

June 19, 1997

**SECY-97-127**

FOR: The Commissioners

FROM: L. Joseph Callan /s/  
Executive Director for Operations

SUBJECT: DEVELOPMENT OF A RISK-INFORMED, PERFORMANCE-BASED  
REGULATION FOR FIRE PROTECTION AT NUCLEAR POWER PLANTS

PURPOSE:

To present the actions the staff will undertake to develop a rulemaking for transitioning to a more risk-informed, performance-based structure for fire protection regulation at nuclear power plants.

BACKGROUND:

On June 21, 1996, the staff submitted a paper to the Commission (SECY-96-134) on, "Options for Pursuing Regulatory Improvement in Fire Protection Regulations for Nuclear Power Plants." Following a substantive discussion of issues, two options for pursuing regulatory improvement through or without rulemaking were presented. The staff recommended the approach to regulatory improvement through rulemaking.

In a Staff Requirements Memorandum (SRM), dated October 2, 1996, the Commission approved the staff's recommendation for regulatory improvement through rulemaking and included the following specific directions to the staff:

- A plan (including milestones and schedules) for transitioning fire regulations to a more risk-informed, performance-based structure should be developed. The plan should identify key elements as well as obstacles that must be overcome to make progress;

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- Weaknesses in Probabilistic Risk Analysis (PRA) methods and operational data should be identified along with ongoing research activities to address weaknesses (if any). The “uncertainty” issue should be explicitly addressed;
- Preliminary IPEEE insights-gained should be factored into rulemaking in this area;
- Risk-informed, performance-based approaches should only be utilized where specifics are amenable to such methods; and
- Issues such as inspection and enforcement in implementation of such a rule should be considered in a manner consistent with the Commission’s preliminary views on Direction Setting Issue 12 regarding Risk-Informed, Performance-Based Regulation.

Following receipt of the SRM on SECY-96-134, the staff informed the Commission (in the Semiannual Report on the Status of the Thermo-Lag Action Plan and Fire Protection Task Action Plan, dated October 31, 1996) that it would include its review of several potential safety issues in the Fire Protection Task Action Plan (FPTAP) in its plan for the fire protection rulemaking. The list included those issues recommended for further study (e.g., adequacy of operability requirements for post-fire safe shutdown equipment and adequacy of fire barrier surveillance requirements) and other confirmation issues in FPTAP (e.g., adequacy of manual fire fighting) that have not been completed to date.

In an SRM, dated January 22, 1997, the Commission provided guidance on emerging policy issues from PRA Implementation Plan activities associated with risk-informed, performance-based regulation which are pertinent to this rulemaking. In the SRM, the Commission included direction that the staff should, in its development of risk-informed guidance and review of applications regarding risk-informed initiatives, evaluate safety impacts of proposed changes in an integrated manner including the use of risk insights to identify areas where requirements should be increased or improvements could/should be implemented. In this regard, the Commission stated that the staff should encourage licensees to use risk assessments for purposes of improvement that may require additional activity or effort on their part, as well as relaxation, in order to realize the full benefit of risk assessments.

#### DISCUSSION:

The additional activities to evaluate safety impacts of the proposed changes in an integrated manner including the use of risk insights to reduce regulatory burden as well as identify areas where requirements should be increased or improvements could be implemented will require more staff work than originally planned. The staff has specifically identified tasks, and delivery dates for products that are needed to develop the rulemaking consistent with staff proposals and Commission directives (discussed above) subsequent to the SRM, dated October 2, 1996, on SECY-96-134.

The staff expects that the development of the rulemaking to allow the implementation of performance-based, risk-informed methods based on current risk information and state of the art of fire sciences will be limited because of existing limitations of methods (as indicated in SECY-96-134). Therefore, in parallel to the development of the rulemaking, the staff will develop a research

plan to advance the state of the art of fire modeling and fire risk analysis methods. The research plan will address the methods, data needs, and uncertainties. The staff will propose a second phase of revisions to the fire regulations to the Commission at a later date if the results of the research program indicate that a revision is appropriate. Attachment 1 includes charts that illustrate the staff's upcoming actions for the rulemaking plan for the first phase of revisions to the fire regulations:

#### Tasks To Be Completed Before Developing the Rulemaking

1. Identify strengths and weaknesses in current fire PRA and fire modeling methods for use in developing an appropriate high level strategy for the rulemaking plan for adopting such methods.

