

October 27, 1998

FOR: The Commissioners

FROM: William D. Travers /S/
Executive Director for Operations

SUBJECT: RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION AT NUCLEAR POWER PLANTS

PURPOSE:

To respond to action items 1 and 6 in the staff requirements memorandum (SRM) dated June 30, 1998, related to SECY-098-58, "Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants."

BACKGROUND:

On March 26, 1998, the staff submitted SECY-098-058, which proposed that the staff defer the fire protection rulemaking and instead work with the National Fire Protection Association (NFPA) and the industry to develop a performance-based, risk-informed consensus standard for fire protection for nuclear power plants. This standard, if successfully developed, could be endorsed by the staff in a future rulemaking as an alternative method of meeting NRC fire protection requirements. The staff briefed the Commission on March 31, 1998, regarding its proposal. In the SRM dated June 30, 1998, the Commission approved the staff's proposal and directed the staff to update the Commission on the status of the NFPA activities, providing an assessment of progress and direction.

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The SRM also directed the staff to "Inform the Commission on how and when the fire protection issues as listed in SECY-097-127 will be closed." It should be noted that SECY-097-127, identifies potential fire issues whose risk significance needs to be evaluated. Most of these potential issues are explicitly included in the individual plant examination of external events (IPEEE) program (see [Attachment 1](#)); those which are shown to be risk significant will be addressed as part of the IPEEE follow up. Note that although the potential issue of "hot shorts" is being addressed in the IPEEE program, it is being resolved under the staff's circuit analysis resolution plan due to its potential risk significance. Note also that two potential issues, "fire detection methods" and "analysis of explosive electrical faults" are not explicitly addressed in the IPEEEs. The evaluation of their risk significance and subsequent follow up will be addressed by the NRC's ongoing fire risk assessment research program.

DISCUSSION:

Status and Schedule:

Since the Commission briefing, on March 31, 1998, the NFPA Technical Committee on Nuclear Facilities has held three meetings concerning the development of NFPA 805, "Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," and has completed a working draft of the standard. The development of the standard is currently on schedule to meet the May 2000 issue date provided to the Commission in SECY-098-058. [Attachment 2](#) provides the detailed schedule for the development of NFPA 805 with associated milestones.

The staff believes that significant progress has been made in the development of the standard in a relatively short time and anticipates that the committee will be successful in developing a risk-informed, performance-based standard for consideration as an alternative to the existing NRC fire protection requirements. This progress is largely due to a substantial commitment by a wide representation of interested stakeholders who are participating in the development of the standard. In addition to the NRC participation from NRR and RES, and the commercial nuclear industry and its consultants, committee participants include representatives from the Department of Energy, Nuclear Electric Insurance Limited, American Nuclear Insurers, the Los Alamos National Laboratory, and the Electric Power Research Institute. All interested parties are invited to participate in the development of the standard through the NFPA's public proposal and comment process.

Purpose of the NFPA Standard:

The purpose of NFPA 805 is to provide a comprehensive fire protection standard to protect the safety of the public, the environment, and plant personnel, as well as limiting the potential for economic loss during and after a fire. The scope of the standard is limited to establishing the minimum requirements for existing light-water reactors during all phases of plant operation (e.g., power operation, shutdown, decommissioning, and degraded conditions). To accomplish its purpose, the standard has established the following four performance goals:

1. Nuclear Safety - Protect the reactor fuel located anywhere at the plant site (e.g., reactor vessel, spent fuel pool, or dry storage) from direct or indirect damage resulting from a fire during all plant modes and configurations.
2. Radiological Release - Provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment.
3. Life Safety - Ensure the safety of plant personnel by providing adequate notification and means of egress in the event of a fire.

4. Property Damage/Business Interruption - Control the potential for economic loss due to a fire within the limits established by the plant owner/operator.

Each of these four performance goals is coupled to corresponding performance objectives and criteria that must be satisfied in order to meet the requirements of the standard. The performance objectives which define the series of actions necessary to meet the goals, are stated in more specific terms than the goals, but are measured in a more qualitative than quantitative basis (e.g., achieve and maintain shutdown reactivity conditions and decay heat removal capability). The specific performance criteria are quantifiable and are stated in engineering terms (e.g., k-effective <.99 and reactor coolant temperature < 177 C (350 F)).

Within the framework of NFPA 805, the plant owner/operator is provided the option of selecting a deterministic approach (e.g., [Appendix R to 10 CFR Part 50](#) and NFPA *Life Safety Code*) or a performance-based approach (e.g., engineering analysis, fire modeling, and probabilistic safety assessment) for satisfying the criteria.

