

JUNE 21, 1996

SECY- 96- 134

FOR: The Commissioners

FROM: James M. Taylor, Executive Director for Operations
/s/

SUBJECT: OPTIONS FOR PURSUING REGULATORY IMPROVEMENT IN FIRE
PROTECTION REGULATIONS FOR NUCLEAR POWER PLANTS

PURPOSE:

To provide a progress report and to obtain Commission approval to implement a rulemaking option for regulatory improvement in fire protection regulations for nuclear power plants.

SUMMARY:

This paper provides the progress made to date in the development of a risk-informed and performance-based regulation for fire protection, and requests Commission approval of specific staff recommendations for the rulemaking. The current regulatory framework, review of basis for revising fire protection regulations, and staff expectations for a risk-informed and performance-based regulation are initially discussed. The major technical, policy, and legal issues discussed are the state of the art of risk-informed and performance-based fire protection methodology, the development of a regulatory framework that would allow implementation of such methods given their state of the art, a Nuclear Energy Institute (NEI) petition that proposed one way to transition to a risk-informed and performance-based

regulatory framework, and the legal framework necessary to correct and avoid regulatory gaps or inconsistencies in the regulations while allowing flexibility to use new requirements and technical methods, or continued compliance with current regulations. An assessment of fire risk analysis and modeling technological advancements,

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summary analysis of the NEI petition, and discussion of options are presented to address the major issues. The staff recommends pursuing the rulemaking, and a transition to a risk-informed and performance-based regulatory framework in a manner different than that proposed by NEI, because the industry proposal does not meet the objectives and criteria established by the Commission.

BACKGROUND:

In a Staff Requirements Memorandum (SRM), dated August 26, 1992, the Commission approved a staff proposal in SECY-92-263, "Staff Plans for Elimination of Requirements Marginal to Safety," dated July 24, 1992, to eliminate requirements marginal to safety that impose unnecessary regulatory burdens on licensees. Some fire protection requirements were identified for this effort as being potentially overly prescriptive. Recommendations for revising fire protection requirements, to make them less prescriptive and more performance-based, were also identified in a regulatory review conducted by the Committee to Review Generic Requirements (CRGR) (see SECY-92-141), by the Regulatory Review Group (RRG) (see SECY-94-003), and in a staff Report on the Reassessment of the NRC Fire Protection Program, dated February 27, 1993 (see SECY-93-143). The staff, in SECY-93-028 dated February 5, 1993, provided a progress report and informed the Commission of proposed policies and a framework for eliminating requirements marginal to safety. The staff subsequently discussed the policies and framework with the public and industry at a workshop in April 1993 (see NUREG/CP-0129). The staff then requested Commission approval of the policies, framework, and plan of action in SECY-94-090, "Institutionalization of Continuing Program for Regulatory Improvement," dated March 31, 1994. The Commission provided its approval in an SRM dated May 18, 1994 (on SECY-94-090). Later, the Commission provided (in an SRM dated June 27, 1994, on SECY-94-127) guidance to the staff in pursuing rulemaking while dealing with Thermo-Lag issues. The Commission stated "...the Commission has approved the staff recommendation to proceed as planned with the development of a performance-based fire protection rule. This should be pursued by the staff as part of its continuing program for regulatory improvement and/or once a request for rulemaking is received. The Commission felt that the

new rule should not be considered a means to resolve the Thermo-Lag issues. "

In SECY-94-127, dated May 12, 1994, the staff informed the Commission of industry's intent to file a petition and the staff's plan for reviewing the petition. On February 2, 1995, NEI on behalf of the nuclear power industry, submitted a petition for rulemaking and requested the NRC to amend 10 CFR 50.48 and proposed adding an Appendix S to 10 CFR Part 50. NEI stated that its proposed Appendix S would provide a flexible alternative to the current fire protection requirements in Appendix R to 10 CFR Part 50. NEI characterized Appendix S as a safety-neutral performance-based alternative to Appendix R. NEI also stated that Appendix S would result in burden relief and cost savings to the industry. On June 6, 1995, the staff published (60 FR 29784) the notice of receipt of the NEI petition, including 13 questions on topics the staff considered important for a proposed rulemaking. The comment period closed on September 30, 1995. Subsequently, the staff solicited (60 FR

57370) public discussion generally on the rulemaking in the RuleNet project in January and February 1996.

To prepare this paper, the staff reviewed the NEI petition, the comments submitted by the Advisory Committee for Reactor Safeguards (ACRS), the comments submitted in response to the Federal Register notice of Receipt of Petition, the RuleNet record, and other background information.

DISCUSSION:

Current Regulatory Framework and Importance of Fire Protection

Current Framework

To mitigate the adverse effects of nuclear power plant fires, each operating reactor has an NRC-approved fire protection program. When properly implemented and maintained, these programs provide reasonable assurance that potential fires will not adversely affect reactor safety. A typical reactor fire protection program consists of fire barriers, safe shutdown

system separation, fire detection systems, fire suppression systems and equipment, administrative controls and procedures, and trained personnel. A properly designed, implemented, and maintained program provides reasonable assurance, through a defense-in-depth approach, that a fire will not prevent the performance of necessary safe plant shutdown functions.

The fire protection requirements for nuclear power plants are derived from GDC 3 of Appendix A to 10 CFR Part 50, 10 CFR 50.48, and for plants operating before January 1, 1979, certain provisions of Appendix R to 10 CFR Part 50. Hence, there are two groups of plants to consider. The first group consists of 60 plants that were licensed to operate before January 1, 1979. Selected provisions of Appendix R to 10 CFR Part 50 apply to this group of plants. The second group consists of the plants that were licensed to operate after January 1, 1979, and Appendix R does not apply to these plants. The Commission, when it promulgated Appendix R (on February 19, 1981), recognized that there would be unique plant conditions whereby the fire protection features identified by Appendix R would not significantly enhance the level of fire safety already provided by the licensee. Therefore, in those cases when a fire hazard analysis could adequately demonstrate that the alternative fire protection features provided an equivalent level of fire safety to that required by Appendix R, the licensee could apply for an exemption under the provisions of 10 CFR 50.48 (c)(6). Thus, the exemption process provided an alternative means of allowing flexibility to meet the performance objectives of Appendix R.

