POLICY ISSUE
NOTATION VOTE

December 17, 2013 SECY-13-0137

FOR: The Commissioners

FROM: Mark A. Satorius
Executive Director for Operations

SUBJECT: RECOMMENDATIONS FOR RISK-INFORMING THE REACTOR OVERSIGHT PROCESS FOR NEW REACTORS

PURPOSE:

This paper responds, in part, to the Staff Requirements Memorandum (SRM) on SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors," dated October 22, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12296A158). Specifically, this paper addresses the Commission's request to give additional consideration to the use of relative risk metrics or other options that would provide a more risk-informed approach to the determination of the significance of inspection findings for new reactors, and to provide a notation vote paper as directed in the SRM.

SUMMARY:

The staff (1) developed a technical basis for its proposal to use qualitative considerations for characterizing the significance of inspection findings, (2) performed a technical evaluation of the use of relative risk measures for characterizing the significance of inspection findings, and (3) evaluated the appropriateness of the existing performance indicators (PIs) and the related thresholds for new reactors. To accomplish these three items, the staff engaged with internal and external stakeholders that have interest and expertise in Reactor Oversight Process (ROP) implementation, risk applications, and new reactor designs. Based on its evaluations and interactions with stakeholders, the staff has adopted new terminology to explain its recommended approach. The staff recommends the development of an integrated risk-informed approach using qualitative measures (formerly referred to as deterministic backstops) along with quantitative risk insights to inform regulatory decisions in a structured

CONTACTS: Ronald K. Frahm, Jr., NRR/DIRS
301-415-2986

Eric Powell, NRO/DSRA
301-415-4052

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manner. This approach is intended to address the potentially significant performance issues that warrant a regulatory response but would not be characterized as significant using only quantitative risk methods. The technical basis for the recommended approach is supported by the underlying risk-informed policy of the ROP. The staff is recommending only the conceptual approach described in this paper; the illustrative example was developed merely to demonstrate how such an approach could work and is not intended as a recommendation. If the Commission approves the staff's recommendation, the staff would work with stakeholders to translate the concept into a structured process that is understandable, maximizes use of objective measures, and produces predictable regulatory outcomes. The process would be developed over time, tested and refined before it is implemented, and enhanced through experience, consistent with the continuous improvement features of the ROP. The staff also concludes that although the relative risk approach has some merit, the shortcomings of the relative risk approach outweigh its benefits. Finally, the staff concludes that many of the PIs are based on regulations or standards that also apply to new reactor designs; however, some PIs in the Initiating Events and Mitigating Systems cornerstones warrant further analysis to fully develop appropriate PIs, thresholds, or guidance for new reactor applications.

BACKGROUND:

Baseline risk estimates for most new reactor designs, including estimates of the risk of both internally and externally initiated events, are expected to be lower than those for a design similar to that of the current fleet, potentially by an order of magnitude or more. The lower risk values raised questions about how to apply acceptance guidelines for changes to the licensing basis and regulatory response in the ROP. Over the past several years, the staff has corresponded with the Commission, as well as the Advisory Committee on Reactor Safeguards (ACRS) and its Subcommittee on Reliability and Probabilistic Risk Assessment (PRA), to address the staff's recommendations related to risk-informed guidance for new light-water reactor applications. A summary of the background and history is provided in Enclosure 1.

Most recently, in its SRM to SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors," dated October 22, 2012 (ADAMS Accession No. ML12296A158), the Commission disapproved the staff's recommendation (Option 3B) related to the ROP, in which the staff, after working with internal and external stakeholders, would identify appropriate changes to augment the existing risk-informed guidance with deterministic backstops to ensure an appropriate regulatory response for the new reactor designs. Specifically, the Commission directed the staff to give additional consideration to the use of relative risk metrics or other options that would provide a more risk-informed approach to the determination of the significance of inspection findings for new reactors, or, if the staff believes that this is not a viable option for new reactor oversight, the Commission directed the staff to provide a technical basis for its conclusions. The SRM further stated that the staff should provide the Commission with a notation vote paper that contains:

1. a technical basis for the staff's proposal for the use of deterministic backstops, including examples;

2. a technical evaluation of the use of relative risk measures, including a reexamination of the pros and cons listed in the staff's 2009 white paper; and

3. a discussion of the appropriateness of the existing PIs and the related thresholds for new reactors.

