

POLICY ISSUE  
(Information)

October 31, 2014

SECY-14-0121

FOR: The Commissioners

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

SUBJECT: Annual Update of the Risk-Informed Activities Public Web Site

PURPOSE:

This paper provides the Commission with summary of major activities contained in the Risk-Informed Activities public web site, including new activities. This paper does not address any new commitments or associated resource implications.

BACKGROUND:

On June 1, 2006, the Commission issued a staff requirements memorandum (SRM) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML061520304) that directed the U.S. Nuclear Regulatory Commission (NRC) staff to improve on the Risk-Informed Regulation Implementation Plan (RIRIP) by developing an integrated master plan for activities designed to help the 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 on the purpose and use of probabilistic risk assessment (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."

CONTACT: Dale Yeilding, RES/DRA  
301-251-7577

To meet the Commission's expectations for both a risk-informed and a performance-based regulatory structure, Enclosure 1 to SECY-07-0074 included explicit criteria for the staff's review and consideration of performance-based approaches to 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 (RPP)," dated October 31, 2007 (ADAMS Accession No. ML072700587), discussed the staff's progress in implementing the RPP and included 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 available to the general public through the agency's public Web site. The NRC provided its most recent version of the public Web site list of risk-informed activities as SECY-13-0118, "Annual Update of the Risk-Informed Activities Public Web Site," dated November 7, 2013 (ADAMS Accession No. ML13273A030).

### DISCUSSION:

This Commission paper contains summary information on 19 of the more significant ongoing risk-informed and performance-based activities. More comprehensive and detailed information for all risk-informed activities appears on the NRC's public Web site at <http://www.nrc.gov/about-nrc/regulatory/risk-informed/rpp.html>. The Web site provides a readily accessible overview and current status of the agency's risk-informed and performance-based regulatory activities, updated at least annually coincident with this paper. Five new risk-informed activities were added to the operating reactor sub-arena this year as described below in items 1-5. Items 6-19 are ongoing activities updated from their status reported to the Commission last year.

The following regulatory initiatives are summarized here, with more details in the enclosure:

#### 1. NRC Risk-Informed Steering Committee

The NRC's Risk-Informed Steering Committee (RISC) is an NRC senior management committee with representatives from key offices that provides strategic direction to the NRC staff to advance the use of risk-informed decisionmaking in licensing, oversight, rulemaking, and other regulatory areas, consistent with the Commission's PRA policy statement. The RISC serves as an NRC interface with industry for risk-informed, performance-based activities.

#### 2. Risk Prioritization Initiatives

This initiative will encourage development of high quality PRA models for power reactor licensees to use and will propose a schedule for implementing regulatory actions as an integrated set and in a way that reflects their risk significance on a plant-specific basis.

#### 3. Risk-Informed Framework for Spent Fuel Storage

The staff is developing a risk-informed framework to better enable the staff to focus spent fuel storage and transportation regulatory efforts, improve guidance, streamline casework activities, help assess changes under Title 10 of the Code of Federal Regulations (10 CFR) 72.48, "Changes, Tests, and Experiments," and evaluate requests for exemptions to the regulations while maintaining appropriate margins of safety and security.

#### 4. Interim Staff Guidance on PRA Technical Adequacy for Advanced Light-Water Reactors

The staff has issued for public comment guidance for applicants' use of the American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA standard to assess the technical adequacy of their PRA for design certification application and combined license applications.

#### 5. Risk Management Regulatory Framework

In 2012, the Commission directed the staff to review NUREG-2150, "A Proposed Risk Management Regulatory Framework," to identify options and make recommendations, including the potential development of a Commission policy statement. In 2014, the Commission provided further direction to provide a description of any interrelationships of ongoing risk-informed initiatives. The staff is evaluating the regulatory framework recommendations in NUREG-2150 and other alternatives to develop recommendations for the Commission on potential regulatory framework changes across all NRC program areas.

#### 6. Probabilistic Flood Hazard Assessment (PFHA)

NUREG/CP-0302, "Proceedings for the Workshop on Probabilistic Flood Hazard Assessment," issued in October 2013, documented the proceedings of the PFHA workshop including recommendations that were considered in the development of an NRC research plan on flooding. The proceedings provide a summary of significant observations, insights and identified opportunities for collaboration among the Federal agency partners (U.S. Army Corps of Engineers, U.S. Geological Survey, Bureau of Reclamation, Federal Energy Regulatory Commission, National Oceanic and Atmospheric Administration, National Weather Service, and U.S. Department of Energy) to share information on PFHAs for hazards such as: flood-induced dam and levee failures; tsunami flooding; riverine flooding, local intense precipitation and storm surges.

#### 7. Regulatory Framework for Extended Storage and Transportation of Spent Nuclear Fuel (SNF)

Staff will use risk-information and performance-based approaches in gap assessments to identify technical and regulatory needs to expand the basis for regulating the extended storage and transportation of SNF.

