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# **Final Rule on Incorporation by Reference of American Society of Mechanical Engineers 2019–2020 Code Editions—Regulatory Analysis**

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

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## Abstract

The U.S. Nuclear Regulatory Commission (NRC) is amending 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; ASME OM Code Case OMN-28, “Alternative Valve Position Verification Approach to Satisfy ISTC-3700 for Valves Not Susceptible to Stem-Disk Separation,” without conditions; the 2011 Addenda to ASME NQA-1-2008, “Quality Assurance Requirements for Nuclear Facility Applications,” with 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 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 up-to-date and technically sound methods developed by ASME to protect the public.

This document is a regulatory analysis for the final rule. To improve the credibility of the NRC’s cost estimate for this regulatory action, the staff conducted an uncertainty analysis to examine 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 shows that the final rule would result in a net averted cost for the industry of between \$10.2 million (using a 7-percent discount rate) and \$11.0 million (using a 3-percent discount rate). Compared to the regulatory baseline, the NRC would realize a net averted cost of between \$0.91 million (using a 7-percent discount rate) and \$0.99 million (using a 3-percent discount rate).

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## Executive Summary

The U.S. Nuclear Regulatory Commission (NRC) is amending its regulations to incorporate by reference the 2019 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (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; ASME OM Code Case OMN-28, "Alternative Valve Position Verification Approach to Satisfy ISTC-3700 for Valves Not Susceptible to Stem-Disk Separation," without conditions; the 2011 Addenda to ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications," with conditions; and the 2012 and 2015 Editions of ASME NQA-1, with conditions. A significant portion of the averted costs from this final rule results from the reduction in plant-specific requests for alternatives because these provisions would be incorporated by reference.

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

- **Final Rule Analysis.** The final 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 for the industry of between \$10.2 million (7-percent net present value (NPV)) and \$11.0 million (3-percent NPV). Relative to the regulatory baseline, the NRC would realize a net averted cost of between \$0.91 million (7-percent NPV) and \$0.99 million (3-percent NPV). Table ES-1 shows that the final rule would result in net averted costs for the industry and the NRC of between \$11.1 million (7-percent NPV) and \$12.0 million (3-percent NPV).

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

Attribute	Costs		
	Undiscounted	7% NPV	3% NPV
Industry Costs	(\$1,260,000)	(\$1,100,000)	(\$1,190,000)
NRC Costs	\$0	\$0	\$0
Total	(\$1,260,000)	(\$1,100,000)	(\$1,190,000)
Attribute	Benefits		
	Undiscounted	7% NPV	3% NPV
Industry Benefits	\$12,940,000	\$11,310,000	\$12,200,000
NRC Benefits	\$1,040,000	\$910,000	\$990,000
Total	\$13,980,000	\$12,220,000	\$13,190,000
Attribute	Net Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Industry Net	\$11,680,000	\$10,210,000	\$11,010,000
NRC Net	\$1,040,000	\$910,000	\$990,000
Total Net	\$12,720,000	\$11,120,000	\$12,000,000

Note: Values are rounded to the nearest ten thousand dollars. Totals throughout this document may differ because of rounding. All values are reported in 2021 dollars.

- **Nonquantified Benefits.** Other benefits of the final rule include the NRC's continued ability to ensure the protection of public health and safety and the environment through its 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 final rule is consistent with the provisions of the National Technology Transfer and Advancement Act of 1995 and the 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 adopt 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 net benefit for this final rule is \$11.1 million, with 90-percent confidence that the net benefit is between \$9.03 million and \$13.4 million (7-percent NPV). From the uncertainty analysis, it is reasonable to infer that issuing the final rule represents an efficient use of resources and leads to averted costs for the NRC and the industry. The number of hours to test a valve under ISTC-3700, the Industry labor rate, and the annual number of personnel completing Level I and II certification training are the factors responsible for the largest variations in averted costs.
- **Decision Rationale.** Relative to the no-action baseline, the NRC concludes that the final 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 final rule is further justified by the nonquantified benefits that would result from it.

## 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 Code	(ASME) Boiler and Pressure Vessel Code
CFR	<i>Code of Federal Regulations</i>
CPI-U	Consumer Price Index for All Urban Consumers
CRGR	Committee to Review Generic Requirements
GDC	general design criterion/criteria
IBR	incorporation by reference
ISI	inservice inspection
IST	inservice testing
NPV	net present value
NQA	Nuclear Quality Assurance
NRC	U.S. Nuclear Regulatory Commission
NTTAA	National Technology Transfer and Advancement Act of 1995
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 final rule to incorporate by reference specific American Society of Mechanical Engineers (ASME) codes and Code Cases. The final rule includes the following provisions:

- incorporation by reference (IBR) of the 2019 Edition of the ASME Boiler and Pressure Vessel Code (BPV Code), Section III, Division 1, and Section XI, Division 1, into U.S. Nuclear Regulatory Commission (NRC) regulations, and delineation of NRC requirements for the use of this code, with conditions
- IBR of the 2020 Edition of Division 1 of the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) into NRC regulations, and delineation of NRC requirements for the use of this code, with conditions
- IBR of the ASME OM Code Case OMN-28, “Alternative Valve Position Verification Approach to Satisfy ISTC-3700 for Valves Not Susceptible to Stem-Disk Separation,” without conditions
- IBR of the 2011 Addenda to ASME NQA-1-2008, “Quality Assurance Requirements for Nuclear Facility Applications” (ASME NQA-1b-2011), into NRC regulations, with conditions
- IBR of the 2012 and 2015 Editions of ASME NQA-1 into NRC regulations, 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 costs 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 and 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 odd years (e.g., 2013, 2015) and the OM Code in even years<sup>1</sup> (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, and clarify them to narrow the applicability of the provision. The new editions and addenda 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

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<sup>1</sup> The 2014 Edition of the 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.

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 IBR. Upon IBR of the ASME Codes into 10 CFR 50.55a, the provisions of the ASME Codes become legally binding NRC requirements, as delineated in 10 CFR 50.55a, subject to the conditions on certain ASME Code provisions specified in 10 CFR 50.55a. The NRC last incorporated by reference editions of and addenda to the ASME Codes into the regulations in a final rule dated July 18, 2017 (Volume 82 of the *Federal Register*, page 32934), 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.

The NTTAA further states that 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 not developed or adopted by voluntary consensus bodies.

Since 1971, the 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. The involvement of this broad spectrum of stakeholders helps to ensure that a wide range of interests are considered.

A directive from the ASME Board on Nuclear Codes and Standards transferred responsibility for developing and maintaining 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 the OM Code to replace the rules in ASME BPV Code Section XI 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, Class 2, Class 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 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 might submit more requests for the use of alternatives under 10 CFR 50.55a(z) or for exemptions under 10 CFR 50.12 or 10 CFR 52.7, both titled "Specific exemptions." These alternative or exemption requests might also include similar broad requests for approval to use the full scope of the ASME Code editions and

addenda. These requests would pose an unnecessary additional cost to both the licensees or applicants and the NRC, because 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 Section XI, Division 1, with conditions; the 2020 Edition of Division 1 of the ASME OM Code, with conditions; ASME NQA-1b-2011, with 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) IBR of the 2019 Edition of the ASME BPV Code, Section III, Division 1, and Section XI, Division 1, with conditions; IBR of the 2020 Edition of Division 1 of the ASME OM Code, with conditions; IBR of the ASME OM Code Case OMN-28, without conditions; IBR of ASME NQA-1b-2011, with conditions; and 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 nonrulemaking 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—Incorporation by Reference of the ASME Codes with Conditions

In Alternative 2, a rulemaking alternative, the NRC would 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–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
- the ASME OM Code Case OMN-28, without conditions
- ASME NQA-1b-2011, with 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 regulatory costs to the industry by eliminating the need for applicants and licensees to submit plant-specific requests for alternatives in accordance with 10 CFR 50.55a(z), as well as the need for the NRC to review those submittals.
- This alternative supports the NRC's goal of ensuring the protection of public health and safety and the environment by continuing to approve 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 allowing the public to participate in it.
- This alternative supports the NRC's commitment to participating in the national consensus standard process by approving updated ASME Code editions, and it conforms to NTTAA requirements.
- The costs of the conditions the NRC is placing on the editions of and addenda to the ASME Codes cited here are more than offset by the reduction in the number of plant-specific alternative requests that the NRC would otherwise need to evaluate. Section 5 of this analysis details the costs and benefits of this alternative compared to the regulatory baseline (Alternative 1).

