POLICY ISSUE
(Information)

December 16, 2014 SECY-14-0143

FOR: The Commissioners

FROM: Mark A. Satorius
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SUBJECT: REGULATORY GAP ANALYSIS OF THE NUCLEAR REGULATORY COMMISSION'S COST-BENEFIT REGULATIONS, GUIDANCE AND PRACTICES

PURPOSE:

This SECY paper is in response to Staff Requirements Memorandum (SRM)-SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," dated March 20, 2013, which directed the U.S. Nuclear Regulatory Commission (NRC) staff to provide the Commission with a regulatory gap analysis prior to developing new cost-benefit guidance for application across business lines (e.g., materials, fuel cycle facilities, or emergency preparedness). In preparing the gap analysis, the staff reviewed NRC regulations, guidance documents, and practices associated with regulatory, backfit, and National Environmental Policy Act (NEPA) cost-benefit analyses. This paper does not address any new commitments or resource implications as it is part of the staff's ongoing initiative to update cost-benefit guidance.

SUMMARY:

The staff did not identify any NRC regulations that constrained how the staff performs cost-benefit analyses, but it did identify differences in cost-benefit analysis practices across the NRC that may benefit from greater harmonization. Furthermore, in the process of conducting the gap analysis, the staff also identified cost-benefit analysis guidance enhancements for further consideration.

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The staff recognizes the value of improving the efficacy of its estimates in cost-benefit analyses and that improvement in harmonizing practices across business lines and programs can be made. Based on the analysis of cost-benefit practices within the NRC, the staff will continue to update, as appropriate, cost-benefit guidance to incorporate cost-estimating best practices. The staff will also pursue harmonization across business lines and programs. In pursuing this harmonization, the staff will consider differences represented by the diverse characteristics of the regulated entities (e.g., reactor versus materials licensees) and/or the differing purposes of the analysis (e.g., regulatory analysis versus NEPA analysis).

The update of the cost-benefit guidance uses a two-phased approach. The first phase will harmonize regulatory guidance across business lines by restructuring and pursuing non-policy revisions to NRC cost-benefit guidance. The second phase will address enhancements and potential policy issues for Commission consideration. As the current cost-benefit regulatory framework is sound, the schedule for these updates will depend on the availability of resources so that it does not affect the completion of Fukushima-related activities and other higher priority work.

BACKGROUND:

On August 14, 2012, the staff issued SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," (Agencywide Documents Access and Management System (ADAMS) Accession Number ML12173A478) for Commission consideration. In that paper, the staff recommended enhancing the currency and consistency of the existing framework through updates to cost-benefit analysis guidance documents that would assist in harmonizing cost-benefit guidance across the agency.

In SRM-SECY-12-0110 dated March 20, 2013 (ADAMS Accession No. ML13079A055), the Commission approved the staff's recommendation and further directed the staff to "provide the Commission with a regulatory gap analysis prior to developing new guidance for application across business lines (e.g., materials, fuel cycle facilities, or emergency preparedness)." The staff prepared this Commission paper in response to that direction.

As described in SECY-14-0002, "Plan for Updating NRC's Cost-Benefit Guidance," the staff is implementing a two-phased approach to revise the NRC's cost-benefit guidance. The first phase focuses on editorial changes, incorporation of cost-estimating best practices, and administrative issues. The second phase addresses the enhancements that need further consideration prior to being included in the cost-benefit guidance. The staff used this gap analysis to identify potential enhancements, which will inform Phase II of the plan. Also, the Commission's direction in response to SECY-14-0087, "Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses," will inform Phase II of the SECY-14-0002 plan.

DISCUSSION:

Gap Analysis Methodology

The scope of this gap analysis evaluated cost-benefit regulations, guidance, and practices across NRC business lines and regulated activities as well as across types of analyses.

Specifically, the staff reviewed cost-benefit information for materials licensees, fuel cycle facilities, reactors, emergency preparedness activities, and security actions. Additionally, the staff reviewed cost-benefit analyses conducted for regulatory analyses, backfit analyses, and NEPA analyses. Enclosure 1 provides more information on the scope of this analysis.

Goals for this gap analysis included:

1. Identifying similarities and differences in cost-benefit practices across the agency.
   a. differences across NRC business lines and regulated activities
   b. differences in analyses (i.e., regulatory, backfitting, and NEPA)
2. Determining if differences are justified.

3. Identifying where additional guidance may be needed to harmonize practices across the agency.

To accomplish these goals, the staff implemented a project plan consisting of questionnaires sent to NRC subject matter experts, a literature review, and a workshop series. The staff's literature review included past cost-benefit analyses, SECY papers and SRMs, Fukushima lessons learned, and previous Advisory Committee on Reactor Safeguards (ACRS) feedback. Additionally, the staff conducted a series of internal workshops led by subject matter experts. Each workshop focused on a different type of cost-benefit analysis (i.e., regulatory analysis, backfit analyses, and NEPA analyses), and the workshop leaders were experts representing the agency's various business lines and activities. This workshop series served to both identify differences and similarities in cost-benefit practices and also served as a knowledge management tool. Furthermore, the staff conducted a review of the economic models used by various Federal and international agencies. In addition, the staff is gaining information through participation in the Organization for Economic Cooperation and Development Nuclear Energy Agency study on approaches to estimating costs of a potential nuclear accident and considered this information during this gap analysis.

Key Results of Gap Analysis

The staff did not identify any NRC regulations that constrained how the NRC staff performs cost-benefit analyses, and therefore no rulemaking is needed to enhance the NRC's cost-benefit guidance and practices. The NRC's overarching guidance documents are NUREG/BR-0058, Rev. 4, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (2004), NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook" (1997), and NUREG-1409, "Backfitting Guidelines" (1990).

The staff identified differences in cost-benefit analysis practice across the NRC. Some of these differences represented logical variations given the diverse characteristics of the regulated entities (e.g., reactor versus materials licensees) or the differing purposes of the analysis (e.g., regulatory analysis versus NEPA analysis). However, there may be a need for additional or updated guidance to harmonize across business lines and programs due to other differences. The intent to harmonize across business lines and programs is not to ensure each analysis is performed in an identical manner. Rather, the intent is to incorporate best practices to produce an accurate and realistic cost-benefit analysis, capturing appropriate costs and benefits to the extent possible and tailoring guidance or practice to the nuances of various analyses and

applications without making the analysis overly onerous or complicated. Furthermore, in the process of conducting the gap analysis, the staff also identified enhancements that may need further consideration prior to developing new guidance. These enhancements do not represent inconsistencies within the agency, but may represent a difference between NRC guidance and the current state of practice.

The staff has made the following findings:

1. Current cost-benefit regulatory framework is sound:

During the staff's review, no current NRC regulation was identified as constraining the staff from performing sufficient cost-benefit analyses or from updating and harmonizing cost-benefit guidance across business lines. The NRC regulations that pertain to cost-benefit analyses are those in 10 CFR Part 51, which concern the consideration of costs and benefits when conducting a NEPA analysis, and the various backfitting regulations. There are no regulations that require or prescribe regulatory analyses; NRC regulatory analyses arose through the Commission's decision to voluntarily comply with Executive Order (E.O.) 12866, "Regulatory Planning and Review," published in 1993 and reaffirmed, with some amendments, by successive administrations. Section 6(a)(3)(c) of E.O. 12866 directs Federal agencies to prepare and submit to the Office of Management and Budget (OMB) an assessment of the anticipated benefits and costs of proposed regulatory actions that are "significant."[1]

The cost-benefit analyses conducted in support of regulatory, backfit, and NEPA analyses account for potential human health and economic consequences associated with unintended radionuclide releases. The guidance documents used by staff in various parts of the NRC to perform cost-benefit analyses are similar and refer to the same basis documents, NUREG/BR-0058, NUREG/BR-0184, and NUREG-1409. There is sufficient flexibility in the guidance to address a broad range of issues and analyses; however, there may not be enough structure to produce consistent results.