#### 8. Methods, Tools and Guidance for Including Digital Systems in Nuclear Power Plant PRAs

Staff continues to develop methods and analytical tools for including models of digital systems in nuclear plant PRAs. Recent efforts have focused on performing statistical testing of a pilot digital instrument and control system and development of a network model for estimating software reliability.

#### 9. Risk Assessment Methodology for Reprocessing Facilities

Staff will identify changes to existing regulatory requirements that are necessary to license a reprocessing facility using risk insights for the variety of chemical-radiological

operations associated with the radiological risks for fission product and actinide separations.

#### 10. Debris Accumulation on PWR Sump Performance, Generic Issue (GI)-191

Staff efforts for the generic issues program and 10CFR50.46(c) rulemaking are considering debris accumulation on the emergency core cooling sump screen that might restrict water flow to the pumps, following a loss-of-coolant accident (LOCA). For one of the agency approved resolution paths, licensees can calculate the portions of core damage frequency and large early release frequency attributable to debris and compare them to the risk acceptance guidelines in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis."

#### 11. Emergency Core-Cooling System Redefined LOCA Large Break Size

The staff's proposed rulemaking is considering redefining the large-break LOCA requirements to provide a risk-informed alternative maximum break size. Staff plans to evaluate an approach using the Risk Management Regulatory Framework approach recommended in NUREG-2150, as well as alternative approaches that will be presented in a future SECY paper.

#### 12. Standardized Plant Analysis Risk Models

The staff continues to maintain and improve models that are used for accident progression from systems, components and operator actions to assess the risk of events and degraded conditions.

#### 13. Human Reliability Analysis (HRA) Methods and Practices

The staff's HRA efforts are addressing the suitability of methods for NRC applications, striving to improve consistency among practitioners by providing improved methods and guidance for quantifying human reliability.

#### 14. Improvements to Standard Technical Specifications

The staff has developed three initiatives to implement risk-informed technical specifications (TS): 1) allow hot shutdown repairs, 2) modify TS completion times, and 3) add actions to preclude entry into limiting condition for operation (LCO) 3.0.3, (times to shutdown modes when LCO and associated actions are not met).

#### 15. National Fire Protection Association Standard 805

Staff is reviewing 19 licensee applications to change the power reactor licensing basis to National Fire Protection Association 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," a standard endorsed through 10 CFR 50.48(c), which uses PRA to transition from existing deterministic fire protection programs. Fire PRA is an integral part of the new licensing basis, and includes both quantitative evaluations of the base risk and changes to the base risk following the guidance in RG 1.174.

16. Revise the Fuel Cycle Oversight Process (RFCOP)

In accordance with the RFCOP Project Plan, the staff will develop an approach to use risk-information to determine the significance of inspection findings at fuel cycle facilities.

17. Full-Scope Site Level 3 PRA

Staff is conducting a full-scope site Level 3 PRA that addresses all internal and external hazards; all plant operating modes; and all reactor units, spent fuel pools, and dry cask storage.

18. Approach for Special Treatment Requirements Categorizing Structures, Systems and Components According to Safety Significance

The staff approved a licensee pilot license amendment, to implement 10 CFR 50.69, "Inspections, Records, Reports, Notifications," safety significance of SSCs. Following the initial pilot application, lessons learned from the application review will be used to revise the associated industry guidance and RG 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance."

19. Risk-Informed Reactor Oversight Process for New Reactors

The staff is developing appropriate performance indicators and thresholds for new reactors for use in the reactor oversight process. The staff is also evaluating how to enhance the significance determination process for new reactors through development of a structured qualitative assessment for events or conditions that are not evaluated in the supporting plant risk models, such as passive safety systems, digital instrumentation and control, and human performance issues.

COORDINATION:

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

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**Michael Case /for/**

Brian W. Sheron, Director  
Office of Nuclear Regulatory Research

Enclosure:

[Risk-Informed Activities Summary and 2014 Update](#)

## **Risk-Informed Activities Summary and 2014 Update**

This summary highlights the 19 major risk-informed and performance-based initiatives that the staff of the U.S. Nuclear Regulatory Commission (NRC) is currently working on or has recently completed in 2014.

### **1. NRC Risk-Informed Steering Committee**

The NRC's Risk-Informed Steering Committee (RISC) is an NRC senior management committee that provides strategic direction to the NRC staff to advance the use of risk-informed decisionmaking in licensing, oversight, rulemaking, and other regulatory areas, consistent with the Commission's probabilistic risk assessment (PRA) policy statement. The NRC's RISC is chaired by the Director of the Office of Nuclear Reactor Regulation (NRR), and includes as members the deputy office directors from the Office of New Reactors (NRO), Office of Nuclear Regulatory Research (RES), Office of Nuclear Security and Incident Response (NSIR), and Office of Nuclear Material Safety and Safeguards (NMSS), as well as the Region I regional administrator. The NRC RISC has held several public meetings with the industry's own RISC. The industry's RISC is a counterpart to the NRC RISC and its membership is comprised of licensee chief nuclear officers and other senior level executives, as well as representatives from the Nuclear Energy Institute (NEI). The NRC and industry each agreed to form two working groups to focus on guidance in two selected areas related to PRA technical adequacy and to deal with uncertainties in risk-informed decisionmaking. These working groups are holding public meetings to continue the efforts and have presented problem statements and action plans to the RISC.