#### **4. Estimation and Evaluation of Costs and Benefits**

This section describes the process for evaluating the costs and benefits expected to result from Alternative 2 relative to the regulatory baseline (Alternative 1). All costs and benefits are monetized, when possible. The net costs and benefits are then summed to determine whether their difference constitutes 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 Alternatives 1 and 2 are expected to affect. 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 affected attributes using NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," Revision 5 (draft final), issued January 2020 (NRC, 2020).

The rule in Alternative 2 would affect the following attributes:

- Public Health (Accident). This attribute accounts for expected changes in public exposure to radiation 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 of workers during normal facility operations (i.e., nonaccident situations). An action could increase worker exposure, either as a one-time effect (e.g., due to installation or modification of equipment in a hot area), or as an ongoing effect (e.g., due to 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 on all affected licensees caused by routine and recurring activities required by the alternative. 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 implementing the alternative. It includes NRC implementation costs and benefits incurred in addition to those expected under the regulatory baseline. At the final rule stage, all NRC implementation costs are sunk.
- NRC Operation. This attribute accounts for the projected net economic effect on the NRC caused by routine and recurring activities 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 updated ASME Code, then the licensee or applicant must submit a request, under 10 CFR 50.55a(z), to apply the unapproved edition or addenda as an alternative to the approved ASME Code provisions. This submittal requires additional staff time to determine whether the updated ASME Code is acceptable and whether any limitations or modifications should apply. The final rule (Alternative 2) would render these alternative requests unnecessary, yielding 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 knowledge acquired as the industry and the NRC staff gain experience with new technology before its incorporation into the ASME Codes and as licensees use advances in ISI and IST. Improved ISI and

IST may also lead to earlier identification of material degradation that, if undetected, could eventually cause 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 through alternative requests. This rulemaking would reduce industry effort on 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 that none of the alternatives are expected to affect 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. Benefits include any desirable changes in affected attributes (e.g., monetary savings, improved safety, and improved security). 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—quantitatively. 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 the calculations. The detailed cost tables used in this regulatory analysis appear in the individual sections for each of the provisions. The NRC evaluated the other six attributes qualitatively, because some of the benefits of consistent policy application and improvements in ISI and IST techniques are not quantifiable, or because the data necessary to quantify and monetize the effects on these attributes are not available. The staff has documented its assumptions throughout this regulatory analysis. 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 final 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, Revision 5 (draft final), 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 final rule will affect all operating light-water nuclear power plants. The analysis considers 52 plant sites containing one or more operating U.S. light-water nuclear power reactor units (with a total of 92 reactors) in 2022, and 51 plant sites (and 91 reactors) in 2023–2024.

#### 4.2.3 *Base Year*

All monetized costs are expressed in 2021 dollars. 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 recurring annual operating expenses. The values for annual operating expenses are modeled as a constant expense for each year of the analysis horizon.

#### 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, Revision 5 (draft final), the staff used net present value (NPV) calculations to determine how much society would need to invest today to ensure that the designated dollar amount is available in a given year in the future. Using NPVs, costs and benefits, regardless of when they are incurred, are valued to a reference year for comparison. The choice of and conceptual basis for the discount rate are 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.”<sup>2</sup> A 7-percent discount rate approximates the marginal pretax real rate of return on an average investment in the private sector. This is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. A 7-percent rate is consistent with the concept of the “opportunity cost of capital,”<sup>3</sup> reflecting the time value of resources directed to meet regulatory requirements.

#### 4.2.5 *Cost-Benefit Inflat*

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 costs and benefits

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<sup>2</sup> The social rate of time preference is the rate at which society is willing to postpone a marginal unit of current consumption in exchange for more future consumption.

<sup>3</sup> An opportunity cost is what is forgone 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 amount of time.



consistently, these inputs are expressed in 2021 base-year dollars. The most common inflator used for conversion from prior-year dollars is the Consumer Price Index for All Urban Consumers (CPI-U), developed by the U.S. Department of Labor’s Bureau of Labor Statistics (BLS). The NRC used the CPI-U to convert 2020 dollar values into 2021 base-year dollars, through the following formula:

$$\frac{CPI - U_{2021}}{CPI - U_{2020}} \times Value_{2020} = Value_{2021}$$

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

**Table 1 CPI-U Inflator**

Base Year	CPI-U Annual Average <sup>a</sup>	Percent Change from Previous Year
2020	258.811	
2021	266.236	2.87%

<sup>a</sup>For 2021, the CPI-U annual average is the average value for the first 6 months based on data availability at the time of the analysis.

Source: BLS, 2020a

#### 4.2.6 Labor Rates

For the purposes of this regulatory analysis, the NRC developed labor rates that include only labor and material costs directly related to the implementation, operation, and maintenance of the proposed rule requirements. This approach is consistent with the guidance in NUREG/CR-3568, “A Handbook for Value-Impact Assessment,” issued December 1983 (NRC, 1983), and with general cost-benefit methodology. The NRC incremental labor rate is \$137 per hour in 2021 dollars.<sup>4</sup>

The NRC used the 2020 BLS Occupational Employment and Wages data (BLS, 2020b) for the nuclear electric power generation industry (North American Industry Classification System Code 221113), which provide labor categories and the mean hourly wage rate by job type. The NRC used the CPI-U to inflate these labor rate data to 2021 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 the estimated procedural, licensing, and utility-related work necessary during and after implementation of the alternative. In establishing the labor rates, the NRC included 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), which are considered incremental expenses. 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 also performed an uncertainty analysis (see Section 5.13).

<sup>4</sup> 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 Position Titles and Occupations**

<b>Position Title (in This Regulatory Analysis)</b>	<b>Standard Occupational Classification Code</b>
Managers	Top Executives (11-1000)
	Chief Executives (11-1011)
	General and Operations Managers (11-1021)
	Industrial Production Managers (11-3051)
	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)
	First-Line Supervisors of Production and Operating Workers (51-1011)
Technical Staff	Nuclear Engineers (17-2161)
	Physicists (19-2012)
	Nuclear Technicians (19-4051)
	Industrial Machinery Mechanics (49-9041)
	Nuclear Power Reactor Operators (51-8011)
Administrative Staff	Office and Administrative Support Occupations (43-0000)
	First-Line Supervisors of Office and Administrative Support Workers (43-1011)
	Office Clerks, General (43-9061)
Licensing Staff	Lawyers (23-1011)
	Paralegals and Legal Assistants (23-2011)

Source: BLS, 2020b

#### 4.2.7 Sign Conventions

This analysis uses the following sign conventions: 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 new editions of its BPV and OM Codes (no addenda) every 2 years, with the BPV Code issued in odd years (e.g., 2013, 2015) and the OM Code in even years (e.g., 2012, 2014). The NRC typically incorporates by reference the latest editions of the BPV and OM Codes through rulemaking at the time of publication of the updated OM Code (when the BPV Code has already been updated the year before). The next edition of the OM Code is expected to be issued in 2022. At that time, the NRC will start the next Code Editions proposed rule, assuming there are no delays in ASME’s next updates to the BPV and OM Codes. Since it is assumed the next Code Editions rule will take 2 years to complete and that the rule proposed here will be in effect at the 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 into its mandated activities. For each mandated activity, the NRC subdivided the work across labor categories (i.e., executives/managers, technical staff, administrative staff, and licensing staff). The NRC estimated the level of effort required for each mandated 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 for many of the estimates. Additionally, the NRC estimated costs and benefits using a buildup method, solicitation of licensee input, and extrapolation techniques.

The NRC began by using the engineering buildup method of cost estimation for some activities. This method combines the incremental costs of an activity from the bottom up to estimate a net cost. For this step, the NRC reviewed previous license submittals and determined the number of pages in each section, then used these data to calculate 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.

