

# POLICY ISSUE INFORMATION

October 27, 2009

SECY-09-0159

FOR: The Commissioners

FROM: Brian W. Sheron, Director  
Office of Nuclear Regulatory Research

SUBJECT: ANNUAL UPDATE OF THE RISK-INFORMED AND PERFORMANCE-BASED PLAN

## PURPOSE:

To provide the Commission with a periodic update on activities contained in the Risk-Informed and Performance-Based Plan (RPP) including a summary of the significant accomplishments achieved over the past year and anticipated for the next year. This paper does not address any new commitments or associated resource implications.

## SUMMARY:

The breadth and depth of programs across the agency demonstrate the NRC staff's commitment to the Commission's goals for risk-informed and performance-based regulation. Since the Commission promulgated the Probabilistic Risk Assessment Policy Statement (60 FR 42622) in 1995, the staff has continued to expand the application of risk-informed technology to regulatory initiatives. Many NRC risk-informed programs, such as the Reactor Oversight Program, are mature elements in the regulatory structure and are not discussed in this paper. These programs continuously improve as the state of the art continues to advance. Other programs, such as most of those discussed in this paper, are in a developmental stage and being integrated into the regulatory process of the agency. The staff continues to engage stakeholders as appropriate to improve our regulatory programs.

## BACKGROUND:

On June 1, 2006, the Commission issued a staff requirements memorandum (available in the Agencywide Documents Access and Management System [ADAMS] under Accession No.

CONTACT: Eliezer B. Goldfeiz, RES/DRA  
(301) 251-7605

ML061520304) that directed the U.S. Nuclear Regulatory Commission (NRC) staff to improve upon the Risk-Informed Regulation Implementation Plan (RIRIP) by developing an integrated master plan for activities designed to help NRC achieve its goal of a holistic, risk-informed, and performance-based regulatory structure. The Commission also directed the staff to seek ways to communicate more transparently to the public and stakeholders the purpose and use of PRA in the agency's reactor, materials, and waste regulatory programs. SECY-07-0074, "Update on the Improvements to the Risk-Informed Regulation Implementation Plan," dated April 26, 2007 (ADAMS Accession No. ML070890396), conveyed that plan, which the staff retitled as the "Risk-Informed and Performance-Based Plan."

To help meet the Commission's expectations for both a risk-informed and a performance-based regulatory structure, Enclosure 1 of SECY-07-0074 included explicit criteria for the staff's review and consideration of performance-based approaches to help determine which initiatives should be both risk-informed and performance based. SECY-07-0191, "Implementation and Update of the Risk-Informed and Performance-Based Plan," dated October 31, 2007 (ADAMS Accession No. ML072700587), discusses the staff's progress in implementing the RPP and includes an updated set of objectives, bases, and goals for the reactor, materials, and waste regulatory arenas. In November 2007, the staff completed its commitment to make all aspects of the RPP, including these objectives, bases, and goals, available to the general public via the agency's public Internet site.

#### DISCUSSION:

The format of this report has been expanded from previous RPP reports to highlight major staff accomplishments. It is similar to previous RPP reports in that most of the information is in the Enclosure and the detailed information is now located on NRC's public Web site. The Web site provides a readily accessible overview and current status of the agency's risk-informed and performance-based regulatory activities.

The following sections, supported by the enclosure "Recent Accomplishments and Near-Term Anticipated Accomplishments," summarize major risk-informed and performance-based initiatives and infrastructure-supporting activities that the staff has completed over the past year and plans for the next year.

#### Regulatory Initiatives in the Reactor Area:

*Fire Protection for Nuclear Power Plants.* The NRC staff continues its effort to implement the risk-informed fire protection rule. The staff expects to complete the review of the Shearon Harris and Oconee NFPA 805 License Amendment Requests and to conduct public meetings to share insights gained from the plant license amendment requests with the nonpilot plants. In parallel, and reflecting the lessons learned in the pilot plant reviews, the staff is completing an update to its regulatory guide and finalizing a new standard review plan section and inspection guidance.

*Risk-Informed Technical Specifications.* The staff continues to work on the risk-informed technical specifications initiatives (Initiative 1 "Modified End States," Initiative 4b "Risk-Informed Completion Times," Initiative 5b "Risk-Informed Surveillance Frequencies," and Initiative 6 "Modification of Selected Technical Specifications for Conditions Leading to Exigent Plant Shutdown"), to add risk-informed components to the standard technical specifications (STS). Under Initiative 1, the Westinghouse topical report has been reviewed and revisions to the

Babcock & Wilcox STS are expected to be made available in fall 2009. Under Initiative 4b, the changes to the pilot plant STS will be submitted to the staff by the end of 2009. Under Initiative 5b, the associated Technical Specification Task Force guidance (TSTF-425) to revise the STS was made publicly available. The industry has express significant interest in implementing these changes for initiatives 4b and 5b over the next 5 years. Under Initiative 6, a revised Combustion Engineering topical report is under review with an expected completion date in the fall of 2009.