The SRM also requested that the staff: (1) provide an information paper to the Commission that reviews the history of the U.S. Nuclear Regulatory Commission's (NRC's) use and consideration of large release frequency and (2) pursue an independent review of the ROP's objectives and implementation. These two activities are outside the scope of this paper. SECY-13-0029, "History of the Use and Consideration of the Large Release Frequency Metric by the U.S. Nuclear Regulatory Commission," was issued on March 22, 2013, and the independent review will also be addressed separately.

DISCUSSION:

To address the aspects of the SRM to SECY-12-0081 related to risk-informing the ROP for new reactors, the staff actively engaged with a variety of internal and external stakeholders with interest and expertise in ROP implementation, risk applications, and new reactor designs. NRC participants included staff from the Office of Nuclear Reactor Regulation (NRR), the Office of New Reactors (NRO), the Office of Nuclear Regulatory Research (RES), the regions, and the ACRS. External stakeholder participants included representatives from the Nuclear Energy Institute (NEI), reactor licensees, industry consultants, and the public.

The staff conducted the first of a series of public meetings with stakeholders on February 5, 2013 (ADAMS Accession No. ML13059A054). Additional public meetings were held on March 25, 2013 (ADAMS Accession No. ML13100A226) and April 15, 2013 (ADAMS Accession No. ML13126A166). This topic was also briefly introduced, discussed, and updated during several monthly ROP Working Group meetings throughout the development of this paper since November 2012. Although notices were posted about these meetings and they were conducted as public meetings, NRC staff and industry representatives were the primary participants in the discussions. Based on discussions and feedback from the public meetings conducted during the development of the draft paper, participants generally agreed with the evaluations, conclusions, and recommendations provided in this paper.

The staff forwarded a draft of this Commission paper to the ACRS on June 24, 2013, and made it publicly available (ADAMS Accession No. ML13169A406). The staff presented and discussed the draft Commission paper with the ACRS Subcommittee on Reliability and PRA and the full ACRS on July 22, 2013, and September 5, 2013, respectively. The ACRS provided its conclusions and recommendations based on the June 24 draft in a letter to the Executive Director for Operations (EDO) on September 19, 2013 (ADAMS Accession No. ML13252A282). The staff is developing its response to the recommendations in the ACRS letter. The ACRS letter and staff response are summarized in the recommendations portion of this paper. The staff also presented and discussed the draft Commission paper with external stakeholders during a public meeting on August 5, 2013 (ADAMS Accession No. ML13234A358). In addition to these discussions, NEI provided formal comments in a letter dated August 15, 2013 (ADAMS Accession No. ML13234A502). Based on feedback from the ACRS and external stakeholders on the draft paper, the staff revised the draft to clarify and better support its conclusions and recommendations.

ROP Framework and Processes for Responding to Performance Issues

Some of the key tenets of the ROP and the drivers in its development were to (1) improve the objectivity of the oversight processes to minimize subjective decision-making, (2) improve the transparency and predictability of NRC actions so that regulatory response has a clear tie to licensee performance, and (3) risk-inform the processes so that NRC and licensee resources are focused on performance issues with the greatest impact on safe plant operation. In ways consistent with Regulatory Guide (RG) 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” the ROP’s risk-informed processes integrate risk insights with more traditional deterministic factors (such as defense-in-depth and safety margins) to guide regulatory decision-making.
The ROP was designed and is continuously assessed to ensure that it meets its intended goals of being objective, risk-informed, predictable, and understandable. The ROP and other NRC processes are also intended to meet the NRC’s Principles of Good Regulation: independence, openness, efficiency, clarity, and reliability.

The regulatory framework for reactor oversight consists of three key strategic performance areas: reactor safety, radiation safety, and safeguards. Within each strategic performance area are seven cornerstones that reflect the essential safety aspects of facility operation: initiating events, mitigating systems, barrier integrity, emergency preparedness, public radiation safety, occupational radiation safety, and security. Satisfactory licensee performance in the cornerstones provides reasonable assurance that the licensee is safely operating its facility and that the NRC’s safety mission is being accomplished. Each cornerstone contains inspection procedures and PIs to verify that its objectives are being met. Both inspection findings and PIs are evaluated and given a color designation based on their safety significance. The color designations for the inspection findings and PIs are considered equally in the ROP Action Matrix to determine a predictable regulatory response.