For some activities, the NRC extrapolated from actual past or current costs to estimate the future cost of similar activities. For example, to estimate the 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, choosing input values at random from the distributions of the input variables. The result was a distribution of values for the output variable of interest. Monte Carlo simulation also shows which input variables have the greatest effect on the value of the output variable. Section 5 of this analysis describes the staff's 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 costs to meet the conditioned requirements. For each applicable case, the conditions may specify additional activities that must be performed, limits on the activities, or supplemental information needed to provide clarity (or a combination of these). This regulatory analysis examines the conditions for the 2019–2020 Editions of the ASME Codes to determine their overall costs and benefits.

### 4.3 Data

This section discusses the data used in analyzing the quantifiable effects of 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 from the staff on attributes affected by the final rule. 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 as either positive or negative, depending on whether the alternative has a favorable or an adverse effect compared to the regulatory baseline. Attributes not presented in monetary values are discussed in qualitative terms. This ex ante cost-benefit analysis<sup>5</sup> provides information that can be useful when deciding whether to select an alternative, even if the analysis is based on estimates of future costs and benefits.

The NRC's regulatory analysis guidelines (NRC, 2020) state that the agency'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 developing 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 choose to adopt without an alternative request if the NRC has approved the Code Cases through IBR in its 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(b) so that they apply to the 2019 Edition of the ASME BPV Code, Section III, Division 1. Therefore, these amendments will not result in any 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 of the ASME BPV Code, Section III, Division 1, will result in incremental benefits to industry and are discussed below with the associated attributes.

The NRC is amending 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

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<sup>5</sup> An ex ante cost-benefit analysis is one that is prepared before a policy, program, or alternative is in place. It can help an organization decide whether to allocate resources to that policy, program, or alternative.

- 10 CFR 50.55a(b)(2)(ix) Section XI condition: metal containment examinations
- 10 CFR 50.55a(b)(2)(xii) 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)(xv) Section XI condition: Appendix VIII specimen set and qualification requirements
- 10 CFR 50.55a(b)(2)(xviii)(A) Section XI condition: nondestructive examination 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 final rule amends, removes, or adds the following conditions for the ASME BPV Code, Section XI:

- The NRC is amending 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 is amending 10 CFR 50.55a(b)(2)(xxv)(B) on mitigation of defects by modification, making editorial changes to the language for greater clarity.
- The NRC is amending 10 CFR 50.55a(b)(2)(xxvi) which 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 affect mechanical joints. In the final rule language, the NRC made editorial changes to simplify the wording of the condition but did not change the effect of the condition from the proposed rule language.
- The NRC is amending 10 CFR 50.55a(b)(2)(xxxii) to increase the timeframe for submittal of summary reports (before the 2015 Edition) and owner activity reports (2015 Edition and later) for inservice examinations and repair/replacement activities from 90 days to 120 days.
- The NRC is removing 10 CFR 50.55a(b)(2)(xl) to no longer 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.
- The NRC is adding 10 CFR 50.55a(b)(2)(xlili) to require submission of certain analyses to the NRC for review. This condition simply retains these requirements from previous editions of ASME Section XI.

Most of 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.

The amending of 10 CFR 50.55a(b)(2)(xxvi) is expected to reduce the number of alternative requests from licensees. This averted cost is included in the total number of annual averted alternative requests discussed in Section 5.3, "Industry Operation," and Section 5.7, "NRC Operation," below.

The current 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, this final rule amends, removes, or adds the following conditions from the ASME OM Code:

- The NRC is removing the IBR of the 2011 Addenda to the ASME OM Code from 10 CFR 50.55a(a)(1)(iv)(B)(2). This allows 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).
- The NRC is also removing 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.
- In response to public comments, the NRC is amending 10 CFR 50.55a(f)(4) to clarify which requirements for dynamic restraints (snubbers) are applicable to licensees using different ASME Code Addenda, and also that inservice test requirements for pumps and valves may be satisfied by an augmented IST program, in accordance with 10 CFR 50.55a(f)(6)(ii), without the need to request relief or an alternative.
- In response to public comments, the NRC is amending 10 CFR 50.55a(f)(7) to remove the requirement for licensees to submit interim IST plan updates. This may result in incremental averted costs that were not quantified, making the final rule more cost beneficial.
- The NRC is amending 10 CFR 50.55a(b)(3)(xi) to allow licensees to extend the position indication testing interval for certain valves to 12 years, rather than the 2-year interval specified in ISTC-3700, by allowing licensees to use ASME OM Code Case OMN-28 for valves that are not susceptible to separation of the stem-disk connection. Licensees may perform the valve position indication tests at 12-year intervals if they have documentation on-site that demonstrates that the stem-disk connection for the specific valves is not susceptible to separation.

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 IBR of the 2020 Edition of Division 1 of the ASME OM Code will result in cost savings because it will reduce the number of alternative requests.

The modification of 10 CFR 50.55a(b)(3)(xi) will result in incremental costs and benefits because this condition will reduce the testing frequency from a 2-year to a 12-year interval. 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, so there are no incremental costs or benefits associated with these amendments.

## 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, although 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 lead to earlier identification of material degradation that, if undetected, could eventually cause a plant transient. Therefore, Alternative 2 would maintain the same level of safety or provide an incremental improvement in safety 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 that the industry is periodically updating to the most current methods and technology, which may make accidents less likely, 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 that can be relied on to remain functional during and after design-basis accidents. Alternative 2 may also decrease the probability of an accident because improved inspection and testing techniques will ensure material remains in acceptable condition.

## 5.2 Industry Implementation

This attribute accounts for the projected net economic effect on licensees of implementing the regulatory changes (conditions on the ASME Code editions). The NRC is adding an alternative to the condition in 10 CFR 50.55a(b)(2)(xviii)(D) on nondestructive examination personnel certification that would allow the use of laboratory practice as a partial substitute for certification. This alternative would allow personnel to complete their ultrasonic examination certifications in less time than under current regulations. The staff estimates that the alternative would reduce the time to complete these certifications by about 78 hours per person, on average. The staff expects that, over the applicability period of this rule, about nine people at each power plant facility would complete certifications using this alternative of laboratory practice. Because a person only needs to complete certification once in their career, Alternative 2 would result in a one-time cost savings (benefit) to the industry for training new personnel. Table 3 details the cost savings over the applicability period of the final rule. The NRC estimates that the reduced training under Alternative 2 will result in averted costs for the industry of between \$4.54 million (7-percent NPV) and \$4.89 million (3-percent NPV).

**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	Cost		
						Undiscounted	7% NPV	3% NPV
2022	Reduced Training for Level I and II Certifications	3	54	78	\$138	\$1,730,000	\$1,620,000	\$1,680,000
2023	Reduced Training for Level I and II Certifications	3	54	78	\$138	\$1,730,000	\$1,510,000	\$1,630,000
2024	Reduced Training for Level I and II Certifications	3	54	78	\$138	\$1,730,000	\$1,410,000	\$1,580,000
<b>Total:</b>						<b>\$5,190,000</b>	<b>\$4,540,000</b>	<b>\$4,890,000</b>

### 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 previously approved 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),<sup>6</sup> which is not an averted cost for Alternative 2.

The use of current ASME Code editions and addenda would benefit NRC nuclear power plant licensees and applicants in several ways. For example, these editions and addenda may introduce 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 it would be beneficial to use a Code edition that the NRC has not approved, the licensee or applicant must prepare a request for its use, 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 it takes an average of 230 hours for a licensee or applicant to research, review, approve, process, and submit a Code alternative request to the NRC under 10 CFR 50.55a(z). The NRC assumes that licensees and applicants decide whether to request an alternative by weighing the cost against the derived benefit. In some cases, because of the cost of requesting an alternative, licensees may decide to forfeit the benefits (whether radiological benefits or cost reductions) provided by using a newer ASME Code.

A review of past submittals shows that plant owners submit Code alternative requests covering multiple units and multiple plant sites. Under Alternative 2, a nuclear power plant licensee would no longer need to submit such requests under 10 CFR 50.55a(z). This would provide a

<sup>6</sup> Regulations in 10 CFR 50.55a(f)(4) and (g)(4) establish the effective ASME Code edition and addenda for licensees to use in performing IST of pumps and valves and ISI of components (including supports), respectively. 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 licensees wishing to update their IST and ISI programs early to later editions of and addenda to the ASME OM Code.



net benefit (i.e., averted cost) to the licensee. The NRC analyzed alternative request submittals across multiple years and determined that, assuming the agency issues this rule by 2022, implementing Alternative 2 would avert the preparation and submission of approximately 22 Code alternative requests each year (see Table 4). The NRC estimates the associated averted costs for the industry, under Alternative 2, at between \$1.83 million (7-percent NPV) and \$1.98 million (3-percent NPV).

