Recent Accomplishments and Near-Term Anticipated Accomplishments

This summary highlights the major risk-informed and performance-based initiatives that the staff of the U.S. Nuclear Regulatory Commission (NRC) has either completed over the past 6 months, or scheduled to be conducted over the next 6 months.

1. **Fire Protection for Nuclear Power Plants**

   The staff continues its effort to implement the risk-informed Fire Protection Rule and conduct fire protection research activities. The following summaries highlight the past and planned accomplishments in this area:

   - In 2004, the staff completed rulemaking to endorse a voluntary alternative risk-informed Fire Protection Rule for operating nuclear power plants, as set forth in Title 10, Section 50.48(c), of the *Code of Federal Regulations* [10 CFR 50.48(c)]. The final rule endorsed consensus standard NFPA-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," promulgated by the National Fire Protection Association (NFPA). In addition, in conjunction with the rule, the Nuclear Energy Institute (NEI) developed NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," which the staff endorsed in Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants." The staff has also chosen two pilot plants (Oconee Nuclear Station and Shearon Harris Nuclear Power Plant) and, to date, 42 operating nuclear power plants have submitted letters of intent to adopt NFPA-805 as their licensing basis.

   - During the past 6 months, as part of the NFPA 805 implementation process, the staff has conducted three pilot plant observation visits and conducted numerous public meetings with those pilots and the NEI 805 Task Force. The staff also issued a Regulatory Information Summary (RIS 2007-19) to formalize the "frequently asked questions" process, and participated in the NEI Fire Protection Information Forum. In addition, the staff is continuing its review of NEI's request for additional enforcement discretion.

   - In the area of fire modeling, in May 2007, the NRC published NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications." The staff also initiated the next phase of the fire modeling project, which will consist of a collaborative effort with the Electric Power Research Institute to develop a fire model user's guide for nuclear power plant applications. In addition, the staff held the Fire Model Phenomena Identification and Ranking Technique meeting and issued NUREG/CR-6931, regarding the Cable Response to Live Fire test project, as a draft for public comment.

   - Over the next 6 months, the staff expects to conduct two additional NFPA 805 pilot observation visits and a review of the fire-related probabilistic risk assessment (PRA) for each pilot plant. The staff will also continue to conduct monthly FAQ-related public meetings with the NEI 805 Task Force and reach a resolution regarding NEI's request for additional enforcement discretion. In addition, the staff plans to host a fire protection workshop for regional inspectors.

2. **Digital Systems PRA**

The Risk-Informing Digital Instrumentation and Control Task Working Group (TWG), in support of the Digital Instrumentation and Control Steering Committee, is addressing issues related to the risk assessment of digital systems. In so doing, the TWG is placing particular emphasis on risk-informing digital system reviews for operating plants, new reactors, and fuel cycle facilities. The TWG's efforts will be consistent with the NRC's Policy Statement on PRA, which states, in part, that the agency supports the use of PRA in 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." Toward that end, the TWG issued the Digital System Project Plan on July 12, 2007, and has held three public meetings with industry stakeholders since April 2007. Also, in November 2007, the staff plans to issue draft interim staff guidance (ISG) for use in reviewing current methods in modeling digital systems for design certification and combined operating license (COL) application PRAs. (The staff plans to issue the final ISG in March 2008.) In addition, over the next 6 months, the staff plans to publish a contractor-prepared NUREG-series report on approaches for using traditional PRA methods for digital systems, and another on the benchmark implementation of two dynamic methodologies for reliability modeling of digital systems. These two reports are part of the agency's overall effort to advance the state-of-the-art in digital systems risk and reliability modeling to the point where it will be possible to risk-inform licensing reviews for digital systems and incorporate related models into nuclear power plant PRAs.

