table **2** summarizes the BLS labor categories used to estimate industry labor costs to implement this proposed rule, and Appendix A lists the industry labor rates used in the analysis. The NRC performed an uncertainty analysis (see Section 5.13).

Table 2 Position Titles and Occupations

Position Title (in This Regulatory Analysis)	Standard Occupational Classification Code
Managers	Top Executives (111000)
	Chief Executives (111011)
	General and Operations Managers (111021)
	Industrial Production Managers (113051)
	First-Line Supervisors of Mechanics Installers and Repairers (491011)
	First-Line Supervisors of Production and Operating Workers (511011)
Technical Staff	Nuclear Engineers (172161)
	Physicists (192012)
	Nuclear Technicians (194051)
	Industrial Machinery Mechanics (499041)
	Nuclear Power Reactor Operators (518011)
Administrative Staff	Office and Administrative Support Occupations (430000)
	First-Line Supervisors of Office and Administrative Support Workers (431011)
	Office Clerks, General (439061)
Licensing Staff	Lawyers (231011)
	Paralegals and Legal Assistants (232011)

Source: BLS, 2019

4.2.7 Sign Conventions

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

4.2.8 Applicability Period

ASME issues editions of its BPV and OM Codes (no addenda) every 2 years, with the BPV Code issued in the odd years (e.g., 2013, 2015) and the OM Code in the even years (e.g., 2012, 2014). The NRC typically will incorporate by reference the editions of the BPV and OM Codes through rulemaking at the time the next edition of the OM Code is updated. The next edition of the BPV Code will have already been updated the year before. The next time the OM Code is expected to be updated is 2022. At that time, the NRC will start the next Code Editions proposed rule, assuming there are no delays in ASME updating the next future editions of the BPV and OM Codes. Since it is assumed the next Code Editions rule will take 2 years to complete and that this rule will be in effect in beginning of 2022, the applicability period of this proposed rule is 2022–2024 or 3 years.

4.2.9 Cost Estimation

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

The NRC gathered data from several sources and consulted ASME Code working group members to develop level of effort and unit cost estimates. The NRC applied several cost estimation methods in this analysis and used its collective professional knowledge and judgment to estimate many of the costs and benefits. Additionally, the NRC used a buildup method, solicitation of licensee input, and extrapolation techniques to estimate costs and benefits.

The NRC began by estimating some activities using the engineering buildup method of cost estimation, which combines incremental costs of an activity from the bottom up to estimate a total cost. For this step, the NRC reviewed previous license submittals and determined the number of pages in each section, then used these data to develop preliminary levels of effort. The NRC consulted subject matter experts within the agency to develop most of the level of effort estimates used in the analysis.

The NRC extrapolated to estimate some cost activities, relying on actual past or current costs to estimate the future cost of similar activities. For example, to calculate the estimated averted costs of alternative requests and the costs for preparation of the proposed rule, the NRC used data on past projects to determine the labor categories of those who would perform the work and to estimate the time required under each category to complete the work.

To evaluate the effect of uncertainty in the model, the NRC used Monte Carlo simulation, which is an approach to uncertainty analysis that expresses input variables as distributions. The staff ran the simulation 10,000 times and chose values at random from the distributions of the input variables**Error! Reference source not found.**. The result was a distribution of values for the output variable of interest. Monte Carlo simulation also enables users to determine the input variables that have the greatest effect on the value of the output variable. Chapter 5 of this analysis describes the Monte Carlo simulation methods and presents the results.

4.2.10 ASME BPV and OM Codes Incorporated by Reference

The NRC analyzed the 2019–2020 Editions of the ASME Codes to determine whether they are (1) acceptable without conditions or (2) generally acceptable with conditions. Typically, when the NRC approves codes with conditions, licensees may experience additional regulatory burden to meet the conditioned requirements. For each applicable case, the conditions may specify additional activities that must be performed, the limits on the activities, or supplemental information needed to provide clarity (or a combination of these). This regulatory analysis looked at the conditions of the 2019–2020 Editions of the ASME Codes to determine the overall costs and benefits.

4.3 Data

This section discusses the data used in analyzing the quantifiable impacts associated with the rulemaking alternative. For this regulatory analysis, the NRC used data from subject matter experts, applied knowledge gained from past rulemakings, and obtained quantitative and qualitative (i.e., nonquantified) information on attributes affected by the proposed rule from the staff. The NRC considered the potential differences between the new requirements and the current requirements and incorporated the incremental changes into this analysis.

5. Results

This section presents the quantitative and qualitative results by attribute for Alternative 2 relative to the regulatory baseline (Alternative 1). As described in the previous sections, costs and benefits were quantified when possible and are shown to be either positive or negative, depending on whether the alternative has a favorable or adverse effect compared to the regulatory baseline. Attributes not presented in monetary values are discussed in qualitative terms. This *ex ante* cost-benefit analysis[5] provides information that can be useful when deciding whether to select an alternative, even if the analysis is based on estimates of the future costs and benefits.

The NRC's regulatory analysis guidelines (NRC, 2020) state that the NRC's practice of periodic review and endorsement of consensus standards, such as new versions of the ASME Codes and associated Code Cases, is a special case because consensus standards have already undergone extensive external review and have received industry endorsement. In addition, endorsement of the ASME Codes and Code Cases has been a longstanding NRC policy. Licensees and applicants participate in the development of the ASME Codes and Code Cases and are aware that periodic updating of the ASME Codes is part of the regulatory process. Code Cases are ASME-developed alternatives to the ASME Codes, which licensees and applicants may voluntarily choose to adopt without an alternative request if the Code Cases are approved through IBR in the NRC's regulations. Finally, endorsement of the ASME Codes and Code Cases is consistent with the NTTAA, because the NRC has determined that sound regulatory reasons exist for establishing regulatory requirements for design, maintenance, ISI, IST, and examination by rulemaking.

The NRC is amending most of the existing conditions of 10 CFR 50.55a(a)(b) so that they apply to the 2019 Edition to the ASME BPV Code, Section III, Division 1. As a result, these amendments will result in no incremental costs or benefits. The following are the existing conditions and the associated BPV Codes:

- 10 CFR 50.55a(b)(1)(ii) Section III condition: weld leg dimensions
- 10 CFR 50.55a(b)(1)(iii) Section III condition: seismic design of piping
- 10 CFR 50.55a(b)(1)(vii) Section III condition: capacity certification and demonstration of function of incompressible-fluid pressure-relief valves
- 10 CFR 50.55a(b)(1)(x) Section III condition: visual examination of bolts, studs, and nuts
- 10 CFR 50.55a(b)(1)(iv) Section III condition: quality assurance

Other amendments that pertain to the 2019 Edition to the ASME BPV Code, Section III, Division 1, will result in incremental benefits to industry and are discussed below with the associated attributes.

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5 An "*ex ante* cost-benefit analysis" is prepared before a policy, program, or alternative is in place and can help in deciding whether resources should be allocated to that alternative.

The NRC proposes to amend the following regulations and conditions to remove references to pre-2001 Editions and Addenda of the ASME BPV Code, Section XI, because licensees are no longer using earlier versions of the code:

- 10 CFR 50.55a(b)(2)(viii) Section XI condition: concrete containment examinations
- 10 CFR 50.55a(b)(2)(ix) Section XI condition: metal containment examinations
- 10 CFR 50.55a(b)(2)(xii and xv) Section XI condition: underwater welding
- 10 CFR 50.55a(b)(2)(xiv) Section XI condition: Appendix VIII personnel qualification
- 10 CFR 50.55a(b)(2)(xviii)(A) Section XI condition: nondestructive examination (NDE) personnel certification
- 10 CFR 50.55a(b)(2)(xix) Section XI condition: substitution of alternative methods
- 10 CFR 50.55a(b)(2)(xx)(A) Section XI condition: system leakage tests: first provision

These amendments will not result in incremental costs or benefits because they remove pre-2001 references that are no longer in use.