2. There are differences in cost-benefit practices within the NRC:

Cost-benefit practice includes choice of attributes, alternatives, modeling, and data assumptions. There are areas where cost-benefit practices differ, but these differences may be justified given the application and purpose of the analysis. In some instances, these differences may benefit from increased harmony across business lines and analyses and/or additional guidance. Examples of these differences are provided below. These examples are representative of the staff's findings and were not ranked based on importance and should not be construed as a comprehensive list. Enclosure 2 provides additional information on these differences and others that the staff identified as well as summary tables of the agency's cost-benefit requirements, guidance, and practices.

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[1] Significant regulatory actions are those that "[h]ave an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities." E.O. 12866, sec. 3(f)(1).

Power Reactor Substantial Safety Enhancement Screen

The staff identified a difference between regulatory analyses conducted for power reactor safety enhancements and all other NRC business lines and programs. Prior to imposing a new safety or security requirement upon a power reactor licensee, the NRC must satisfy the NRC's backfit regulation for operating reactor licensees (10 CFR 50.109).[2] Specifically, the backfit regulation requires that the NRC demonstrate that any such requirement imposed upon an existing power reactor licensee, except in cases where the requirement is needed to ensure adequate protection or for compliance, results in a substantial increase in the overall protection of the public health and safety or the common defense and security and be cost-justified (10 CFR 50.109(a)(3)). Similar backfitting requirements apply for Parts 70, 72 and 76 licensees. Where the practice differs, however, is in the NRC guidance document for regulatory analyses, NUREG/BR-0058, Section 3, which applies the Commission's Policy Statement on Safety Goals for the Operation of Nuclear Power Plants (Safety Goals)[3] to power reactor safety enhancement regulatory analyses. Thus, the staff uses the Safety Goals as a screen to determine if a substantial increase in safety exists. The guidance does not apply these reactor-centric Safety Goals to any other regulated activities subject to backfit analyses.[4] Therefore, for these other regulated activities, the substantial increase in safety or security is qualitatively determined for the justification of the regulatory action.

Time Horizon

The staff identified a difference among business lines in the approach to the analysis timeframe of regulatory analyses. In 2003, OMB published Circular A-4, "Regulatory Guidance" to assist agencies in preparing regulatory analysis documents that meet the criteria of E.O. 12866. Circular A-4 states, "the time frame for your analysis should cover a period long enough to encompass all the important benefits and costs likely to result from the rule." NUREG/BR-0058 Section 4.3 states that costs and benefits should be estimated by year for the entire period that affected groups will be subject to the proposed regulatory action. The guidance also states that for licensed facilities, estimates should be made for the remainder of the operating license or projected useful life of the facility (i.e., extended into the license renewal period). For nuclear power reactors, the analyst assumes one license renewal and takes the average of the

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[2] Persons holding NRC approvals under 10 CFR Part 52 would be covered by the applicable issue finality provisions of that part (e.g., 10 CFR 52.63 concerns issue finality for holders of standard design certifications).

[3] See Volume 51, page 28044, of the Federal Register dated August 4, 1986, as revised, "Safety Goals for the Operation of Nuclear Power Plants, Policy Statement."

[4] Although reactor safety goals have been established through the August 4, 1986, policy statement, the Commission's approach for safety goals for the materials and waste regulated areas is less formal. The Commission approved in the SRM for SECY-04-0182, "Status of Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," dated October 7, 2004, the staff's plan to continue applying risk-informed methods on materials and waste repository issues. Furthermore, the Commission stated that the staff should consider applying the risk-informed decision-making guidance, which contained the six proposed safety goals for materials and waste activities, to planned and emergent activities. The safety goals are contained in "Risk-Informed Decision Making for Nuclear Material and Waste Applications" (ADAMS Accession No. ML080720238).

remaining life of the class of plants. For materials licensees, the analyst evaluates one license term.

The NRC's licensees are a diverse group with differing license terms and renewals. Determining a common timeframe for covering all relevant benefits and costs for all NRC licensees is difficult and in many cases, may not be appropriate. However, the NRC approach may benefit from additional consistency and consideration, if practical, of representative license duration periods based on historical and projected evaluations for the specific groups of licensees affected by the regulatory action.

Sensitivity Analyses

The staff identified that the use of a sensitivity analysis should be consistently applied across business lines for regulatory analyses. Sensitivity analyses constitute a quantitative risk analysis and modeling technique used to help determine the factors that will have the most potential impact as a result of the regulatory action. Sensitivity analyses can examine the extent to which the uncertainty of each element affects the cost to achieve the regulatory objective being examined, or the risk, when all other uncertain elements are held to their baseline values. The NRC can benefit from a harmonized approach in the use of sensitivity analyses across business lines.

Quantification of Benefits

The staff identified a difference among business lines regarding the extent to which benefits are quantified in regulatory analyses. For example, security regulatory actions do not quantify the benefits because of the very large uncertainty in the frequency and consequences of security events. However, for power reactors, with the use of computer codes such as MELCOR/MACCS and the application of probabilistic risk assessment (PRA) techniques, the NRC can provide, in some cases, quantification of benefits in terms of averted consequences. Similar modeling tools and techniques for quantifying benefits are largely not available to other business lines. The staff is currently in the process of seeking Commission approval for plans to update guidance on qualitatively considering factors in regulatory analyses as stated in SECY-14-0087, "Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses." Per SECY-14-0087, the staff proposes updating cost-benefit guidance to enhance the transparency and consistency of qualitatively considering factors in analyses as well as emphasizing the importance of a robust quantitative analysis.

Enhancements to be Considered in Future Guidance Updates

In the process of conducting the gap analysis, the staff also identified enhancements that may need further consideration prior to developing new guidance. In general, the staff recognizes the need to improve the accuracy of the agency's quantitative estimates. The importance of a robust quantitative analysis was emphasized in correspondence with the ACRS[5] and members

[5] http://pbadupws.nrc.gov/docs/ML1425/ML14255A101.pdf

of Congress. Improving guidance and practice related to quantifying the costs and benefits of a proposed regulatory action is an overarching priority for the staff and is the subject of a current staff plan as described in SECY-14-0002. The enhancements identified below may represent specific examples that the staff could address in order to improve the overall currency and accuracy of cost-benefit analyses. In this respect, the following enhancements do not represent inconsistencies within the agency, but rather general areas that may benefit from improvement. The following topics will be assessed in more detail by the staff as part of Phase II of the SECY-14-0002 plan to update NRC's cost-benefit analysis guidance. More information on these enhancements, as well as other regulatory analysis considerations that the staff identified during the gap analysis, is presented in Enclosure 3.

Treatment of Uncertainty

Some NRC regulatory analyses do not contain an analysis of uncertainties. NRC regulatory analyses may benefit from additional discussion of the uncertainty inherent in some benefit and cost estimates. For example, estimating benefits for regulatory actions concerning severe reactor accidents requires a complex chain of analyses and evaluations of cost drivers on estimates. This process includes establishing baselines for the demographics and health status of the exposed population, the release frequency and the source term for different regulatory alternatives. These are used to estimate the changes in population exposure with different protective action guidelines.