3. **Risk-Informed Environment**

In December 2006, the staff issued an action plan entitled "Fostering a Risk-Informed Environment in the Office of Nuclear Reactor Regulation." That plan outlined five major actions designed to broaden the staff's knowledge and application of risk insights in its day-to-day activities. Specifically, those five actions related to staff qualification plans and training, first-line supervisors' risk knowledge, and knowledge management tools. Since that time, the staff has completed all five actions. The staff also added a unit on risk-informed regulation to the office qualification plans, and created a Web-based forum for knowledge management in the area of risk-informed regulation. In addition, an interoffice PRA Training Focus Group developed two new basic courses on risk-informed regulation for managers and non-PRA technical staff. Those courses were piloted in the fourth quarter of Fiscal Year (FY) 2007, and are now included in the curriculum offered by the NRC's Technical Training Center.

4. **Risk-Informed Technical Specifications (RITS)**

The staff continues to work on the RITS initiatives to add a risk-informed component to the standard technical specifications (STS). The following summaries highlight the major accomplishments in this area:

- Initiative 1, "Modified End States," would allow equipment to be repaired during hot-shutdown rather than cold-shutdown. The topical reports supporting this initiative for boiling-water reactor (BWR), Combustion Engineering (CE), and Babcock & Wilcox (B&W) plants have been approved, and revisions to the BWR and CE STS have been made available. The Westinghouse

topical report, submitted in September 2005, is currently under review, with approval anticipated in FY 2008, while revisions to the B&W STS are expected to be issued in January 2008.

- Initiative 4b, "Risk-Informed Completion Times," modifies technical specification completion times to reflect a configuration risk management approach that is more consistent with the approach described in the Maintenance Rule, as specified in 10 CFR 50.65(a)(4). The staff also approved Revision 0 of the NEI 06-09, "Risk-Managed Technical Specifications (RMTS) Guidelines: Industry Guidance Document," in April 2007, and issued the license amendment for the first pilot plant (South Texas Project) in July 2007. In addition, the submittal from the second pilot plant (Ft. Calhoun Station) is expected in FY 2008.

- Initiative 5b, "Risk-Informed Surveillance Frequencies," relocates surveillance test intervals to a licensee-controlled document and provides a risk-informed method to change the intervals. Toward that end, the staff approved the industry's guidance document (Revision 0 of NEI 04-10) in September 2006, along with the license amendment for the pilot plant (Limerick Generating Station). Revision 1 of NEI 04-10, which proposes to relocate staggered testing requirements and makes other administrative changes, is currently under staff review, with approval anticipated in FY 2008. In addition, the staff is currently reviewing the associated Technical Specification Task Force guidance (TSTF-425) to revise the STS, which the staff expects to approve and make available via the Consolidated Line Item Improvement Process in FY 2008.

- Initiative 6, "Modification of Limiting Condition for Operation (LCO) 3.0.3, 'Actions and Completion Times'," revises the surveillance requirement LCO by requiring that risk be taken into account in determining the correct course of action. A revised CE topical report will be submitted for staff review in Fall 2007. That topical report will support a future revision of the CE Standard TS to incorporate this initiative. In addition, a topical report for Westinghouse plants is expected to be submitted in FY 2008.

5. **Risk-Informed Decision-Making**

The Office of Nuclear Reactor Regulation (NRR) developed Revision 1 of its Office Instruction LIC-504, "Integrated Risk-Informed Decision-Making for Emergent Issues," to address recommendations that the U.S. Government Accountability Office raised in its report, GAO-04-415, entitled "Nuclear Regulation — NRC Needs To More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant's Shutdown," issued in May 2004. The staff subsequently issued Revision 2 of LIC-504 on February 12, 2007, to incorporate comments from pilot applications of Revision 1. In addition, the staff presented an overview of LIC-504, as well as training on critical thinking and decision-making, to the NRR Executive Team and Leadership Team on April 19, 2007, and to the NRR Branch Chiefs on June 26, 2007.