On April 24, 1986, the staff issued Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements." In this GL the staff provided a process that allowed licensees to make changes to their plant-specific fire protection programs without prior NRC approval. Specifically, the NRC requested that each licensee incorporate its NRC-approved fire protection program, including the fire hazards analysis and major commitments that form the fire protection program basis, into its Final Safety Analysis Report and adopt a standard fire protection license condition. After the licensee completed this licensing action, it could change its fire protection program without prior approval of the Commission provided those changes did not adversely affect the

ability to achieve and maintain safe shutdown in the event of a fire or did not require an exemption. GL 86-10 also provided staff interpretations of Appendix R and clarified when exemptions were required. To date, 96 plants have adopted the standard fire protection license condition. Attachment 1 includes a detailed summary of the history and description of the regulatory framework for reactor fire protection.

Importance of Fire Protection

In their "Report on the Reassessment of the NRC Fire Protection Program," dated February 27, 1993, the staff recognized the importance of fire protection features at plants. The report referred to an NRC-sponsored study, "Fire Risk Scoping Study - NUREG/CR-5088," that concluded that plant modifications made as a result of Appendix R requirements reduced core damage frequencies at some plants up to a factor of ten. However, some risk assessments still show that fire events are risk significant and that fire induced core damage frequencies can be comparable to internal events, and that fires can contribute as much as 50 percent to the plant's overall core damage frequency.

Insights of the risk significance of fire scenarios will also be forthcoming from the individual plant examination for external events (IPEEE) program (fire is categorized as an external event in PRAs). Information on this has been provided to the Commission in SECY-96-088 dated April 29, 1996. The staff's review of licensee submittals on the IPEEE program was recently initiated, and risk insights will be compiled as the reviews are completed.

Review of Basis For Revising Fire Protection Regulations to Enhance Flexibility and Improve Regulatory Efficiency

Previous Reviews

The potential benefits of revising the fire protection regulations while maintaining an adequate level of fire protection was reviewed by the RRG, as well as by the staff in its "Report on the Re-assessment of the NRC Fire Protection

Program" (SECY-93-143). The RRG recommended revising the regulations for fire protection to make them more performance-based and issuing guidance to clarify that other alternative methods of compliance can be developed and be acceptable.

The staff's review of the regulations in the "Report on the Re-assessment of the NRC Fire Protection Program" included a finding that the current requirements and guidelines were developed before the staff or the industry had the benefit of PRAs for fires and before there was a significant body of operating experience. This report recommended that NRR support the activities in the NRC Office of Research relating to a potential revision for the fire protection regulation. The report also stated that a revised 10 CFR 50.48 (and perhaps elimination of Appendix R to 10 CFR Part 50) could accomplish the following: 1) establish a more reactor-safety oriented fire protection rule, 2) add appropriate flexibility in some areas, 3) eliminate the potential for confusion, 4) better cover shutdown conditions, and 5) codify the appropriate role and limitations for fire watches.

The NRC program for Elimination of Requirements Marginal to Safety identified fire protection regulations as candidates that could be made more effective by decreasing their prescriptiveness and providing flexibility to licensees. The staff proposed that some of the prescriptive requirements were potentially unnecessarily conservative and could be eliminated or replaced with safety objectives without any adverse impact on safety. The staff also identified an opportunity for making the fire protection regulations more focused based on risk significance, thereby improving the efficiency of the overall fire protection program.

Current Review

The recommendations previously identified for making the fire protection regulatory framework more efficient, and risk-informed and performance-based are still valid. In addition, there are two other related reasons that support revising the fire protection regulations:

1. Since Appendix R was issued, about 850 alternative fire

protection approaches or exemptions, which were evaluated by the staff and determined on a plant-specific bases to provide an equivalent level of fire safety, have been granted. The Commission recognized during its promulgation of Appendix R requirements that exemptions would be required to provide alternative means for complying with the regulation. The staff now believes that it can develop a simpler and more efficient fire protection regulation, which would allow flexibility and facilitate the use of alternative approaches to meet the fire safety objectives, without the need for exemptions.

2. As described above, an inconsistency exists in the regulatory framework for fire protection for plants licensed before and after 1979. The plants licensed before 1979 are required to comply with the sections of Appendix R specified by 10 CFR 50.48(b) and would require exemptions if they were to pursue alternatives to these fire protection requirements outside the scope of previously-granted exemptions. Generally, most of these exemptions were narrowly written to approve a specific plant configuration as part of the exemption. Therefore, the exemption does not constitute either an approval for the applicant/licensee to depart from the relevant requirements of Appendix R for other parts of the plant not specifically included in the exemption, or a broad-based approval for other plants to rely on the same rationale for an exemption. Plants licensed after 1979 were not required to comply with Appendix R but have implemented guidance on methods equivalent to that in Appendix R, and therefore these plants have the option of implementing changes to their programs without prior staff approval in accordance with GL 86-10.

Staff Expectations for a Comprehensive Performance-Based and Risk Informed Fire Protection Regulation

On the basis of its reviews of current regulations and the determination that there is a potential for regulatory improvement, the staff had informed the Commission of preliminary criteria it had developed for a performance-based and risk-informed regulatory approach for rulemakings (including fire protection) in SECY-93-028. The staff discussed them at a public workshop in April 1993, and subsequently proposed final criteria to the Commission in SECY-94-090. These criteria were: 1) Revised rules will focus on establishing regulatory safety objectives and acceptance criteria without prescribing the methods or hardware necessary to accomplish the objective. The main aim of a performance-based regulatory approach is to allow licensees the flexibility to use cost-effective methods for implementation of the objectives, 2) The regulatory objective will be derived, to the extent feasible, from risk considerations and in relationship to safety goals, 3) Details of technical methods for measuring or judging the acceptability of licensee's performance relative to the regulatory objectives will be provided in regulatory guides. To the extent possible, approved industry standards and guidance will be endorsed in this regard, 4) Collective industry efforts (NEI, Electric Power Research Institute, Owner's groups) should maintain some degree of standardization, 5) The new rules will be optional for current licensees and thus licensees can decide to remain in compliance with current regulations, 6) The scope of the revision will not be limited to regulations, but will address the body of regulatory practice, e. g., Standard Review Plan, inspection procedures, technical specifications, and other regulatory documents, 7) Performance-based regulatory approaches should provide incentives for innovation, and 8) The following issues with regard to the proposed rulemaking activities (including fire protection) need to be addressed in the process: (i) can the new rule and its implementation yield an equivalent level of, or have an insignificant adverse impact on, safety; (ii) can the regulatory/safety objective (qualitative or quantitative) be established in a manner to allow a common understanding between licensees and the NRC on how the performance or results will be measured or judged; and (iii) can the regulation and implementing

documents be developed in such a manner that they can be objectively and consistently inspected and enforced against. The Commission approved the framework for risk-informed and performance-based regulations that included these criteria in an SRM dated May 18, 1994 (SECY-94-090).