Quantifying uncertainty is an estimating best practice, which is addressed in many guides and references. The explicit identifying and quantifying of sources of uncertainty in regulatory analyses lead to better decisionmaking by providing a means to understand this uncertainty (e.g., the impact of data, assumptions, accident frequency and consequence), impact of variations within different regulatory analysis groupings (e.g., categories of licensees), and the potential range of incremental costs and benefits that result.

Use of Probabilistic Risk Assessment and Other Studies in Regulatory Analyses

PRA and other related severe accident studies can improve the fidelity of regulatory analyses and provide useful insights. In some cases efficiency can be enhanced by using PRA studies that have been previously completed. In order to do so, the analyst must be cognizant of underlying assumptions and modeling performed. For example, the historical PRA studies referenced in NRC regulatory analysis guidance documents for operating nuclear power plants are typically partial-scope PRAs for a single reference plant or a limited number of reference plants; embody modeling choices that could affect the results; and may not always reflect the current state-of-practice in PRA analysis. Severe accident and PRA research activities conducted over the last several decades have resulted in improvements to the NRC's PRA tools and could alleviate some of these limitations if incorporated into regulatory analyses. Furthermore, more recent studies such as the State of the Art Reactor Consequence Analysis (SOARCA) study, the spent fuel pool consequence study, and the Level 3 PRA project can provide insights for updating Regulatory Analysis guidance documents. Therefore, cost-benefit guidance should encourage the use of application specific analyses to the degree possible. If legacy analyses are used,

then the underlying assumptions and the effect of these assumptions should be clearly documented and understood.

Two examples of analysis choices – time truncation and distance truncation – are discussed further below.

Time Truncation

NRC cost-benefit analysis guidance documents do not currently specify or recommend a truncation time for severe reactor accident analyses because the intent is to evaluate the accident until uncontrolled radiological releases have ceased, potentially through mitigation, and an extension of the analyzed accident period would not change the results. Various accident duration periods have been used in studies performed over the years. For example, 24 hours was used for the analysis in NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," circa 1990. More recently in NUREG-1935, "State-of-the-Art Reactor Consequence Analyses (SOARCA) Report," 2012, 48 hours was used for the majority of sequences analyzed. In the Containment Protection and Release Reduction rulemaking technical bases currently under development, 72 hours is being applied. The NRC's ongoing Site Level 3 PRA project is likely to set different truncation times dependent on the accident under consideration. The source term, and hence consequences, may be affected by the selected truncation time. Some severe accidents are projected to continue releasing radionuclides beyond 48-72 hours, unless the accident can be successfully terminated by effective mitigative actions. In practice, the description and analysis of required mitigative actions are likely to vary across cost-benefit analyses. With regard to specifying a truncation time, there is also the question of the correct reference time "zero" (i.e., the onset of core damage), or the start of the accident (e.g., station blackout).

Distance Truncation

Regulatory analyses performed by the NRC have historically considered the health and economic consequences that apply to the population and land within 50 miles of the facility. Current regulatory analysis guidance found in NUREG/BR-0058 Rev. 4 states in Section 4.3.3:

> *In the case of nuclear power plants, changes in public health and safety from radiation exposure and offsite property impacts should be examined over a 50-mile distance from the plant site. The appropriate distance for other types of licensed facilities should be determined on a case-by-case basis.*

The staff notes, however, that the Federal guidance on cost-benefit analysis found in OMB Circular A-4, which the NRC voluntarily complies with, states that the regulatory analysis "should focus on benefits and costs that accrue to citizens and residents of the United States." Thus, there is a question about the choice of an appropriate distance to use in regulatory analyses. Given the potential effect of distance truncation on

regulatory analysis results, the staff is considering whether the 50 mile radius should be reaffirmed or modified.

Time and distance truncation are only two modeling assumptions that may potentially change the outcome of estimates that could be applied in a subsequent cost-benefit analysis. The assumptions and inputs used in PRA studies and severe accident consequence analyses should be understood in order to determine whether they support the needs of the specific regulatory, backfitting, or environmental analysis being conducted.

As explained in NRC regulatory analysis guidance, the set of attributes listed in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*, is believed to be reasonably comprehensive for most cost-benefit analyses for NRC regulatory decisionmaking. Attribute 18, "Other Considerations," however, provides that any particular regulatory analysis "may also identify attributes unique to itself," and that any such attributes "should be appropriately described and factored into the analysis." These could include attributes that are unique to a specific nuclear power plant site or attributes of particular concern to a subset of the population. Examples of these considerations are described below.

The Consideration of Distributive Impacts and Equity in NRC Cost-Benefit Analyses

Executive Order 12866, paragraph 1(b)(5) states,

> *When an agency determines that a regulation is the best available method of achieving the regulatory objective, it shall design its regulations in the most cost-effective manner to achieve the regulatory objective. In doing so, each agency shall consider incentives for innovation, consistency, predictability, the costs of enforcement and compliance (to the government, regulated entities, and the public), flexibility,* ***distributive impacts*****, and** ***equity*** [emphasis added].[6]

Thus, issues concerning the distributive impacts of a proposed regulatory action, or the equity of a proposed regulatory action could be considered in a regulatory analysis as part of "other considerations" under Attribute 18 (see NUREG/BR-0184).

Although the NRC, as an independent agency, is not required to comply with E.O. 12866, the NRC has determined, as a matter of policy, to comply with the spirit of E.O. 12866. As such, the process of addressing other considerations, including distributive impacts and equity, needs to be better understood, explained, and/or defined in any revision of NRC's regulatory analysis cost-benefit guidance.

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[6] The terms "distributive impacts" and "equity" are not defined in E.O. 12866. While not defining either term, OMB Circular A-4 defines the term "distributional effects," which is "how both benefits and costs are distributed among sub-populations of particular concern." OMB Circular A-4, 14 (2003).

Furthermore, issues involving distributive impacts and equity could also overlap with environmental justice concerns.[7] Office of Nuclear Reactor Regulation (NRR) Office Instruction, LIC-203, Revision 3, defines staff responsibilities for addressing environmental justice in rulemakings (see Appendix D, page D-9, Procedures for Rulemaking Activities) as follows:

> *Staff responsible for rulemaking should address environmental justice in the preamble to any proposed and final rules that require an Environmental Impact Statement (EIS), a supplement to an EIS, or generic EIS…If it is known in advance that a particular rulemaking might disproportionately affect a minority and/or low-income population or community, NRC staff should ensure that the population and/or community knows about the rulemaking and are given the opportunity to participate…Public comments on the environmental justice review should be addressed in the statements of consideration to the final rule when published in the Federal Register. Comments on the environmental justice review should be addressed at the same level of detail and in the same location as comments received on other parts of the rule.*

In addition to the NRC's voluntary compliance with E.O. 12866, the staff notes that there is no statutory requirement to consider "distributive impacts" or "equity" in NRC regulatory analyses. In this respect, the Commission stated, in SRM-SECY-12-0110, that it "finds that economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety." Thus, if distributive impacts or equity considerations are to be formalized as part of any update or revision to NRC cost-benefit guidance, then such update or revision will make clear that these considerations are secondary to the NRC's obligations under the Atomic Energy Act, including matters of adequate protection of public health and safety and matters of common defense and security.