Within the ROP, the significance determination process (SDP) is used to characterize the safety and security significance of inspection findings. All inspection findings require a performance deficiency, the vast majority of which are associated with violations. SDP implementation guidance is contained in Inspection Manual Chapter (IMC) 0609, “Significance Determination Process” (ADAMS Accession No. ML101400479). IMC 0609, Appendix A, “The Significance Determination Process (SDP) for Findings At-Power” (ADAMS Accession No. ML101400574), is used to determine the safety significance of inspection findings in the cornerstones of initiating events, mitigating systems, and barrier integrity. Within these cornerstones, risk thresholds are established based on increases in core-damage frequency (ΔCDF) and large early release frequency (ΔLERF) from a plant’s baseline risk.

For those relatively infrequent cases in which sufficient PRA methods and tools are not available or appropriate to provide reasonable and timely estimates of safety significance, the staff uses IMC 0609, Appendix M, “Significance Determination Process Using Qualitative Criteria” (ADAMS Accession No. ML101550365), which considers factors such as defense-in-depth, safety margins, recovery, and the potential for plant-wide impacts from the performance deficiency to determine the safety significance in those cases. The current Appendix M process consists of a bounding evaluation and several decision attributes derived from some of the elements of RG 1.174. SDPs in the other ROP cornerstones are structured in a more deterministic fashion to determine an appropriate regulatory response (e.g., emergency preparedness, radiation safety, and security). In addition, the current event response guidance, as stated in Management Directive (MD) 8.3, "NRC Incident Investigation Program" (ADAMS Accession No. ML031250592) and IMC 0309, "Reactive Inspection Decision Basis for Reactors" (ADAMS Accession No. ML111801157), uses an integrated risk-informed approach using deterministic criteria for initial event screening, and risk thresholds are subsequently applied to determine if a reactive inspection will be launched. An important over-arching goal of the SDP and ROP in general is to address safety issues in a timely manner before an unacceptable erosion of defense-in-depth and safety margin occurs. In addition to determining regulatory response, SDP results are used to inform other program evaluations, such as the Accident Sequence Precursor Program (ASP) and the Industry Trends Program (ITP).

In addition, several current regulatory and programmatic controls exist and can be leveraged as necessary, to help inform and ensure appropriate response and oversight of new reactors, including: (1) the ROP self-assessment process as described in IMC 0307, "Reactor Oversight Process Self-Assessment Program," could be used to evaluate and potentially adjust the ROP for new reactors in the future as a result of additional experience and lessons learned; (2) all inspection findings (including those characterized as very low safety significance) are entered in the licensee's corrective-action program, receive attention by licensees and the NRC, and would also be considered for cross-cutting aspects in accordance with the current process; and (3) deviations from the ROP Action Matrix as described in IMC 0305, "Operating Reactor Assessment Program," could also be used to adjust the staff's actions in providing an appropriate regulatory response, if deemed necessary, and then each deviation would be evaluated for potential program improvements. In addition, performance and condition of structures, systems, and components (SSCs) would be monitored in accordance with Title 10 of the *Code of Federal Regulations* Section 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." Once the ROP for new reactors has been established, adjustments and refinements to the ROP for new reactors would evolve over time based on experience through the continuous improvement features of the ROP.

During the August 5, 2013, public meeting and in the subsequent submittal of formal comments, NEI proposed that the staff provide and recommend a "status quo" approach to the Commission for consideration. This approach would postpone any changes to the ROP for new reactors and use existing ROP tools until experience has been gained in its application during plant operations. The staff would use the existing SDP processes for determining the safety significance of inspection findings, with a greater reliance on the use of Appendix M to IMC 0609, as well as the Action Matrix deviation process to ensure an appropriate regulatory response to performance issues. After careful consideration, the staff did not accept this proposal for a number of reasons. The Action Matrix deviation process is intended to be infrequently used for unanticipated instances in which the prescribed process and regulatory actions dictated by the Action Matrix do not provide the most appropriate response. Similarly, the current Appendix M to IMC 0609 is intended to be used infrequently and only when existing quantitative methods and tools are unable to appropriately characterize the safety significance of the finding. NEI's proposed approach for new reactor oversight would routinely use two processes that were intended to be used infrequently. Because of this reliance on the more subjective and less predictable aspects of the ROP, NEI's proposed approach as applied to new reactors would not align with several of the NRC's Principles of Good Regulation (e.g., the approach would be less clear and reliable) and the goals of the ROP (e.g., the approach would be less predictable, objective, and understandable), and would provide a less risk-informed approach to the determination of the significance of inspection findings and regulatory response for new reactors.