This proposed rule amends or adds the following conditions from the ASME BPV Code, Section XI:

- The NRC proposes to amend 10 CFR 50.55a(b)(2)(x) to approve for use the version of NQA-1 referenced in the 2019 Edition of ASME BPV Code, Section XI, Table IWA 1600-1, which this proposed rule is incorporating by reference.
- The NRC proposes to amend 10 CFR 50.55a(b)(2)(xxxii) to increase the timeframe for submittal of summary reports (pre-2015 Edition) or owner activity reports (2015 Edition and later) for inservice examinations and repair replacement activities from 90 days to 120 days.
- The NRC proposes to amend 10 CFR 50.55a(b)(2)(xl) to prohibit the use of ASME BPV Code, Section XI, IWC-3510.5(b)(4), IWC-3510.5(b)(5), and Tables A-4200-1 and G-2110-1.

These amendments will not result in incremental costs or benefits because they either clarify how to incorporate the 2019 Edition of the ASME BPV Code, Section XI, by reference or do not result in meaningful operational changes to industry and the NRC. Other amendments that pertain to the 2019 Edition of the ASME BPV Code, Section XI, Division 1, will result in incremental benefits to industry and are discussed below with the associated attributes.

The current NRC regulations in 10 CFR 50.55a(a)(1)(iv)(B)(2) incorporate by reference the 2011 Addenda to the ASME OM Code. The NRC is streamlining 10 CFR 50.55a to provide clearer IST regulatory requirements for nuclear power plant licensees and applicants. As part of this effort, the NRC has determined that the IBR of the 2011 Addenda to the ASME OM Code into 10 CFR 50.55a is not necessary. Therefore, the NRC proposes to remove the IBR of the

2011 Addenda to the ASME OM Code from 10 CFR 50.55a(a)(1)(iv)(B)(2), which would allow the NRC to remove the condition on the use of the 2011 Addenda specified in 10 CFR 50.55a(b)(3)(xi) as well as the reference to the 2011 Addenda in 10 CFR 50.55a(b)(3)(ix). For similar reasons, the NRC also proposes to remove the IBR of the 2015 Edition of the ASME OM Code from 10 CFR 50.55a(a)(1)(iv)(C)(2) because the 2017 Edition of the ASME OM Code was incorporated by reference into 10 CFR 50.55a on the same date as the 2015 Edition. The removal of the 2011 Addenda to the ASME OM Code and the removal of the IBR of the 2015 Edition of the ASME OM Code will result in no incremental costs or benefits. However, the modification of 10 CFR 50.55a(b)(3)(xi), OM condition: Valve Position Indication, will result in incremental costs and benefits because this condition will reduce a licensee's testing frequency of a valve to a 10-year interval, rather than the 2-year interval specified in ISTC-3700. The licensees may use the 10-year interval testing if they can provide justifying documentation to the NRC that demonstrates that the stem-disk connection for the valve is not susceptible to separation. All other amendments pertaining to the ASME OM Code editions clarify how licensees should continue to meet the current regulations of 10 CFR 50.55a, and there are no incremental costs and benefits associated with these amendments. Lastly, the IBR of the 2020 Edition to Division 1 of the ASME OM Code will result in cost savings due to the reduced number of alternative requests. One condition that the NRC proposes to amend, in 10 CFR 50.55a(b)(2)(xxvi), relaxes the pressure testing requirement in the current condition to, at minimum, a leak check defined by the owner on all repair/replacement activities which impact mechanical joints. This relaxation is expected to reduce the number of alternative requests from licensees, and this averted cost is included in the total number of annual averted alternative requests in the Industry Operation and NRC Operation sections below.

5.1 Public Health (Accident)

The NRC's practice of adopting the latest ASME BPV and OM Code editions may incrementally reduce the likelihood of a radiological accident in a positive, but not in an easily quantifiable manner. Pursuing Alternative 2 would meet the NRC goal of maintaining safety by approving the latest ASME Code editions. Incorporating the latest ASME Code editions into plant procedures may also result in the earlier identification of material degradation that, if undetected, could cause further degradation that eventually leads to a plant transient. As such, Alternative 2 would maintain the same level of safety or provide an incremental improvement in safety when compared to the regulatory baseline (Alternative 1).

Compared to the regulatory baseline, Alternative 2 meets the NRC's goal of ensuring the protection of public health and safety and the environment by approving the latest ASME Code editions. This ensures the industry is periodically updating to the most current methods and technology and may decrease the potential for an accident, thus decreasing the overall risk to public health.

Compared to the regulatory baseline, Alternative 2 may decrease the probability of an accident because it ensures that plant safety systems are designed with equipment relied on to remain functional during and following design-basis accidents. Also, Alternative 2 may decrease the probability of an accident because of improved inspection and testing techniques to ensure material condition.

5.2 Industry Implementation

This attribute accounts for the projected net economic effect on the affected licensees as a result of implementing the regulatory changes (conditions on the ASME Code editions). The NRC proposes to add an alternative to the condition in 10 CFR 50.55a(b)(2)(xviii)(D) on NDE personnel certification that would allow the use of laboratory practice as a partial substitute for certification. This alternative would result in personnel completing their ultrasonic examination certifications in less time than under current conditions. The staff estimates that the time to complete the ultrasonic examination certifications can be reduced on average by about 78 hours for each person. The staff expects that about nine people at each power plant facility would complete certifications using this alternative of laboratory practice over the applicability period of this rule. Because a person only needs to complete certification once, Alternative 2 would result in a one-time cost savings (benefit) to the industry for personnel training by allowing laboratory practice as a partial substitute to meet ultrasonic examination certification requirements. Table 3 details the cost savings over the applicability period of the proposed rule.

Table 3 Industry Implementation—Averted Costs for Reduced Training

Year	Activity	Number of Personnel per Power Plant	Number of Power Plants	Reduced Training Hours per Person	Weighted Hourly Rate	Benefit (Cost)		
						Undiscounted	7% NPV	3% NPV
2022	Reduced Training for Level I and II Certifications	3	54	78	$134	$1,680,000	$1,470,000	$1,580,000
2023	Reduced Training for Level I and II Certifications	3	54	78	$134	$1,680,000	$1,370,000	$1,540,000
2024	Reduced Training for Level I and II Certifications	3	54	78	$134	$1,680,000	$1,280,000	$1,490,000
					Total	**$5,040,000**	**$4,120,000**	**$4,610,000**

5.3 Industry Operation

This attribute accounts for the projected net economic effect of routine and recurring activities required by the alternative for all affected licensees. Under Alternative 2, a nuclear power plant licensee would not need to submit an alternative request under 10 CFR 50.55a(z) to receive permission to use the latest edition of or addenda to the ASME Codes as an alternative to the ASME Code provisions. This provides a net benefit (i.e., averted cost) to the licensee. Some licensees may need to submit an early update request under 10 CFR 50.55a(f)(4)(iv) or (g)(4)(iv),[6] which is not an averted cost for Alternative 2.

[6] Regulations in 10 CFR 50.55a(f)(4) and (g)(4) establish the effective ASME Code edition and addenda to be used by licensees in performing IST of pumps and valves and ISI of components (including supports), respectively. NRC Regulatory Issue Summary 2004-12, “Clarification on Use of Later Editions and Addenda to the ASME OM Code and Section XI,” dated July 28, 2004 (NRC, 2004), clarified the requirements for IST and ISI programs for updating early to later editions of and addenda to the ASME OM Code.

The use of later editions of and addenda to the ASME Codes would benefit NRC nuclear power plant licensees and applicants for several reasons. Later editions of and addenda to the ASME Codes may introduce the use of advanced techniques, procedures, and measures.

Submission of an alternative request to the NRC is not a trivial matter. Once ASME issues a Code edition, the licensee or applicant must determine the applicability of the Code edition to its facility and the benefits of using it. If the licensee or applicant determines that use of the Code would be beneficial, but the NRC has not approved the Code edition, the licensee or applicant must prepare a request for use of the Code alternative, and appropriate levels of licensee or applicant management must review and approve the request before submission to the NRC. A review of Code alternative requests submitted to the NRC over a 5-year period found that these submittals ranged from a few pages to a few hundred pages.

Therefore, the NRC estimates that a Code alternative request submittal requires an average of 230 hours for the licensee or applicant to research, review, approve, process, and submit the document to the NRC for the use of alternatives under 10 CFR 50.55a(z). The NRC assumes that licensees or applicants would decide whether to request an alternative by weighing the cost against the derived benefit. In some cases, licensees may decide to forfeit the benefits of using a newer ASME Code, whether in terms of radiological considerations or burden reduction.