The Impact of Regulatory Decisionmaking on Offsite Properties with Iconic Value

There is currently no NRC guidance on the consideration of offsite properties with iconic value (e.g., historic properties, viewsheds, and traditional cultural properties) in cost-benefit analyses for regulatory decisionmaking. The staff is not aware of any other Federal agency that considers such impacts in the regulatory analysis. The impacts of NRC licensing actions on such properties are considered in the NEPA process (which typically includes compliance with the section 106 consultation procedures of the National Historic Preservation Act), but are not factored into the cost-benefit estimates of

[7] The term "environmental justice" is not defined in the underlying government-wide environmental justice executive order, E.O. 12898, issued on February 11, 1994 and published in the *Federal Register* on February 16, 1994 (59 FR 7629). Similarly, the NRC's environmental justice policy statement (69 FR 52040; August 24, 2004), does not define the term "environmental justice." Whether an environmental justice issue exists in relation to any proposed NRC action is a case- or site- specific determination that must consider a variety of factors (e.g., the presence of a minority and/or low-income population in the project area, whether the proposed action will have a disproportionately high and adverse health or environmental effect on such population, etc.). The NRC addresses any potential environmental justice issues through its NEPA compliance process.

the regulatory analysis.[8] The consideration of the impact of regulatory decisionmaking on offsite properties with iconic value, including the valuation of such properties, is an issue that has been raised in public comments by at least one American Indian tribe.

Expanding regulatory analyses to include information on offsite properties with iconic value could provide information for NRC decisionmakers, members of the public, and other stakeholders to assess the potential impacts of the proposed regulatory action. Documenting these impacts in regulatory analyses (although likely qualitative or highly subjective in nature) may also provide information the NRC could use in addressing environmental justice concerns, if appropriate. Environmental impact considerations and cost-benefit can mutually interact to improve regulatory decisionmaking.

Valuing such impacts, however, would not be a trivial task. Impacts are measured by the value (importance) individuals place on the attribute (e.g., traditional cultural property) potentially affected by the proposed regulatory action. This value could be measured in terms of the individual's willingness to accept changes between the current state of the world (baseline), and the consequences of the regulatory action. As the attribute potentially affected by the regulatory action — preservation of historic or cultural properties — is not traded in markets, the monetary value of the attribute cannot be assessed.

Current NRC regulatory analyses do not require the duplicate consideration of the environmental impacts addressed in NEPA documents because, "Such an evaluation is usually handled separately from the value-impact analysis" (see NRC's *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184, Section 5.5.17, Environmental Considerations, page 5.13). Given the potential impact of regulatory decisionmaking on offsite historic and cultural properties, the NRC staff is considering whether current regulatory analysis guidance should be strengthened to account for these attributes. Any consideration of such attributes, if ultimately approved, would be made in accordance with the Commission's direction in SRM-SECY-12-0110, which states that "economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety." Thus, if the potential impacts of regulatory decisionmaking on offsite historic and cultural properties are formalized as part of any update or revision to NRC cost-benefit guidance, then such an update or revision will make clear that these considerations are secondary to the NRC's obligations under the Atomic Energy Act, including matters of adequate protection of public health and safety and matters of common defense and security.

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[8] It is important to note the different intents of NEPA analyses and regulatory analyses. The NEPA review is conducted to determine the environmental consequences (and benefits) of a proposed Federal action. Council on Environmental Quality regulations, which the NRC takes voluntary account of, state that a cost-benefit analysis "relevant to the choice among environmentally different alternatives" may be incorporated by reference or appended to the environmental review as an "aid in evaluating the environmental consequences" (40 CFR 1502.23, "Cost-Benefit Analysis"). The NRC regulation 10 CFR 51.71(d), "Draft Environmental Impact Statement – Contents," requires the consideration of the economic, technical, and other benefits and costs of the proposed action and alternatives in NRC NEPA reviews. Conversely, regulatory analyses are intended to be an integral part of the NRC's decisionmaking that systematically provides complete disclosure of the relevant information supporting a proposed regulatory action. The scope of the NEPA review and the regulatory analysis support separate and distinct decisionmaking processes and do not reveal a gap.

Impact on Critical Infrastructure

Critical infrastructure is defined by the U.S. Department of Homeland Security as "the assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health and safety, or any combination thereof."[9] Within cost-benefit analyses for all business lines and programs, the NRC does not consider effects on critical infrastructure. A significant impact on critical infrastructure could affect the outcome of a cost-benefit analysis and more heavily weigh the benefits of preventing an unintended radiological release, and thus may be an important consideration.

Given the potential effect of these enhancements regarding uncertainty, PRA, time and distance truncation, distributive impacts and equity, iconic value, and critical infrastructure on cost-benefit analysis results, the staff plans to investigate whether these enhancements should be incorporated into the NRC's current cost-benefit guidance, and if so, the extent to which these enhancements should be incorporated.

Path forward

Based on the analysis of cost-benefit practices within the NRC, the staff will update cost-benefit guidance, as appropriate, to harmonize across business lines and programs as discussed above. The staff recognizes that cost-benefit practices may in some cases differ among business lines and programs considering differences in risk presented by different facilities and materials. Therefore, the staff will document its rationale for dispositioning any cost-benefit practice differences in the guidance development process.

As described in SECY-14-0002, the staff is updating the cost-benefit guidance using a two-phased approach. The first phase will harmonize regulatory guidance across business lines by restructuring and pursuing non-policy revisions to NRC cost-benefit guidance. The second phase will address enhancements and potential policy issues for Commission consideration. As the current cost-benefit regulatory framework is sound, the schedule for these updates will depend on the availability of resources so that it will not affect the completion of Fukushima-related activities and other higher priority work. The staff will seek Commission guidance regarding any potential policy issues that may arise in updating the NRC's cost-benefit guidance. As previously noted, such potential policy issues will be developed during the implementation of Phase II of the cost-benefit guidance updates. This phase will be a multi-year effort and its duration will depend on the availability of resources and priorities of other ongoing work. Further, the staff will continue to engage the ACRS during guidance development and will seek Commission approval of guidance prior to final publication.

[9] http://www.dhs.gov/what-critical-infrastructure

COORDINATION:

The Office of the General Counsel has reviewed this Commission paper and has no legal objection.

Interactions with the Advisory Committee on Reactor Safeguards

The NRC staff has discussed the regulatory gap analysis of the NRC's cost-benefit practices with the ACRS in December 2014.

/RA/
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Enclosures:
1. Scope and Methodology of Gap Analysis of NRC Cost-Benefit Practice
2. Differences in Cost-Benefit Practice Within the NRC
3. Enhancements to be Considered in Future Cost-Benefit Updates

SCOPE AND METHODOLOGY OF GAP ANALYSIS OF THE U.S. NUCLEAR REGUALTORY COMMISSION'S COST-BENEFIT PRACTICE

Purpose & Scope

The staff's regulatory gap analysis focused on U.S. Nuclear Regulatory Commission (NRC) regulations, guidance, methodologies, and tools used for cost-benefit determinations to identify any differences across NRC business lines (e.g., material users, fuel cycle facilities, reactors) and across analyses (i.e., regulatory, backfitting, and National Environmental Policy Act (NEPA) analyses). Goals for this analysis included:

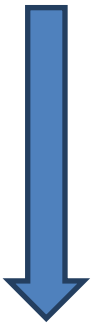
1. Identifying similarities and differences in cost-benefit practices across the agency
   a. differences across NRC business lines and programs
   b. differences in analyses (i.e., regulatory, backfitting, and NEPA environmental)
2. Determining if differences are justified.
3. Identifying where additional guidance may be needed to ensure consistency across the agency.

The scope of this analysis was limited to NRC cost-benefit practices for regulatory actions and is illustrated in the following table[1]:

Figure 1

NRC Business lines and programs[2]	**Regulatory Analyses**	**Backfit Analyses**	**NEPA Analyses**
Operating Reactors	For each cell: • Regulatory Requirements • Guidance • Practice		
New Reactors			
Materials			
Fuel Cycle Facilities			
Emergency Preparedness			
Security			

Differences across business lines and programs



Differences across cost-benefit analyses

[1] Enclosure 2 provides a completed version of this table.