SECY-12-0081 Recommended Approach for Responding to Performance Issues

As noted in SECY-12-0081 (ADAMS Accession No. ML12117A012), the tabletop results demonstrated that the existing risk-informed SDP is acceptable, and could occasionally generate an increased regulatory response based on greater-than-green results. However, the performance deficiencies would likely have to involve common-cause failures that affect multiple systems or involve long-term exposures of risk-significant components. In addition, the case study on reactor coolant system integrity demonstrated that the existing quantitative process does not produce the appropriate response for degradation of passive components and barriers. To address the shortfalls identified by the tabletop exercises, the staff recommended in SECY-12-0081 that the SDP analyses for new reactor designs be augmented with additional qualitative considerations, in a manner consistent with the integrated risk-informed decision-making framework in RG 1.174, to provide a “deterministic backstop” that would ensure that performance issues receive an appropriate regulatory response. For example, the staff had noted that “deterministic backstops” could potentially be developed to reinforce the importance of maintaining barrier integrity, to address extended equipment outages resulting from degraded conditions, or to address repetitive equipment failures that could degrade the reliability or availability of SSCs in performing their intended safety functions. The staff further noted that these “deterministic backstops” should not infringe on the operational flexibility afforded by the more robust new reactor designs, but should instead be designed to identify the infrequent yet potentially significant performance issues that would not otherwise be revealed by the risk evaluations to ensure an appropriate regulatory response.

Integrated Risk-Informed Approach Using Qualitative Measures

In the SRM to SECY-12-0081, the Commission directed the staff to provide a more risk-informed approach to the significance determination of inspection findings for new reactors. The staff was specifically instructed to provide “a technical basis for the staff’s proposal for the use of deterministic backstops, including examples.” To more accurately reflect the intent of the staff’s recommendation in SECY-12-0081 and its proposed approach as described in this paper, the staff has replaced the term “deterministic backstops” with the term “qualitative measures.” As discussed below and in Enclosure 2, the staff developed a conceptual approach (complete with technical basis and an illustrative example) that integrates risk information with qualitative measures to characterize the significance of ROP inspection findings.

The staff is recommending only the conceptual approach described in this paper; the illustrative example was developed merely to demonstrate how such an approach could work and is not intended as a recommendation. If the Commission approves the staff’s recommendation, the details and framework of a methodology would need to be developed over time with significant stakeholder involvement. Furthermore, the resulting product may not resemble the illustrative example; it also would need to be tested and refined to ensure it produces reliable and predictable regulatory outcomes. In short, the concept must evolve into a fully conceived and vetted methodology before it is ready for implementation in the ROP.

The conceptual approach is consistent with the current ROP framework, which applies deterministic criteria and risk insights to inform regulatory decisions. The technical and policy bases for using qualitative measures are already part of an integrated risk-informed approach with its tenets taken from several sources, most notably: (1) RG 1.174, which states that decisions “are expected to be reached in an integrated fashion, considering traditional engineering and risk information, and may be based on qualitative factors as well as quantitative analyses and information;” (2) SECY-99-007A, “Recommendations for Reactor Oversight Process Improvements (Follow-Up to SECY-99-007)” (ADAMS Accession No. ML992740073), which established the basis for ROP implementation and notes its alignment with the RG 1.174 principles; (3) the SRM for SECY-98-144 (Revision 1), “White Paper on Risk-Informed, Performance Based Regulation” (ADAMS Accession No. ML003753593), which states that a risk-informed approach should consider “other” factors; and (4) the Commission’s PRA Policy Statement from 1995 (60 FR 42622, “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement”), which declares that “the use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy.” In addition, a key tenet of the ROP is to risk-inform the processes so that NRC and licensee resources are focused on performance issues with the greatest impact on safe plant operation. The current SDP and event response processes use qualitative measures in an integrated risk-informed fashion, and these processes could be modified to incorporate a more transparent and predictable structure to provide for a reliable and appropriate regulatory response.