The staff will also develop the performance-based and risk-informed methods in a manner that complements the existing deterministic approaches and supports the traditional defense-in-depth philosophy. Consistent with the risk significance of fire events, the "Report on the Reassessment of the NRC Fire Protection Program," and the resulting Fire Protection Task Action Plan, the staff will review operating experience and will address a variety of fire safety issues. If the staff identifies significant issues or new requirements that should be included in the fire protection regulations, it will inform the Commission.

The ACRS, in its review of the NEI petition to amend NRC's fire protection regulations in a letter dated September 15, 1995, expressed their views on the NEI petition and a risk-based fire protection regulation. The ACRS expressed the view that performance-based regulations developed from risk considerations should include clearly stated objectives with demonstrable performance requirements (expressed in either deterministic or probabilistic terms), flexibility in the methods that the licensee is permitted to use to meet the performance goals or criteria (the methods should be supported by operational data and experimental results), and that the regulatory body must have a valid means to establish that the performance criteria have been met.

The views expressed by the ACRS support the criteria developed earlier by the staff stated above. The staff affirms that the criteria established for developing a performance-based and risk-informed fire protection rule, should be met by any rule proposed by the industry or developed by the staff.

Assessment of Fire Risk Analysis and Modeling Technological Advancements

Per staff commitments in SECY-94-090, the staff is studying the

current state of the art of fire modeling and risk-informed approaches to fire safety in nuclear and general building industries in this country and abroad. For the general building industries, the staff noted some progress in Japan, New Zealand, Canada, United Kingdom, Sweden, and Australia in adopting performance-based means of certifying alternative building designs within the framework of the prescriptive requirements. Some countries have revised their building codes to utilize performance language to allow alternative design methods that may be used to establish equivalency to the prescriptive building code requirements. Advanced performance-based fire analysis methods, i. e., fire models and risk-informed approaches, are being developed and have been applied to special projects on a limited basis where compliance with the prescriptive regulations (still maintained as an option in the guidance documents) would be costly or prohibit new design features. The staff is evaluating the potential applicability of these programs to nuclear power plants.

France is pursuing development of performance-based and risk-informed fire protection approaches in their nuclear program. Both the technical support organization (Institute of Protection and Nuclear Safety of the French Atomic Energy Commission) and the utility (Electricite de France) have programs to enhance the current generation of fire computer codes used in fire PRAs and are conducting experiments to generate data for fire code validation and input for fire PRAs. The staff is also evaluating the potential applicability of these programs to U. S. nuclear power plants. The programs for developing and implementing performance-based fire protection programs in the countries cited above have required the investment of a considerable amount of resources and engineering talent.

On the basis of its review of the state of the art of risk-informed performance-based methods for fire protection, the staff believes that the current state of technology in several areas limits the ability to codify and implement quantitative performance goals for fire protection at nuclear power plants at this time. For example, there are significant uncertainties in fire initiation frequencies, operator effectiveness in fire fighting and response to fires, fire propagation and suppression

models, failure thresholds of safety systems and components, and reliability of fire suppression systems. These uncertainties could make it very difficult to establish quantitative performance goals and criteria, and for licensees to demonstrate that such goals had been met.

Review of NEI Petition

The NEI petition requested the Commission to add flexibility for implementing current fire protection program requirements by decreasing the prescriptiveness of the regulations and considering the use of recent advances in fire PRA and sciences as a means to establish performance-based requirements. NEI claimed that the proposed new Appendix S would provide a more flexible alternative to the current fire protection requirements without reducing protection of public health and safety. The petitioner claimed that the technical content of this proposed appendix is evolutionary and includes functional acceptance criteria for corresponding detailed requirements in Appendix R that could be voluntarily adopted in whole or in part by licensees; and NEI claims that this approach will allow cost-effective implementation of the safety objectives of Appendix R without reducing safety. Attachment 2 includes a summary of the petition.

In a letter dated September 15, 1995, the ACRS found the rule proposed in the NEI petition deficient in that it did not meet the expectations of the ACRS for a performance-based regulation based on risk considerations.

The staff received comments from 17 organizations and individuals on its notice of receipt of the NEI petition. Comments were divided in terms of the support for the objective and the proposed methods in the petition. Industry groups, a standards organization, and licensees generally indicated support for the petition, while public interest groups, a consulting firm, and some individuals questioned the need and motivation for the petition and the maturity of fire modeling and PRAs proposed. Comments received on RuleNet on the rulemaking in general were similar in nature and extent. A summary and categorization of the public comments is included in Attachment 3.

The staff has reviewed the NEI petition, ACRS and public comments received on it, and the RuleNet record and concluded that the proposed revision to 10 CFR 50.48 and the new Appendix S as a whole does not meet the staff's criteria, discussed earlier, or form a basis for an extensive risk-informed and performance-based fire protection rule. In addition, it is not clear how the proposed rule would provide the level of safety achieved by the current regulation, or even if the proposed rule would provide reasonable assurance of an adequate level of safety. NEI claimed that its proposed rule is performance-based in that the ability to shutdown the reactor following a fire is the ultimate goal. NEI contended that its proposed rule provides for compliance with GDC 3 through continued compliance with Appendix R or through the implementation of the proposed alternative approaches in Appendix S. However, NEI did not recognize that Appendix R addresses only a portion of the fire protection program features needed to satisfy GDC 3. The proposed rule, therefore, is not adequate to meet the intent of GDC 3. The staff also found a number of technical issues with the fire protection rule proposed by NEI. For example, the proposed rule allows fire damage to both trains of equipment needed for hot shutdown. It also may adversely affect fire protection defense in depth because it eliminates minimum requirements (e.g., for fire barriers, automatic suppression, administrative controls, etc.) that the staff believes should be considered even in a performance-based and risk-informed regulation. For these reasons, the staff concluded that the rule proposed by NEI, revised 10 CFR 50.48 and Appendix S should be rejected.