### **2. Risk Prioritization Initiative**

In February 2013, the Commission approved Staff Requirements Memorandum (SRM) COMGEA-12-0001/COMWDM-12-0002, "Proposed Initiative to Improve Nuclear Safety and Regulatory Efficiency," dated February 6, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13037A541) to further explore the idea of enhancing nuclear safety and regulatory efficiency by applying PRA. This initiative could encourage the development of high-quality, plant-specific PRA models by allowing licensees to use PRA models to propose a schedule for implementing regulatory actions as an integrated set and in a way that reflects their risk significance on a plant-specific basis. The staff is developing options to present to the Commission in March 2015.

### **3. Risk-Informed Framework for Spent Fuel Storage**

This initiative includes the development of a risk-informed framework to better enable the staff to focus spent fuel storage and transportation regulatory efforts, improve guidance, streamline casework activities, help assess Title 10 of the Code of Federal Regulations (10 CFR) 72.48 ("Changes Tests, and Experiments") changes, and evaluate requests for exemptions to the regulations while maintaining appropriate margins of safety and security.

### **4. Interim Staff Guidance on PRA Technical Adequacy for Advanced Light-Water Reactors**

The staff is currently developing interim staff guidance (ISG). ISG DC/COL-ISG-028, "Assessing the Technical Adequacy of the Advanced Light-Water Reactor (ALWR) Probabilistic Risk Assessment for the Design Certification Application and Combined License Application," will

Enclosure

provide guidance on how applicants can use the American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA Standard (RA-Sa-2009), "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," for assessing the technical adequacy of their PRA. This ISG supplements Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," to address the pre-operational phases (e.g., 10 CFR Part 52 ("Licenses, Certifications, and Approvals for Nuclear Power Plants") licensing) and large release frequency (LRF) for ALWRs. The staff plans to incorporate the ISG into RG 1.200, RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR edition)," and Standard Review Plan 19.0, "Standard Review Plan, Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors," following the issuance of the next edition of the PRA standard. The NRC issued the ISG for a 30-day public comment period on October 14, 2014, (ADAMS Accession No. ML14248A683). The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on Reliability and PRA was briefed on this ISG before it was issued for public comment.

## 5. Risk Management Regulatory Framework

NUREG-2150, "A Proposed Risk Management Regulatory Framework," (ADAMS Accession No. ML12109A277) recommended that the NRC adopt a risk management regulatory framework applicable to all NRC program areas. The Chairman's tasking memorandum dated June 14, 2012 (ADAMS Accession No. ML121660102) directed the staff to review NUREG-2150 and identify options and make recommendations, including the potential development of a Commission policy statement. The Commission's SRM dated May 19, 2014, (ADAMS Accession No. ML14139A104) on SECY-13-0132 (ADAMS Accession No. ML13277A413) directed that the staff's paper providing recommendations with respect to NUREG 2150 also include "a description of any interrelationships of ongoing risk-informed initiatives to ensure the activities are well coordinated, and effectively planned and implemented."

## 6. Probabilistic Flood Hazard Assessment

In cooperation with the NRC's Federal partners; U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), Bureau of Reclamation (BoR), Federal Energy Regulatory Commission (FERC), National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS) and Department of Energy (DOE), the Office of Nuclear Regulatory Research organized a workshop on probabilistic flood hazard assessment (PFHA) that was held on January 29–31, 2013. The NRC published the workshop proceedings as NUREG/CP-0302, "Proceedings of the Workshop on Probabilistic Flood Hazard Assessment (PFHA)," in October 2013 (see: <http://www.nrc.gov/reading-rm/doc-collections/nuregs/conference/cp0302/> ).

NUREG/CP-0302 documents the presentations and panel discussions on probabilistic flood-hazard assessments for hazards from the Federal community. The topics included: Federal agencies' interests and needs in the following:

- PFHA
- flood hazards
- extreme precipitation events

- flood-induced dam and levee failures
- tsunami flooding
- riverine flooding
- storm surges for coastal areas
- combined events flooding

The proceedings provide a summary of significant observations, insights and identified opportunities for collaboration among the federal agency to share information on PFHAs for hazards such as: flood-induced dam and levee failures; tsunami flooding; riverine flooding, local intense precipitation flooding, and storm surges. The NRC established a public Web site for viewing the video of the workshop, presentation slides and agenda at:

<http://www.nrc.gov/public-involve/public-meetings/meeting-archives/research-wkshps.html>

Following the workshop, the NRC staff briefed the ACRS on the insights and recommendations from the PFHA workshop; discussed how this information is being used in development of an RES research plan on flooding; and conducted a bilateral technical exchange with the French regulatory authority on PFHAs and flood protection in cooperation with U.S. Federal partners; USACE, USGS and NWS.