In the process of assessing potential qualitative measures, one of the key considerations was how to integrate these qualitative measures with the quantitative risk assessment in a reliable and predictable fashion. The staff conceived an approach that would use both quantitative methods and qualitative methods in an integrated risk-informed fashion. In this integrated risk-informed approach, qualitative measures, such as, but not limited to, defense-in-depth, safety margins, condition time, and qualitative credit, would be rated based on their individual impacts on safety to determine the level of degradation that these measures would contribute to the inspection finding. The evaluation would progress through a structured methodology (e.g., a decision tree, table, and/or flowchart) to arrive at an overall qualitative rating. This overall qualitative rating would then be considered along with the quantitative risk result using a significance-determination table to arrive at the resultant significance color band in an integrated, reliable, and predictable fashion. More detail on the conceptual approach and technical basis, as well as illustrative examples, is provided in Enclosure 2. The approach described in Enclosure 2 is an illustration of how an integrated risk-informed approach could be applied. The staff is not proposing a specific methodology at this time; the details and framework would need to be developed over time with significant stakeholder involvement.

Participants at the public meetings, including industry representatives, generally agreed that this conceptual approach was consistent with RG 1.174 and appeared to appropriately incorporate qualitative measures with quantitative results, but agreed that additional detail regarding how the approach would work would need to be developed before its efficacy could be gauged. Industry participants expressed concern that some factors may be “double-counted” in both the quantitative and qualitative evaluations; the staff noted its intent to explicitly define the qualitative measures in a manner that would exclude those that have already been accounted for in the quantitative risk evaluation. Also, members from industry noted that the qualitative evaluation seemed to only escalate the significance of a finding and did not appear to mitigate the significance. The staff noted its intent to clarify that the significance could be reduced as well as increased based on the proposed qualitative evaluation, particularly for mitigating capability that is not modeled in the quantitative PRA evaluation.

The technical basis for this approach is also consistent with recommendations from the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident and with the Risk Management Regulatory Framework, NUREG-2150, "A Proposed Risk Management Regulatory Framework" (ADAMS Accession No. ML12109A277). Specifically, Recommendations 1 and 12 from the NTTF report state that "the task force recommends establishing a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense-in-depth and risk considerations," and "the task force recommends that the NRC strengthen regulatory oversight of licensee safety performance (i.e., the ROP) by focusing more on defense-in-depth requirements consistent with the defense-in-depth framework." The overarching Recommendation 2.3 of NUREG-2150 states that "A balanced approach that considers traditional and risk assessment techniques should be used to identify barriers and controls so that appropriate requirements are defined to prevent, contain, and mitigate exposures to radioactive materials." If the staff were to further pursue the integrated risk-informed approach described in this paper, those efforts would be coordinated with the efforts underway to implement the NTTF and NUREG-2150 recommendations.

The integrated risk-informed approach is also consistent with the ROP goals of being objective, risk-informed, predictable, and understandable, as well as the Principles of Good Regulation: being independent, open, efficient, clear, and reliable. This approach can also be considered for the current fleet of operating reactors, as well as future reactor designs that may have even lower baseline risk values, so that there would be a reliable and predictable regulatory approach for operating reactor oversight, regardless of vintage. The use of qualitative measures is also consistent with the current SDP and event response guidance. The conceptual methodology described in this paper is presented to demonstrate how an approach using qualitative measures could be used. The specific details and framework of an integrated risk-informed approach would need to be developed over time with significant stakeholder involvement, including determining the elements of the qualitative measures, defining the impact rating thresholds, establishing the framework to determine the combined qualitative ratings, and developing an implementation plan.

Relative Risk Approach

In the SRM to SECY-12-0081, the Commission directed the staff to give additional consideration to the use of relative risk metrics, or, if the staff believes that this is not a viable option for new reactor oversight, to provide a technical basis for its conclusions. The SRM also directed the staff to provide a technical evaluation of the use of relative risk measures, including a reexamination of the pros and cons listed in the staff's 2009 white paper (ADAMS Accession No. ML090160004).