[RES/DST, October 1997]<sup>1</sup>

- 2a. Perform an analysis of past exemption requests to identify areas where risk-informed, performance-based analyses (qualitative or quantitative) were used to justify the submission and approval of the exemptions;

[NRR/DSSA, September 1997]

- 2b. Based on the above analysis, develop performance criteria that could be incorporated into a rulemaking plan and which envelop the technical basis for the approval of the exemptions;

[RES/DRA, October 1997]

3. Based on IPEEE reviews to date, other fire PRA information, and on an analysis of exemptions (Task 2) and case studies being conducted in areas where exemptions have been granted, determine potential areas in the fire regulations (e.g. fire protection systems maintenance, test, and surveillance, and fire protection of safe shutdown capability) for application of risk-informed, performance-based methods, in lieu of current deterministic and prescriptive methods, in order to provide flexibility to licensees, eliminate requirements marginal to safety, and reduce regulatory burden.

[RES/DRA, October 1997]

4. Review vulnerabilities identified in the IPEEE program to determine any generic vulnerabilities in plant fire protection programs that need to be addressed through rulemaking. Analyze the plant-specific disposition of potential fire safety issues (Attachment 2) currently being examined in IPEEEs and confirm (or otherwise) the staff's initial analysis and conclusions documented in NUREG reports (e.g. NUREG-1472, NUREG-1364) that generic requirements for the disposition of these issues are

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<sup>1</sup>This identifies the completion date and responsible organization for the action. An internal staff report will be developed for each milestone identified in this paper.

not warranted. The analysis will be based on 24 submittals that the staff expects to have reviewed by September 1997. This analysis will be updated once all the IPEEE submittals have been reviewed, and used for preparing the proposed rule.

[RES/DST, December 1997]

5. Evaluate potential fire safety issues identified from FPTAP (Attachment 2) and determine if any are candidates for rulemaking, and those that need further research. Those issues requiring further research will be addressed in the fire research program discussed above. The issues currently being addressed in the IPEEE program will be covered under Task 4;

Based on the special study on "Fire Events - Feedback of U.S. Operating Experience" , determine the impact on performance of systems needed for plant safe shutdown resulting from component failure associated with fire. Identify any potential risk significant issues regarding the programs that should be addressed through rulemaking, based on feedback of U.S. operating experience.

[RES/DRA, December 1997]

6. Review results of pilot Fire Protection Functional Inspections and develop insights regarding opportunities for the adoption of risk-informed, performance-based approaches;

[NRR/DSSA, December 1997]

7. Review and evaluate initiatives for developing performance-based fire standards by professional organizations (e.g. National Fire Protection Association) to determine whether these initiatives could support the transition to a risk-informed, performance-based regulatory structure.

[RES/DRA, December 1997]

8. Review and evaluate the information obtained from the public in the RuleNet record from early 1996 for suggested regulatory approaches (e.g. a "graded" approach to developing a fire protection program to focus on risk significant protection features);

[RES/DRA, December 1997]

9. Develop a final position on the potential safety issue on threats from fires during shutdown conditions. The proposed rule for Shutdown and Fuel Pool Operations is due to the Commission by July 31, 1997. The rule, as currently drafted, proposes that licensees include in the fire protection plan provisions to minimize the frequency of fires during shutdown operation and their potential consequences in those areas where a fire could impair the decay heat removal system in operation. The current plan is to publish a proposed rule for public comment in September 1997 for a 90-day period.

[NRR/DSSA, March 1998]

10. Determine the mechanism for application in this rulemaking of the guidance being developed as part of the PRA Implementation Plan for an approach for using PRA in risk-informed decisions on plant-specific changes to the current licensing basis;

[RES/DRA, December 1997]

11. Based on inputs from the above tasks, develop a rulemaking plan that will include the type and nature of the performance criteria, and the range of performance-based, risk-informed analysis methods that would be used to demonstrate compliance with the performance criteria. A draft plan will be developed before a public workshop (see Task 12 below), and finalized based on comments received at the workshop;

[RES/DRA, June 1998]

12. Conduct discussions on a draft rulemaking plan at a public workshop and solicit input from all interested parties. Explore the possibility of conducting this dialogue with the industry and public in electronic forums such as RuleNet.