The NRC in partnership held two follow-up workshops that were recommended in NUREG/CP-0302: (1) FERC-NRC workshop on expert elicitation and assessment based on lessons from the Senior Seismic Hazard Analysis Committee process; and (2) the Subcommittee of Hydrology/Extreme Storm Event Work Group workshop to define needed storm products (e.g., Storm Catalogue, NOAA Atlas 14, updating of hydrometeorological reports for probable maximum precipitation estimates) for assessing floods.

A PFHA research plan was completed that describes a set of the research projects and tasks that the NRC will implement to enhance the NRC's risk-informed and performance-based regulatory approach with regard to external flood hazard assessment. This plan incorporates needs from both NRR and NRO and is currently under final review for concurrence.

#### 7. Regulatory Framework for Extended Storage and Transportation (EST) of Spent Nuclear Fuel (SNF)

The staff completed a technical gap assessment using a risk-informed and performance-based approach to expand the technical basis for regulating the extended storage and transportation of SNF. The staff is conducting additional research to enhance the technical bases in the areas of aging management, thermal behavior, functional monitoring, concrete degradation and cladding stress of spent fuel in dry cask storage systems.

The staff continues to focus on the assessment of technical areas related to EST. The staff is evaluating potential policy issues already identified in the proposed regulatory program review, COMSECY-10-0007, "Project Plan for the Regulatory Program Review To Support Extended Storage and Transportation of Spent Nuclear Fuel," June 15, 2010 (ADAMS Accession No. ML101390216).

As discussed in SECY-13-0057, "Annual Status Report: Activities Related to Extended Storage and Transportation," May 31, 2013 (ADAMS Accession No. ML13130A148), the goal of the EST project is to identify what changes in the NRC's regulatory framework might be needed for extended storage and transportation of SNF. This goal requires assessment of both technical and potential regulatory issues. With the anticipated resources, the staff projects that this assessment will be completed by 2021, in accordance with the previous schedule set forth in the 2013 Annual Status Report, COMSECY-10-0007.

At this point, the staff anticipates that the EST project is more likely to lead to changes in staff guidance and inspection procedures, rather than changes in regulations. Although the EST project encompasses both technical and potential regulatory issues, most of the staff's focus this past year has been on technical areas associated with EST.

As discussed in the 2013 Annual Status Report paper, future plans for EST involve continued assessment using results of work done by the NRC, industry, and other parties (e.g., DOE). The staff will use the technical information and the associated risk insights to inform decisions on potential revisions to guidance and regulations.

#### 8. Methods, Tools, and Guidance for Including Digital Systems in Nuclear Power Plant PRAs

Digital instrumentation and control (I&C) systems have unique characteristics compared with analog I&C systems, such as using software, and may have different failure causes or modes; hence, incorporating them into nuclear power plant (NPP) PRAs entails special challenges.

Since digital I&C systems are expected to play an increasingly important safety role at NPPs, the NRC established a plan for digital system research defining a coherent set of projects to support regulatory needs (ADAMS Accession No. ML100541484). One of the projects included in this research plan addresses risk assessment methods and data for digital systems (described in Section 3.1.6 of the plan). The objective of the NRC's digital system risk research is to identify and develop methods, analytical tools, and regulatory guidance for (1) including models of digital systems in NPP PRAs, and (2) incorporating digital systems in the NRC's risk-informed licensing and oversight activities.

The staff has previously completed substantial work in modeling digital system hardware within a PRA context. Current research activities are focused on the quantification of software reliability. The staff recently catalogued potential quantitative software reliability methods to identify a set of methods with desirable characteristics suitable for quantifying software failure rates and per-demand failure probabilities of digital systems in PRAs. Based on this evaluation, the staff selected the Bayesian Belief Network (BBN) approach and statistical testing method (STM) to be applied to an example software-based protection system to demonstrate their feasibility, practicality, and usefulness in NPP PRAs. RES is currently performing proof-of-concept studies applying the BBN and STM approaches to a protection function of the Loop Operating Control System of the Idaho National Laboratory Advanced Test Reactor. In fiscal year (FY) 2015 and beyond, the staff plans to continue to support digital I&C PRA research consistent with the agency's digital I&C research plan.

