

POLICY ISSUE INFORMATION

May 23, 2011

SECY-11-0068

FOR: The Commissioners

FROM: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

SUBJECT: LESSONS-LEARNED FROM THE PILOT PLANT TRANSITION TO A
RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION
LICENSING BASIS

PURPOSE:

The purpose of this paper is to provide the Commission with the lessons-learned from the pilot plant transitions to the new fire protection licensing basis under the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.48(c), “National Fire Protection Association Standard NFPA 805.”

BACKGROUND:

In June 2004, the Commission promulgated a rule change in 10 CFR 50.48, “Fire Protection,” adding a new section, 10 CFR 50.48(c), to permit existing reactor licensees to adopt the fire protection requirements of National Fire Protection Association (NFPA) Standard 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition,” in place of the fire protection requirements under 10 CFR 50.48(b).

In spring 2005, two licensees, Oconee Nuclear Station (ONS) and Shearon Harris Nuclear Power Plant (HNP), submitted letters of intent to transition to NFPA 805 and volunteered to be pilot plants. Between 2005 and 2008, these pilots developed fire probabilistic risk assessments (PRAs) and evaluated their facilities for transition. The U.S. Nuclear Regulatory Commission (NRC) staff conducted a series of observation visits with the pilots to evaluate their transition

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efforts. The NRC staff also evaluated industry guidance on making the transition and eventually endorsed this guidance, with a few exceptions, in Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 0, issued May 2006. In May 2008, both licensees submitted their license amendment requests (LARs) to adopt NFPA 805 (10 CFR 50.48(c)).

In SECY-09-0005, dated January 8, 2009, the NRC staff presented the Commission with options for accelerating the pilot LAR reviews. In SRM-SECY-09-0005, the Commission gave the following instruction:

When the staff has completed the ongoing pilots and the pilot plants have successfully completed the transition to NFPA 805, the staff should document the results in a paper to the Commission. Such a paper should include any lessons-learned to be incorporated into the larger tranche of license amendment request reviews.

In 2010, the NRC staff completed both pilot LAR reviews and issued license amendments for HNP and ONS to transition their fire protection licensing basis to NFPA 805 (10 CFR 50.48(c)). In early 2011, HNP completed their implementation and modifications to fully transition to an NFPA 805 licensing basis. ONS has an NFPA 805 license conditions for implementation and modification that are scheduled to be completed for all three units by 2015.

DISCUSSION:

The NRC staff has learned numerous lessons during the review of the pilot LARs. The enclosure highlights several of the more important lessons.

The most important lesson-learned from the pilots was that both industry and the NRC staff underestimated the complexity and resources necessary to address the technical issues associated with the transition to NFPA 805. Issuance of the HNP and ONS license amendments represents a major milestone in the NRC and industry efforts that began with the development of the consensus standard more than a decade ago. Both HNP and ONS have identified and made risk-informed modifications that demonstrate how risk insights can be used to enhance fire safety at nuclear power plants.

In December 2009, the NRC staff incorporated lessons-learned into RG 1.205, Revision 1, and NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection Program." In September 2010, Supplement 1, "Fire Probabilistic Risk Assessment Methods Enhancements," to NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," was issued and documents the pilot fire PRA lessons-learned. In February 2011, the Advisory Committee on Nuclear Safeguards (ACRS) reported to the Commission that NUREG/CR-6850 and Supplement 1 "provide a sound technical basis for the development of fire PRA models and analyses to support the transition to a risk-informed licensing framework in accordance with NFPA 805 and 10 CFR 50.48(c)."

The NRC staff has worked with the Nuclear Energy Institute (NEI) to use lessons-learned from the pilot LAR reviews to update NEI's NFPA 805 LAR template and the NRC's NFPA 805 safety evaluation (SE) template. The LAR template is scheduled to be added to industry guidance, and the SE template will be added to the next revision of NUREG-0800, Chapter 9.5.1.2. The NRC staff determined there is sufficient guidance for non-pilot plants to complete their LARs, but has requested and received Commission approval to provide additional resources and

enforcement discretion to allow a staggered LAR submittal schedule (SRM-SECY-11-0033).

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of Nuclear Regulatory Research has reviewed this paper and concurs.