**Table 4 Industry Operation—Averted Costs for Alternative Requests**

Year	Activity	Requests Prepared per Year	Average Labor hours per Request	Weighted Hourly Rate	Cost		
					Undiscounted	7% NPV	3% NPV
2022	Alternative request preparation and submission	22	230	\$138	\$700,000	\$650,000	\$680,000
2023	Alternative request preparation and submission	22	230	\$138	\$700,000	\$610,000	\$660,000
2024	Alternative request preparation and submission	22	230	\$138	\$700,000	\$570,000	\$640,000
<b>Total:</b>					<b>\$2,100,000</b>	<b>\$1,830,000</b>	<b>\$1,980,000</b>

Note: All values are reported in 2021 dollars.

The NRC is providing an alternative to 10 CFR 50.55a(b)(2)(xxv)(B) to allow licensees to measure loss of material rates at up to two different locations with similar corrosion conditions, similar flow characteristics, and the same piping configuration (e.g., straight run of pipe, elbow, tee). Allowing the use of equivalent locations provides flexibility and reduces cost to licensees. The staff estimates that eight power plants would likely use this provision each year, and that the provision would save each of these power plants 180 hours of labor. Table 5 delineates the estimated averted costs for licensees each year if the NRC granted this alternative to 10 CFR 50.55a(b)(2)(xxv)(B). The NRC estimates that, under Alternative 2, the option to use different measurement locations would result in averted costs for the industry of between \$520,000 (7-percent NPV) and \$560,000 (3-percent NPV).

**Table 5 Industry Operation—Averted Costs for Alternative Measurement Locations**

Year	Activity	Number of Power Plants per Year	Averted Labor Hours per Plant	Weighted Hourly Rate	Benefits (Costs)		
					Undiscounted	7% NPV	3% NPV
2022	Loss of Material Rates Measured at Alternative Locations	8	180	\$138	\$200,000	\$190,000	\$190,000
2023	Loss of Material Rates Measured at Alternative Locations	8	180	\$138	\$200,000	\$170,000	\$190,000
2024	Loss of Material Rates Measured at Alternative Locations	8	180	\$138	\$200,000	\$160,000	\$180,000
<b>Total:</b>					<b>\$600,000</b>	<b>\$520,000</b>	<b>\$560,000</b>

The NRC is modifying 10 CFR 50.55a(b)(3)(xi), including a statement that it is acceptable for licensees to use ASME OM Code Case OMN-28, which is being incorporated by reference in 10 CFR 50.55a(a)(1)(iii). The ASME OM Code Case OMN-28 provides a structured approach for testing valves that have a stem-disk connection that is not susceptible to separation and allows up to 12 years as the maximum interval for valve position verification testing. Therefore,

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 at 12-year intervals rather than at 2-year intervals. To take this benefit, the licensee must have documentation on-site demonstrating that the stem-disk connection is not susceptible to separation, based on the internal design and evaluation of the stem-disk connection and on vendor recommendations. Licensees would perform additional effort and incur costs to collect the necessary data and prepare such documentation. If the licensee can demonstrate that the valve is not susceptible to stem-disk connection separation, then the licensee will not have to perform another ISTC-3700 test for this valve for 12 years. Thus, the licensee will save the costs of testing the valve under ISTC-3700 every 2 years (twice over the analysis horizon for this final rule).

Table 6 shows the additional cost for licensees to collect data and documents to show 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 amounts licensees would save by testing the valves once every 12 years instead of every 2 years. The staff assumes that under this final rule, licensees would already have completed testing of these valves under ISTC-3700, so that they would not need to test the valves again for another 12 years. The NRC estimates that these changes under Alternative 2 will result in net averted costs for licensees of between \$3.32 million (7-percent NPV) and \$3.58 million (3-percent NPV). Because there may be a radiation field near some of these valves that would subject testing personnel to dose, there are also additional minor averted costs due to avoiding this dose that were not quantified.

**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	Benefits (Costs)		
						Undiscounted	7% NPV	3% NPV
2022	Effort to justify that stem-disk connection is not susceptible to separation	92	100	0.5	\$138	(\$630,000)	(\$590,000)	(\$610,000)
2024	Effort to justify that stem-disk connection is not susceptible to separation	91	100	0.5	\$138	(\$630,000)	(\$510,000)	(\$580,000)
<b>Total:</b>						<b>(\$1,260,000)</b>	<b>(\$1,100,000)</b>	<b>(\$1,190,000)</b>

**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	Benefits (Costs)		
						Undiscounted	7% NPV	3% NPV
2022	Averted testing of valves under ISTC-3700	92	100	2	\$138	\$2,540,000	\$2,370,000	\$2,470,000
2024	Averted testing of valves under ISTC-3700	91	100	2	\$138	\$2,510,000	\$2,050,000	\$2,300,000
<b>Total:</b>						<b>\$5,050,000</b>	<b>\$4,420,000</b>	<b>\$4,770,000</b>

#### 5.4 Occupational Health (Accident and Routine)

The NRC practice of reviewing the latest ASME BPV and OM Code editions and incorporating them 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 in this way, as it would provide for NRC approval of the latest

ASME Code editions. This may incrementally decrease the likelihood of accidents resulting in worker radiological exposure and may decrease worker exposure during routine inspections or testing, compared to the regulatory baseline.

## 5.5 Net Industry Costs

Table 8 shows the net industry costs, broken down into implementation and operation costs, for the proposed rule under Alternative 2. These net industry costs represent averted costs of between \$10.2 million (7-percent NPV) and \$11.0 million (3-percent NPV).

**Table 8 Net Industry Costs**

Attribute	Net Industry Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Net Implementation Costs:	\$5,190,000	\$4,540,000	\$4,890,000
Net Operation Costs:	\$6,490,000	\$5,670,000	\$6,120,000
<b>Net Industry Cost:</b>	<b>\$11,680,000</b>	<b>\$10,210,000</b>	<b>\$11,010,000</b>

Note: Net costs are rounded to the nearest \$10,000. All values are reported in 2021 dollars.

## 5.6 NRC Implementation

The NRC implementation costs are from the rulemaking process and are sunk at this stage of the final rule.

## 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. The NRC expects implementation of Alternative 2 to avert 22 alternative request submittals per year. The IBR of the latest ASME Code editions in the *Code of Federal Regulations* allows a nuclear power plant licensee to use current ASME Code editions and addenda without submitting an alternative request for NRC review.

As shown in Table 9, the NRC estimates that each alternative request 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. The NRC staff estimates that eliminating the need for these submittals would lead to averted costs of between \$0.91 million (7-percent NPV) and \$0.99 million (3-percent NPV).

**Table 9 NRC Operation Costs—Averted Alternative Request Reviews**

Year	Activity	Requests Reviewed per Year	Average NRC Staff Hours per Request	Weighted Hourly Rate	Benefits (Costs)		
					Undiscounted	7% NPV	3% NPV
2022	Review alternative request	22	115	\$137	\$347,000	\$324,000	\$340,000
2023	Review alternative request	22	115	\$137	\$347,000	\$303,000	\$330,000
2024	Review alternative request	22	115	\$137	\$347,000	\$283,000	\$320,000
<b>Total:</b>					<b>\$1,041,000</b>	<b>\$910,000</b>	<b>\$990,000</b>

Note: All values are reported in 2021 dollars.

## 5.8 Net NRC Costs

Table 10 shows the net NRC costs, broken down into implementation and operation costs, for Alternative 2. These net NRC costs represent averted costs (savings) estimated at between \$0.91 million (7-percent NPV) and \$0.99 million (3-percent NPV).

**Table 10 Net NRC Costs**

Attribute	Net NRC Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Net Implementation Cost:	\$0	\$0	\$0
Net Operation Cost:	\$1,041,000	\$910,000	\$990,000
<b>Net NRC Cost:</b>	<b>\$1,041,000</b>	<b>\$910,000</b>	<b>\$990,000</b>

Note: All values are reported in 2021 dollars.