[RES/DRA, January 1998]

The rulemaking plan that reflects comments received at the public workshop will be submitted for Commission review and approval by June 1998. The plan will also include a range of possible actions and outcomes based on the evaluation of critical rulemaking issues such as mandatory versus voluntary licensee implementation of the revised rule, and maintaining the same scope and level of protection as current requirements or establishing broader scope and achieving a higher level of protection with the rule revision. Furthermore, the rulemaking plan will include a schedule for the proposed and final rulemaking.

The staff is continuing to address the Thermo-Lag issues on a plant-specific basis. Staff work on the activities described in this paper will not require a change to this course of action. In addition, the staff has not identified significant fire safety issues that require prompt action through rulemaking.

This paper describes the staff's efforts for regulatory improvement for fire protection regulation of nuclear power plants. The status and outcome of the various tasks will be monitored by NMSS as this information may relate to consideration for fire protection regulatory guidance for fuel cycle facilities licensed under Part 70.

#### RESOURCES:

Resources for this program are included in the Five-Year Plan. 2.6 FTE and \$ 230 K for contractor support will be required to complete the above tasks and develop a rulemaking plan, and 2.4 FTE and \$ 200 K for contractor support will be required for one and one-half years to develop a final rule.

COORDINATION:

The Office of General Counsel has no legal objection to this paper. The staff has provided a copy of this paper to the ACRS for their information.

In order to coordinate the efforts of several organizations that will be involved in this effort, I have formed an Inter-Office Working Group and Steering Committee for this effort. Attachment 3 lists the members of these groups.

RECOMMENDATION:

Unless otherwise directed by the Commission, the staff plans to proceed as described above.

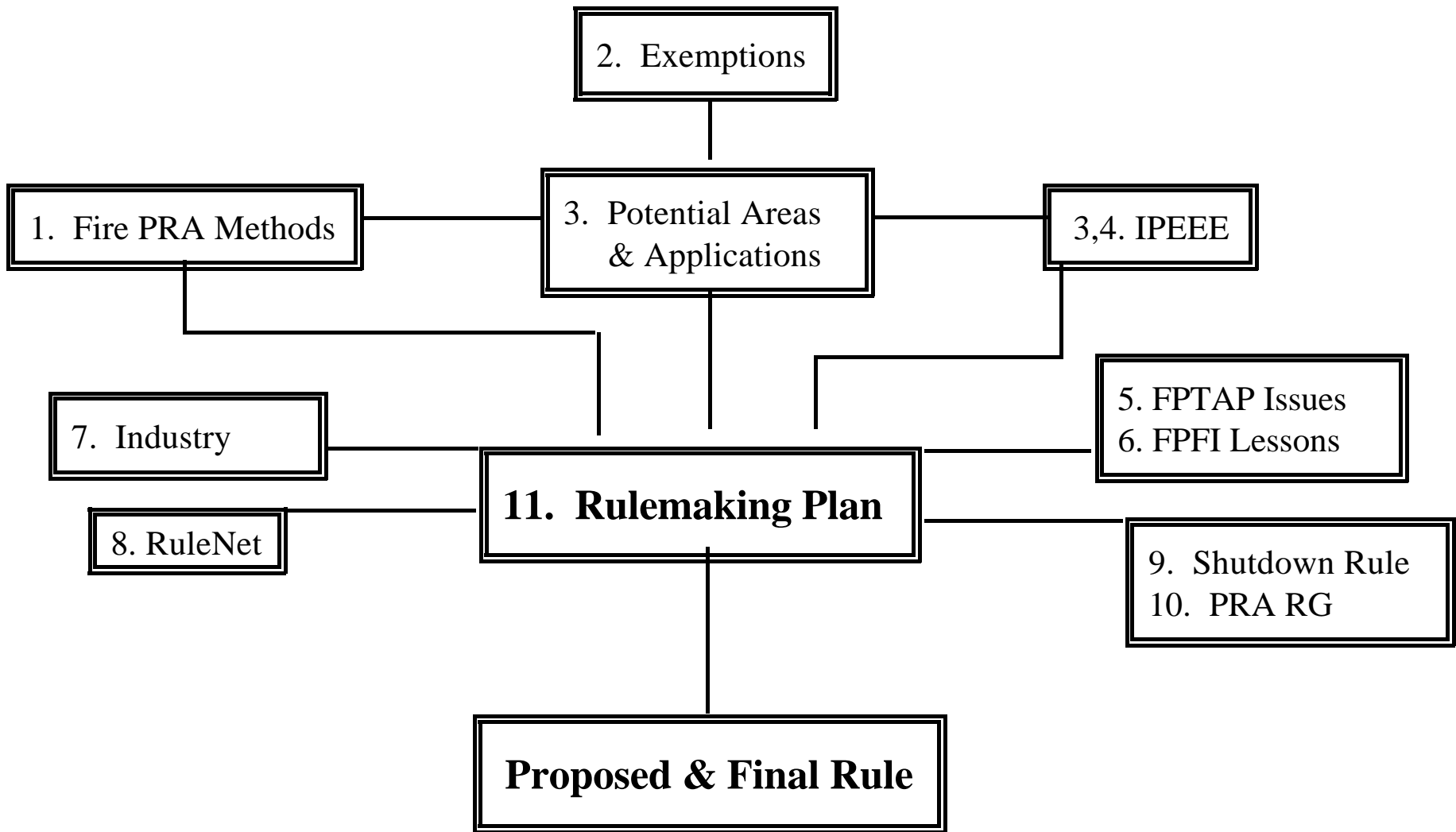
L. Joseph Callan  
Executive Director  
For Operations