A review of past submittals of Code alternative requests shows that plant owners submit Code alternative requests covering multiple units and multiple plant sites. Under Alternative 2, a licensee of a nuclear power plant would no longer need to submit the previously mentioned Code alternative requests under 10 CFR 50.55a(z). This would provide a net benefit (i.e., averted cost) to the licensee. The NRC analyzed alternative request submittals across multiple years and, based on an assumption that the agency would issue this rule by 2022, determined that the implementation of Alternative 2 would result in the avoidance of approximately 22 Code alternative requests (and their associated preparation) each year (see Table **4**). The NRC estimates that the industry operation averted costs for the averted alternative requests range from $1.67 million (7-percent NPV) to $1.86 million (3-percent NPV), for Alternative 2.

Table 4 Industry Operation—Averted Costs for Alternative Requests

Year	Activity	Requests Prepared per Year	Average Labor hours per Request	Weighted Hourly Rate	Benefit (Cost)		
					Undiscounted	7% NPV	3% NPV
2022	Request Preparation and Submission	22	230	$134	$680,000	$590,000	$640,000
2023	Request Preparation and Submission	22	230	$134	$680,000	$560,000	$620,000
2024	Request Preparation and Submission	22	230	$134	$680,000	$520,000	$600,000
				Total	**$2,040,000**	**$1,670,000**	**$1,860,000**

Note: All values reported in 2020 dollars.

The NRC proposes to provide an alternative to 10 CFR 50.55a(b)(2)(xxv)(B) and allow loss of material rates to be measured at different locations (maximum of two) with similar corrosion conditions, similar flow characteristics, and the same piping configuration (e.g., straight run of pipe, elbow, tee). Allowing equivalent locations to be used to obtain loss of material rates provides flexibility and reduces burden to the licensees. The staff estimates that eight power plants would likely use this provision each year, saving each power plant 180 hours of labor by measuring loss of material rates at a different location. Table 5 delineates the estimated averted costs to licensees each year if the NRC granted this alternative to 10 CFR 50.55a(b)(2)(xxv)(B).

Table 5 Industry Operation—Averted Costs for Loss of Material Rates

Year	Activity	Number of Power Plants per Year	Averted Labor Hours per Plant	Weighted Hourly Rate	Benefit (Cost)		
					Undiscounted	7% NPV	3% NPV
2022	Loss of Material Rates Measured at Alternative Locations	8	180	$134	$190,000	$170,000	$180,000
2023	Loss of Material Rates Measured at Alternative Locations	8	180	$134	$190,000	$160,000	$170,000
2024	Loss of Material Rates Measured at Alternative Locations	8	180	$134	$190,000	$140,000	$170,000
				Total	**$570,000**	**$470,000**	**$520,000**

The NRC proposes to modify 10 CFR 50.55a(b)(3)(xi), OM condition for the Valve Position Indication. Under this modification, if a valve is determined not to be susceptible to stem-disk separation, the position verification testing specified in paragraph ISTC-3700 may be performed on a 10-year interval versus a 2-year interval. For a licensee to take this benefit, they must provide justification to the NRC, upon request, demonstrating that the stem-disk connection is not susceptible to separation based on the internal design and evaluation of the stem-disk connection and vendor recommendations. The justification will require additional effort and costs for the licensee to collect data and documents that would show that the stem-disk connection is not susceptible to separation. If the licensee properly justifies that the stem-disk connection is not susceptible to separation for a valve, the licensee will not have to perform another test under ISTC-3700 for this valve until 10 years later. This 10-year testing interval will allow the licensee to avert testing the valve under ISTC-3700 every 2 years, which will result in costs savings to the licensee.

Table 6 shows the additional cost for licensees to collect data and documents to justify that a stem-disk connection is not susceptible to separation for the valves in a reactor unit subject to ISTC-3700 testing. Table 7 shows the cost savings that licensees would have if they were to test the valves once every 10 years. It is assumed that when this rule is finalized, the licensees would have already completed testing of these valves under ISTC-3700 so that they would not need to test these valves again until 10 years later.

Table 6 Industry Operation—Additional Costs to Justify the Stem-Disk Connection

Year	Activity	Number of Reactors Units	Typical Number of Valves Tested	Labor Hours to Justify Each Valve	Weighted Hourly Rate	Benefit (Cost)		
						Undiscounted	7% NPV	3% NPV
2022	Effort to justify that stem-disk connection is not susceptible to separation	92	100	0.5	$134	($620,000)	($540,000)	($580,000)
2024	Effort to justify that stem-disk connection is not susceptible to separation	91	100	0.5	$134	($610,000)	($470,000)	($540,000)
					Total	**($1,230,000)**	**($1,010,000)**	**($1,120,000)**

Table 7 Industry Operation—Averted Costs for Testing Valves Under ISTC-3700

Year	Activity	Number of Reactors Units	Typical Number of Valves Tested	Averted Labor Hours per Valve	Weighted Hourly Rate	Benefit (Cost)		
						Undiscounted	7% NPV	3% NPV
2022	Averted testing of valves under ISTC-3700	92	100	2	$134	$2,460,000	$2,150,000	$2,320,000
2024	Averted testing of valves under ISTC-3701	91	100	2	$134	$2,440,000	$1,860,000	$2,170,000
					Total	**$4,900,000**	**$4,010,000**	**$4,490,000**

5.4 Occupational Health (Accident and Routine)

The NRC practice of reviewing the latest ASME BPV and OM Code editions that are then incorporated by reference into the regulations ensures that the mandated ASME Code requirement results in acceptable quality and safety. Pursuing Alternative 2 would continue to meet the NRC goal of maintaining safety, as it would still provide NRC approval of the latest ASME Code editions. This may incrementally decrease the likelihood of an accident resulting in worker exposure or in worker radiological exposures during routine inspections or testing when compared to the regulatory baseline.

5.5 Total Industry Costs

Table 8 shows the total industry costs broken down by implementation and operation costs for the proposed rule under Alternative 2. These total industry costs represent averted costs of $6.26 million (7-percent NPV) and $6.99 million (3-percent NPV).

Table 8 Total Industry Costs

Attribute	Total Industry Benefit (Costs)		
	Undiscounted	7% NPV	3% NPV
Total Implementation Costs	$5,040,000	$4,120,000	$4,610,000
Total Operation Costs	$2,610,000	$2,140,000	$2,380,000
Total Industry Cost	**$7,650,000**	**$6,260,000**	**$6,990,000**

Notes: Total costs are rounded to the nearest $10,000. All values reported in 2020 dollars.

5.6 NRC Implementation

The NRC will incur implementation costs for the stages of the rulemaking process. These costs include writing the *Federal Register* notice, reviewing and addressing public comments on the rule, and reviewing the rule. The NRC implementation costs account for the development of the final rule. The staff estimates a total of 2,600 hours for development of the rule. Table 9 shows the NRC implementation costs to develop and issue the final rule.

Table 9 NRC Implementation Costs—Rulemaking

Year	Activity	Number of Actions	Hours	Weighted Hourly rate	Benefit (Cost)		
					Undiscounted	7% NPV	3% NPV
2022	Develop and Issue Final Rule	1	2,600	$131	($340,000)	($320,000)	($330,000)
				Total	**($340,000)**	**($320,000)**	**($330,000)**

Notes: Total costs are rounded to the nearest $10,000. All values reported in 2020 dollars. Final rule development is shown in one year to simplify the table.

5.7 NRC Operation

When the NRC receives an alternative request, it requires staff time to evaluate the acceptability of the request against the current agency-approved criteria. Under Alternative 2, the NRC expects an additional 22 alternative request submittals per year to be averted. The IBR of the ASME Code editions in the *Code of Federal Regulations* allows a nuclear power plant licensee to use a more current ASME Code edition or addenda without submitting an alternative request for NRC review.

As shown in Table 10, the NRC estimates that each submittal would require 115 hours of staff time to perform the technical review (including resolving technical issues), document the evaluation, and respond to the licensee about its request. By eliminating the need for these submittals, the NRC staff estimates that the averted cost would range from $0.81 million (7-percent NPV) to $0.90 million (3-percent NPV).