## 9. Apply Risk Assessment Methodology for Reprocessing Facilities

In SRM-SECY-07-0081, "Regulatory Options for Licensing Facilities Associated with the Global Nuclear Energy Partnership," dated June 28, 2007 (ADAMS Accession No. ML071800084), the Commission directed the NRC staff to conduct a regulatory gap analysis and to identify changes in the regulatory requirements necessary to license a potential reprocessing facility. The staff's gap analysis identified 14 "high priority," 5 "intermediate priority," and 4 "low priority" gaps in existing regulations (ADAMS Accession Nos. ML091520280, and ML091520365). In 2011, the staff issued a draft regulatory basis document that identified alternative methods for resolving the 19 high and intermediate priority gaps (ADAMS Accession No. ML113202350). In SRM-SECY-11-0163 dated August 30, 2012 (ADAMS Accession No. ML122430189), the Commission directed the staff to provide, within 1 year, a notation vote paper providing the staff's assessment of the current state of activity (DOE and industry plans) regarding reprocessing, its recommendations regarding the need for continued effort to develop a rule, and the anticipated schedule and resources required to complete the rule, as well as an appropriate range of options. In SECY-13-0093 "Reprocessing Regulatory Framework – Status and Next Steps," (ADAMS Accession No. ML13178A243) dated July 1, 2013, the staff responded to SRM-SECY-11-0163 recommending a new regulation (10 CFR Part 7x) and finalization of the regulatory basis for licensing a reprocessing facility. In SRM SECY-13-0093 dated November 4, 2013, the Commission approved the staff's recommendation to develop 10 CFR Part 7x for reprocessing, but directed the staff to limit the scope of its efforts for the time being to resolving only one high-priority gap (Gap 5 on safety and risk assessment methodologies). The Commission also directed the staff to remain cognizant of developments in advanced fuel cycle technologies and to continue to coordinate and participate with DOE and the U.S. Environmental Protection Agency (EPA) in regulatory and scientific programs related to advanced fuel cycle technologies. The NRC staff is currently expending limited resources towards resolving Gap 5. The results of this effort may provide insights for the staff's ongoing multiyear effort to revise the fuel cycle oversight process.

## 10. Debris Accumulation on PWR Sump Performance, GI-191<sup>1</sup>

The generic safety issue (GI)-191 addresses the effects of debris on the Emergency Core Cooling System (ECCS) following a loss-of-coolant accident (LOCA). Research originally concluded that debris clogging of sump strainers could lead to recirculation system ineffectiveness as a result of a loss of net positive suction head for the ECCS and containment spray system (CSS) pumps. Resolution of GI-191 currently involves two distinct but related safety concerns: (1) potential clogging of the sump strainers that results in ECCS or CSS pump failure; and (2) potential clogging of flow channels within the reactor vessel by debris that penetrates or bypasses the sump strainer (in-vessel effects).

Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," requested that addressees perform an evaluation of the ECCS and CSS recirculation functions in light of the information

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<sup>1</sup> The NRC identifies Generic Issues (GI) through the assessment of plant operation, involving public health and safety, the common defense and security, or the environment that could affect multiple entities under NRC jurisdiction. These issues are documented and tracked through resolution. These issues were previously identified as Generic Safety Issues (GSI) with the program described in Management Directive 6.4 (Generic Issues Program) and NUREG-0933, (Resolution of Generic Safety Issues).

provided in the letter and, if appropriate, take additional actions to ensure system function. Of the several resolution paths approved by the Commission, two rely on risk-informed decisionmaking. One allows risk-informing the overall effects of debris on long term core cooling for both the strainer and in-vessel effects, and the other addresses the strainer portion deterministically, with only in-vessel effects being risk-informed. In addition, the intent of part of an ongoing 10 CFR 50.46(c) rulemaking is to codify some limited use of risk in evaluating debris and long term core cooling related to these issues.

#### 11. Emergency Core-Cooling System Redefined LOCA Large Break Size

The staff prepared a proposed rule containing emergency core-cooling system evaluation requirements that could be used as an alternative to the current requirements in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems (ECCS) for Light-Water Nuclear Power Reactors." This proposed rulemaking is designed to redefine the large-break loss-of-coolant accident requirements to provide a risk-informed alternative maximum break size. In October 2006, the staff produced a draft final rule and briefed the ACRS.

In response, the ACRS recommended that the 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 (ADAMS Accession No. ML070180466), to provide a plan (including resource and schedule estimates) for responding to the ACRS recommendation and related comments.

Then, in SRM-SECY-07-0082, dated August 10, 2007 (ADAMS Accession No. ML072220595), the Commission agreed with the staff's recommendation that completing the rulemaking should be assigned a medium priority. Nonetheless, the SRM also directed the staff to continue to make progress on the 10 CFR 50.46(a) rulemaking and to apply resources to the effort in FY 2008. On April 1, 2008, the Executive Director for Operations provided the staff's schedule for completing the final rule to the Commission. Following Commission approval, the NRC published a supplemental proposed rule, "Performance-Based Emergency Core Cooling System Acceptance Criteria" (74 FR 40765, August 13, 2009), for public comment. The public comment period ended in January 2010.

After reviewing public comments and making changes to address these comments (and ACRS comments), the staff submitted a final rulemaking package to the Commission for approval on December 10, 2010, in SECY-10-0161, "Final Rule: Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements (10 CFR 50.46(a)) (RIN 3150-AH29)" (ADAMS Accession No. ML102210460). On April 20, 2012, the staff requested withdrawal of the 10 CFR 50.46a final rule from Commission consideration so that the staff could review the rule and ensure its compatibility with the ongoing regulatory framework activities under Recommendation 1 of the Fukushima Near-Term Task Force (NTTF) report. The Commission approved the staff's request in SRM-SECY-10-0161, dated April 26, 2012 (ADAMS Accession No. ML12117A121). The staff does not plan to publish a notice in the *Federal Register* withdrawing the 10 CFR 50.46(a) final rule. In response to the SRM on SECY-13-0132, "Nuclear Regulatory Commission Staff Recommendation for the Disposition of Recommendation 1 of the Near-Term Task Force Report," (ADAMS Accession No. ML13277A413), the staff is requesting an

extension to this and other initiatives, across all NRC program areas, to evaluate the Risk Management Regulatory Framework approach recommended in NUREG-2150 as well as alternative approaches for achieving a risk-informed regulatory framework.