Attachment: As stated

Attachment 1 - Fire Protection Rulemaking Action Plan

TASK NAME	Jun '97	Jul '97	Aug '97	Sep '97	Oct '97	Nov '97	Dec '97	Jan '98	Feb '98	Mar '98	Apr '98	May '98	Jun '98
1. Fire PRA Method	████████████████████												
2. Exemptions	████████████████												
3. Potential Areas & Applications	████████████████████												
4. IPEEE issues	████████████████████												
5. FPTAP issues	████████████████████												
6. FPI Lessons	████████████████████												
7. Codes & Stds.	████████████████████												
8. RuleNet	████████████████████												
9. Shutdown rule	████████████████████												
10. PRA RG Appl.	████████████████████												
11. Ruleplan	████████████████████												
12. Workshop								██████					

# Fire Protection Rulemaking Action Plan







## Attachment 2

### List of Potential Fire Issues

1. Other modes of operation<sup>2</sup> - Current fire protection requirements provide protection for equipment necessary to take the plant from 100% power operations to hot standby/shutdown and do not address other plant modes of operation (including degraded, shutdown, and refueling modes). Therefore, cold shutdown systems are presently not required to be protected against fire damage. The risk significance of this gap needs to be evaluated.
2. Fire impact on reactor safety\* - The risk significance of fire-induced reactor transients caused by fire damage to cables (e.g., electrical faults), and balance-of-plant fire risks (e.g., turbine failures and fires; failures of station transformers), and other plant events which have the potential to cause a fire and a related plant transient needs to be evaluated.
3. Hot Shorts - Hot shorts in faulted cables may be a potential mode of component damage and are not fully addressed by current risk assessment methods. These faults may result in the application of power to unpowered circuits, the application of destructive voltages to lower power-voltage circuits, false instrument readings, or the simulation of a switch closing. These failure modes and their risk significance need to be evaluated.
4. Smoke impact on reactor safety\* - Assessment of smoke propagation and its affect on manual fire fighting operations, its impact on plant shutdown equipment operability and manual operator actions (human errors of omission and commission) may be needed. Manual fire fighting effectiveness was identified by GI-148.
5. Testing/compensatory measures - The need for additional guidance for surveillance testing/compensatory measures related to risk sensitive fire mitigation/protection features and post-fire safe shutdown functions (e.g., fire protection features which are the most risk important in assuring mitigation should be tested and inspected at a higher frequency than others) should be evaluated.
6. Main control room/cable spreading room fire interaction analysis methods\* - Current methods for analysis of either main control room or cable spreading room fire scenarios do not directly address fire growth and smoke development, fire-induced spurious equipment operations/interactions, operator actions of either omission or commission, and determine if shutdown equipment controlled from outside the main control or cable spreading rooms is fully capable of performing its intended shutdown function. Methods to better address these issues needs to be developed to examine their risk significance. This item is related to GI -147.
7. Fire detection methods - The analysis of fire detection effectiveness and timing is critical to fire mitigation and fire brigade and operator response. Therefore, it is critical to understand detection system design limitations and their potential impact on detector response and notification. Enhanced analytical tools should be developed to model and predict fire detection.