*Risk-Informed Approach to Special Treatment Requirements.* The staff completed its review of the topical report that proposed a structure, system and component categorization process and issued its final safety evaluation. The staff found the categorization process described in the topical report to be acceptable, but neither approved nor endorsed any specific treatment process. The staff plans to develop guidance for sample inspections to be conducted at plants voluntarily choosing to implement 10 CFR 50.69. The staff plans to issue draft inspection guidance to obtain stakeholder input and issue final inspection guidance by the summer 2011. Inspection efforts will be focused on the most risk significant aspects related to implementation of 10 CFR 50.69.

*Risk-Informed Rulemaking.* The NRC published a supplemental proposed rule on 10 CFR 50.46a, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," for public comment in early August 2009 (74 Fr 40006). After reviewing public comments and making changes, the staff will provide a final rulemaking package to the Commission. Over the last several years, the NRC staff has been working on a performance-based rulemaking related to decoupling an assumed loss of offsite power from a loss-of-coolant accident per 10 CFR Part 50, Appendix A, General Design Criterion 35. In September 2009, the NRC Staff sent an options paper to seek a Commission decision on the staff's recommended option to discontinue the rulemaking effort. In addition, the final rulemaking package for 10 CFR 50.61a, "Alternate Fracture Toughness Requirements for Protection against Pressurized Thermal Shock Events," has been completed. The Commission approved the alternative PTS rule in its September 22, 2009, SRM on SECY-09-0059, "Final Rule Related to Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events (10 CFR 50.61a)." The rule will be published in the Federal Register after Office of Management and Budget review and clearance.

*Infrastructure for a Risk-Informed and Performance-Based Environment for New Light water Reactors.* During FY 2009, the NRC staff developed a white paper and held two public meeting regarding the implementation of risk-informed applications for new light-water reactors (LWRs). The discussions in these forums addressed the regulatory framework as applied to currently operating reactors and highlighted potential implementation issues if and when applied to new reactor designs. In FY 2010, NRC will continue to participate in the development of consensus PRA standards specific to new and advanced LWRs, and work with stakeholders to define the risk-informed approach to inservice inspection of piping as it pertains to new reactors.

*Advanced Reactor Regulatory Structure.* The NRC staff issued NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing," in 2007. This staff report documents a framework that provides an approach, scope, and criteria that could be used to develop an alternative set of risk-informed and performance-based requirements to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," for advanced nuclear power plants. The staff is developing a regulatory guide for identifying design

basis events for future nuclear power plants using the approach from the framework and expects to produce a draft by the end of CY 2009.

#### Technical Support for Regulatory Initiatives in the Reactor Area:

The increased use of PRAs in NRC's regulatory decisionmaking process requires consistency in the quality, scope, methodology, and data used in such efforts. A key aspect of implementing a phased approach to PRA quality is the development of PRA standards and related guidance documents. In addition, support is required in the areas of risk analysis software, plant PRA models, and operational data. The following discussion provides details for reactor related PRA-improvement initiatives.

*Phased Approach to Probabilistic Risk Assessment Quality.* The objective of this effort is to develop the PRA guidance documents for demonstrating PRA technical acceptability. The staff continues to engage professional societies and the nuclear industry to develop national consensus standards and guidance on the use of PRA in regulatory decisionmaking. The most notable examples are provided below.

Revision 2 to Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," was issued in March 2009 (ADAMS Accession No. ML090410014). This revision addressed concerns regarding model uncertainties and related assumptions and included guidance for new and advanced LWRs. This revision also endorsed Addenda A to the joint American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA standard, "Level 1 and Large Early Release Frequency (LERF) PRA Standard" (ASME/ANS RA-Sa-2009), which was published in February 2009. This standard applies to at-power internal and external hazards for operating reactors. Additional related documents endorsed in RG 1.200 include revisions to Nuclear Energy Institute (NEI) documents on PRA and fire PRA peer review (i.e., NEI 05-04 and NEI 07-12, "Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard" and "Fire Probabilistic Risk Assessment Peer Review Guidelines," respectively).

With the issuance of Revision 2 to RG 1.200, two application-specific regulatory guides are being updated to reference RG 1.200. Proposed revisions to RG 1.174 "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and RG 1.177 "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," were issued for public review and comment in August 2009.

In March 2009, the NRC staff issued NUREG-1855, "Treatment of Uncertainties from PRAs in Risk-Informed Decision Making." The NRC report and a complementary Electric Power Research Institute (EPRI) report provide guidance on meeting the requirements in the PRA standard ASME/ANS RA-Sa-2009. The staff and EPRI plan to continue improving these guidance documents.

In FY 2009, the agency also supported the review of the draft PRA standards for advanced non-LWRs and on risk-informed approaches to establishing nuclear safety design criteria for modular helium-cooled reactor plants.