The standard is risk informed in that a site-wide risk evaluation is required to assess the overall level of plant fire safety. The specific risk criteria (e.g., fire-induced core damage frequency) established by the plant owner/operator is subject to the acceptance of the authority having jurisdiction (e.g., the NRC). To meet the requirements of the standard, both the performance criteria specified in the standard and the risk criteria established by the plant owner/operator must be satisfied. Acceptable methods for conducting the site-wide risk assessment and the performance-based approaches will be included with the standard. Alternative analytical methods not included in the standard may be used, provided they are acceptable to the authority having jurisdiction.

Outstanding Issues:

Several outstanding issues must be resolved by the NFPA technical committee in the near term to support the aggressive schedule. The major issues identified by the staff that must be resolved include (1) documentation requirements; (2) the scope of the base fire protection program (the minimum fire protection systems and features that are applicable to all plants, e.g., water supply, fire brigade, etc.); (3) monitoring of system and program performance and feedback of those indicators into the program; (4) fire protection provided during degraded plant conditions; (5) roles of the authorities having jurisdiction other than the NRC, and (6) developing acceptable methods for evaluating compliance with the performance and risk criteria established by the standard. Regarding (6) it is recognized that there are a number of gaps in the current state-of-the-art for fire risk assessment, and that the NRC fire risk assessment research program will not address all of these gaps before the standard is issued. The standard will be written to accommodate these gaps. The committee is actively engaged in the resolution of all outstanding issues, and the staff expects that a successful resolution will be achieved.

Impact of Standard on Industry:

In the past several months, the Commission has received several letters from utility executives expressing their concern regarding the development of a risk-informed, performance-based fire protection regulation to replace the existing deterministic NRC fire protection requirements. The concern is primarily related to the additional burden that would be imposed upon licensees to comply with the new requirements. As stated in Option 2 of SECY-098-058, as approved in the SRM of June 30, 1998, if the NRC determines that the NFPA standard, when completed, is acceptable for meeting NRC fire protection requirements, the adoption of the standard will be voluntary by licensees, and the additional burden, if any, associated with the adoption of the NFPA standard will be at their choice. Each licensee will be able to decide if the potential long-term savings associated with adoption of a risk-informed, performance-based fire protection standard sufficiently offsets the short-term resource expenditure required to make the transition from the existing requirements. The staff expects that additional analysis, beyond that currently documented by licensees, will be required by licensees that choose to adopt NFPA 805. The level of analysis required for each plant will depend upon the degree to which performance-based approaches are adopted over the existing deterministic approaches. The site-wide risk evaluation required by the standard is anticipated to be an enhancement of the plant's existing fire risk evaluation conducted as part of the IPEEE.

CONCLUSION:

The staff concludes that significant progress has been made in the development of the NFPA standard and anticipates that the technical committee will be successful in developing a risk-informed, performance-based standard for consideration as an alternative to the existing NRC fire protection requirements. The staff expects that the standard will be issued on schedule following the May 2000 annual meeting of the NFPA. The staff has not identified any issues that would change the staff recommendation provided in SECY-098-058 and approved by the Commission in the SRM of June 30, 1998.

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- Attachments:
1. Resolution of Potential Fire Issues from SECY 97-127
 2. Detailed Schedule and Milestones for NFPA 805

1. **Other modes of operation** - This issue is included in the scope of NFPA 805, scheduled to be issued in May 2000.
 2. **Fire impact on reactor safety** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 3. **Hot shorts** - This issue is being addressed in the circuit analysis resolution plan, scheduled to be completed June 1999.
 4. **Smoke impact on reactor safety** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 5. **Testing/compensatory measures** - This issue is included in the scope of NFPA 805, scheduled to be issued in May 2000, and will be included in the comprehensive fire protection regulatory guide, scheduled to be issued September 1999.
 6. **Main control room/cable spreading room fire interaction analysis methods** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 7. **Fire detection methods** - This issue is included in the fire risk assessment research program. (Refer to [SECY-98-230](#), Insights From NRC Research on Fire Protection and Related Issues)
 8. **Analysis of explosive electrical faults** - This issue is included in the fire risk assessment program. (Refer to [SECY-98-230](#))
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1. **Reliability of fire barriers** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 2. **Broken or leaking flammable gas lines** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 3. **Equipment protection from fire suppression system actuation** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.
 4. **Seismic/fire interactions** - As stated in SECY 97-127 this issue is being addressed in the IPEEE program. The schedule for the completion of the review of licensee's submittals is November 1999. Additional follow up may be required to resolve this potential issue.

ATTACHMENT 2

Schedule for the Development of NFPA 805

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| Working Draft Available for Public Proposals | 10/30/98 |
| Public Proposals Due | 01/08/99 |
| Standard Published for Public Comment | 07/30/99 |
| Public Comments Due | 10/08/99 |
| Final Draft Published | 03/31/00 |
| Vote on Standard by NFPA Membership | 05/21/00 |