[2] SRM-SECY-12-0110 provided a list of business lines for the gap analysis.

Methodology & Schedule

The NRC cost-benefit working group performed the analysis, and the cost-benefit steering committee, comprised of agency-wide division management, provided overall guidance. The analysis consisted of the following items, each of which is explained more fully in the subsections below:

- **Questionnaires:** Agency subject matter experts responded to questions regarding cost-benefit practices for the individual cells in Figure 1.

- **Workshops:** The staff conducted a series of half-day internal workshops during which participants walked through example cost-benefit analyses and compared practices. The workshops were arranged by analysis-type (e.g., regulatory analyses, backfitting, NEPA analyses).

- **Literature review:** The staff performed a literature review of past NRC cost-benefit analyses, SECY papers and staff requirements memorandums, Fukushima lessons learned, and previous feedback from the Advisory Committee on Reactor Safeguards.

Once the questionnaires, workshops, and literature review were completed, the cost-benefit working group consolidated the information and determined key messages.

Questionnaires

The objectives of the questionnaires were to establish baseline information on NRC cost-benefit practices and facilitate the internal workshop series. Agency subject matter experts provided responses on the following topics:

- Regulatory Analysis for Materials
- Regulatory Analysis for Fuel Cycle Facilities
- Regulatory Analysis for Operating Reactors
- NEPA Analyses for New Reactors
- NEPA Analyses for Operating Reactors
- Security and Emergency Preparedness
- Backfit Analysis for All Business Lines Subject to a Backfit Requirement

Subject matter experts provided information on the following questions:

1. What are the regulatory requirements for performing this analysis? If there are none, provide other pertinent background information (e.g., voluntarily complying with executive orders).
2. What guidance documents are used to perform this analysis?

3. What additional guidance or information would be useful to perform this analysis?

4. Are there any known differences between this analysis and the majority of other NRC cost-benefit determinations? If so, what are these differences and are these differences justified? Identify the documents evaluated to make this determination. Are there any significant similarities?

5. What assumptions are inherent in this analysis?

6. Please provide one or more example analyses representative of this category.

Workshops

The workshops were arranged by analysis type (e.g., regulatory analyses, backfitting, NEPA analyses). Objectives of these workshops included:

- thorough walk-through of examples of cost-benefit analyses;
- identification of differences;
- identification of areas for potential future guidance;
- knowledge management and transfer.

The workshops consisted of roundtable discussions to establish an understanding of practices and identify any differences. The scope included the following topics:

- overall process
- for each attribute:
  - What is the data source?
  - What are the assumptions?
  - What degree of qualitative consideration is typically used to evaluate?

Literature Review

Below is a list of documents considered in this analysis. These documents have formed the basis for regulatory analysis guidance within the NRC.

Document Identifier	Document Title
Policy Issues	
SECY-97-117	Final Policy Statement on Restructuring and Economic Deregulation of the Electric Utility Industry
Industry Initiatives	
SECY-97-303	The Role of Industry (DSI-13) and Use of Industry Initiatives
SECY-99-063	The Use by Industry of Voluntary Initiatives in the Regulatory Process
SECY-99-178	Treatment of Voluntary Initiatives in Regulatory Analyses
SECY-00-0116	Industry Initiatives in the Regulatory Process

Document Identifier	Document Title
SECY-13-0132	U.S. Nuclear Regulatory Commission Staff Recommendation for the Disposition of Recommendation 1 of the Near-Term Task Force Report
Cost Estimating	
SECY-96-089	Comparison of Costs of Generic Requirements Estimated by the NRC with Those Estimated by Industry; Staff Effort Expended on Generic Activities
SECY-97-171	Consideration of Severe Accident Risk in NRC Regulatory Decisions
SECY-99-169	Treatment of Averted Onsite Costs in Regulatory Analyses
SECY-02-0225	Proposed Criteria for the Treatment of Individual Requirements in a Regulatory Analysis
SECY-04-0045	Final Criteria for the Treatment of Individual Requirements in a Regulatory Analysis
SECY-11-0032	Consideration of the Cumulative Effects of Regulation in the Rulemaking Process
SECY-12-0137	Implementation of the Cumulative Effects of Regulation Process Changes
SECY-14-0002	Plan for Updating the U.S. Nuclear Regulatory Commission's Cost-Benefit Guidance
SECY-14-0087	Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses
Safety Goals	
SECY-97-208	Elevation of the Core Damage Frequency Objective to a Fundamental Commission Safety Goal
SECY-98-101	Modifications to the Safety Goal Policy Statement
SECY-99-191	Modifications to the Safety Goal Policy Statement
SECY-13-0029	History of the Use and Consideration of the Large Release Frequency Metric by the U.S. Nuclear Regulatory Commission
Offsite Consequences	
SECY-12-0110	Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission’s Regulatory Framework
Backfitting	
SRM-SECY-93-086	Backfitting Considerations

NUREG Identifier	NUREG Title
Uncertainty	
NUREG-1855, Rev. 1	Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making
Emergency Preparedness	
NUREG/CR-6864	Identification and Analysis of Factors Affecting Emergency Evacuations
Dollar per person-rem conversion factor	
NUREG-1530	Reassessment of NRC’s Dollar Per Person-Rem Conversion Factor Policy

NUREG Identifier	NUREG Title
Cost Estimating	
NUREG/CR-4627, Rev. 2	NRC Labor Rates in the Generic Cost Catalog

Other Documents and Resources

- Fukushima Nuclear Accident Analysis Report, Tokyo Electric Power Company, Inc., June 20, 2012

- Institute of Nuclear Power Operations, INPO 11-005, “Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station,” Revision 0, November 2011

- Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants, The National Academies Press, 2014

DIFFERENCES IN COST-BENEFIT PRACTICES WITHIN THE NRC

Difference	Power Reactor Substantial Safety Enhancement Screen Substantial safety enhancement screens for power reactor backfit analyses are assessed using the Safety Goal Policy Statement to the extent practical. This screen is not applicable to other U.S. Nuclear Regulatory Commission (NRC) business lines and programs subject to backfit requirements.
Basis for Difference	For power reactor safety regulatory actions that are subject to a backfit analysis, the staff uses the Safety Goals to determine if a substantial increase in safety exists.[1] However, reactor Safety Goals or equivalent quantitative criteria do not apply to any other regulated activities subject to backfit analyses. Therefore, for these other non-power reactor regulated activities, the substantial increase in safety or security is qualitatively determined for the justification of the regulatory action.
Additional Information	Benefits involving substantial security enhancements are not quantified because these are generally based on deterministic approaches that may involve compliance with predefined threat levels. To date, no backfit analyses have been required for rules amending Title 10 of the *Code of Federal Regulations* (10 CFR) Parts 72 ("Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste") and 76 ("Certification of Gaseous Diffusion Plants").

[1] Because spent fuel pool (SFP) accident releases are similar enough to reactor accident releases and SFPs are part of nuclear power facilities (and therefore contribute to the overall risk for which the safety goals and quantitative health objectives were formulated), SFP accidents are evaluated using the safety goal policy statement. The subsidiary criteria (e.g., core damage frequency and large early release frequency) are primarily related to reactor accidents.