The staff does not disagree with the intent of the NEI petition to achieve enhanced flexibility and commensurate burden reduction in the fire protection area. This objective was established by the staff, as described earlier, in its reports on the Reassessment of the NRC Fire Protection Program, the CRGR Special Review, the Regulatory Review Group Recommendations, and the Regulatory Improvement program before NEI docketed its petition. Also, the proposal by NEI to establish revised requirements that may be voluntarily adopted by licensees is also consistent with the policy of the Regulatory Improvement program. However, NEI's proposed 10 CFR 50.48 and Appendix S have failed to meet the objectives and criteria listed earlier for a proposed

performance-based and risk-informed regulation.

Fire Protection Regulatory Improvement Options

Options

Based on the review of the NEI petition, ACRS and public comments received on it, the RuleNet record, and the above discussion, the staff believes there are two viable options with regard to fire protection regulations:

1. Make no changes to the current fire protection regulations.

Discussion: All operating nuclear power plants have NRC approved fire protection programs which meet GDC 3 and 10 CFR 50.48. The plants licensed before 1979, comply with different sections of Appendix R depending on the issues that required resolution at each plant. The current regulatory framework (GL 86-10 license condition and the 10 CFR 50.59 process) provides most plants with a mechanism for flexibility required to make changes to their fire protection programs as long as these changes do not result in an unreviewed safety question or adversely affect the ability to achieve and maintain the reactor in a safe shutdown condition. Note, however, that for plants licensed to operate prior to January 1, 1979, this approach would not eliminate the need for exemptions when the licensee chooses to use an alternative approach in lieu of meeting the prescriptive requirements of the applicable sections of Appendix R. Under this option, the staff would (1) issue guidance for using 10 CFR 50.59 to make fire protection program changes and (2) deny the NEI petition.

2. Revise 10 CFR 50.48 and modify or remove Appendix R.

Discussion: Under this option, Appendix R may be modified or removed as a regulation, and 10 CFR 50.48 would be revised to facilitate the use of performance-based and risk-informed methods as they are developed. This option is consistent with the Commission's PRA Policy Statement. It will allow implementation of PRA technology to the extent

supported by the state of the art in PRA methods and data and in a manner that complements the Commission's deterministic approach and supports the traditional defense-in-depth philosophy. The revision to 10 CFR 50.48 would incorporate existing fire safety objectives for nuclear power plant fire protection programs and reference a regulatory guide in order to establish a consistent regulatory framework for plants licensed before and after 1979. In developing this option, the staff will address any regulatory gap or inconsistency that could be potentially created by the modification or removal of Appendix R. The regulatory framework and methods acceptable to the staff for meeting the requirements of GDC 3 and 10 CFR 50.48 contained in the Standard Review Plan and Branch Technical Positions (that are substantially similar to Appendix R) would be included in the regulatory guide as appropriate. Therefore, this modification would not compromise the safety beneficial actions implemented as a result of Appendix R.

As discussed above, the state of the art of fire modeling and risk assessment methods is not sufficiently developed to support codification of quantitative performance goals for fire protection at this time because it would be difficult to demonstrate compliance with such goals. However, significant regulatory improvement can still be achieved now while retaining the qualitative approach of 10 CFR 50.48 as the rule is revised. The regulatory guide (discussed above) would provide for the use of risk informed and performance-based approaches as they are developed by industry without the need for future rulemaking.

This option would also establish a uniform fire protection regulation for all plants and should eliminate the need for future fire protection exemptions. The development of the regulatory guide would be based on current staff fire protection guidance and the requirements of Appendix R, including any generic bases for alternative fire protection approaches granted under the Appendix R exemption process. This would allow the application of limited risk-informed and performance-based approaches consistent with exemptions that already have been granted and that can be adequately

supported by proven technological advancements. As with Option 1, the staff would include guidance (in the regulatory guide) in this option with respect to the application of the 10 CFR 50.59 process to fire protection program implementation. Under this option, NEI's proposed revision to 10 CFR 50.48 and the new Appendix S would be rejected.

Thermo-Lag

In an SRM, dated June 27, 1994, the Commission approved the staff recommendation to proceed with the development of a performance-based fire protection rule while requiring compliance with existing NRC requirements with consideration of requests for exemptions currently permitted by regulations. In that SRM, the Commission also stated that it felt that the new rule should not be considered as a means to resolve the Thermo-Lag issues. Licensees have submitted their schedules and plans to establish compliance by resolving the Thermo-Lag fire barrier issues with the staff. The staff is addressing these issues on a plant-specific basis. Option 2, revising 10 CFR 50.48, "Fire Protection," removing the current Appendix R regulatory requirements, and developing a comprehensive regulatory guide would not require a change to this course of action.

STAFF RECOMMENDATION:

Option

The staff recommends adoption of Option 2. The initial implementation of the revised regulation would allow certain licensees added flexibility, specifically those plants licensed prior to January 1, 1979, in that they will be able to make changes to their approved fire protection program under 10 CFR 50.59 without the need to seek prior Commission approval (i.e., request an exemption for the use of an alternative approach that provides a level of fire safety equivalent to that required by Appendix R). This approach would provide guidance, and would also provide an incentive, to industry for further development of the PRA and fire modeling tools needed to support more extensive performance-based and risk-informed fire protection regulatory

determinations.

The staff will keep up to date on emerging information related to fire protection at nuclear power plants including operating experience, and will continue efforts to improve fire risk assessment methodologies and to evaluate the validity of fire environment modeling and equipment vulnerability data as resources permit. These efforts will support continued staff decision making on fire issues, and will provide guidance to industry and allow the staff to be responsive to any industry initiatives to develop innovative fire protection programs.

The development of future performance-based and risk-informed approaches will be largely dependent on the industry efforts to advance fire PRA and reduce its uncertainties, develop and validate models that address nuclear power plant fire problems, and develop the operational and experimental data needed to make responsible fire protection decisions. The revision to the regulation will be developed so that it will allow the implementation of performance-based and risk-informed approaches as they are developed and proposed by the industry and licensees and accepted by the staff without the need for future rulemaking.