## 5.9 Net Costs

Table 11 shows the Alternative 2 costs, broken down into implementation and operation costs, for both the industry and the NRC. The net averted costs are estimated at between \$11.1 million (7-percent NPV) and \$12.0 million (3-percent NPV).

**Table 11 Net Costs**

Attribute	Net Benefits (Costs)		
	Undiscounted	7% NPV	3% NPV
Industry Implementation	\$5,190,000	\$4,540,000	\$4,890,000
Industry Operation	\$6,490,000	\$5,670,000	\$6,120,000
<i>Net Industry Cost</i>	<i>\$11,680,000</i>	<i>\$10,210,000</i>	<i>\$11,010,000</i>
NRC Implementation	\$0	\$0	\$0
NRC Operation	\$1,041,000	\$910,000	\$990,000
<i>Net NRC Cost</i>	<i>\$1,041,000</i>	<i>\$910,000</i>	<i>\$990,000</i>
<b>Net Cost:</b>	<b>\$12,721,000</b>	<b>\$11,120,000</b>	<b>\$12,000,000</b>

Note: All values are reported in 2021 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 earlier identification of material degradation that, if undetected, could eventually cause a plant transient.

## 5.11 Regulatory Efficiency

Compared to the regulatory baseline (Alternative 1), Alternative 2 would increase regulatory efficiency by making the ASME Codes and NRC regulations consistent. Licensees and applicants that wish to use current editions of or addenda to the ASME Codes would not have to submit 10 CFR 50.55a(z) alternative requests to the NRC for review and approval. This would

give licensees and applicants more 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) Under Alternative 1, licensees would submit many alternative requests to use more current editions of or addenda to the ASME Codes under 10 CFR 50.55a(z). This would increase regulatory costs for licensees and the NRC.
- (2) The choice of Alternative 1 would undermine the NRC's role as an effective industry regulator because, although ASME periodically revises its codes, outdated material would remain incorporated by reference in the *Code of Federal Regulations*.

## 5.12 Other Considerations

### *5.12.1 Consistency with National Technology Transfer and Advancement Act of 1995 and Implementing Guidance*

Alternative 2 is consistent with the provisions of the NTTAA and the implementing guidance in OMB Circular A-119, "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities," dated January 27, 2016 (OMB, 2016), which encourage Federal regulatory agencies to adopt voluntary consensus standards as an alternative to de novo agency development of standards affecting an industry.

### *5.12.2 Continuation of 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 through IBR of ASME Code editions and addenda 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 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 ASME OM Code Case OMN-28, without conditions
- the 2011 Addenda to ASME NQA-1-2008 (ASME NQA-1b-2011), with conditions
- the 2012 and 2015 Editions of ASME NQA-1, with conditions on their use

### 5.12.3 Increased Public Confidence

Alternative 2 incorporates into NRC regulations the current ASME Code editions, addenda, and Code Cases for the design, construction, operation, ISI, and IST of nuclear power plants by approving them in 10 CFR 50.55a. This alternative allows 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.<sup>7</sup> 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. This uncertainty analysis is based on Monte Carlo simulations performed using @Risk.

Monte Carlo simulations account for uncertainty in the analysis by replacing point estimates of the input variables used to calculate base-case costs and benefits with probability distributions. This provides an effective way to model the influence of uncertainty on the results of the analysis (i.e., the net benefits).

The probability distributions chosen for the variables in the analysis were bounded by the range-referenced input and the staff’s professional judgment. The probability distributions to be used in a Monte Carlo simulation need to be characterized by summary statistics. These summary statistics include the minimum, most likely, and maximum values of a program evaluation and review technique (PERT) distribution,<sup>8</sup> 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 12 identifies the data elements, the distribution and summary statistics for each, and the mean value of the distribution used in the uncertainty analysis.

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<sup>7</sup> Information about this software is available at <http://www.palisade.com>.

<sup>8</sup> 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. Like the triangular distribution, the PERT distribution is bounded on both sides and therefore may not be adequate for modeling that needs to capture tail or extreme events.

**Table 12 Uncertainty Analysis Variables**

<b>Data Element</b>	<b>Mean Estimate</b>	<b>Distribution</b>	<b>Low Estimate</b>	<b>Best Estimate</b>	<b>High Estimate</b>
<b>Labor Rates</b>					
Weighted Hourly Rate for Industry	\$137.78	PERT	\$109.55	\$139.75	\$158.09
Weighted Hourly Rate for the NRC	\$137	None			
<b>Reduced Industry Training for Level I and II Certifications per Power Plant</b>					
Industry Hours Reduced	78	Uniform	75		80
Number of Personnel Completing Training at Each Power Plant	3	PERT	2	3	4
<b>Loss of Material Rates Measured at Alternative Locations (Industry)</b>					
Reduced Industry Hours	180	PERT	120	180	240
Number of Power Plants to Implement the "Alternative Location" Benefit Annually	8	PERT	6	8	10
<b>Cost to Justify the Stem-Disk Connection (Industry)</b>					
Number of Valves per Reactor Unit	100	PERT	75	100	125
Number of Hours to Collect Justification Data for Each Valve	0.50	PERT	0.25	0.50	0.75
<b>Averted Testing under ISTC-3700 (Industry)</b>					
Number of Valves per Reactor Unit	100	PERT	75	100	125
Number of Hours Averted to Test a Valve	2	PERT	1	2	3
<b>2019 Edition of the ASME BPV Code, Section III, Division 1, and Section XI, Division 1</b>					
<b>Averted Alternative Request (Industry)</b>					
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
<b>Review of Averted Alternative Request (NRC)</b>					
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
<b>2020 Edition of Division 1 of the ASME OM Code</b>					
<b>Averted Alternative Request (Industry)</b>					
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

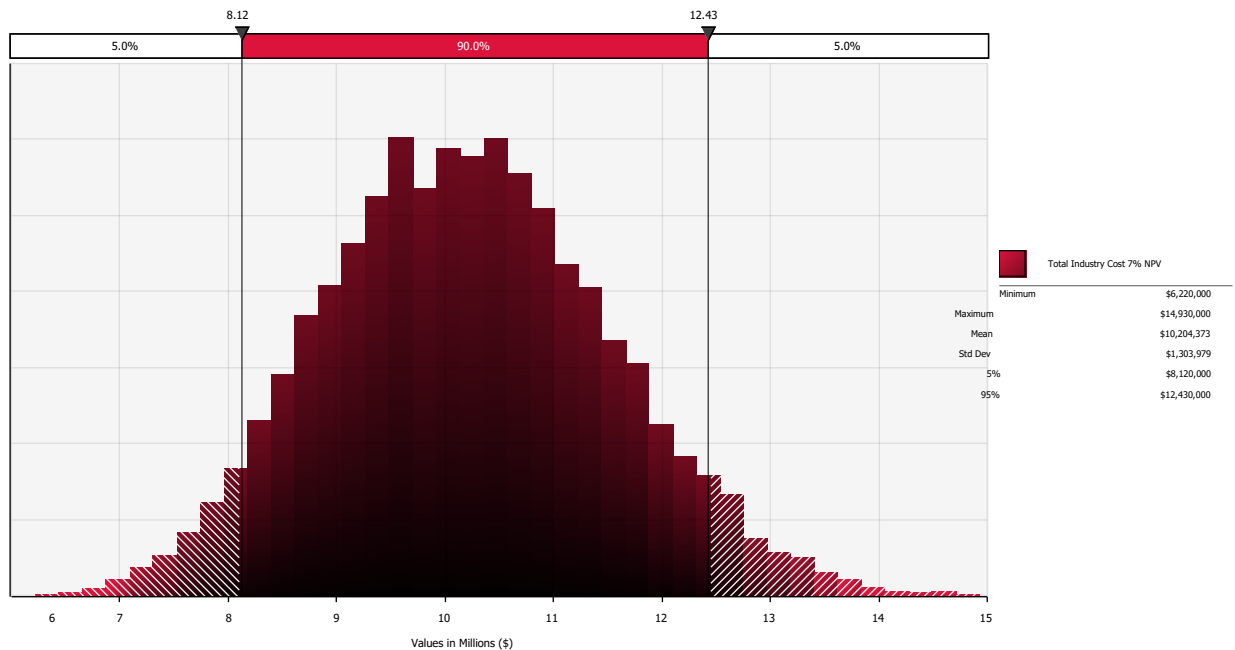
Data Element	Mean Estimate	Distribution	Low Estimate	Best Estimate	High Estimate
<b>Review of Averted Alternative Request (NRC)</b>					
NRC Hours to Evaluate Alternative Request for the OM Code	115	PERT	85	115	145
Number of Alternative Requests Produced Annually for the 2020 Edition of the OM Code	20	PERT	18	20	22

Note: All values are reported in 2021 dollars.