Table 10 NRC Operation Costs—Averted Alternative Request Review

Year	Activity	Requests Reviewed per Year	Average NRC Staff Hours per Request	Weighted Hourly Rate	Benefit (Cost)		
					Undiscounted	7% NPV	3% NPV
2022	Review Request Submittal	22	115	$131	$330,000	$290,000	$310,000
2023	Review Request Submittal	22	115	$131	$330,000	$270,000	$300,000
2024	Review Request Submittal	22	115	$131	$330,000	$250,000	$290,000
				Total	**$990,000**	**$810,000**	**$900,000**

Note: All values reported in 2020 dollars.

5.8 Total NRC Costs

Table 11 shows the total NRC costs broken down by implementation and operation costs for Alternative 2. These total NRC costs represent averted costs (savings) and are estimated to range from $0.49 million (7-percent NPV) to $0.57 million (3-percent NPV).

Table 11 Total NRC Costs

Attribute	Total NRC Benefit (Costs)		
	Undiscounted	7% NPV	3% NPV
Total Implementation Cost	($340,000)	($320,000)	($330,000)
Total Operation Cost	$990,000	$810,000	$900,000
Total NRC Cost	$650,000	$490,000	$570,000

Note: All values reported in 2020 dollars.

5.9 Total Costs

Table 12 shows the Alternative 2 costs and benefits broken down by implementation and operation for industry and the NRC. These total averted costs are estimated to range from $6.75 million (7-percent NPV) to $7.56 million (3-percent NPV).

Table 12 Total Costs

Attribute	Total Benefits (Costs)		
	Undiscounted	**7% NPV**	**3% NPV**
Industry Implementation	$5,040,000	$4,120,000	$4,610,000
Industry Operation	$2,610,000	$2,140,000	$2,380,000
Total Industry Cost	*$7,650,000*	*$6,260,000*	*$6,990,000*
NRC Implementation	($340,000)	($320,000)	($330,000)
NRC Operation	$990,000	$810,000	$900,000
Total NRC Cost	*$650,000*	*$490,000*	*$570,000*
Total Cost:	***$8,300,000***	***$6,750,000***	***$7,560,000***

Note: All values reported in 2020 dollars.

5.10 Improvements in Knowledge

Compared to the regulatory baseline (Alternative 1), Alternative 2 would improve knowledge by allowing the industry and the staff to gain experience with new technology and by permitting licensees to use advances in ISI and IST. Improved ISI and IST may lead to the earlier identification of material degradation that, if undetected, could result in further degradation that eventually causes a plant transient.

5.11 Regulatory Efficiency

Compared to the regulatory baseline (Alternative 1), Alternative 2 would increase regulatory efficiency because of the resulting consistency between the ASME Codes and NRC regulations. Licensees and applicants that wish to use more current editions of or addenda to the ASME Codes would not be required to submit 10 CFR 50.55a(z) alternative requests to the NRC for review and approval. This would provide licensees and applicants with flexibility and would decrease licensee uncertainty when making modifications or preparing to perform ISI or IST.

The NRC does not recommend Alternative 1 for the following two reasons:

(1) Licensees would submit many requests for alternatives to use more current editions of or addenda to the ASME Codes under 10 CFR 50.55a(z). This process would result in increased regulatory burden for licensees and the NRC.

(2) The NRC's role as an effective industry regulator would be undermined. Although ASME periodically publishes and revises its codes, under Alternative 1, outdated material would remain incorporated by reference in the *Code of Federal Regulations*.

5.12 Other Considerations

5.12.1 National Technology Transfer and Advancement Act of 1995

Alternative 2 is consistent with the provisions of the NTTAA and its implementing guidance in OMB Circular A-119 (OMB, 2016), which encourage Federal regulatory agencies to consider adopting voluntary consensus standards as an alternative to *de novo* agency development of standards affecting an industry.

5.12.2 Continued NRC Practice of Incorporation by Reference of ASME Code Editions and Addenda into the Code of Federal Regulations

Alternative 2 would continue the NRC's practice of establishing requirements for the design, construction, operation, ISI, and IST of nuclear power plants by approving the use of editions of and addenda to the ASME Codes in 10 CFR 50.55a.

Given the existing data and information, Alternative 2 is the more effective way to implement the updated ASME Codes. The updates would amend 10 CFR 50.55a to incorporate by reference the following ASME Code editions and addenda:

- the 2019 Edition of the ASME BPV Code, Section III, Division 1, and ASME BPV Code, Section XI, Division 1, with conditions on its use

- the 2020 Edition of the ASME OM Code, Division 1, with conditions on its use

- the 2011 Addenda to ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications" (ASME NQA-1b-2011), without conditions, and

- the 2012 and 2015 Editions of ASME NQA-1, with conditions on their use

5.12.3 Increased Public Confidence

Alternative 2 incorporates the current ASME Code edition, addenda, and Code Cases for the design, construction, operation, ISI, and IST of nuclear power plants by approving the use of later editions of and addenda to the ASME Codes in 10 CFR 50.55a. This alternative would allow licensees to use risk-informed, performance-based approaches and the most current methods and technology to design, construct, operate, examine, and test nuclear power plant components while maintaining NRC oversight of these activities, which increases public confidence.

5.13 Uncertainty Analysis

The NRC completed a Monte Carlo sensitivity analysis for this regulatory analysis using the specialty software @Risk.[7] The Monte Carlo approach answers the question, "What distribution of net benefits results from multiple model simulations using the probability distributions assigned to key input variables?"

5.13.1 Uncertainty Analysis Assumptions

As this regulatory analysis is based on estimates of values that are sensitive to plant-specific cost drivers and plant dissimilarities, the NRC provides the following analysis of the variables that have the greatest uncertainty. To perform this analysis, the NRC employed a Monte Carlo simulation analysis using the @Risk software program.

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[7] Information about this software is available at http://www.palisade.com.

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

The probability distributions chosen to represent the different variables in the analysis were bounded by the range-referenced input and the staff's professional judgment. When defining the probability distributions for use in a Monte Carlo simulation, summary statistics are needed to characterize the distributions. These summary statistics include the minimum, most likely, and maximum values of a program evaluation and review technique (PERT) distribution,[8] the minimum and maximum values of a uniform distribution, and the specified integer values of a discrete population. The staff used the PERT distribution to reflect the relative spread and skewness of the distribution defined by the three estimates.

Table 13**Error! Reference source not found.** identifies the data elements, the distribution and summary statistic, and the mean value of the distribution used in the uncertainty analysis.

Table 13 Uncertainty Analysis Variables

Data Element	Mean Estimate	Distribution	Low Estimate	Best Estimate	High Estimate
Labor Rates					
Weighted hourly rate for industry	$133.81	PERT	$108.03	$135.77	$151.78
Weighted hourly rate for NRC	$131	None			
Rulemaking Effort					
Hours to develop rule	4500.0	PERT	2076.3	4152.5	8305.0
Reduced Industry Training for Level I and II Certifications per Power Plant					
Industry hours reduced	78	Uniform	75		80
Number of personnel completing training at each power plant	3	PERT	2	3	4
Loss of Material Rates Measured at Alternative Locations (Industry)					
Reduced industry hours	180	PERT	120	180	240
Number of power plants to implement this "alternative location" benefit annually	8	PERT	6	8	10
Burden to Justify the Stem-Disk Connection (Industry)					
Number of valves per reactor unit	100	PERT	75	100	125
Number of hours to collect justification data each valve	0.50	PERT	0.25	0.50	0.75
Averted Testing Under ISTC-3700 (Industry)					
Number of valves per reactor unit	100	PERT	75	100	125
Number of hours averted to test a valve	2	PERT	1	2	3

8 A PERT distribution is a special form of the beta distribution with specified minimum and maximum values. The shape parameter is calculated from the defined *most likely* value. The PERT distribution is similar to a triangular distribution, in that it has the same set of three parameters. Technically, it is a special case of a scaled beta (or beta general) distribution. The PERT distribution is generally considered superior to the triangular distribution when the parameters result in a skewed distribution, 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 modeling purposes that need to capture tail or extreme events.