The revisions to the regulations and the regulatory guide will be developed so that any new approaches would only be adopted on a voluntary basis by licensees. Licensees that have an NRC-approved fire protection program will not need to take any additional action, unless they choose to do so. If the staff identifies significant issues or new requirements that would need a backfit analysis, it will provide to the Commission a plan and schedule for those actions at that time.

The advantages of Option 2 are:

- ! A consistent fire protection regulatory framework will be created for all plants.
- ! The new regulation should eliminate the need for future exemption requests.
- ! The revised regulation and new guidance should enhance flexibility and reduce regulatory burden without an adverse impact on safety.
- ! The revised regulation will allow the industry more latitude to develop performance-based and risk-informed approaches to focus efforts on risk-significant fire protection activities.
- ! The new regulatory guide will clarify the staff's fire protection program expectations, consolidate previous staff fire protection guidance and positions and establish the criteria for making fire protection program changes using the 10 CFR 50.59 process.

NEI Petition

Based on discussions presented earlier in the paper, the staff recommends the Commission reject NEI's proposed revision to 10 CFR 50.48 and the new Appendix S. A complete disposition of the petition will be included in the statement of considerations of the proposed rule.

SCHEDULE:

If the Commission approves Option 2, the staff would develop a rulemaking plan consistent with Management Directive 6.3 for Commission approval by the end of 1996. A proposed rule (revision to 10 CFR 50.48 and accompanying regulatory guide) would be provided to the Commission by the end of 1997. If the staff identifies any significant issues or additional alternatives to fire protection regulation they will be provided for Commission approval.

RESOURCE IMPLICATIONS:

Resources for this program are included in the Five-Year Plan.

COORDINATION:

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

RECOMMENDATION:

That the Commission approve the staff recommendations for action on the NEI petition and rulemaking option, presented herein.

James M. Taylor
Executive Director
for Operations

Attachments:

1. Fire Protection Program Guidance
and Requirements
2. Summary of NEI Petition
3. Summary of Public Comments

Attachment 1

**NRC Fire Protection Program Guidance
and Requirements**

History and Development

NRC Fire Protection Program Guidance and Requirements History and Development

History

General Design Criteria (GDC) 3 of Appendix A to 10 CFR Part 50 requires that structures, systems, and components important to safety be designed and located to minimize the probability and adverse effects of fires and explosions, that noncombustible and heat resistant material be used whenever practical, and that fire detection and suppression systems be provided to minimize the effects of fires on structures, systems, and components important to safety. In the 1970s, safety evaluations based on GDC 3 served as the justification for AEC and early NRC acceptance of fire protection programs. However, because of the lack of implementation guidance, the level of fire protection provided by a plant was typically found adequate if it complied with applicable local fire codes and received an acceptable rating from its insurance underwriter. As a result, the fire safety features imposed on commercial nuclear power plants were very similar to those imposed on conventional fossil-fueled electric power generation stations.

Browns Ferry Fire

On March 22, 1975, a fire occurred at Unit 1 of the Browns Ferry Nuclear Power Station (licensee - Tennessee Valley Authority). The fire began in a bank of cable trays in an area of the cable spreading room where the trays passed through a penetration in a wall separating the cable spreading room from the reactor building. The greatest amount of fire damage occurred on the opposite side of the penetration in an area of the reactor building approximately 40 feet (12.2 meters) by 20 feet (6.1 meters). Although damage was limited to a relatively small area of the plant, more than 1600 cables routed in 117 conduits and 26 cable trays were affected, and of those, 628 cables were safety related. The fire damage experienced by electrical power and control systems impeded the functioning of normal and standby reactor cooling systems and degraded the operator's capability to monitor the status of the plant. Because of the loss of multiple

safety systems, operators were required to initiate emergency repair actions to restore required systems so that the reactor could be brought to a safe shutdown condition.

Investigations of the cause and possible consequences of this event on the health and safety of the public demonstrated that the occupant life safety and property protection concerns of the major nuclear fire insurance underwriters did not sufficiently encompass nuclear safety issues, particularly with regard to the potential for fire damage to cause the failure of redundant trains of systems and components important to the safe shutdown of the reactor. Consequently, the NRC special review team that investigated the possible cause and potential effects concluded that fire protection requirements for nuclear power plants must be expanded to include the additional objectives of ensuring nuclear safety.

Two recommendations made by the Special Review Group that investigated the Browns Ferry fire pertained to assurance that the fire protection programs at operating nuclear power plants conform to GDC 3. One of the recommendations was that NRC should develop specific guidance for implementing GDC 3. The other was that NRC should make a detailed review of the fire protection program at each operating plant, comparing it to the guidance developed pursuant to the above recommendation.

Fire Protection Guidelines for Nuclear Power Plants

In May 1976, the NRC issued Auxiliary and Power Conversion Systems Branch (APCSB), Branch Technical Position (BTP) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," which applied to plants that filed for a construction permit after July 1, 1979. This BTP incorporated the fire protection recommendations from the Browns Ferry fire special review team. In addition, the NRC developed Appendix A to BTP 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976." This appendix established a minimum level of fire protection at older operating plants without significantly affecting the design or operation of the plant. The intent of these new fire protection guidelines was to establish a fire protection program that is based on a defense-in-depth philosophy.

By the late 1970s, the majority of operating plants had completed their analysis and had implemented most of the fire protection program requirements of Appendix A to APCS BTP 9.5-1. In most cases, the fire protection modifications proposed by the licensees were found acceptable by the staff. In certain cases, technical disagreements developed between certain licensees and the NRC staff and several plants refused to adopt certain fire protection program recommendations contained in Appendix A to APCS BTP 9.5-1. Even though certain fire protection program issues were contested by only a few plants, the NRC determined that the issues were a potential generic problem and rulemaking was deemed necessary to resolve these problems and assure the full implementation of the Commission's policy with respect to fire protection. Therefore, to resolve the 17 generic fire

protection issues at 32 plants, the NRC amended its regulations and issued 10 CFR 50.48, "Fire Protection," and Appendix R, "Fire Protection Program for Nuclear Power Plants operating Prior to January 1, 1979" (45 FR 36082).