### 5.13.2 Uncertainty Analysis Results

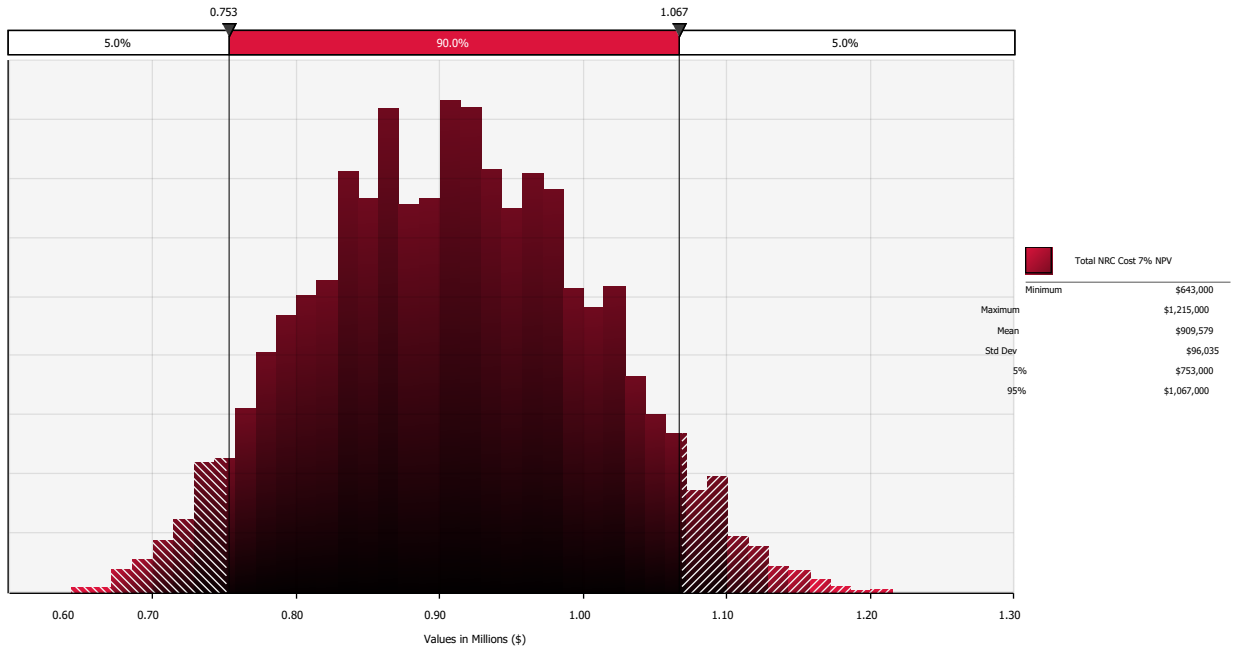
The NRC performed the Monte Carlo simulation by recalculating the results 10,000 times. For each iteration, the NRC staff chose values randomly from the probability distributions defining the input variables. The staff recorded the values of the output variables for each iteration and used these to define the resultant probability distribution.

Figures 1, 2, and 3 display the histograms of the incremental costs and benefits from the regulatory baseline (Alternative 1). For the analysis summarized in each figure, the NRC ran 10,000 simulations, changing the key variables to assess the effects on costs and benefits. The analysis shows that both the industry and the NRC would benefit from the issuance of the final rule.

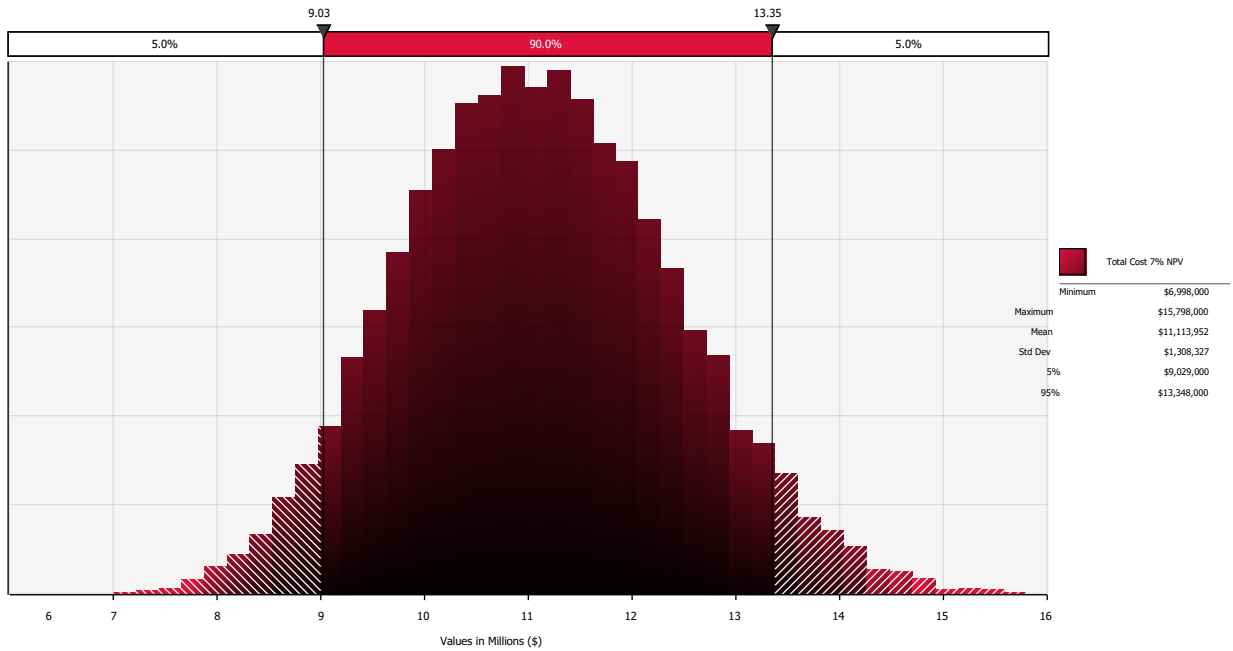


**Figure 1 Net industry costs (7-percent NPV)—Alternative 2**





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



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

Table 13 presents descriptive statistics on the uncertainty analysis. The 5-percent and 95-percent values that appear above the vertical lines in Figures 1, 2, and 3 (labeling the bands left and right of the 90-percent band) are given in Table 13 as the 0.05 and 0.95 values, respectively.

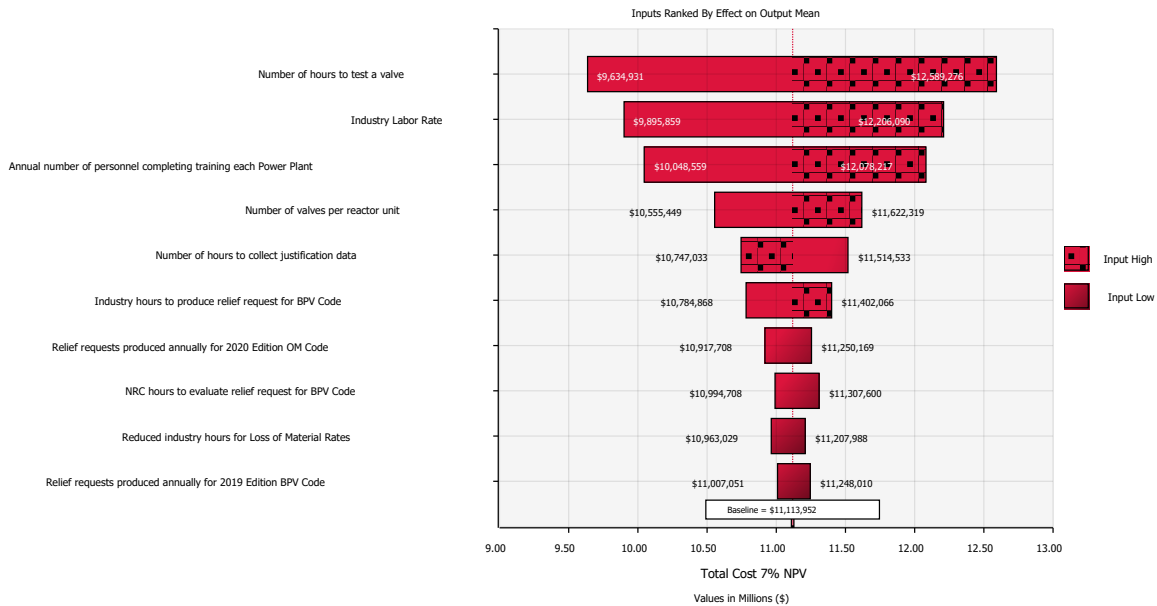
**Table 13 Descriptive Statistics for Uncertainty Results (7-Percent NPV)**