## 12. Standardized Plant Analysis Risk (SPAR) Models

SPAR models are NRC plant-specific PRA models that cover accident sequence progression, plant systems and components, and plant operator actions. These standardized models represent the as-built and as-operated plant to the extent needed to support NRC regulatory activities. As such, they permit the staff to perform risk-informed regulatory activities by independently assessing the risk of events or degraded conditions at operating nuclear power plants. In addition, the NRC staff continues to maintain and improve Version 8 of the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) software to support risk-informed programs. The staff provided the Commission with an update of these activities in SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014 (ADAMS Accession No. ML14230A084). The staff plans to continue the SPAR and SAPHIRE development and maintenance programs consistent with RES and user office needs.

## 13. Human Reliability Analysis (HRA) Methods and Practices

The Commission directed the ACRS in SRM-M061020, "Meeting With Advisory Committee on Reactor Safeguards," November 8, 2006, to "work with the staff and external stakeholders to evaluate the different human reliability models in an effort to propose either a single model for the agency to use or guidance on which model(s) should be used in specific circumstances." In response, the staff in 2012 supported and participated in an international HRA empirical study that involved the collection of reactor operator crew performance observations and comparison with the results of different HRA methods used to evaluate the actions involved in simulated scenarios. The NRC published NUREG-2127, "The International HRA Empirical Study, Lessons Learned from Comparing HRA Methods Predictions to HAMMLAB (Halden Reactor Project's Human-Machine Laboratory) Simulator Data," August 2014. The International HRA Empirical Study, documents the overall lessons learned from the study NUREG/IA-0216, "International HRA Empirical Study-Phase 3 Report," that will be published later in 2014. The staff continues to address issues associated with the differences in HRA methods available for quantifying human failure events in a PRA.

RES signed an agreement with a U.S. utility in March 2011 to collaborate on the collection of human performance information in operator simulator training. The information sources include the licensed-operator simulator training, job performance measures, and emergency drills. To aid in data collection, the staff developed the Scenario Authoring, Characterization, and Debriefing Analysis (SACADA) tool. The staff is currently seeking both U.S. and international collaboration in use of this tool for data collection.

In 2013, under an agreement with a U.S. utility, the staff performed a study to evaluate a specific set of HRA methods used in regulatory applications through a comparison of HRA predictions to crew performance in simulator experiments performed in a U.S. nuclear power plant. The results of this study are being used to determine the potential limitations of data collected in non-U.S. simulators.

The staff collaborated in 2013 with the Electric Power Research Institute (EPRI) to address HRA variability by developing a new HRA method that integrated the strengths and improved the weak areas in existing methods. The approach aims to use an explicit human performance framework for establishing causal relationships of human failures to underlying failure mechanisms through the use of the current understanding of cognitive psychology as a technical basis for postulating failure events, failure mechanisms, and underlying performance drivers. The method will go through further testing in 2014 and 2015.

#### 14. Improvements to Standard Technical Specifications

The staff continues to work on the risk-informed technical specifications (RITS) initiatives to add a risk-informed component to the standard technical specifications (STS). The following summaries highlight these activities:

Initiative 1, "Modified End States," allows licensees to repair equipment during hot shutdown rather than cold shutdown. The topical reports supporting this initiative for boiling water reactor (BWR), Combustion Engineering (CE), Babcock & Wilcox (B&W), and Westinghouse plants have been approved by the staff, and revisions to the BWR, CE, B&W, and Westinghouse STS are available for use (ADAMS Accession Nos. ML093570241, ML093570241, ML103360003, ML093570241).

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). As reported previously in SECY-07-0191, "Implementation and Update of the Risk-Informed and Performance-Based Plan," dated October 31, 2007 (ADAMS Accession No. ML072690619), the staff issued the license amendment for the first pilot plant, South Texas Project, in July 2007.

In July 2010, Southern Nuclear Company submitted a letter of intent for Vogtle (Units 1 and 2) to implement RITS Initiative 4b. The NRC granted the associated fee waiver request and received a pilot application in September 2012, which the staff is currently reviewing. The associated Technical Specification Task Force guidance (TSTF-505) to revise the STS, became available in March 2012.

Initiative 6, "Add Actions To Preclude Entry into LCO 3.0.3," modifies technical specification action statements for conditions that result in a loss of safety function related to a system or component included within the scope of the plant technical specifications. The staff approved the industry's topical report for CE nuclear power plants (Revision 2 to WCAP-16125-NP-A, "Justification for Risk-Informed Modifications to Selected Technical Specifications for Conditions Leading to Exigent Plant Shutdown") in August 2010 (ADAMS Accession No. ML110070500). The associated TSTF guidance (Revision 5 of TSTF-426) to revise the CE STS was submitted for NRC review in November 2011 (ADAMS Accession No. ML113260461). Based on the approved CE topical report, the industry has also submitted requests to revise the B&W STS (Revision 0 of TSTF-538) and the STS for BWRs (Revision 0 of TSTF-540) in March 2012 and May 2012, respectively. Industry has decided not to pursue NRC review of TSTF-538 or TSTF-540 by letters dated January 6, 2014 and October 6, 2014, respectively.