10 CFR 50.48 and Appendix R to 10 CFR Part 50

In its original proposal for Appendix R, the staff intended these requirements to be applicable only to settle the APCS BTP 9.5-1 Appendix A open fire protection issues. Thus, the staff had not originally intended the provisions of Appendix R to require additional modification of previously approved fire protection features. However, during the rulemaking process the Commission determined that the requirements of Sections III.G, III.J, and III.O of Appendix R were of such safety significance that they would be applied to all plants.

On November 19, 1980, the NRC published in the Federal Register the final version of 10 CFR 50.48, to ensure that each plant has a fire protection program, and Appendix R to 10 CFR Part 50 (45 FR 76602), to ensure satisfactory resolution of disputed issues. As stated in 10 CFR 50.48(a), in part, the fire protection program is to limit fire damage to structures, systems, or components important to safety so that the capability to safely shut down the plant is ensured. Appendix R concerns only a limited number of issues since the general requirements relating to fire protection were already set forth in GDC 3 and the NRC guidance documents. Specifically, the provisions of Appendix R are divided into two categories: (1) Sections III.G, III.J, and III.O, which were backfit to all plants operating prior to January 1, 1979, regardless of whether or not alternatives to the specific requirements of these sections previously had been approved by the staff; and (2) all other sections, which were backfit to certain plants operating prior to January 1, 1979, to resolve items that previously had not been approved by the staff as satisfying the provisions of Appendix A to BTP APCS 9.5-1.

Appendix R Exemption Process

The Commission, when it promulgated the Appendix R fire protection requirements, recognized that there would be unique plant conditions where the fire protection features identified by Appendix R would not greatly enhance the level of fire safety already provided by the licensee. Therefore, in those cases when a fire hazard analysis could adequately demonstrate that the alternative fire protection features provided a level of fire safety equivalent to that required by Appendix R, the licensee could apply for an exemption under the provisions of 10 CFR 50.48(c)(6).

Fire Protection Guidelines for Plants Licensed after January 1, 1979

For plants licensed to operate after January 1, 1979, the staff reviewed the fire protection programs during the licensing process. Therefore, as discussed in Generic Letter 86-10, there was no need to backfit Appendix R to plants licensed to operate after January 1, 1979. NUREG-0800, "Standard Review Plan" (SRP), Section 9.5-1, "Fire Protection Program," incorporates the guidance of BTP APCS 9.5-1, Appendix A to BTP APCS 9.5-1, and the criteria of Appendix R to 10 CFR Part 50. Therefore, licensees can also implement the guidance contained in Section 9.5-1 of the SRP to establish a fire protection program that complies with 10 CFR 50.48 and GDC 3.

Burden Relief - GL 86-10 License Condition

In Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements," dated April 24, 1986, the NRC requested licensees to adopt a standard license condition for fire protection. As part of this process, the NRC requested licensees to incorporate their fire protection program that had been approved by the NRC, including the fire hazards analysis and major commitments that form the basis for the fire protection program, into their Final Safety Analysis Report (FSAR). Once the process was completed, and the license condition was implemented, the provisions of 10 CFR 50.59 would apply directly for changes the licensee desires to make in the fire protection program. In this context, the determination of the involvement of an unreviewed safety question defined in 10 CFR 50.59(a)(2) would be made based on the

"accident ... previously evaluated" (i.e., the postulated fire in the fire hazard analysis for the fire area affected by the change). Therefore, licensees that have adopted the standard license condition for fire protection may make changes to the approved fire protection program without prior approval of the Commission only if those changes do not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. Currently, 96 of 110 operating reactors have the standard license condition for fire protection and can make the necessary operational fire protection program changes without seeking prior Commission approval.

Attachment 2

Summary of NEI Petition

Summary of NEI Petition

The following is a summary of the petition for rulemaking received from NEI. A complete notice of receipt of the petition was published on June 6, 1995 (60 FR 29784).

NEI (the petitioner) requested that the NRC amend the regulations in 10 CFR Part 50 that govern fire protection at nuclear power plants. The petitioner believes that significant strides have been made in the fire sciences and that licensees' fire protection programs have matured since the current NRC fire protection requirements in 10 CFR 50.48 and Appendix R to 10 CFR Part 50 were adopted. The petitioner also noted that the NRC has gained nearly two decades of experience in reviewing licensee fire protection programs and requested that the NRC adopt a more current and less prescriptive approach to fire protection that builds on the defense-in-depth concept used to establish the existing requirements. NEI cited the "NRC Program for Elimination of Requirements Marginal to Safety," published on November 24, 1992 (57 FR 55157), and a separate initiative entitled "Reducing the Regulatory Burden on Nuclear Licensees," published on June 18, 1992 (57 FR 27187), as examples in which the NRC proposed amending its regulations to continue efforts to eliminate requirements that are marginal to safety and to reduce the regulatory burden when the benefit realized is not commensurate with the resulting cost. The petitioner also noted that the NRC's Regulatory Review Group (RRG) identified the existing rule on fire protection as one of the regulations that should be improved.

The petitioner proposed an amendment to 10 CFR 50.48 and the addition of a new appendix that it believes will provide a more flexible alternative to the current fire protection requirements in Appendix R to 10 CFR Part 50. The petitioner claimed the new appendix is evolutionary, includes functional acceptance criteria for corresponding detailed requirements in Appendix R that could be voluntarily adopted in whole or in part by licensees, and would not reduce public health and safety in any way. The petitioner believes this performance-based approach would allow cost-effective implementation of the safety objectives of

Appendix R without reducing safety. The proposed changes envisioned by the petitioner include the development of a new guidance document, to be developed by industry concurrent with promulgation of the revised rule. The petitioner noted that the NRC uses a defense-in-depth approach to fire protection for nuclear power plants that includes key elements of protection, detection, and suppression within a fire protection program to attain the required objective of protecting the safe shutdown capability of the plant. However, the petitioner believes that the current requirements are too prescriptive because they apply equally in all plant areas without providing a mechanism for determining the actual fire hazard and risk significance in each area. The petitioner stated that its proposed rule provides for licensees and NRC resources to be better focused toward the objective of achieving and maintaining safe shutdown in the unlikely event of fire.