Data Element	Mean Estimate	Distribution	Low Estimate	Best Estimate	High Estimate
2019 Edition to the ASME BPV Code, Section III, Division 1, and ASME BPV Code, Section XI, Division 1					
Averted Alternative Request (Industry)					
Industry hours to produce alternative request for the BPV Code	230	PERT	170	230	290
Number of alternative requests produced annually for the 2019 Edition of the BPV Code	2	PERT	1	2	3
Averted Alternative Request (NRC)					
NRC hours to evaluate alternative request for the BPV Code	115	PERT	85	115	145
Number of alternative requests produced annually for the 2019 Edition of the BPV Code	2	PERT	1	2	3
2020 Edition to Division 1 of the ASME OM Code					
Averted Alternative Request (Industry)					
Industry hours to produce alternative request for the OM Code	230	PERT	170	230	290
Number of alternative requests produced annually for the 2020 Edition of the OM Code	20	PERT	18	20	22
Averted Alternative Request (NRC)					
NRC hours to evaluate alternative request for the OM Code	115	PERT	85	115	145
Number of alternative requests produced annually for the 2020 Edition of the OM Code	20	PERT	18	20	22

Note: All values reported in 2020 dollars.

5.13.1 Uncertainty Analysis Results

The NRC performed the Monte Carlo simulation by repeatedly recalculating the results 10,000 times. For each iteration, the NRC staff chose values **Error! Reference source not found.**randomly from the probability distributions that define the input variables. The staff recorded values of the output variables for each iteration and used these resulting values to define the resultant probability distribution.

Figure **1**, 2, and 3 display the histograms of the incremental costs and benefits from the regulatory baseline (Alternative 1). For the analysis shown in each figure, the NRC ran 10,000 simulations, changing the key variables to assess the resulting effect on costs and benefits. The analysis shows that both the industry and the NRC would benefit if this proposed rule is issued.