/RA by William H. Ruland for

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Enclosure:

Lessons-Learned from the Pilot Plant Transition
to a Risk-Informed Fire Protection License Basis

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Lessons-Learned from the Pilot Plant Transition to a Risk-Informed Fire Protection Licensing Basis

On June 16, 2004, the U.S. Nuclear Regulatory Commission (NRC) promulgated the risk-informed, performance-based rule for fire protection, Final Rule, "Voluntary Fire Protection Requirements for Light-Water Reactors; Adoption of NFPA 805 as a Risk-Informed, Performance-Based Alternative," (69 FR 33536; June 16, 2004). This added 10 CFR 50.48(c), "National Fire Protection Association Standard NFPA 805." With minor exceptions and clarifications, 10 CFR 50.48(c) incorporated by reference the risk-informed, performance-based standard developed by the National Fire Protection Association (NFPA), NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition." An accompanying enforcement discretion policy revision provided incentives to the licensees to adopt the new approach; "NRC Enforcement Actions: Fire protection programs at operating nuclear power plants; policy statement; revision, 69 FR 33684." Two plants, consisting of four reactor units (Oconee Nuclear Station, Units 1, 2, and 3 (ONS), and Shearon Harris Nuclear Power Plant (HNP)) volunteered to become the NFPA 805 pilot plants.

On May 29, 2008, HNP filed a license amendment request (LAR) to transition to NFPA 805, and on April 5, 2010, HNP submitted a final supplement to its LAR to resolve the NRC staff's requests for additional information. In June 2010, the NRC staff completed its LAR review and issued a safety evaluation approving the HNP license amendment to transition to NFPA 805.

On May 30, 2008, ONS filed a LAR to transition to NFPA 805. On April 14, 2010, ONS revised its LAR to reflect insights from the revised Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, issued December 2009. In December 2010, the NRC staff completed its LAR review and issued a safety evaluation approving the ONS license amendment to transition to NFPA 805.

The pilot LAR reviews generated the following results and major lessons learned:

- **The experience with the pilot plants confirms that although plants are safe, the transition to the new licensing basis can result in further reductions in plant risk.**
 - Both ONS and HNP expended significant resources to evaluate and install modifications using risk insights. These modifications improved fire safety and enhanced nuclear safety. For example, HNP moved at-risk safe-shutdown cables, installed new 3-hour-rated cable, and installed very early warning fire detection (incipient smoke detection) systems in risk-critical electrical cabinets that are designed to alert plant personnel before a fire develops beyond the initial preignition stage.
 - Some plant improvements implemented to reduce fire risk resulted in significant reduction in plant risk. For example, HNP installed an alternate reactor coolant pump seal injection system that will significantly improve reactor safety, not only from fire but also from other events such as station blackout.
 - ONS is committed to install a protected service water system, which should significantly improve reactor safety from fire as well as reduce the overall risk from other types of events.

- **The frequently asked question (FAQ) process was instrumental in resolving regulatory and technical implementation issues in an open, collaborative, and timely manner.**
 - The NRC established an FAQ process to provide interim NRC staff positions in a timely manner on technical issues identified by pilot and non-pilot plants. Regulatory Issue Summary 2007-19, "Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified During the Pilot Application of National Fire Protection Association Standard 805," dated August 20, 2007, established the FAQ process and describes the process in detail.
 - The industry and NRC staff resolved technical and regulatory challenges during the pilot transition period. To date, industry has submitted more than 45 FAQs related to NFPA 805. The NRC has dispositioned almost all of these FAQs and continues to work on the remainder.
 - The interim NRC staff positions that the FAQ process generates provide a measure of regulatory stability to licensees who are transitioning to NFPA 805. The staff finalizes these positions by formally incorporating them into regulatory documents.
 - In December 2009, the staff incorporated most of the resolved interim NRC staff positions into Revision 1 of RG 1.205.
 - The NRC staff intends to continue the FAQ process through the pilot implementation phase and into the non-pilot LAR review period as a process for identifying and addressing any remaining technical issues in a timely manner.
 - The NRC staff has seen a reduction in the number of FAQs submitted. This is an indication of the increased stability in the NFPA 805 regulatory infrastructure.
- **The pilot plants used and advanced current technologies in fire probabilistic risk assessment (PRA) and fire modeling.**
 - In September 2005, the Office of Nuclear Regulatory Research (RES), working under a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI), published NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities."
 - Fire models used for performance-based evaluations are required to be acceptable to the NRC as well as verified and validated (NFPA 805, Section 2.4.1.2). In May 2007, RES, working in collaboration with EPRI, published NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," to provide the industry with a variety of acceptable fire models for their use.
 - The pilot plants made extensive use of the fire PRA methods given in NUREG/CR-6850 and used the FAQ process to resolve identified issues, such as the development of a new method to provide fire PRA credit for installing very

early warning fire detection (incipient smoke detection) systems in high-risk electrical cabinets.