NEI acknowledged that a prescriptive rule was necessary in 1980 because nuclear power plant fire protection technology was relatively new at that time. However, the petitioner believes that those fire protection standards have been difficult to implement consistently for nuclear power plants and noted that the NRC has granted more than 1,200 exemptions after the inception of the rule. The petitioner believes that the difficulty in implementing the standards results not only from the prescriptiveness of the current rule but also because fire protection standards in other industries are directed primarily toward protection of life and property, whereas fire protection at nuclear power facilities focuses on preserving the plant's safe shutdown capability to adequately protect the public health and safety.

The petitioner noted that other Federal agencies, such as the General Services Administration (GSA), have enhanced their fire protection regulations based on recent advances in fire modeling techniques. The petitioner alleges that GSA uses fire modeling to identify fire safety risks and develop performance-based approaches for achieving adequate levels of protection. The petitioner also noted that the Advisory Committee on Reactor Safeguards has briefed the Commission on the development of performance-based approaches to fire protection at nuclear power plants in the United Kingdom and Canada. The petitioner contended that the RRG has specifically recommended that probabilistic safety assessment techniques be used to develop fire protection regulations that are more performance-based. The petitioner indicated agreement with the RRG on the general philosophy of focusing on key objectives related to measurable performance in order to permit resources to be applied to and attention centered on activities most directly related to protection of the public health and safety.

The petitioner claimed that its proposed rule and Appendix would provide less prescriptive alternative requirements corresponding to each section of Appendix R to 10 CFR 50, and burden relief is requested in all these areas.

Attachment 3

Summary of Public Comments

Summary of Public Comments

On June 6, 1995, the staff published (60 FR 29784) the notice of receipt of the NEI petition, including 13 questions on topics the staff considered important for the rulemaking. The comment period closed on September 30, 1995. Subsequently, the staff solicited (60 FR 57370) public discussion on the rulemaking in the RuleNet project in January and February 1996.

Public comments on NEI Petition

The staff received comments from seventeen organizations and individuals that may be grouped as follows: 6 licensees, 2 industry organizations, 1 fire protection consulting firm, 1 standards organization, 2 public interest groups, and 5 individuals.

Most of the comments that were received are directly related to the 13 specific areas for public comment as presented in the Federal Register notice. One industry group, one standards organization, and six licensees indicated general support for the petition. One public interest group and two individuals believe that this petition represents a decrease in overall safety that is not appropriate for such an important aspect of nuclear plant safety. Two public interest groups, a consulting firm, and one individual indicated that the apparent motivation for the petition is the desire to avoid the difficult and expensive compliance issues caused by the deficiencies discovered in fire barriers such as Thermo-Lag. A standards organization, a licensee, and a consulting firm provided the staff with options for the rulemaking. The following are summaries of comments on some of the topics for comment identified by the staff.

1. Scope of Proposed Rule and Exclusion of New Requirements

Most of the comments received on this topic essentially agreed with the focus of the petition for rulemaking on the safe shutdown function only. A consulting firm disagreed with the petition's focus, stating that requirements should be included for safe shutdown and safety related systems.

An industry group stated that regulatory requirements should be limited to circumstances that are necessary to provide reasonable assurance of adequate protection, unless a backfit analysis supports additional requirements. The commenter stated that 15 years of experience with the current rule suggests that a backfit analysis would not support the inclusion of additional equipment and requirements in a revised rule. NEI stated that further regulations to explicitly address other fire protection functions will not provide a significant safety benefit and new requirements are neither necessary or warranted. Other comments received on this topic concurred with the existing policy of separating regulatory action for new fire protection issues from efforts to improve regulatory efficiency. One utility indicated it was very concerned that an attempt to simultaneously deal with "new safety issues" would cause needless additional delays or even thwart the much needed revisions of the existing regulations.

2. Demonstration of Safety-Neutrality of Proposed Rule

NEI referred to the plant-specific nature of a PRA, the lack of an approved systematic fire risk assessment, and the difficulty of quantifying the level of safety under the current prescriptive fire regulations in its deferral of a meaningful quantitative comparison. NEI and several other commenters believe the issue should not be equivalency with Appendix R, but whether the proposed rule and the associated licensee compliance measures will provide adequate protection of public health and safety. NEI cites the current regulation that requires fire barriers to meet certain explicit criteria on fire duration, even for plant areas where fire hazards cannot sustain fires for the specified duration, as an example that exceeds measures required for adequate protection of public health and safety. Also, the requirement to plan for worst case fire scenarios that may not be realistic is cited as another example. One industry group indicated that alternatives to current requirements that can provide sufficient assurance of adequate protection exist and that NRC has affirmed this

proposition many times by approving exemptions that deviate from the specific features identified in Appendix R. One utility advocated the use of the safety evaluation process of 10 CFR 50.59 to determine the impact of fire risk. One commenter concluded that the proposed approach is expected to be safety positive in comparison to Appendix R, reasoning that the operators are currently procedurally constrained to use less reliable systems.

A consulting firm, on the other hand, believes that sufficient technical justification must be provided to move away from the current regulatory approach. Until NEI provides information concerning the safety neutral question, no member of the public can adequately comment on their proposal -- either to support or constructively criticize. One individual expressed concern that the use of PRA to compare approaches to fire safety is not a well established practice. A rational methodology needs to be developed for this demonstration. If not, neither the regulators nor the regulated will be assured that the demonstration has been performed soundly.

3. Implementation Guidance

NEI states it is proceeding to develop implementation guidance, and the details of the document will be discussed with the NRC staff throughout its development to facilitate NRC review. One licensee noted that the maintenance rule was promulgated without any guidance and serves as a precedent for this proposed rule. Other commenters cited the ACRS review of the NEI petition and concurred with the ACRS criticisms, which include the petition's lack of probabilistic requirements and the extensive use of non-quantitative language. NEI stated that it is impractical to generically address the implementation details of risk-based models in a rule, and NEI continues to believe a guidance document is the best approach to provide details.

In response to the NRC request for specific information on advances in the fire sciences and PRA that would support this petition, NEI notes that the intent of the proposed

rule is to provide the flexibility to use any techniques that may be available now or at a later time consistent with guidelines to be provided in the guidance document. One model that is presently available is the Fire Induced Vulnerability Evaluation (FIVE). NEI also referred to several analytical models for assessing fire.