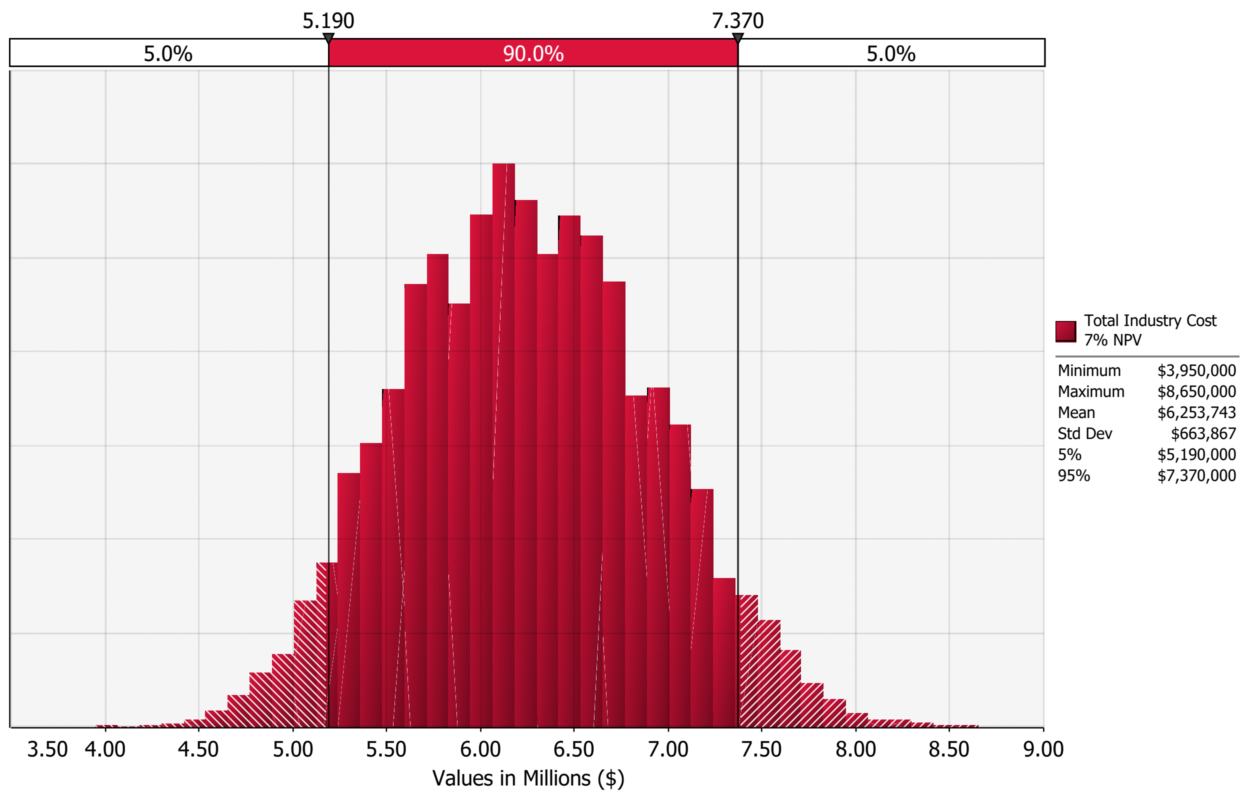

Figure 1 Total industry costs (7-percent NPV)—Alternative 2

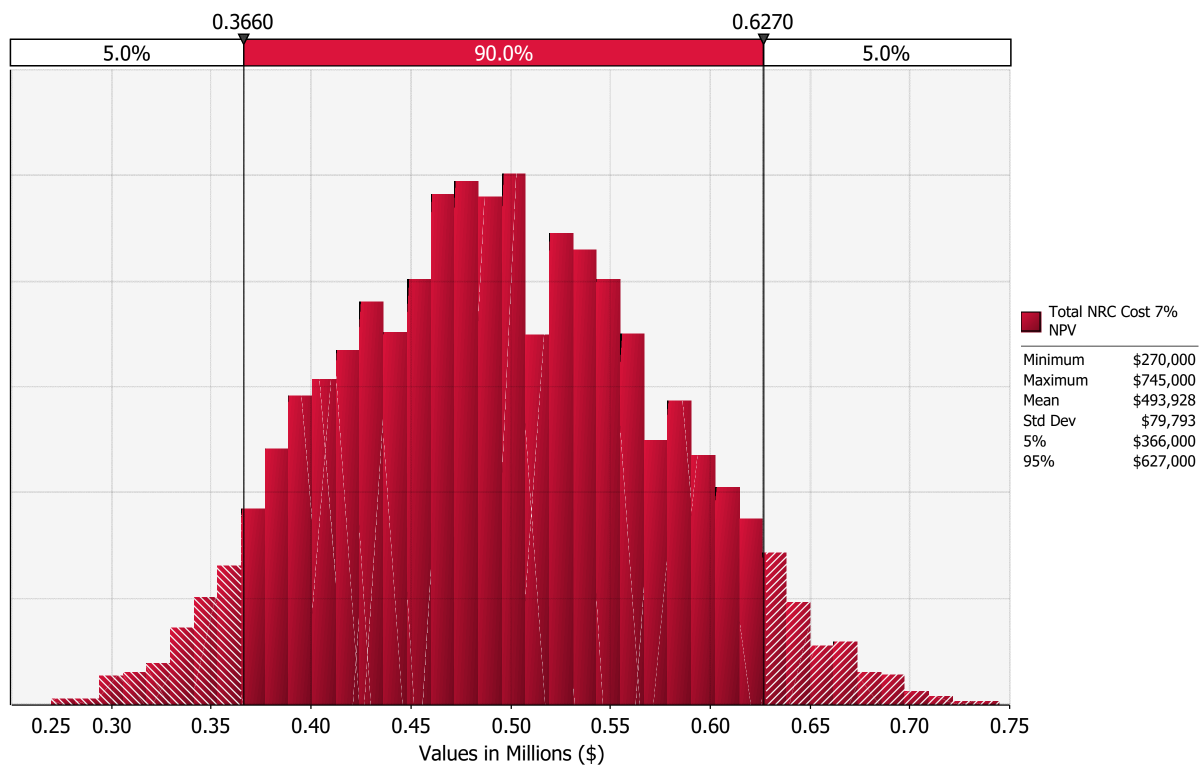

Figure 2 Total NRC costs (7-percent NPV)—Alternative 2

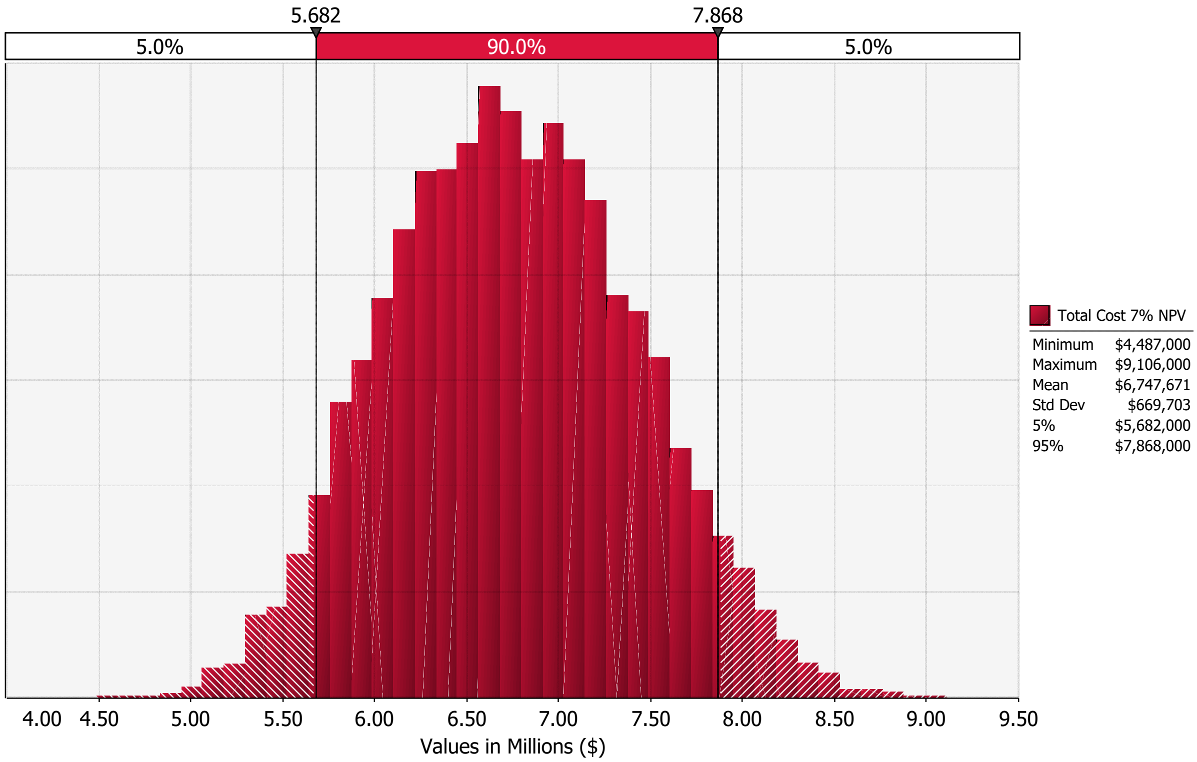

Figure 3 Total costs (7-percent NPV)—Alternative 2

Table 14 presents descriptive statistics on the uncertainty analysis. The 5-percent and 95-percent values (labeling the bands to either side of the 90-percent band) that appear as numerical values on the top of the vertical lines in Figure **1**, 2, and 3 are reflected in Table 14 as the 0.05 and 0.95 values, respectively.

Table 14 Descriptive Statistics for Uncertainty Results (7-Percent NPV)

Uncertainty Result	Incremental Cost-Benefit (2020 million dollars)					
	Minimum	**Mean**	**Standard Deviation**	**Maximum**	**0.05**	**0.95**
Total Industry Benefit (Cost)	$3.95	$6.25	$0.66	$8.65	$5.19	$7.37
Total NRC Benefit (Cost)	$0.27	$0.49	$0.08	$0.75	$0.37	$0.63
Total Benefit (Cost)	$4.49	$6.75	$0.67	$9.11	$5.68	$7.87

Note: All values rounded.

Examining the range of the resulting output distribution shown in Table 14, it is possible to more confidently discuss the potential incremental costs and benefits of the proposed rule. This table displays the key statistical results, including the 90-percent confidence interval, in which the net benefits would fall between the 5-percent and 95-percent values.

Figure 4 shows a tornado diagram that identifies the cost drivers, whose uncertainty has the largest impact on total costs (and averted costs) for this proposed rule. This figure ranks the cost drivers based on their impact to the uncertainty in the total cost. The two biggest cost drivers of uncertainty for this rule are the annual number of personnel that complete training for the Level I and II certifications and the industry labor rate. The remaining cost drivers show diminishing variation.

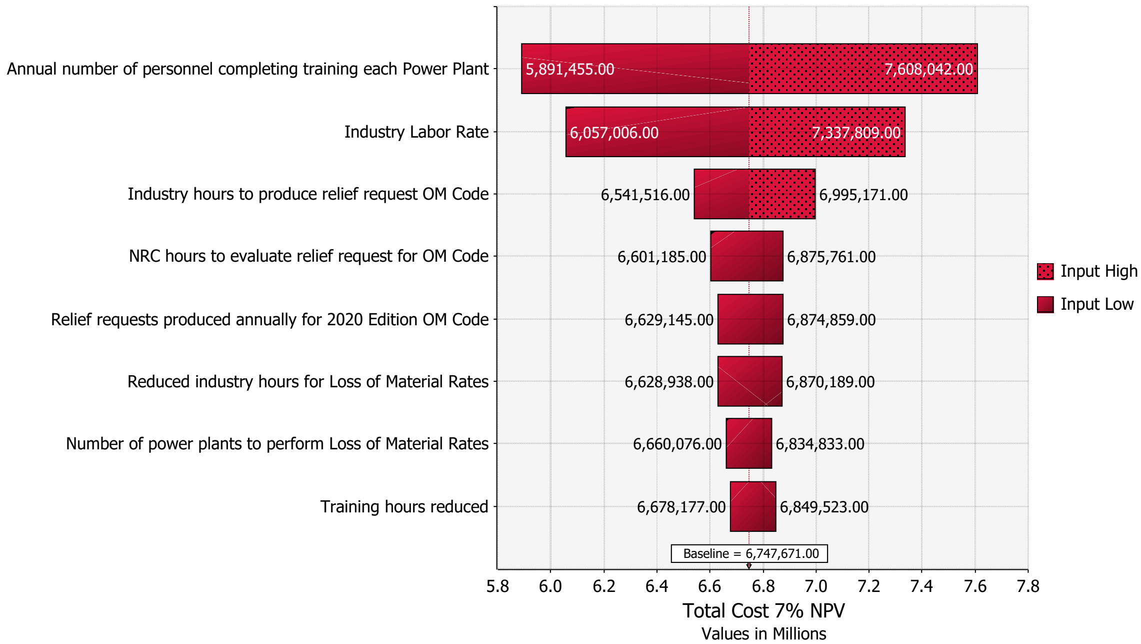

Figure 4 Top eight cost drivers (7-Percent NPV)—Alternative 2

5.13.2 Summary of Uncertainty Analysis

The simulation analysis shows that the estimated mean benefit (i.e., positive averted costs or savings) for this proposed rule is $6.75 million with a 90-percent confidence interval that the benefit is between $5.68 million and $7.87 million using a 7-percent discount rate, and that this rule is cost beneficial in all simulations. A reasonable inference from the uncertainty analysis is that proceeding with this rule represents an efficient use of resources and averted costs for the NRC and the industry.

5.14 Disaggregation

To comply with the guidance contained in Section E.2.3, “Criteria for the Treatment of Individual Requirements,” in Appendix E, “Special Circumstances and Relationship to Other Procedural Requirements,” to NUREG/BR-0058 (NRC, 2020), the NRC performed a screening review to determine whether any of the individual requirements (or set of integrated requirements) of the proposed rule would be unnecessary to achieve the objectives of the rulemaking. The NRC determined that the objectives of the rulemaking are to incorporate standards by reference; provide updated rules for the design, construction, operation, ISI, and IST of safety-related systems; and impose conditions on the use of the updated standards referenced in the rules. Furthermore, the NRC concludes that each of the requirements in the proposed rule would be necessary to achieve one or more objectives of the rulemaking. Table 15 shows the results of this screening review.