The relative risk approach considers the total baseline CDF (x-axis) and the ΔCDF (y-axis) for a plant to determine the significance of an inspection finding using sloped lines for the thresholds, as shown in Figure 1 on the following page. The concept behind this approach is that the lower the baseline CDF of a plant, the lower the ΔCDF value, or the larger the fractional change, necessary for increased significance of a finding. Conversely, the higher the baseline CDF of a plant, the higher the ΔCDF value, or the smaller the fractional change, necessary for increased significance of a finding. Therefore, the significance of a finding would be relative to the baseline CDF value, instead of the current thresholds that do not change given a particular plant's baseline CDF.

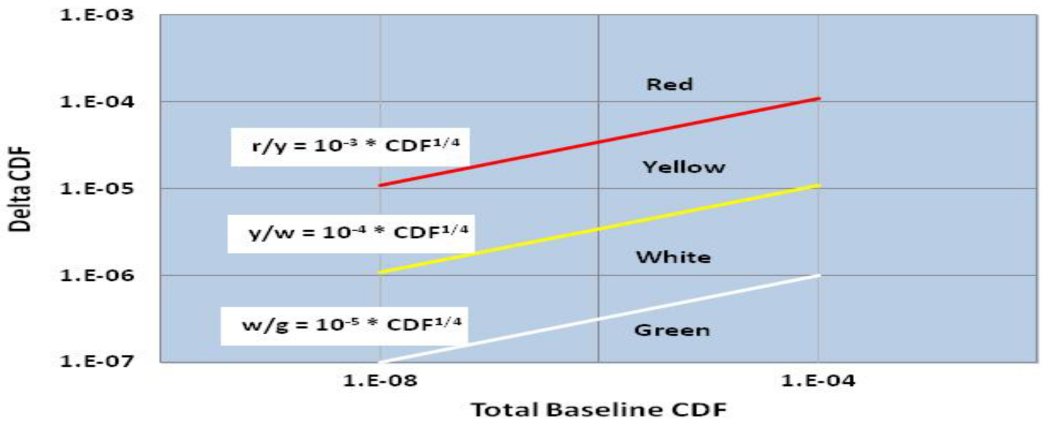

Figure 1: Relative Risk Approach

The staff performed its technical evaluation of the use of relative risk measures and presented the results during the public meetings. The staff took the same scenarios from the 2011 tabletop and applied ACRS' conceptual relative risk approach to determine the significance of potential findings. The result was an increase in the significance, and therefore regulatory response, of most findings compared to the existing approach. Baseline CDFs for new reactors will include internal and external events (e.g., seismic, flooding, and fires), and for new reactor designs with low internal-event CDF values, the PRA results will likely be dominated by external events, particularly seismic events. Staff expects that in most cases, once external events are quantified and factored into a plant's baseline CDF, it will likely result in an increase in the baseline CDF values for the new reactor designs. If a relative risk approach was applied that takes into account external events, the likely result would be a decrease in the significance of some findings. This is a consequence of the concept behind a relative risk approach that the higher the baseline CDF of a plant, the higher the ΔCDF value necessary for increased significance of a finding.

The staff also considered alternative options to the conceptual ACRS relative risk approach: (1) a staircase thresholds approach that incorporates step drops in ΔCDF at specific baseline CDF values; and (2) a hybrid thresholds approach that includes an absolute CDF threshold at higher baseline CDF values, and transitions into a relative CDF threshold at lower baseline CDF values. As a result of the discussions at the public meetings, staff and industry agreed that the staircase thresholds approach does not offer an additional advantage over a relative risk approach, primarily because of the cons associated with acute cliff effects. Of the alternative options considered, the industry generally supported the hybrid thresholds approach if the <u>total</u> baseline CDFs were used and the transition point was established at or near 10^{-6}/year. However, the staff believes that the hybrid thresholds approach does not offer an additional advantage over the relative risk approach.