Uncertainty Result	Incremental Cost-Benefit (2021 million dollars)					
	Minimum	Mean	Standard Deviation	Maximum	0.05	0.95
Net Industry Benefit (Cost)	\$6.22	\$10.2	\$1.30	\$14.9	\$8.12	\$12.4
Net NRC Benefit (Cost)	\$0.64	\$0.91	\$0.096	\$1.22	\$0.75	\$1.07
Net Benefit (Cost)	\$7.00	\$11.1	\$1.31	\$15.8	\$9.03	\$13.3

Note: All values are rounded.

Examining the range of the output distribution shown in Table 13 makes it possible to discuss the potential incremental costs and benefits of the final rule with more confidence. 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, which are the input variables whose uncertainty has the largest impact on net costs (and benefits) for this final rule. This figure ranks the cost drivers based on their impact on the uncertainty in the net cost. The three biggest cost drivers for this rule are the number of hours to test a valve under ISTC-3700, the Industry labor rates, and the annual number of personnel that complete training for the Level I and II certifications. The remaining cost drivers show diminishing variation.



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

### 5.13.3 Summary of Uncertainty Analysis

The simulation analysis shows that the estimated mean benefit (i.e., savings or averted costs) for this final rule is \$11.1 million, with 90-percent confidence that the benefit is between \$9.03 million and \$13.4 million, using a 7-percent discount rate. In particular, the rule is cost-beneficial in all simulations for both industry and the NRC. From the uncertainty analysis, it is reasonable to infer that issuing this rule represents an efficient use of resources and leads to averted costs for the NRC and the industry.

## 5.14 Disaggregation

To comply with the guidance in Section E.2.3, “Criteria for the Treatment of Individual Requirements,” of Appendix E, “Special Circumstances and Relationship to Other Procedural Requirements,” to NUREG/BR-0058, Revision 5 (draft final), the NRC performed a screening review to determine whether any of the individual requirements (or the set of integrated requirements) of the final rule were 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 requirement in the final rule is necessary to achieve one or more objectives of the rulemaking. Table 14 shows the results of this screening review.

**Table 14 Disaggregation**

Regulatory Goals for Final 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
ASME OM Code Case OMN-28	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 15 shows the estimated benefits and costs to the industry and the NRC, along with the net cost or benefit, for each provision in this final rule for which the staff has calculated quantitative benefits. The final rule itself is cost-beneficial in all provisions. The licensee’s effort to demonstrate that valves are not susceptible to stem-disk separation is more than offset by the cost savings from averted testing of such valves under ISTC-3700.

**Table 15 Costs by Provision**

Provision	Averted Cost (Cost), 7% NPV		
	Industry	NRC	Net
Alternative Requests Averted by Rulemaking	\$1,830,000	\$910,000	\$2,740,000
Reduced Training for Level I and II Certifications	\$4,540,000	\$0	\$4,540,000
Loss of Material Rates Measured at Alternative Locations	\$520,000	\$0	\$520,000
Reduced Frequency Testing of Valves under ISTC-3700	\$3,790,000	\$0	\$3,790,000
All Other Conditions to 10 CFR 50.55a in This Rulemaking	\$0	\$0	\$0

## 5.15 Summary

This regulatory analysis identifies both quantifiable and nonquantifiable costs and benefits that would result from incorporating updated NRC-approved ASME BPV and OM Code editions and addenda by reference into the *Code of Federal Regulations*. Although quantifiable costs and

benefits appear more tangible, the staff urges decisionmakers not to disregard nonquantifiable costs and benefits. The latter can be just as important as, or even more important than, costs and benefits that can be quantified and monetized.

#### *5.15.1 Quantified Net Benefit*

As shown in Table 11, 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 are between approximately \$11.1 million (7-percent NPV) and \$12.0 million (3-percent NPV). This table also shows that Alternative 2 would be cost-beneficial for both the NRC and the industry, considered separately.

#### *5.15.2 Nonquantified Benefits*

In addition to the quantified benefits discussed in this regulatory analysis, Alternative 2 would yield numerous nonquantified benefits for the industry and the NRC in relation to public health (accident), improvements in knowledge, regulatory efficiency, and other considerations. The sections below summarize these benefits.

##### *5.15.2.1 Advances in Inservice Inspection and Inservice Testing*

Advances in ISI and IST captured in the updated ASME Codes may incrementally decrease the likelihood of a radiological accident, the likelihood of postaccident plant worker exposure, and the level of plant worker radiological exposures during routine inspections and testing. Alternative 2 may also contribute to plant safety by allowing for improved examination methods, which may lead to the earlier identification of material degradation that, if undetected, could eventually cause 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 Radiation Exposures*

The industry's adoption of the ASME BPV and OM Code Cases incorporated by reference into NRC regulations may incrementally reduce the likelihood of a radiological accident, although not in an easily quantifiable manner. Improvements in ISI and IST may also lead to earlier identification of material degradation that, if undetected, could eventually cause a plant transient. Therefore, compared to the regulatory baseline, Alternative 2 would either maintain the same level of safety or provide an incremental improvement in safety, which could incrementally decrease public radiation exposures.

##### *5.15.2.3 Improvements in Knowledge*

Alternative 2 would improve knowledge by allowing the industry and the NRC 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 earlier identification of material degradation that, if undetected, could eventually cause a plant transient.

#### 5.15.2.4 *Consistency with National Technology Transfer and Advancement Act of 1995 and Implementing Guidance*

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

#### 5.15.2.5 *Continuation of 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 through IBR of ASME Code editions and addenda in 10 CFR 50.55a.

#### 5.15.2.6 *Increased Public Confidence*

Alternative 2 would allow licensees to use the most current methods and technology, as captured in the latest ASME Code editions and addenda, to design, construct, operate, examine, and test nuclear power plant components, while maintaining NRC oversight of these activities.

The timely IBR of current ASME Code editions and addenda into the *Code of Federal Regulations* would uphold the NRC's role as an effective industry regulator and boosts public confidence. Conversely, this role would 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 consider 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 procedures (NRC, 2018) appears in this regulatory analysis or in the *Federal Register* notice for the final rule. Table 16 provides cross-references to the relevant parts of this document or the *Federal Register* notice for this information.

**Table 16 Specific CRGR Regulatory Analysis Information Requirements**

<b>Citation in CRGR Procedures (NRC, 2018)</b>	<b>Information Item To Be Included in a Regulatory Analysis Prepared for CRGR Review</b>	<b>Where Item Is Discussed</b>
Appendix B, (i)	The new or revised generic requirement or staff position as it is issued as a final rule	Final rule text in <i>Federal Register</i> notice for the final rule
Appendix B, (ii)	Draft papers or other documents supporting the requirements or staff positions	<i>Federal Register</i> notice for the final rule
Appendix B, (iii)	The sponsoring office's position on whether each requirement or staff position would modify, implement, relax, or reduce existing requirements or staff positions	Regulatory Analysis, Section 5, and Section XIII, "Backfitting and Issue Finality," of <i>Federal Register</i> notice for the final rule
Appendix B, (iv)	The method of implementation	Regulatory Analysis, Section 7
Appendix B, (vi)	The category of power reactors, new reactors, or nuclear materials facilities or activities to which the generic requirement or staff position applies	Regulatory Analysis, Section 4.2.2
Appendix B, (vii)–(viii)	The items required at 10 CFR 50.109(c) and the required rationale at 10 CFR 50.109(a)(3) if the action involves a power reactor backfit and the exceptions at 10 CFR 50.109(a)(4) are not applicable	Section XIII, "Backfitting and Issue Finality," of <i>Federal Register</i> notice for the final rule
Appendix B, (xvi)	An assessment of how the action relates to the Commission's Safety Goal Policy Statement	Regulatory Analysis, Section 5.15

## 6. Decision Rationale

Table 17 provides the quantitative and qualitative costs and benefits for Alternative 2. The quantitative analysis used best estimate values.