Difference	Time Horizon The time horizon for which the NRC staff conducts regulatory analyses is different for nuclear power reactors and materials licensees. For power reactors, the NRC analyst assumes one license renewal and takes the average of the remaining life for the specific class of plants. For materials licensees, the NRC analyst uses the term of the license.
Basis for Difference	Varying degrees of uncertainty exist regarding the life expectancy of NRC licenses and certificates. In general, the uncertainty is less pronounced for power reactor licenses than for non-power reactor licenses and certificates. For reactors, a certain amount of predictability concerning time horizons exists in terms of the initial license period and any anticipated license renewals. However, for many materials licenses, the time horizon is difficult to establish because facility upgrade life extensions and premature shutdowns, which can be driven by the need for process improvements or prevailing market conditions, are not uncommon.
Additional Information	Office of Management and Budget (OMB) Circular A-4 states: "The time frame for your analysis should cover a period long enough to encompass all the important benefits and costs likely to result from the rule. Regulatory analyses specify a base year and include economic benefits and costs for that specified year. Regulatory analyses also typically include estimates for future years (e.g., remaining operating life of a plant, post-operation decommissioning). However, in general, regulatory analyses do not give special consideration to input variables that may change over time (e.g., offsite population, property values, value of statistical life), which may result in the unintentional underestimation of consequences."

Difference	Sensitivity Analyses The use of sensitivity analysis is not uniformly applied across business lines for regulatory analyses.
Basis for Difference	For power reactors, computer codes allow the staff to conduct sensitivity analyses. These or other similar modeling tools and techniques for conducting sensitivity analyses are largely not available to other NRC business lines and programs. Therefore, detailed sensitivity analyses for such cases are not typically conducted.
Additional Information	Sensitivity analyses constitute a quantitative risk analysis and modeling technique used to help determine the factors that will have the most potential impact as a result of the regulatory action. Sensitivity analyses can examine the extent to which the uncertainty of each element affects the cost to achieve the regulatory objective being examined, or the risk, when all other uncertain elements are held to their baseline values. The NRC can benefit from a more uniform approach in the use of sensitivity analyses across business lines. Sensitivity analyses for cost estimating are also not uniformly applied across business lines for regulatory analyses. Some of the differences are justified, as use of sensitivity analyses is not necessary for all regulatory analyses. Sensitivity analyses for cost estimating provide additional information to the decisionmakers in relation to the potential variation in implementing the regulatory action.

Difference	Quantification of Benefits There is a difference among business lines regarding the extent to which benefits are quantified in regulatory analyses.
Basis for Difference	For power reactors, with the use of computer codes such as MELCOR/MACCS and the application of probabilistic risk assessment techniques, the NRC can provide, in some cases, quantification of benefits in terms of averted consequences and risks. These, or other similar modeling tools and techniques for quantifying benefits, are largely not available to other business lines.
Additional Information	The staff is currently in the process of seeking, per SECY-14-0087, Commission approval for plans to update guidance on qualitatively considering factors in regulatory analyses. Per SECY-14-0087, the staff proposes updating cost-benefit guidance to enhance the transparency and consistency of qualitatively considering factors in analyses as well as emphasizing the importance of a robust quantitative analysis. For material licenses and certificates and for security-related regulatory actions, benefits are typically not quantified other than financial cost savings, if they exist.

Difference	Terminology and other “minor” differences There is a difference among business lines in the terminology used in regulatory analyses. For example, cost offsets are sometimes considered positive and other times considered negative.
Basis for Difference	The difference is due to varying interpretations amongst staff of the NUREG/BR-0058 guidance document and the NUREG/BR-0184 handbook. These guidance documents do not provide detailed terminology to be used within a regulatory analysis. Therefore, based on the business lines’ practices, the meanings of certain terms vary from business line to business line.
Additional Information	The staff believes that these are minor differences than can be addressed in future guidance updates. These differences have no significant impacts on any ongoing regulatory analyses.

Difference	Changes in Variables Over Time
Basis for Difference	For Severe Accident Management Design Alternatives (SAMDA) within NEPA, the analysis includes an assumption for "reasonably foreseeable impacts." As a SAMDA is performed before the plant is licensed, the analysis forecasts the population density and economic factors during the operating life of the nuclear power plant. For regulatory analyses, modeling assumptions vary between analyses in which some analysts consider the most recent census data and apply multipliers to account for population growth and increases in land value. Other analyses assume that there would be no significant changes in the variables over time. While this is an implicit assumption within regulatory analyses, this is not explicitly addressed in the NUREG/BR-0058 guidance document and the NUREG/BR-0184 handbook and there may be certain situations where the analyst should model that the variables will change over time.
Additional Information	

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

NEPA Analysis			
	Regulatory Requirements	Guidance	Practice
Operating Reactors	**Cost Benefit Analysis:** For draft environmental impact statements (EISs): 10 CFR 51.71(d) and (f) For final supplemental EISs: 10 CFR 51.92(e)(4) For post-construction supplemental EISs: 10 CFR 51.95(c)(2) For records of decision: 10 CFR 51.103(a)(3) **Applicant's Environmental Report:** 10 CFR 51.45 and 51.53	NUREG-1555 Supplement 1; RG 4.2 Supplement 1; NUREG/BR-0058; NUREG/BR-0184; NUREG-1530	Assumptions: license life, waste confidence, purpose and need, fuel cycle generic, design specific information probabilistic risk assessment (PRA), emergency response modeled, meteorology data for the airborne plume modeled, other pathways release data (generic or site-specific, economic data (generic or site-specific)
New Reactors	**Cost Benefit Analysis:** For draft environmental impact statements (EISs): 10 CFR 51.71(d) and (f), 51.75 and	**NRC:** NUREG-1555; RG 4.2 (in revision), NUREG/BR-0058; NUREG/BR-0184; NUREG-1530	Same as operating reactors. Note: A cost-benefit analysis is required for radwaste systems in the safety review of a new

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

NEPA Analysis			
	Regulatory Requirements	Guidance	Practice
	51.76(f) For final supplemental EISs: 51.92(e)(4) For records of decision: 10 CFR 51.103(a)(3) **Severe Accident Mitigation Design Alternatives (SAMDAs):** For SAMDAs/Environmental Assessments: 10 CFR 51.30(d)-(e) and 51.31(c) For SAMDAs/EISs: 10 CFR 51.75(c)(2)-(3) For SAMDA/Issue Finality: 10 CFR 52.171(a)(3) **Applicant's Environmental Report:** 10 CFR 51.45, 51.49(f), 51.50(b)(2) and (c), 51.54, 51.55, 52.17(a)(2), 52.47(b)(2), and		reactor application by Section II.D of 10 CFR Part 50 Appendix I.

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

NEPA Analysis			
	Regulatory Requirements	Guidance	Practice
	52.80(b)		
Materials	**Cost Benefit Analysis:** For draft environmental impact statements (EISs): 10 CFR 51.71(d) and (f), and 51.80 For final supplemental EISs: 51.92(e)(4) For records of decision: 10 CFR 51.103(a)(3) **Applicant's Environmental Report:** 10 CFR 51.45, 51.60, 51.61, and 51.62	**External:** None **NRC:** NUREG-1748; NUREG/BR-0058; NUREG/BR-0184; NUREG-1530	No severe accident analyses or use of PRAs. No SAMDAs.
Fuel Cycle Facilities	**Cost Benefit Analysis:** For draft environmental impact statements (EISs): 10 CFR 51.71(d) and (f), and 51.80	**External:** None **NRC:** NUREG-1748; NUREG/BR-0058; NUREG/BR-0184; NUREG-1530	No severe accident analyses or use of PRAs. No SAMDAs.

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

NEPA Analysis			
	Regulatory Requirements	Guidance	Practice
	For final supplemental EISs: 51.92(e)(4) For records of decision: 10 CFR 51.103(a)(3) **Applicant's Environmental Report:** 10 CFR 51.45 and 51.60		
Emergency Preparedness	Same as for the affected entity	**External:** **NRC:**	No severe accident analyses or use of PRAs. No SAMDAs.