Table 15 Disaggregation

Regulatory Goals for Proposed Rule	(1) Approve Use of the Code Edition or Addenda	(2) Make IBR Conforming Changes
2019 Edition of the ASME BPV Code	X	X
2020 Edition of the ASME OM Code	X	X
2011 Addenda to ASME NQA-1-2008	X	X
2012 Edition of ASME NQA-1	X	X
2015 Edition of ASME NQA-1	X	X

Table 16 shows the estimated benefits and costs to industry, the NRC, and the total for each of the provisions in this proposed rule for which the staff has calculated quantitative benefits. The proposed rule itself is cost beneficial in all provisions. The licensee's effort to justify that valves are not susceptible to stem-disk separation is more than offset by the cost savings from averted testing of valves under ISTC-2700 if the valves are not susceptible to stem-disk separation.

Table 16 Costs by Provision

Provision	Averted Cost (Cost) 7% NPV		
	Industry	NRC	Total
Alternative Requests Averted by Rulemaking	$1,670,000	$810,000	$2,480,000
Reduced Training for Level I and II Certifications	$4,120,000	$0	$4,120,000
Loss of Material Rates Measured at Alternative Locations	$470,000	$0	$470,000
Effort to justify the stem-disk connection for testing under ISTC-3700	($1,010,000)	$0	($1,010,000)
Averted testing of valves under ISTC-3700	$4,010,000	$0	$4,010,000
All Other Conditions to 10 CFR 50.55a in This Rulemaking	$0	$0	$0

5.15 Summary

This regulatory analysis identified both quantifiable and nonquantifiable costs and benefits that would result from incorporating NRC-approved ASME BPV and OM Code editions by reference into the *Code of Federal Regulations*. Although quantifiable costs and benefits appear to be more tangible, the staff urges decisionmakers not to disregard costs and benefits that are nonquantifiable. Such benefits or costs can be just as important, or even more important, than benefits or costs that can be quantified and monetized.

5.15.1 Quantified Net Benefit

As shown in Table 12, the estimated quantified incremental averted costs for Alternative 2 relative to the regulatory baseline (Alternative 1) over the remaining term of the affected entities' operating licenses range from approximately $6.75 million (7-percent NPV) to $7.56 million (3-percent NPV). This table also shows that Alternative 2 would be cost beneficial for the NRC and the industry when they are considered separately.

5.15.2 Nonquantified Benefits

In addition to the quantified costs discussed in this regulatory analysis, the attributes of public health (accident), improvements in knowledge, regulatory efficiency, and other considerations would produce a number of nonquantified benefits for the industry and the NRC. The sections below summarize these benefits.

5.15.2.1 Advances in Inservice Inspection and Inservice Testing

Advances in ISI and IST may incrementally decrease the likelihood of a radiological accident, the likelihood of post-accident plant worker exposure, and the level of plant worker radiological exposures during routine inspections or testing. The NRC's approval of later editions and addenda of the ASME Codes may contribute to plant safety by providing improved examination methods that may lead to the earlier identification of material degradation that, if undetected, could cause further degradation and result in a plant transient. These improved methods may increase the assurance of plant safety-system readiness and may prevent, through inspection and testing, the introduction of a new failure mode or common-cause failure mode not previously evaluated.

5.15.2.2 Reduction in Public Health Radiation Exposures

The industry's practice of adopting the ASME BPV and OM Code Cases that are incorporated by reference into the regulations may incrementally reduce the likelihood of a radiological accident in a positive, but not easily quantifiable, manner. Improvements in ISI and IST may also result in the earlier identification of material degradation that, if undetected, could lead to further degradation that eventually causes a plant transient. For this reason, Alternative 2 would maintain the same level of safety, or provide an incremental improvement in safety, which may result in an incremental decrease in public health radiation exposures when compared to the regulatory baseline.

5.15.2.3 Improvements in Inservice Inspection and Inservice Testing Knowledge

The NRC approval of later editions of and addenda to the ASME Codes would improve knowledge by allowing the industry and the staff to gain experience with new technology before its incorporation into the ASME Codes and by permitting licensees to use advances in ISI and IST. Improved ISI and IST may lead to the earlier identification of material degradation that, if undetected, could result in further degradation that eventually causes a plant transient.

5.15.2.4 Consistent with National Technology Transfer and Advancement Act of 1995 and Implementing Guidance

Alternative 2 is consistent with the provisions of the NTTAA and its implementing guidance in OMB Circular A-119 (OMB, 2016), which encourage Federal regulatory agencies to consider adopting voluntary consensus standards as an alternative to *de novo* agency development of standards affecting an industry.

5.15.2.5 Continued NRC Practice of Incorporation by Reference of ASME Code Editions and Addenda into the Code of Federal Regulations

Alternative 2 would continue the NRC's practice of establishing requirements for the design, construction, operation, ISI, and IST of nuclear power plants by approving the use of later editions of and addenda to the ASME Codes in 10 CFR 50.55a.

5.15.2.6 Increased Public Confidence

Alternative 2 would incorporate the current ASME Code editions, and addenda for the design, construction, operation, ISI, and IST of nuclear power plants by approving the use of editions of and addenda to the ASME Codes in 10 CFR 50.55a. This alternative would allow licensees to use the most current methods and technology to design, construct, operate, examine, and test nuclear power plant components, while maintaining NRC oversight of these activities.

The timely IBR of current addenda to and editions of the ASME Codes into the *Code of Federal Regulations* and would maintain the NRC's role as an effective industry regulator. This role would likewise be undermined if outdated material remains incorporated by reference in the *Code of Federal Regulations*.

5.16 Safety Goal Evaluation

Alternative 2 would allow licensees and applicants to apply the most recent ASME BPV and OM Code editions and addenda and NRC-approved Code Cases, sometimes with NRC-specified conditions. The NRC's safety goal evaluation applies only to regulatory initiatives considered to be generic safety-enhancement backfits subject to the standard at 10 CFR 50.109(a)(3). The NRC does not regard the IBR of ASME Code editions and addenda and NRC-approved Code Cases to be backfitting. The proposed rule published in the *Federal Register* gives the basis for this determination. For these reasons, a safety goal evaluation is not appropriate for this regulatory analysis.

5.17 Results for the Committee to Review Generic Requirements

This section addresses regulatory analysis information requirements for rulemaking actions or staff positions subject to review by the Committee to Review Generic Requirements (CRGR). All information called for by the CRGR charter (NRC, 2018) is presented in this regulatory analysis or in the *Federal Register* notice for the proposed rule. Table 17 provides cross-references for the relevant information to its location in this document or the *Federal Register* notice.

Table 17 Specific CRGR Regulatory Analysis Information Requirements

CRGR Charter Citation (NRC, 2018)	Information Item to Be Included in a Regulatory Analysis Prepared for CRGR Review	Where Item Is Discussed
Appendix C, (i)	the new or revised generic requirement or staff position sent out to licensees or issued for public comment	Proposed rule text in *Federal Register* notice for the proposed rule
Appendix C, (ii)	draft papers or other documents supporting the requirements or staff positions	*Federal Register* notice for the proposed rule

CRGR Charter Citation (NRC, 2018)	Information Item to Be Included in a Regulatory Analysis Prepared for CRGR Review	Where Item Is Discussed
Appendix C, (ii)	documents supporting the requirements or staff positions	*Federal Register* notice for the proposed rule
Appendix C, (iii)	the sponsoring office's position on each requirement or staff position as to whether the change would modify, implement, or relax or reduce existing requirements or staff positions	Regulatory Analysis, Section 5, and Backfitting and Issue Finality, Section XIII, *Federal Register* notice for the proposed rule
Appendix C, (iv)	the method of implementation	Regulatory Analysis, Section 7
Appendix C, (vi)	identification of the category of power reactors, new reactors, or nuclear materials facilities or activities to which the generic requirement or staff position applies	Regulatory Analysis, Section 4.2.2
Appendix C, (vii)–(viii)	if the action involves a power reactor backfit and the exceptions at 10 CFR 50.109(a)(4) do not apply, the items required at 10 CFR 50.109(c) and the required rationale at 10 CFR 50.109(a)(3)	Does not apply.
Appendix C, (xi)	an assessment of how the action relates to the Commission's Safety Goal Policy Statement	Regulatory Analysis, Section 5.16

6. Decision Rationale

Table 18 provides the quantified and qualified costs and benefits for Alternative 2. The quantitative analysis used best estimate values.