**Table 17 Summary of Costs and Benefits**

<b>Net Monetary Savings (Costs)—NPV</b>	<b>Nonquantified Benefits (Costs)</b>
<b>Alternative 1:</b> No action \$0	None
<b>Alternative 2:</b> Incorporate by reference ASME BPV Code 2019 Editions and ASME OM Code 2020 Editions, with conditions  Industry (all provisions): \$10.2 million using a 7% discount rate \$11.0 million using a 3% discount rate	Benefits: <ul style="list-style-type: none"> <li>• <b>Advances in ISI and IST:</b> May incrementally decrease the likelihood of a radiological accident, the likelihood of postaccident plant worker exposure, and the level of plant worker radiological exposures during routine inspections or testing.</li> </ul>

<b>Net Monetary Savings (Costs)—NPV</b>	<b>Nonquantified Benefits (Costs)</b>
<p>NRC (all provisions):            \$0.91 million using a 7% discount rate            \$0.99 million using a 3% discount rate</p> <p>Net benefit (cost) (all provisions):            \$11.1 million using a 7% discount rate            \$12.0 million using a 3% discount rate</p>	<ul style="list-style-type: none"> <li>• <b>Public Health (Accident):</b> May incrementally reduce the likelihood of a radiological accident, although not in an easily quantifiable manner. Pursuing Alternative 2 would continue to uphold the NRC’s goal of maintaining safety by approving current ASME Code editions and addenda to permit licensees to use advances in ISI and IST; providing alternative examinations for older plants; responding expeditiously to user needs; and providing limited, clearly focused alternatives to specific ASME Code provisions. Improvements in ISI and IST may also lead to earlier identification of material degradation that, if undetected, could eventually cause a plant transient. Thus, compared to the regulatory baseline, Alternative 2 would either maintain the same level of safety or provide an incremental improvement in safety, which could incrementally decrease public radiation exposures.</li> <li>• <b>Occupational Health (Accident and Routine):</b> The use of current ASME Code editions and addenda may reduce postaccident occupational radiation exposures, although not in an easily quantifiable manner. Advances in ISI and IST may incrementally decrease the likelihood of an accident resulting in worker exposure, compared to the regulatory baseline.</li> <li>• <b>Improvements in ISI and IST Knowledge:</b> The staff and the industry would gain experience with new technology and advances in ISI and IST.</li> <li>• <b>Consistency with NTTAA and Implementing Guidance:</b> Alternative 2 is consistent with the provisions of the NTTAA and the implementing guidance in OMB Circular A-119, which encourage Federal regulatory agencies to adopt 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.</li> </ul> <p>Costs:</p> <ul style="list-style-type: none"> <li>• <b>Nonquantified Costs:</b> If the staff has overestimated the number or the complexity of the submittals eliminated under Alternative 2, then the averted costs will decrease accordingly, causing the quantified net costs of Alternative 2 to increase.</li> </ul>

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

- Costs to licensees and the NRC will be averted because licensees will not have to submit as many ASME Code alternative requests on a plant-specific basis under 10 CFR 50.55a(z), and the NRC will not have to review those requests.
- Costs to licensees will be averted because personnel will need less time to complete their ultrasonic examination certifications.
- Costs to licensees will be averted because they will be able to measure loss of material rates at different locations with similar corrosion conditions and flow characteristics, which reduces the time needed for these measurements.
- Costs to licensees will be averted because they will be able to increase the ISTC-3700 valve testing interval from 2 years to 12 years if they can show that the valves are not susceptible to stem-disk separation.

Furthermore, Alternative 2 would have the qualitative benefit of upholding the NRC's goal of protecting public health and safety and the environment by approving the use of current ASME Code editions and addenda, allowing licensees to use 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 demonstrates the agency's commitment to participating in the national consensus standards process. This would help 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 the ASME Codes in 10 CFR 50.55a through the rulemaking process of IBR. Retaining this practice would ensure regulatory stability and predictability, as well as consistency across the industry. It would assure the industry and the public that the NRC supports the use of the most up-to-date and technically sound methods developed by ASME to adequately protect the public. The ASME Codes are voluntary consensus standards developed by participants with broad and varied interests, and they have already undergone extensive external review before the NRC's 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., agency-developed) standards, unless this is 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 net quantified benefits of the regulatory action would exceed its costs at a 7-percent discount rate. The uncertainty analysis shows a net benefit (averted cost) for all simulations, with the averted cost ranging from \$4.49 million to \$9.11 million (using a 7-percent NPV).

## **7. Schedule**

This rule will become effective 30 days after the publication of the final rule in the *Federal Register*.



## 8. References

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*U.S. Code of Federal Regulations*, "Licenses, certifications, and approvals for nuclear power plants," Part 52, Chapter 1, Title 10, "Energy."

*U.S. Code of Federal Regulations*, "Fees for facilities, materials, import and export licenses, and other regulatory services under the Atomic Energy Act of 1954, as amended," Part 170, Chapter 1, Title 10, "Energy."

## Appendix A Major Assumptions and Input Data

Data Element	Best Estimate	Unit	Source or Basis of Estimate
Key Years			
Final rule effective date	2022	year	U.S. Nuclear Regulatory Commission (NRC) input.
Analysis base year	2021	year	NRC input.
Number of Reactor Units			
Number of operating reactor units forecast in 2022	92	units	Based on NUREG-1350, “Information Digest,” Volume 32, Appendix A, issued September 2020. Units 3 and 4 of the Vogtle Electric Generating Plant are expected to begin operation in 2022 and 2023, respectively.
Number of operating reactor units forecast in 2023–2024	91	units	Based on NUREG-1350, Volume 31, Appendix A. Units 3 and 4 of the Vogtle Electric Generating Plant are expected to begin operation in 2022 and 2023, respectively.
Number of Sites			
Number of sites with operating reactors forecast in 2022	52	sites	Obtained from the NRC’s “Operating Nuclear Power Reactors (by Location or Name)” at <a href="https://www.nrc.gov/info-finder/reactors/">https://www.nrc.gov/info-finder/reactors/</a> with data current as of March 24, 2021 (last accessed on April 15, 2021).
Number of sites with operating reactors forecast in 2023–2024	51	sites	Calculation: [total number of sites with operating reactors] + [number of sites with construction completed in years 2020–2024] - [number of sites with all units closed in years 2020–2024]. Information was obtained from the NRC’s “Operating Nuclear Power Reactors (by Location or Name)” at <a href="https://www.nrc.gov/info-finder/reactors/">https://www.nrc.gov/info-finder/reactors/</a> with data current as of March 24, 2021 (last accessed on April 15, 2021).

Data Element	Best Estimate	Unit	Source or Basis of Estimate
Applicability Period (Years)			
Rule applicability term	3	years	The staff assumes that the final rule will be published in the <i>Federal Register</i> at the beginning of 2022, and the next Code Editions final rule will be published by the end of 2024.
Labor Rates			
Executives	\$229	dollars per hour	Labor rates used are from the Bureau of Labor Statistics (BLS) Employer Costs for National Compensation Survey dataset, 2020 values. These hourly rates were inflated to 2021 dollars using the Consumer Price Index for All Urban Consumers. A multiplier of 2.4 to cover fringe and indirect management costs was then applied, producing the displayed labor rates.
Managers	\$144	dollars per hour	BLS tables.
Technical staff	\$119	dollars per hour	BLS tables.
Administrative staff	\$76	dollars per hour	BLS tables.
Licensing staff	\$138	dollars per hour	BLS tables.
Nuclear technicians	\$107	dollars per hour	BLS tables.
Nuclear engineers	\$153	dollars per hour	BLS tables.
NRC staff	\$137	dollars per hour	NRC calculation, 2021.

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