6. **Risk-Informed Rulemaking Activities Currently in Progress**

- The staff prepared a proposed rule containing emergency core cooling system

evaluation requirements, as an alternative to those specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems (ECCS) for Light-Water Nuclear Power Reactors," which could be used in lieu of the current requirements. That proposed rulemaking is designed to redefine the large-break loss-of-coolant accident (LOCA) requirements to provide a risk-informed alternative maximum break size. Since October 2006, the staff produced a draft final rule and briefed the NRC's Advisory Committee on Reactor Safeguards (ACRS). In response, the ACRS recommended that Commission should not issue the proposed rule in its present form. As a result, the staff prepared SECY-07-0082, "Rulemaking To Make Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements: 10 CFR 50.46a, 'Alternative Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors'," dated May 16, 2007, which provided a plan (including resource and schedule estimates) for responding to the ACRS recommendation and related comments. Then, in an SRM related to SECY-07-0082, August 10, 2007, the Commission agreed with the staff's recommendation that the rulemaking should be assigned a medium priority. Nonetheless, the SRM also stated the Commission's expectation that the staff would continue to make progress on the 10 CFR 50.46 rulemaking and apply resources to the effort in FY 2008. The staff anticipates issuing the final NUREG-series report on expert elicitation results for LOCA frequencies by December 2007.

- In 2005, the staff completed the development of the technical basis to support a risk-informed rulemaking to modify the pressurized thermal shock screening criteria in 10 CFR 50.61. That technical basis was reviewed at various stages by the NRC's external stakeholders, a select external peer review panel of technical and regulatory experts, the ACRS, and various NRC technical staff. In addition, in July 2006, the staff made the technical basis reports available for public review and comment, and published the final reports in December 2006. The staff also issued SECY 07-0104, "Proposed Rulemaking — Alternate Fracture Toughness Requirements for Protection against Pressurized Thermal Shock Events (RIN 3150-AI01)" on June 25, 2007. That paper requested the Commission's approval to publish for public comment a proposed rule that would provide new fracture toughness requirements for pressurized-water reactors. In response, on September 11, 2007, the Commission directed the staff to proceed with soliciting public comments. The proposed rule was published in the *Federal Register* for public comment on October 3, 2007 (72 FR 56275).

- The staff received and evaluated public comments on the Advanced Notice of Proposed Rulemaking (71 FR 26267) regarding whether to issue a risk-informed and performance-based revision of 10 CFR Part 50 for advanced reactors (which would become 10 CFR Part 53). After considering those comments, the staff prepared SECY-07-0101, "Staff Recommendations Regarding a Risk-Informed and Performance-Based Revision to 10 CFR Part 50 (RIN 3150-AH81)," dated June 14, 2007. In that paper, the staff recommended that the Commission should approve deferring the rulemaking until after the development of the licensing strategy for the Next-Generation Nuclear Plant or receipt of a design certification or license application for the Pebble Bed Modular Reactor. In response, in an SRM dated September 10, 2007, the Commission approved the staff's recommendation.

7. **High-Level Waste**

The staff completed Version 5.1 of the Total-System Performance Assessment code in June 2007, followed by a related comprehensive user's guide in July 2007. The purposes of these efforts were to (1) facilitate calculations beyond 10,000 years, (2) incorporate proposed revisions to the regulatory requirements specified in 10 CFR Part 63, and (3) accommodate a review of potential U.S. Department of Energy design changes.

8. **Byproduct Materials Rulemaking**

The Commission approved the final rulemaking regarding exemptions from the licensing and reporting requirements specified in 10 CFR Parts 30, 31, 32, and 150 for general licenses and distribution of byproduct material (SECY-07-0113). This rulemaking was risk-informed, in part, by NUREG-1717, "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials." The Commission published the final rule in the *Federal Register* on October 16, 2007 (72 FR 58473).

9. **Analytical Tools for Risk Applications**

For Version 7 of the Systems Analysis Program for Hands-on Analysis and Integrated Reliability Evaluations (SAPHIRE) code, the staff completed a module to perform uncertainty analysis for importance measures. In addition, over the next 6 months, the staff plans to complete a modification to SAPHIRE 7 to implement a new common-cause failure evaluation module, and complete the SAPHIRE 8 beta release for acceptance review.