Table 18 Summary of Totals

Net Monetary Savings or (Costs)—Total Present Value	Nonquantified Benefits or (Costs)
Alternative 1: No-Action $0	None
Alternative 2: Incorporate by reference ASME BPV Code 2019 Editions and ASME OM Code 2020 Editions, with conditions Industry: (all provisions) $6.26 million using a 7% discount rate $6.99 million using a 3% discount rate NRC: (all provisions) $0.49 million using a 7% discount rate $0.57 million using a 3% discount rate Net Benefit (Cost): (all provisions) $6.75 million using a 7% discount rate	Benefits: • **Advances in ISI and IST:** May incrementally decrease the likelihood of a radiological accident, the likelihood of post-accident plant worker exposure, and the level of plant worker radiological exposures during routine inspections or testing. • **Public Health (Accident):** May incrementally reduce the likelihood of a radiological accident in a positive, but not easily quantifiable, manner. Pursuing Alternative 2 would still meet the NRC goal of maintaining safety by continuing to provide NRC approval of the use of later editions of and

Net Monetary Savings or (Costs)— Total Present Value	Nonquantified Benefits or (Costs)
$7.56 million using a 3% discount rate **Alternative 2 (continued)**	addenda to the ASME Codes to permit licensees to use advances in ISI and IST; provide alternative examinations for older plants; respond expeditiously to user needs; and provide a limited, clearly focused alternative to specific ASME Code provisions. Improvements in ISI and IST may also lead to the earlier identification of material degradation that, if undetected, could result in further degradation that eventually causes a plant transient. Thus, Alternative 2 would maintain the same level of safety or would provide an incremental improvement in safety when compared to the regulatory baseline, which may result in an incremental decrease in public health radiation exposures. • **Occupational Health (Accident):** The use of later editions of and addenda to the ASME Codes may reduce post-accident occupational radiation exposures in a positive, but not easily quantifiable, manner. The advances in ISI and IST may lead to an incremental decrease in the likelihood of an accident resulting in worker exposure when compared to the regulatory baseline. • **Improvements in ISI and IST Knowledge:** Staff would gain experience with new technology and ISI and IST advances. • **Consistent with the NTTAA and Implementing Guidance:** Alternative 2 is consistent with the provisions of the NTTAA and implementing guidance in OMB Circular A-119, which encourage Federal regulatory agencies to consider adopting voluntary consensus standards as an alternative to *de novo* agency development of standards affecting an industry. Furthermore, the ASME Code consensus process is an important part of the regulatory framework. Costs: • **Quantified Costs:** Licensees will have to collect data and documents that would show that the stem-disk connection is not susceptible to separation if they want to test the valves under ISTC-3700 every 12 years. • **Nonquantified Costs:** If the staff has overestimated the number or the complexity of these eliminated submittals, then the averted costs would decrease proportionally, causing the quantified net costs of Alternative 2 to increase.

The industry and the NRC would benefit from Alternative 2 because of the following cost savings:

- Costs will be averted by licensees because of reduced ASME Code alternative requests on a plant-specific basis under 10 CFR 50.55a(z).
- Costs will be averted by licensees because of less time spent by personnel to complete their ultrasonic examination certifications.
- Costs will be averted by licensees because of less time spent to measure loss of material rates at different locations with corrosion conditions and flow characteristics similar to those at the current locations.
- Costs will be averted by licensees for testing valves under ISTC-3700 if they can show that the stem-disk connection for the valves are not susceptible to separation.

Alternative 2 would also have the qualitative benefit of meeting the NRC's goal of ensuring the protection of public health and safety and the environment through the NRC's approval of the use of later editions of and addenda to the ASME Codes. It would also allow for the use of the most current methods and technology. Alternative 2 would also support the NRC's goal of maintaining an open regulatory process because approving ASME Code editions would demonstrate the agency's commitment to participating in the national consensus standards process and maintain the NRC's role as an effective regulator.

The NRC has had a decades-long practice of approving or mandating, or both, the use of certain parts of editions of and addenda to these ASME Codes in 10 CFR 50.55a through the rulemaking process of "incorporation by reference." Retaining the practice of approving or mandating the ASME Codes would continue the regulatory stability and predictability provided by the current practice. Retaining the practice would also ensure consistency across the industry and assure the industry and the public that the NRC will continue to support the use of the most updated and technically sound techniques developed by ASME to adequately protect the public. In this regard, these ASME Codes are voluntary consensus standards developed by participants with broad and varied interests, and the codes have already undergone extensive external review before undergoing NRC review. Finally, the NRC's use of the ASME Codes is consistent with the NTTAA, which directs Federal agencies to adopt voluntary consensus standards instead of developing "Government-unique" (i.e., Federal agency-developed) standards, unless inconsistent with applicable law or otherwise impractical.

Based solely on quantified costs and benefits, this regulatory analysis shows that the rulemaking is justified because the total quantified benefits of the regulatory action would exceed the costs of the action at a 7-percent discount rate. The uncertainty analysis shows a net benefit (averted cost) for all simulations, with a range of averted cost from $4.49 million to $9.11 million (using a 7-percent NPV).

7. Schedule

The proposed rule will be available for public comment for 60 days after publication in the *Federal Register*. The NRC plans to issue a final rule in 2022, an estimated 12 months after the close of the public comment period.

8. References

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Appendix A Major Assumptions and Input Data

Data Element	Best Estimate	Unit	Source or Basis of Estimate
Key Years			
Proposed rule effective date	2020	year	U.S. Nuclear Regulatory Commission (NRC) input.
Analysis base year	2020	year	NRC input.
Number of Reactor Units			
Number of currently operating reactor units in 2020	94	units	Based on NUREG-1350, "2019–2020 Information Digest," Volume 31, issued August 2019, Appendix A (NRC, 2019).
Number of forecasted operating reactor units in 2024	91	units	Based on NUREG-1350, Volume 31, Appendix A (NRC, 2019). Vogtle Electric Generating Plant, Units 3 and 4, is expected to begin operation in 2021 and 2022, respectively.
Number of Sites			
Number of sites with currently operating reactors in 2020	57	sites	Information on operating reactor sites was obtained from the NRC's "Operating Nuclear Power Reactors (by Location or Name)" Web site, http://www.nrc.gov/info-finder/reactor/, with data current as of August 26, 2019 (last accessed on April 3, 2020). Information on nuclear power reactors that have or will prematurely shut down was obtained from http://www.beyondnuclear.org/reactors-are-closing/.
Number of sites forecasted with currently operating reactors in 2024	54	sites	Calculation: [total number of sites with operating reactors] + [sites with construction completed in years 2020 through 2024] - [sites with all units closed in years 2020 through 2024]. Information on operating reactor sites was obtained from the NRC's "Operating Nuclear Power Reactors (by Location or Name)" Web site, http://www.nrc.gov/info-finder/reactor/, with data current as of August 26, 2019 (last accessed on April 3, 2020). Information on nuclear power reactors that have or will prematurely shut down was obtained from http://www.beyondnuclear.org/reactors-are-closing/.

Data Element	Best Estimate	Unit	Source or Basis of Estimate
Applicability Period (Years)			
Rule applicability term	3	years	It is assumed that the final rule will be published in the Federal Register beginning of 2022 and the next Code Editions final rule will be published by the end of 2024.
Labor Rates			
Executive	$243	Dollars per hour	Labor rates used are from the Bureau of Labor Statistic (BLS) tables. These hourly rates were inflated to 2020 dollars using values of the Consumer Price Index for All Urban Consumers. A multiplier of 2.4, which includes fringe and indirect management cost, was then applied and resulted in the displayed labor rates.
Managers	$157	Dollars per hour	BLS tables.
Technical staff	$115	Dollars per hour	BLS tables.
Administrative staff	$83	Dollars per hour	BLS tables.
Licensing staff	$122	Dollars per hour	BLS tables.
Industry plant technician	$104	Dollars per hour	BLS tables.
NRC staff	$131	Dollars per hour	NRC group e-mail Rulemaker@nrc.gov, “NRC Labor Rates for Use in Regulatory Analyses,” 2019.

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DATE	5/22/2020	6/12/2020	6/2/2020	11/17/2020	11/18/2020
OFFICE	NMSS/REFS/D	OGC	NRR/D		
NAME	KCoyne for JTappert*	SClark*	AVeil*		
DATE	12/10/2020	02/25/2021	03/02/2021		

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