*Initiative to Enhance Risk Tools for Oversight.* The staff has initiated a structured approach involving internal stakeholders in NRR, RES and each region to define, prioritize, and implement enhancements to risk tools used by risk analysts, inspectors and their management in the agency's oversight of nuclear reactors. The definition and prioritization of enhancements are complete, and the staff is currently developing a 5-year plan to implement the most value-added enhancements. The plan will encompass such tools as SAPHIRE, SPAR, the Significance Determination Process, the RASP handbook, and risk training.

*Human Reliability Analysis (HRA).* Under a Memorandum of Understanding, NRC's Office of Nuclear Regulatory Research and EPRI have embarked on a cooperative program of HRA research. In response to Commission direction, the staff is evaluating several human reliability models in an effort to reduce the number of models needed, or to provide guidance on which model(s) should be used in specific circumstances. In addition, EPRI and NRC are working to improve the state-of-the art HRA in fire risk studies to support the NFPA 805 transition initiative. This methodology is currently undergoing public comment with a final report planned in 2010.

*PRA Software and Risk Models.* The NRC's PRA software, Systems Analysis Program for Hands-on Integrated Reliability Evaluations (SAPHIRE) is undergoing a significant upgrade that is planned to be released in April 2010. SAPHIRE version 8 includes a new user interface for significance determination process (SDP) Phase 2 assessments in the Reactor Oversight Process. SAPHIRE is used to run the NRC's Standardized Plant Analysis Risk (SPAR) models, which are plant-specific PRA models of each operating reactor. The staff plans to continue implementing enhancements to the Revision 3 SPAR models and to incorporate additional external events and low-power/shutdown models to support the Accident Sequence Precursor Program and the SDP. Enhancements planned for FY 2010 include improvements to SPAR model success criteria (e.g. thermal-hydraulic success of feed/bleed strategies) based on the results of staff developed and/or staff reviewed thermal-hydraulic analysis, and transitioning the SPAR models to SAPHIRE version 8. The changes to the SPAR models will take advantage of the many new features in SAPHIRE 8.

*Reactor Performance Data Collection/Industry Trends.* The staff has been collecting data and information for over 20 years to support reliability studies and risk analyses of nuclear power plant operational experience. Over the next year, the staff plans to make an improved LER search software publicly available on the external NRC website. In addition, the staff is continuing to improve support for the Industry Trends Program and Risk Assessment Standardization Project for use in SDP evaluations, including a comprehensive update to the existing fire database.

*Digital Systems Probabilistic Risk Assessment.* The staff continues its research into PRA methodologies for assessment of digital instrumentation and control (I&C) system risk. Previous and current research projects have identified a set of desirable characteristics for reliability models of digital I&C systems and have applied various probabilistic reliability modeling methods to an example digital system. The results of these studies have been compared to the set of desirable characteristics to identify areas where additional research might improve the capabilities of the methods. One specific area that is currently being pursued is the quantification of software reliability. Motivated by the lack of consensus on how to model software failure in a nuclear power plant PRA, or even if it should be modeled, a workshop was convened in May 2009 involving experts with knowledge of software reliability and/or nuclear power plant PRA. The staff is now performing a review of quantitative software reliability

methods with the aim of developing one or two technically sound approaches to modeling and quantifying software failures in terms of failure rates and probabilities. Assuming such approaches can be developed, they will then be applied to an example software-based protection system in a proof-of-concept study.

#### Regulatory Initiatives in the Materials Area:

*Developing Significance Determination Process (SDP) Tools for the Fuel Cycle Oversight Process (FCOP) Revision.* Based on recent Commission guidance, the staff is developing the framework of the FCOP and developing SDP tools that will be used to evaluate the significance of inspection findings in fuel cycle facilities. In 2010, the staff will begin internal and external peer review of the first draft of the tools.

*Depleted Uranium Rulemaking.* Based on the risk-informed analysis of options described in SECY-08-0147, "Response to Commission Order CLI-05-20 Regarding Depleted Uranium," dated October 7, 2008 (ADAMS Accession No. ML081820762), the NRC staff is performing a limited rulemaking to specify a requirement for a site-specific performance assessment and associated technical requirements for unique waste streams including, but not limited to, the disposal of significant quantities of depleted uranium. The staff has conducted public workshops in September 2009 to discuss issues associated with this rulemaking. Based on these workshops, the staff will begin development of the technical basis for the draft rulemaking. The technical basis will consider the input from the stakeholders at the workshops and that which is provided to the docket.

*Risk-Informed Prioritization of Items to be Inspected.* Staff applied a previously developed risk-informed method to prioritize items for inspection during operational readiness reviews of gas centrifuge enrichment plants. This method used information from licensee Integrated Safety Analyses.

*Initiated Risk-Informed Review of the Yucca Mountain License Application.* The staff continues its review of the Yucca Mountain license application using the Yucca Mountain Review Plan, risk insights baseline, and review team strategies previously developed to conduct a risk-informed review.

The Commissioners

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COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

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Office of Nuclear Regulatory Research

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