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<sup>2</sup>This issue is currently being addressed in the rulemaking for shutdown and fuel pool operations.

\*This issue is currently being addressed in the IPEEE program.

8. Analysis of explosive electrical faults - Current fire scenario evaluation tools are unable to predict the type of explosive fire events associated with a high energy electrical fault. Such faults have been experienced during switchgear-initiated fire events. Given the importance of switchgear to plant operations and the relative importance of switchgear fire scenarios in risk assessment, improvements in analysis methods in this area may be needed.
9. Reliability of fire barriers\* - Methods for the analysis of fire barrier systems are not fully developed (fire barriers between adjacent fire areas). In typical fire analysis, these barriers are assumed to be 100% reliable for their full ASTM E-119 fire endurance time rating for any postulated fire threat. This assumption, in all cases may not be justified for fire scenarios involving certain active fire barrier elements such as, fire doors and fire dampers, and for areas involving "high hazard" fire sources (e.g., diesel generator rooms, turbine buildings). Further development of these tools is necessary.
10. Broken or leaking flammable gas lines\* - Flammable gas lines may be present in areas that are near safety-related equipment and a leaking line could potentially jeopardize plant safety. This item is related to GI-106 and needs to be evaluated for risk significance.
11. Equipment protection from fire suppression system actuation\* - Actuations of fire suppression systems have caused damage to safety-related equipment, indicating that some equipment may not be adequately protected from the effects of fire suppression and some areas may not be adequately sealed. This issue is related to GI-57, and its risk significance needs to be evaluated.
12. Seismic/fire interactions\* - During a seismic event, fires may occur and sources of fire water may be lost, causing a significant reduction in fire protection. In addition automatic fire detection systems may be affected by a seismic event and fire protection features may become dislodged and inoperable. The significance of this interaction needs to be determined.

## Attachment 3

### Members of the Steering Committee and Working Group

#### Steering Committee

1. Joseph A. Murphy, Director, DRA:RES, Chair
2. M. Wayne Hodges, Director, DST:RES
3. Gary M. Holahan, Director, DSSA:NRR
4. Charles E. Rossi, Director, SPD:AEOD
5. William J. Olmstead, Associate General Counsel, OGC

#### Working Group

1. Moni Dey, Senior Nuclear Engineer, RDB:DRA:RES
2. Nathan Siu, Senior Level for PRA, PRAB:DST:RES
3. Ed Connell, Senior Fire Protection Engineer, SPLB:DSSA:NRR
4. Jim Houghton/Hal Ornstein<sup>3</sup>, Plant Systems Engineer, RRAB:SPD:AEOD
5. Geary Mizuno, Senior Attorney, OGC
6. Rex Wescott, Senior Fire Protection Engineer, SPB:FCSS:NMSS<sup>4</sup>

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<sup>3</sup>Participation will be on a consultation basis.

<sup>4</sup>Participation will be as necessary to obtain information and insights that could be used for regulatory guidance for fuel cycle facilities.

**Intermediate Schedule and Responsible Managers**  
**(Provided per EDO direction for information,  
not as part of the proposed SECY paper)**

<b><u>Task</u></b>	<b><u>Responsible Manager</u></b>	<b><u>Scheduled Completion Date</u></b>
1.	M. W. Hodges, DST:RES	October 1997
2.	(a) G. M. Holahan, DSSA:NRR	September 1997
	(b) J. A. Murphy, DRA:RES	September 1997
3.	J. A. Murphy, DRA:RES	October 1997
4.	M. W. Hodges, DST:RES	December 1997
5.	J. A. Murphy, DRA:RES	December 1997
6.	C. E. Rossi, SPD:AEOD	December 1997
7.	G. M. Holahan, DSSA:NRR	December 1997
8.	J. A. Murphy, DRA:RES	December 1997
9.	J. A. Murphy, DRA:RES	December 1997
10.	G. M. Holahan, DSSA:NRR	March 1998
11.	J. A. Murphy, DRA:RES	December 1997
12.	J. A. Murphy, DRA:RES	January 1998
13.	J. A. Murphy, DRA:RES	June 1998