Regulatory Analysis			
	Regulatory Requirements (No regulation requires a regulatory analysis)	Guidance	Practice

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

Regulatory Analysis			
	Regulatory Requirements (No regulation requires a regulatory analysis)	Guidance	Practice
Operating Reactors	None	**External:** OMB Circular A-4, OIRA Primer, EO 12866, EO 13563 **NRC:** NUREG/BR-0058, NUREG/BR-0184, NUREG-1748, NUREG/CR-3568, NUREG/CR-3971, NUREG/CR-4627, NUREG-1530	Substantial safety enhancement determinations use Safety Goals as a screen, cost estimating practices; use of quantitative modeling, baseline determinations, inflators, and sensitivity and uncertainty analyses; evaluation of time-frame; consideration of affected parties, affects to non-US entities, and labor rates; ensuring public availability of reference information and documentation
New Reactors	None	Same	Same as operating reactors
Materials	None	Same	Same as operating reactors, except Safety Goals are not used as a screen to determine substantial safety enhancements; and time-frame covered by regulatory analysis is different

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

Regulatory Analysis			
	Regulatory Requirements (No regulation requires a regulatory analysis)	Guidance	Practice
Fuel Cycle Facilities	None	Same	Same as operating reactors, except Safety Goals are not used as a screen to determine substantial safety enhancements; and time-frame covered by regulatory analysis is different
Emergency Preparedness	None	Same	Same as for the affected entity

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

Backfit Analysis			
	Regulatory Requirements	Guidance	Practice
Operating Reactors	10 CFR 50.109	**External:** None (NRC unique) **NRC:** NUREG-1409, CRGR Charter, Section 043 of NRC Manual Chapter 0514 **NRC Supporting Guidance:** NUREG/BR-0058, NUREG/BR-0184, NUREG/CR-4627, NUREG-1530	Determinations of substantial increase in the overall protection of the public health and safety or the common defense and security rely upon the Safety Goals
New Reactors	Issue finality regulations: 10 CFR 52.39 (early site permits [ESP]), 52.31 (ESP renewals), 52.63 (standard design certifications [SDC]), 52.59 (SDC renewals), 52.83 (referenced NRC approvals), 52.98 (combined licenses), 52.145 (standard design approvals), 52.171 (manufacturing licenses), and 52.179 (manufacturing license	Same as operating reactors	Same as operating reactors

Summary Table of NRC Cost-Benefit Regulations, Guidance and Practices

Backfit Analysis			
	Regulatory Requirements	Guidance	Practice
	renewals)		
Materials	10 CFR 70.76 (special nuclear material)	Same as operating reactors	Same as operating reactors except: Safety goals are not applicable in determining whether proposed regulatory action results in a substantial increase in the overall protection of the public health and safety
Fuel Cycle Facilities	10 CFR 72.62 (ISFSIs); 10 CFR 76.76 (Gaseous diffusion plants)	Same as operating reactors	Same as operating reactors except: Safety goals are not applicable in determining whether proposed regulatory action results in a substantial increase in the overall protection of the public health and safety
Emergency Preparedness	Same as for the affected entity	Same as for the affected entity	Same as for the affected entity.

ENHANCEMENTS TO BE CONSIDERED IN FUTURE GUIDANCE UPDATES

Topic	Treatment of Uncertainty
Basis for Enhancement	Some Nuclear Regulatory Commission (NRC) regulatory analyses do not contain an analysis of uncertainties. NRC regulatory analyses may benefit from additional discussion of the uncertainty in benefit and cost estimates.
Additional Information	Analysis of benefits for severe accident rules requires a complex chain of analyses and evaluations of cost drivers on estimates. This process includes establishing baselines for the demographics and health status of the exposed population, the release frequency and the source term for different regulatory alternatives. These are used to estimate the changes in population exposure with different protective action guidelines. Because of the potential compounding of high or low estimate assumptions in developing benefit estimates, the analyst, decisionmakers, and the public cannot know with any certainty whether the net benefit estimates (e.g., low, best, and high point estimates) provided by a regulatory analysis are overly conservative or optimistic. Quantifying uncertainty is an estimating best practice, which is addressed in many guides and references. The explicit identification and quantification of sources of uncertainty in regulatory analyses leads to better decisionmaking by providing a means to understand this uncertainty (e.g., the impact of data, assumptions, accident frequency and consequence), impact of variations within different regulatory analysis groupings (e.g., categories of licensees), and the potential range of incremental costs and benefits that result. Most importantly, decisionmakers need to understand that any uncertainty analysis is only as good as the comprehensiveness of risks and uncertainties identified and the breadth of the underlying model. Unknown risks are difficult if not impossible to quantify. Estimates of costs, benefits and other economic impacts should be accompanied by indications of the most important sources of uncertainty embodied in the estimates, and if possible, a quantitative assessment of their importance. Office of Management and Budget (OMB) requires formal quantitative analysis of uncertainties for rules with annual economic effects of $1 billion or more (OMB Circular A-4).

Topic	Addressing "Other Considerations," Attribute 18 in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*—the impact of regulatory decisionmaking on offsite properties with iconic value
Basis for Enhancement	As explained in the guidance, the set of attributes listed in NUREG/BR-0184 is believed to be reasonably comprehensive for most cost-benefit analyses for NRC regulatory decisionmaking. Attribute 18, "Other Considerations," however, provides that any particular regulatory analysis "may also identify attributes unique to itself," and that any such attributes "should be appropriately described and factored into the analysis." These could include attributes that are unique to a specific nuclear power plant site or attributes of particular concern to a subset of the population. A specific example would be the impacts of the regulatory action on offsite properties with iconic value or a unique value to a particular community or group, e.g., a historic property or district, or Native American tribal lands. Part of the impetus for this potential enhancement is to address a concern raised by a Native American tribal representative during public outreach, namely, how the NRC would evaluate tribal lands as part of a severe accident offsite property damage analysis. Any update or revision of NRC's regulatory analysis cost-benefit guidance should provide that these "other considerations," should be identified, described and considered in the regulatory analysis (most likely, such consideration could be of a qualitative nature), provided that such revision is also in accordance with the Commission's direction in SRM-SECY-12-0110. In SRM-SECY-12-0110, the Commission stated that it "finds that economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety." Thus, if the potential impacts of regulatory decisionmaking on offsite properties with iconic value are formalized as part of any update or revision to NRC cost-benefit guidance, then such update or revision will make clear that these considerations are secondary to the NRC's obligations under the Atomic Energy Act, including matters of adequate protection of public health and safety and matters of common defense and security.
Additional Information	Staff will consider whether limits need to be placed on Attribute 18 "Other Considerations."