The pros and cons of a relative risk approach, including a reexamination of those noted in the staff's and NEI's white papers from 2009 were evaluated and discussed during the public meetings. The primary advantage, or pro, of a relative risk approach is that it could be developed and applied in a manner that is consistent with the Commission's stated expectation to maintain the enhanced safety margins for new reactors, while providing greater operational flexibility than is possible with current reactors. Some of the more significant impediments, or cons, to a relative risk approach that were evaluated and discussed included: (1) the potential to inadvertently focus licensee and staff attention on less significant safety issues; (2) concerns with public perception issues in communicating the safety significance of findings; and (3) concerns with creating less incentive for licensees to enhance safety margin.

Based on the staff's evaluation, the relative risk approach has some merit, but the shortcomings of the relative risk approach outweigh its benefits. Enclosure 3 contains a more detailed technical evaluation of the use of relative risk measures, including additional discussion of the reexamination of the pros and cons listed in the staff's and NEI's 2009 white papers.

Appropriateness of Existing Performance Indicators and Thresholds

As discussed in SECY-12-0081, the case studies developed for the Mitigating System Performance Index (MSPI) tabletops showed that the existing MSPI is not adequate for new reactor designs and would be largely ineffective in determining an appropriate regulatory response. Furthermore, a meaningful MSPI may not even be possible for passive systems using the current formulation of the indicator. The staff noted that the existing performance limit approach, which serves as a backstop, potentially could be modified and emphasized for new reactor designs. The staff concluded in SECY-12-0081 that (1) alternate PIs in the Mitigating Systems cornerstone could be developed and (2) additional inspection could be used for the new reactors to supplement insights currently gained through MSPI for the current fleet.
In response to the SRM on SECY-12-0081, the staff reviewed the basis and related thresholds for the remaining PIs to determine whether these PIs and thresholds could be appropriately applied to the operation of plants for new reactor designs. The staff concludes that many of the PIs are based on regulations or standards that would also apply to new reactor designs and that many of the thresholds are deterministic. The staff notes that for the Unplanned Scrams with Complications indicator in the Initiating Events cornerstone, a complicated scram for new reactor designs would need to be defined. As noted in SECY-12-0081, a risk-informed alternative to the MSPI indicators in the Mitigating Systems cornerstone would need to be developed for new reactors. The staff concludes that the remaining PIs and associated thresholds could apply to new reactors. A more detailed discussion is provided in Enclosure 4.

RECOMMENDATIONS:

As a result of the staff's evaluations and stakeholder interactions, the staff concludes that an integrated risk-informed approach using both qualitative and quantitative measures in a structured manner is an effective means to achieve an appropriate regulatory response. The intent of this approach would not be to increase the number of inspection findings that result in an escalated response or to place an increased reliance on qualitative assessments, but the approach should instead be designed to identify the infrequent yet potentially significant performance issues that would not otherwise be revealed solely by quantitative risk evaluations. Further, the staff concludes that although the relative risk approach has some merit, the staff believes that the shortcomings of this approach outweigh its benefits. Although the staff is not recommending the relative risk approach, the staff will continue to be open to additional ideas as it develops the recommended integrated risk-informed approach with stakeholder input. The staff believes that an integrated risk-informed approach would provide a clear and efficient way of ensuring reliable and predictable regulatory outcomes within the existing ROP framework, which would be consistent with the NRC's Principles of Good Regulation.

The staff is recommending the conceptual approach described in this paper; the example is simply illustrative to demonstrate how an integrated risk-informed approach could work and is not fully conceived or recommended. If the Commission approves the recommendation, the staff would work with stakeholders to develop the approach over the next few years, ahead of projected dates for operation of new reactors, which would factor in qualitative considerations in a structured manner to arrive at a risk-informed decision. The staff would test the approach via methods such as tabletop exercises or some form of pilot program with stakeholder involvement to verify that the methodology produces reliable regulatory outcomes and is predictable and understandable. The staff could present its recommendations to the Commission prior to implementation. The staff would also need to consider if SDP outcomes could be applied to other programs, such as ASP and ITP, when developing any future changes to the SDP. Lastly, the staff concludes that many of the PIs are based on regulations or standards that also apply to new reactor designs, but some PIs in the Initiating Events and Mitigating Systems cornerstones warrant further analysis to fully develop appropriate PIs, thresholds, or guidance for new reactors.