- The NRC staff and industry agree that the current fire PRA techniques would benefit from continued refinement. RES and EPRI continue to work together under the MOU to address these issues.
 - The agency will incorporate future fire PRA-related FAQ resolutions into supplements or revisions of NUREG/CR-6850.
- **The process for reviewing the LARs for HNP and ONS enabled improved alignment among NRC staff and with licensees on the types of analyses that must be performed in support of the transition to NFPA 805.**
 - RG 1.205, Revision 0, issued May 2006, provided general guidance on several required risk assessment calculations.
 - The pilot process illustrated the need for further clarity and prompted additional discussions among NRC staff and licensees. In December 2009, the staff revised RG 1.205 to capture these lessons-learned.
 - The NRC staff used a draft section of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” during the early portion of the LAR reviews to capture lessons-learned. In December 2009, the staff formally published Section 9.5.1.2, “Risk-Informed, Performance-Based Fire Protection Program,” of NUREG-0800 to formalize the NFPA 805 LAR review process.
 - The NRC staff used the request for additional information process to ensure that the HNP LAR met the guidance of the revised RG 1.205. ONS was able to revise its LAR to address the revision to RG 1.205.
- **The issuance of the pilot license amendments confirmed that transition to NFPA 805 can provide a clear and stable licensing basis for a risk-informed fire protection program.**
 - The pretransition licensing bases of both plants were complex and ambiguous. For example, the NRC staff and industry had different views on whether the licensees were required to postulate and mitigate fire-induced concurrent multiple spurious actuations (MSAs). The licensees currently rely on either an exemption from Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979,” to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” or the NRC staff’s approval of deviations from their licensing basis.
 - While transitioning to NFPA 805, the pilot plants used their fire PRAs to identify and disposition MSA issues in a risk-informed manner. Transition to NFPA 805 has enabled both pilot plants to be in compliance with 10 CFR 50.48 requirements without relying on these exemptions or deviations by incorporating the resolution of the MSAs into their new licensing basis.

- **The implementation of the new rule and the review of the pilot LARs demonstrate the viability of risk-informing NRC regulations with reliance on consensus standards.**
 - The risk-informed fire protection rule is an example of the use of consensus standards in the NRC's regulatory activities. The rule was implemented without taking more than minimal exceptions to the NFPA standard.
 - Since risk evaluations and the use of established risk acceptance guidelines are integral aspects of 10 CFR 50.48(c), the approved amendments constitute successful applications of a rule consistent with the Commission's PRA policy.
 - The risk-informed lessons-learned from 10 CFR 50.48(c) are being reflected in another draft rule, 10 CFR 50.46a, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors."
- **Both industry and the NRC staff underestimated the complexity and resources it takes to transition to NFPA 805.**
 - The level of analysis and required review time for the two pilot plants greatly exceeded industry and NRC staff expectations.
 - The NRC staff anticipates that the review time will decrease as experience is gained from additional LAR reviews.

Additionally, NRC interactions with industry groups prompted a significant change in the fire safety programs of about half of the Nation's nuclear power plants and caused them to voluntarily transition to a risk-informed, performance-based licensing basis. Industry took a strong role in this initiative by developing NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 2, issued April 2008. This guide provides detailed instructions for licensees transitioning to NFPA 805. Industry also developed NEI 00-01, "Guidance for Post Fire Safe Shutdown Circuit Analysis," Revision 2, issued May 2009. This guidance also provides detailed instructions for analyzing postfire safe-shutdown circuit analysis. RG 1.205 endorsed NEI 04-02 (with exceptions and clarifications), as well as a portion of NEI 00-01, to provide one method of complying with 10 CFR 50.48(c). NUREG/CR-6850, prepared under a memorandum of understanding between RES and EPRI, provided fire PRA methods acceptable to the NRC. The NFPA 805 FAQ process involves monthly public meetings with an NEI NFPA 805 task force to discuss emerging issues and develop solutions in an open collaborative forum. This effort is a model for pooling the expertise of the NRC and stakeholders to develop and implement risk-informed regulations.