Topic	Addressing "Other Considerations," Attribute 18 in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*—the consideration of distributive impacts and equity in NRC cost-benefit analyses
Basis for Enhancement	The set of attributes listed in NUREG/BR-0184 is believed to be reasonably comprehensive for most cost-benefit analyses for NRC regulatory decisionmaking. Attribute 18, "Other Considerations," however, provides that any particular regulatory analysis "may also identify attributes unique to itself," and that any such attributes "should be appropriately described and factored into the analysis." These could include attributes that are unique to a specific nuclear power plant site or attributes of particular concern to a subset of the population. Executive Order 12866, paragraph 1(b)(5) states, "When an agency determines that a regulation is the best available method of achieving the regulatory objective, it shall design its regulations in the most cost-effective manner to achieve the regulatory objective. In doing so, each agency shall consider incentives for innovation, consistency, predictability, the costs of enforcement and compliance (to the government, regulated entities, and the public), flexibility, ***distributive impacts*****, and *equity*** [emphasis added]." Thus, issues concerning the distributive impacts of a proposed regulatory action, or the equity of a proposed regulatory action could be considered "other considerations" under Attribute 18. The NRC, as an independent regulatory agency, is not required to comply with Executive Order 12866. Moreover, there is no statutory requirement to consider "distributive impacts" or "equity" in NRC regulatory analyses. In SRM-SECY-12-0110, the Commission stated that it "finds that economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety." Thus, if distributive impacts or equity considerations are to be formalized as part of any update or revision to NRC cost-benefit guidance, then such update or revision will make clear that these considerations are secondary to the NRC's obligations under the Atomic Energy Act, including matters of adequate protection of public health and safety and matters of common defense and security. *Background* NUREG/BR-0058, *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission*, Rev. 4, states "Except for certain planning functions in Section 4 of E.O. 12866, the NRC, as an independent agency, is not required to comply with E.O. 12866.

	Nevertheless, this fourth revision of the Guidelines reflects the intent of E.O. 12866, in part, because of the Commission's previously expressed desire to meet the spirit of Executive Orders related to regulatory reform and decisionmaking." Because most other Federal agencies are required to comply with Executive Order 12866 and NRC's desire to meet the spirit of Executive Orders related to regulatory reform and decisionmaking, addressing other considerations, including distributive impacts and equity, needs to be better understood, explained, and/or defined in any revision of NRC's regulatory analysis cost-benefit guidance. NRC did not determine that other agencies have widely applied the concepts of "distributive impacts and equity". Issues involving distributive impacts and equity may overlap with environmental justice concerns. Office of Nuclear Reactor Regulation (NRR) Office Instruction, LIC-203, Revision 3, describes NRR staff responsibilities for addressing environmental justice in rulemakings (see Appendix D, page D-9, Procedures for Rulemaking Activities) as follows: "Staff responsible for rulemaking should address environmental justice in the preamble to any proposed and final rules that require an EIS, a supplement to an EIS, or generic EIS…If it is known in advance that a particular rulemaking might disproportionately affect a minority and/or low-income population or community, NRC staff should ensure that the population and/or community knows about the rulemaking and are given the opportunity to participate…Public comments on the environmental justice review should be addressed in the statements of consideration to the final rule when published in the *Federal Register*. Comments on the environmental justice review should be addressed at the same level of detail and in the same location as comments received on other parts of the rule."
Additional Information	The terms "distributive impacts" and "equity" are not defined in either E.O. 12866 or the implementing OMB guidance document, Circular A-4. OMB Circular A-4, however, defines the term "distributional effects" as "how both benefits and costs are distributed among sub-populations of particular concern" and provides additional guidance on this issue.[1] In this regard, OMB Circular A-4 states that those "who bear the costs of a regulation and those who enjoy its benefits often are not the same people" and that "[b]enefits and costs of a

[1] See OMB Circular A-4, 14 (2003).

	regulation may be distributed unevenly over time, perhaps spanning several generations."[2] OMB Circular A-4 recommends that the effects of a proposed regulatory action should be expressed quantitatively to the extent possible and that agencies "should be alert for situations in which regulatory [actions] result in significant changes in treatment or outcomes for different groups."[3] The Environmental Protection Agency (EPA) has also implemented guidance to address the distribution of benefits and costs associated with its regulatory actions.[4]

[2] Id.

[3] Id.

[4] EPA, Guidelines for Preparing Economic Analysis, December 17, 2010 (updated May 2014), accessible at http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf

Topic	Use of PRA Studies in Regulatory Analyses
Basis for Enhancement	PRA and other related severe accident studies can improve the fidelity of regulatory analyses and provide useful insights. However, resource and scheduling limitations may necessitate the use of limited scope or historical PRA studies as bases for evaluating the impact of regulatory alternatives. In repurposing PRA and other studies in this fashion, the analyst must be cognizant of underlying assumptions and modeling performed. For example, the historical PRA studies referenced in NRC regulatory analysis guidance documents for operating nuclear power plants are typically partial-scope PRAs for a single reference plant or a limited number of reference plants; embody modeling choices that could affect the results; and do not always reflect the current state-of-practice in PRA analysis. Severe accident and PRA research activities conducted over the last several decades have resulted in improvements to the NRC's PRA tools and could alleviate some of these limitations if incorporated into regulatory analyses. Furthermore, more recent studies such as the State of the Art Reactor Consequence Analysis (SOARCA) study, the spent fuel pool (SFP) consequence study, and the Level 3 PRA project can provide insights for updating Regulatory Analysis guidance documents. Two examples of analysis choices – time truncation and distance truncation – are discussed further below. Time and distance truncation are only two modeling assumptions that may potentially change the outcome of estimates that could be applied in a subsequent cost-benefit analysis. The assumptions and inputs used in PRA studies and severe accident consequence analyses should be understood in order to determine whether they support the needs of the specific regulatory, backfitting, or environmental analysis being conducted.

Time Truncation

NRC cost-benefit analysis guidance documents do not currently specify or recommend a specific truncation time for severe reactor accident analyses because the intent is to evaluate the accident until uncontrolled radiological releases are mitigated and an extension of the analyzed accident period would not change the results. Various accident duration periods have been used in studies performed over the years. For example, 24 hours was used for the analysis in NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," circa 1990. More recently in the State of the Art Reactor Consequence Analyses (NUREG-1935, "State-of-the-Art Reactor Consequence Analyses (SOARCA) Report," 2012), 48 hours was used for the majority of sequences analyzed. In the Containment Protection and Release Reduction rulemaking technical bases currently under development, 72 hours is being applied. The NRC's ongoing Site Level 3 Probabilistic Risk Assessment project is likely to set different truncation times dependent on the accident under consideration. The source term, and hence consequences, may be affected by the selected truncation time. Some severe accidents are projected to continue releasing radionuclides beyond 48-72 hours, unless the accident can be successfully terminated by effective mitigative actions. In practice, the description and analysis of required mitigative actions are likely to vary across cost-benefit analyses. With regard to specifying a truncation time, there is also the question of the correct reference time "zero" (i.e., the onset of core damage), or the start of the accident (e.g., station blackout).

Distance Truncation

Regulatory analyses performed by the NRC have historically considered the health and economic consequences that apply to the population and land within 50 miles of the facility. Current regulatory analysis guidance found in NUREG/BR-0058 Rev. 4 states:

> *In the case of nuclear power plants, changes in public health and safety from radiation exposure and offsite property impacts should be examined over a 50-mile distance from the plant site. The appropriate distance for other types of licensed facilities should be determined on a case-by-case basis.*

The staff notes, however, that the Federal guidance on cost benefit analysis found in OMB Circular A 4, which the NRC voluntarily complies with, states that the regulatory analysis "should focus on benefits and costs that accrue to citizens and residents of the United States." Thus, there is a question about the choice of an appropriate distance to use in regulatory analyses. Given the potential effect of distance truncation on regulatory analysis results, the staff is considering whether the 50 mile radius should be reaffirmed or modified.

Additional Information	The American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) Level 2 PRA Standard that is likely to be issued for trial use and pilot application in November contains the following requirement: SPECIFY and JUSTIFY the end-point or termination time of severe accident calculations. For the purpose of source term evaluation, USE a minimum end-point or termination time of 36 hours after the onset of core damage (and containment has reached a stable configuration) for all severe accident calculations. [See Note (4).] Note (4): Justification of end-point/termination time would typically address trends in results at the termination time and provide a technical basis for claims that results and conclusions drawn from the calculation would not change if the termination time was extended.