10. **Industry Trends Program Support**

Over the past 6 months, the staff published the following contractor-prepared NUREG-series reports:

- NUREG/CR-6932, "Baseline Risk Index for Initiating Events (BRIIE)"
- NUREG/CR-6268, Revision 1, "Common-Cause Failure Database and Analysis System: Event Collection, Classification, and Coding"
- NUREG/CR-6928, "Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants"

In addition, the staff updated the NRC's public Web site with trends, charts, and graphs for system and component studies, common-cause failures, and initiating events through FY 2005.

11. **Reactor Performance Data Collection Program**

Over the past 6 months, the staff updated the Integrated Data Collection and Coding System with FY 2007 data and provided the data to the Operating Experience Clearinghouse. In addition, the staff updated the agency's LERSearch database to reflect the latest licensee event reports (LERs) and to add LERs from 1981. The staff will further enhance that database in FY 08 to provide additional

search options and provide more risk-related operational data.

12. **Standardized Plant Analysis Risk (SPAR) Model Development**

Over the past 6 months, the staff completed the following SPAR model development activities:

- cut-set-level reviews of 17 models
- the Browns Ferry Unit 1 interim model (to support the plant's restart in May 2007)
- six external events models, including two to support the State-of-the-Art Reactor Consequence Analyses
- two new next-generation low-power/shutdown models

The staff also initiated a project to extend the SPAR models for three plant classes to support analyses beyond Level 1. In addition, an addendum to the memorandum of understanding between the EPRI and the NRC's Office of Nuclear Regulatory Research (RES) was approved by RES to address the resolution of key PRA-related technical issues with industry stakeholders.

In FY 2008, the staff will continue to implement enhancements to the Revision 3 SPAR models and complete additional external events and low-power/shutdown models to support the Accident Sequence Precursor program and the Significance Determination Process. In addition, the staff plans to extend the Level 1 SPAR models to incorporate containment systems for six additional plant classes.

13. **Phased Approach to PRA Quality**

The increased use of PRAs in the NRC's regulatory decision-making process requires consistency in the quality, scope, methodology, and data used in such analyses. A key aspect of implementing a phased approach to PRA quality is the development of PRA standards and related guidance documents. To achieve that objective, professional societies, the nuclear industry, and the staff have undertaken initiatives to develop national consensus standards and guidance on the use of PRA in regulatory decision-making.

Over the next 6 months, the staff expects to initiate work on Revision 2 of RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." That revision will endorse the "Level 1 and Large Early Release Frequency (LERF) PRA Standard (ASME/ANS RA-S-2007), promulgated by the American Society of Mechanical Engineers (ASME) and the American Nuclear Society (ANS), which applies to at-power internal events, internal fire events, and external events.

With the issuance of Revision 1 of RG 1.200, which endorsed the ASME standard for a Level 1/LERF PRA of internal events at-power, and in anticipation of Revision 2 of RG 1.200, the staff also began developing Web-based training on the use of RG 1.200, which will be completed early in 2008. In addition, the staff entered into a cooperative agreement with ASME to develop training on its Level 1/LERF PRA standard for internal events at-power. That training will involve three major modules. Module 1, which will be ready late in 2007, will be Web-based and targeted toward both analysts and managers. Module 2, which will be ready early in 2008, will also be Web-based

and targeted toward analysts and managers. Module 3, which will be ready in mid-2008, will be classroom training targeted exclusively toward PRA analysts.
Finally, the staff plans to issue draft NUREG-1855, "Treatment of Uncertainties from PRAs in Risk-Informed Decision-Making," for public review and comment. That NUREG-series report provides information and guidance on uncertainties associated with PRA, including their impact on PRA results and decision-making.

14. **Risk Insights in Support of New Reactor License Application Reviews**

In September 2007, the staff completed the development of risk insights for the Advanced Boiling Water Reactor (ABWR). The ABWR risk insights will assist the staff in performing risk-informed review of the COL application for South Texas Project Units 3 and 4. The staff is also developing risk insights for the AP1000 and ESBWR designs. These risk insights are expected to be completed in the near future to support the review of upcoming COL applications.