The staff is requesting Commission direction before it invests resources to develop and eventually implement these recommendations:

Recommendation 1: Develop an integrated risk-informed approach for evaluating the safety significance of inspection findings for new reactor designs. The integrated risk-informed approach would use qualitative measures to supplement the risk evaluations in a structured manner to ensure an appropriate regulatory response to performance issues.

Recommendation 2: Develop appropriate PIs and thresholds for new reactor applications, specifically those PIs in the Initiating Events and Mitigating Systems cornerstones, or develop additional inspection guidance to address identified shortfalls to ensure that all cornerstone objectives are adequately met.

The staff expects that the proposed process enhancements for Recommendations 1 and 2 could be developed over the next few years, using existing resources, well in advance of their potential implementation in the oversight of new reactor operations. These process enhancements, if approved and implemented, would be refined based on experience and lessons learned in ways consistent with existing provisions for ROP continuous improvement. The staff would work with internal and external stakeholders to formulate the process changes and develop the guidance necessary to implement the noted recommendations and provide an appropriate regulatory response for new reactors. The staff would also ensure that the approach is properly vetted and tested to confirm that it meets the goals of the ROP by producing predictable, understandable, and objective regulatory responses. The staff would provide a paper to the Commission with its proposed approach for using qualitative factors at least 1 year before its scheduled implementation.

The staff forwarded a draft of this Commission paper and discussed it with the ACRS. By its letter dated September 19, 2013, the ACRS agreed that the staff should develop guidance for a structured evaluation of qualitative measures, regardless of whether absolute or relative measures are used for the quantitative assessment of risk significance. They further recommended that the staff develop an integrated SDP that places primary reliance on the quantitative measures, supplemented as necessary by qualitative assessments of conditions that are not evaluated fully in the supporting plant risk models. The staff believes that its recommended approach would appropriately balance the quantitative and qualitative measures in a structured, integrated, and risk-informed fashion, without detracting from the benefits of the risk evaluations. The letter further noted that the ACRS encourages the staff to continue exploration of the use of relative risk measures, but the staff continues to believe that although the relative risk approach has some merit, the shortcomings of the relative risk approach outweigh its benefits. In addition, the staff believes that the proposed integrated risk-informed approach is a simpler approach for ensuring appropriate and predictable regulatory responses within the existing ROP framework that would be consistent with the principles of good regulation and the ROP program goals of being objective, risk-informed, understandable, and predictable. Finally, the ACRS concurred with the staff's recommendation to develop additional indicators, thresholds, and guidance as appropriate for monitoring the cornerstone performance objectives for new reactors. It should also be noted that the ACRS reviewed and commented on the June 24, 2013, draft version of this paper. Based on feedback from the ACRS and external stakeholders, the staff revised the paper to clarify and better support its conclusions and recommendations.

RESOURCES:

The resource implications associated with the staff's recommendations are addressed in Enclosure 5, which is non-public.

COORDINATION:

This paper has been coordinated with the Office of the General Counsel, which has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections. A draft copy of this paper was provided and presented to the ACRS. The ACRS issued a letter dated September 19, 2013 (ADAMS Accession No. ML13252A282), about its conclusions and recommendations on the draft paper. The staff is developing its response to the recommendations in the ACRS letter.

/RA/

Mark A. Satorius
Executive Director
for Operations

Enclosures:
1. Background and History
2. Technical Basis and Examples of Integrated Risk-Informed Approach Using Qualitative Measures
3. Technical Evaluation of Relative Risk Measures, Including Reexamination of Pros and Cons
4. Appropriateness of Existing Performance Indicators and Thresholds
5. Resource Implications

COORDINATION:

This paper has been coordinated with the Office of the General Counsel, which has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections. A draft copy of this paper was provided and presented to the ACRS. The ACRS issued a letter dated September 19, 2013 (ADAMS Accession No. ML13252A282), about its conclusions and recommendations on the draft paper. The staff is developing its response to the recommendations in the ACRS letter.

/RA/

Mark A. Satorius
Executive Director
for Operations

Enclosures:
1. Background and History

2. Technical Basis and Examples of Integrated Risk-Informed Approach Using Qualitative Measures
3. Technical Evaluation of Relative Risk Measures, Including Reexamination of Pros and Cons
4. Appropriateness of Existing Performance Indicators and Thresholds
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