15. National Fire Protection Association Standard 805

In 2004, the Commission approved a voluntary risk-informed and performance-based fire protection rule for existing nuclear power plants. The rule endorsed National Fire Protection Association (NFPA) consensus standard NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants." In addition, the NEI developed NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c)," dated September 30, 2005 (ADAMS Accession No. ML052590476), that the staff endorsed in RG 1.205, "Risk-Informed, Performance - Based Fire Protection for Existing Light-Water Nuclear Power Plants," issued in May 2006 (ADAMS Accession No. ML061100174). To date, nearly half of the nuclear power units operating in the United States, including those that participated in the pilot program, have committed to transition to NFPA 805 as their licensing basis. The Oconee and Shearon Harris plants were the pilot plants for 10 CFR 50.48(c). In June 2010, a safety evaluation approved the Shearon Harris NFPA 805 pilot application. A safety evaluation in December 2010 approved the Oconee NFPA 805 pilot application. NEI 04-02 was revised (Revision 2) in April 2008 and the staff revised RG 1.205 (Revision 1) in December 2009 (ADAMS Accession No. ML092730314) to reflect lessons learned from the pilot reviews. The staff developed NUREG-800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Chapter 9, "Auxiliary Systems," Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection Program Review Responsibilities," issued December 2009, to provide staff guidance for the review of licensee applications to transition to NFPA 805. Additionally, the NRC developed a Frequently Asked Question (FAQ) process to review and establish a preliminary staff position on application, review, and implementation issues.

Lessons learned from the pilot applications indicated that the staff and the industry underestimated the complexity and resources necessary to complete the reviews. In SRM-SECY-11-0033, "Proposed NRC Staff Approach To Address Resource Challenges Associated with Review of a Large Number of NFPA 805 License Amendment Requests," dated April 20, 2011 (ADAMS Accession No. ML111101452), the Commission approved the staff's recommendation to increase resources to review NFPA 805 applications, develop a staggered review process, and modify the current enforcement policy. The NRC sent the revised enforcement policy to the Commission in SECY-11-0061, "A Request to Revise the Interim Enforcement Policy for Fire Protection Issues on 10 CFR 50.48(c) To Allow Licensees To Submit License Amendment Requests in a Staggered Approach," dated April 29, 2011 (ADAMS Accession No. ML11117A264) and approved in SRM-SECY-11-0061, dated June 10, 2011 (ADAMS Accession No. ML111610616). To enhance the efficiency and effectiveness of the NFPA 805 application reviews, the industry developed an application template and the staff developed a safety evaluation template. The staff has received 25 applications to date and expects another two by the end of calendar year (CY) 2016.

16. Revise the Fuel Cycle Oversight Process (RFCOP)

NMSS, with the support of NSIR, the Office of Enforcement (OE), NRR, and Region II, is implementing a multiyear project plan to revise the fuel cycle oversight process with the objective of improving the degree of transparency, predictability, objectivity, and consistency, using risk-informed and performance-based tools. The staff has engaged the public and industry stakeholders at public meetings and has requested public comment on development

activities associated with the revised fuel cycle oversight process (RFCOP). Recent achievements in implementing the RFCOP project plan include the following:

- Approved the corrective action program of URENCO-USA's national enrichment facility for the purposes of the NRC's enforcement policy, (ADAMS Accession No. ML14050A349).
- Completed Phase I of the RFCOP project plan and the issued of the following documents:
  - RG 3.75, "Corrective Action Programs for Fuel Cycle Facilities", July 2014 (ADAMS Accession No. ML14139A321)
  - Inspection Procedure 88161, "Corrective Action Program Implementation at Fuel Cycle Facilities", July 2014 (ADAMS Accession No. ML14178A494)
  - Inspection Manual Chapter 0616, "Fuel Cycle Safety and Safeguards Inspection Reports", July 2014 (ADAMS Accession No. ML14071A139), to include a new appendix with screening questions and examples to characterize inspection findings as more than minor.

The staff will continue to move forward with the enhancements to the Fuel Cycle Oversight Process as directed in SRM-SECY-11-0140 consistent with current budget priorities.