Other commenters indicated the present state of the art of fire modeling could generally be characterized as "primitive." Some commenters also had reservations about the present capabilities of PRA. One commenter quoted the ACRS statement that, given the uncertainties in the state of the art, fire PRAs cannot be the sole basis for regulatory requirements.

Other commenters discussed their desire for rigorous testing or concerns about the difficulties of verifying and validating generic models for plant-specific applications. NEI stated that the availability of experimental data to support the development or use of fire modeling techniques is not crucial and indicated the sensitivity and uncertainty analyses of PRA models such as IPEs can be used to yield meaningful insights. NEI believes the NRC does not need to perform prior review and approval of specific modeling techniques other than through concurrence with examples that might be cited in the guidance document. One commenter foresees unspecified difficulties with the specification of fire modeling methods in a new rule. The National Fire Protection Association believes the ANSI-accredited voluntary standard process will ensure a thorough review and technical analyses of issues during the development of a standard.

4. The Availability of Other Processes for Burden Relief

Both NEI and another industry group acknowledged that a number of licensees can pursue fire protection changes through 10 CFR 50.59. They stated that, although some of the changes proposed by the petitioner may be performed by some licensees under 10 CFR 50.59, important aspects of the proposed changes cannot be performed under Section 50.59.

Licensees that must comply with Appendix R or clear license requirements to have certain Appendix R features cannot change these requirements without exemptions or license amendments. They stated that the numerous exemptions requested indicate the need for flexibility in the regulation. Moreover, they state that, in cases when an exemption or license amendment is not required, the history of NRC enforcement of fire protection requirements has caused licensees to adopt a highly conservative approach to determining whether a proposed change would constitute an unreviewed safety question under 10 CFR 50.59. They stated that even when there is no safety significance to a contemplated change, licensees have been reluctant to expose themselves to the possibility of enforcement for implementing such a change. One utility also indicated that experience has shown that the exemption process is a cumbersome, labor-intensive process. NEI stated that maintaining the current fire protection regulations simply because available mechanisms for limited burden relief to some licensees exist would be inconsistent with the goal of regulatory improvement. They cite SECY-93-143, the "Reassessment of the NRC Fire Protection Program" report that stated revision of current regulations could "... eliminate the potential for confusion and conflict between 10 CFR 50.48 and GL 86-10..." NEI urged the staff to implement a revision to the regulations that would have a more comprehensive effect on reducing regulatory burden.

Two commenters believe efficiencies can be achieved with limited changes to the existing rule or by development of criteria for determining acceptable technical alternatives to assure safe shutdown. One of the commenters stated that regulatory relief is provided by allowing licensees to assess changes to the fire protection program via the 10 CFR 50.59 process. The NEI proposed rule does not provide additional relief to licensees with respect to evaluating the impact on the ability to safely shut down. Another commenter indicated the preferred mechanism is to update the rule based on current staff practices and shift the focus to inspection.

5. Evolutionary Approach versus Comprehensive Modification of Fire Regulations

In response to this question, NEI stated that the petition provides for an adequate evolutionary approach by maintaining the structure of the current regulation while allowing progression toward a more functional approach. However, NEI noted the staff's interest in perhaps revising the general requirements of 10 CFR 50.48 so that it would incorporate the general objectives of the proposed rule (with the details of the proposed rule identified in an industry guidance document). One utility indicated concern that the significant effort expended by NEI and member utilities will be discarded in the hopes of finding a marginally better approach.

Another utility believes additional guidance could negate the need to revise the current rule. A consulting firm recommended changes to NEI's rule aimed at regulatory stability founded in current policies that remain relevant, such as flexibility to substitute functionally equivalent approaches as new knowledge and technology becomes available, simplification of the existing regulation to provide a better balance with inspection and enforcement policy, and greater focus on safety matters.

Comments Received on RuleNet

The staff conducted a pilot project using the computer-based Internet technology to enhance public participation during the rulemaking process. The aim is to use advanced technologies that may help the consensus building process among the public, industry, and other interested parties. This pilot project was conducted as part of the National Performance Review RegNet project aimed at further democratization of the citizen-government interface by enhancing public participation in government decisionmaking.

Significant discussions in 3 phases over a 4-week period were conducted on a number of topics on the rulemaking. In the first phase, the topics of specific interest to the staff were identified for solicitation of written comments (see above) and

were posted on RuleNet for discussion. In the second phase, a synthesis of issues raised by commenters were categorized and alternatives for resolution of these issues were solicited. In the third phase, a summary of RuleNet discussions was posted to provide participants a chance to agree or modify the staff conclusions. A complete evaluation of the RuleNet process will be provided to the Commission separately in the near future. The discussions were constructive and provided the staff with greater insights of commenters views than could be achieved by a one-time submittal of written comments. The following is the staff's summary of discussions on RuleNet.

Regulatory Flexibility

No participant advocated that rulemaking was necessary as a resolution to a public health and safety deficiency in the existing rule. Rather, some participants endorsed rulemaking as necessary to provide licensees with more flexibility in implementing fire protection regulations (although there was no agreement on how this should be done). Other participants thought that certain benefits could be achieved by working within the existing rule, for example, by ensuring that staff interpretations of the existing rule were consistent or by ensuring that NRC enforcement guidance recognizes that not all fire protection requirements are equal in contributing to safety. Others did not believe that licensees could demonstrate that they were complying with the existing rule, and therefore, no rulemaking should be undertaken until this demonstration is made.

Risk And Fire Modeling

There was general consensus that risk information and fire modeling can be beneficial in developing a regulation to focus licensee activities on safety- significant activities in order to improve the cost-effectiveness of plant fire protection programs without adversely affecting safety. However, to develop such a rule would require the necessary risk and fire models.

Fire Protection Requirements

There was general consensus that fire protection requirements are not all equal in their contribution to safety, and fire protection features should be "graded" or "binned" according to their relative importance to plant safety. For example, activities for Appendix R to 10 CFR Part 50 and Appendix A to BTP 9.5.1 should be differentiated, the fire threat for each fire area should be defined, and protection should be provided based on the threat rather than equal protection across the board.