#### 17. Full-Scope Site Level 3 Probabilistic Risk Assessment

The staff continues to develop a full-scope site Level 3 PRA as directed in SRM-SECY-11-0089, "Options for Proceeding with Future Level 3 Probabilistic Risk Assessment (PRA) Activities" (ADAMS Accession No. ML112640419). The staff is conducting a full-scope site Level 3 PRA that addresses all internal and external hazards; all plant operating modes; and all reactor units, spent fuel pools, and dry cask storage. The staff completed the reactor, at-power, internal event and internal flood Level 1 and Level 2 PRAs in June 2014 and September 2014, respectively, and an ASME/ANS PRA Standard-based peer review of the Level 1 PRA in July 2014. Also in September 2014, the staff completed the reactor, at-power, high wind, Level 1 PRA and a screening evaluation of reactor, at-power "other" hazards (i.e., hazards other than internal events, internal floods, internal fires, high winds, and seismic events). Although continuing project challenges have resulted in an overall project delay of 16 to 18 months, the staff is continuing to move forward in all technical areas of the project in a manner consistent with the established project technical analysis approach plan, Rev. 0b (ADAMS Accession No. ML13296A064). In FY2015, the staff plans to complete the reactor, at-power, seismic event and internal fire Level 1 and Level 2 PRAs, and the public-health consequence (Level 3 PRA) modeling for all reactor, at-power, hazards. In the upcoming year, the staff also expects to complete the reactor, low power and shutdown, Level 1 PRA for all hazards; develop source term frequencies and characterization for dry cask storage; make progress in estimating the frequency of fuel damage for SFP storage; and conduct several more ASME/ANS PRA Standard-based peer reviews of project models.

#### 18. Approach to Special Treatment Requirements Categorizing Structures, Systems, and Components According to Safety Significance

In 1998, the Commission decided to consider issuing new regulations that would provide an alternative risk-informed approach for special treatment requirements in the current regulations

for power reactors. The NRC published the final rule (10 CFR 50.69, "Risk-Informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors") in the *Federal Register* on November 22, 2004 (69 FR 68008). The NRC staff issued RG 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance," Revision 1, in May 2006 (ADAMS Accession No. ML061090627).

The staff completed its review of Westinghouse topical report WCAP-16308-NP (Revision 0, July 2006), "Pressurized Water Reactor Owners Group 10 CFR 50.69 Pilot Program - Categorization Process - Wolf Creek Generating Station" (ADAMS Accession No. ML092430194), and issued its final safety evaluation on March 26, 2009 (ADAMS Accession No. ML090260674). By letter dated December 6, 2010, the Southern Nuclear Company (SNC) informed the NRC of its intent to submit a license amendment request for implementation of 10 CFR 50.69 for Vogtle Units 1 and 2 and requested pilot plant status and a waiver of review fees. By letter dated June 17, 2011, the staff informed SNC that the NRC has granted the fee waiver request for the proposed licensing action in accordance with 10 CFR 170.11(b). SNC submitted the licensing action request on August 31, 2012. Following the initial pilot application, lessons learned from the application review will be used to revise the associated industry guidance and RG 1.201.

In addition, the NRC staff issued draft Inspection Procedure 37060, "10 CFR 50.69 Risk-Informed Categorization and Treatment of Structures, Systems, and Components Inspection," on February 16, 2011. NEI and one licensee provided comments on the procedure. The NRC staff addressed the comments and issued the revised inspection procedure in 2011. The NRC will focus its inspection efforts on the most risk-significant aspects related to implementation of 10 CFR 50.69 (i.e., proper categorization of SSCs and treatment of Risk-Informed Safety Class (RISC)-1 and RISC-2 SSCs). Additionally, the inspections are expected to be performance-based, with SSCs of lower safety significance (e.g., classified RISC-3) not receiving a major portion of inspection focus unless adverse performance trends are observed. The staff recognizes the need for an effective, stable, and predictable regulatory climate for the implementation of 10 CFR 50.69. The NRC views inspection guidance developed with industry stakeholder input as an efficient vehicle for reaching a common understanding of what constitutes an acceptable treatment program for SSCs because specific treatment plans are not reviewed as part of a licensee's application to implement 10 CFR 50.69. During the pilot application review, the staff expects to continue to work with the industry and pilot licensees to modify the inspection procedure to reflect lessons learned and information gleaned from the pilot's proposed treatment program.

#### 19. Risk-Informed Reactor Oversight Process for New Reactors

In response to SRM-SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors," the staff submitted SECY-13-0137, "Recommendations for Risk-informing the Reactor Oversight Process (ROP) for New Reactors." In that SECY paper the staff recommended the development of 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. Also, the staff recommended the development of appropriate performance indicators (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.

In its SRM to SECY-13-0137, the Commission approved the staff's recommendation to develop appropriate PIs and thresholds for new reactors. The Commission requested that the staff develop, with appropriate stakeholder input, the necessary updates to the PIs, including any new PIs or changes to thresholds, and submit them to the Commission for approval before power operation for the first new reactor units.

The Commission disapproved the staff's recommendation to develop an integrated risk-informed approach for evaluating the safety significance of inspection findings for new reactor designs. The Commission directed the staff to enhance the Significance Determination Process (SDP) by developing a structured qualitative assessment for events or conditions that are not evaluated in the supporting plant risk models, such as passive safety systems, digital I&C, and human performance issues. The Commission requested that the staff submit a paper to the Commission with its proposed approach for any revisions to the SDP for new reactors at least 1 year before the scheduled implementation of any changes to the ROP.