Fire Fighting Protocol

QUESTION 1. Please provide examples of station fire fighting manuals, other training materials and training records which substantiate the implementation of this three phase technique or illustrate the fire brigades are actually being instructed on how to locate fire barrier penetration seals and tear into these seals to discover potentially deep seated fires.

ANSWER.

This information is provided in Appendix C.

Fire Fighting Protocol

QUESTION 2. How long would it take for fire-fighting personnel to dismantle one penetration seal?

ANSWER.

The amount of time that it would take fire-fighting personnel to dismantle one penetration seal would depend on the type of seal, its size and location, the type and number of penetrants, and the extent to which it was involved in the fire. The staff does not believe that the time required to dismantle a penetration seal would be a significant factor in the overall success of the fire fighting effort. For example, one or both sides of a fire barrier penetration seal is generally accessible to a fire hose stream. Therefore, even if a particular seal is not physically accessible until late in the fire fighting evolution, the brigade could control any fire involving the seal until it can gain physical access to the seal.

Fire Fighting Protocol

QUESTION 3. How will the fire brigade find and access all affected penetration seals, many of which are inaccessible because of design and installation obstructions?

ANSWER.

After the fire brigade obtains control over the fire, it would enter the fire area, visually inspect the fire barriers, and determine if penetration seals were involved in a fire. If so, the fire brigade would take appropriate action. For example, if the fire brigade cannot access a seal from the fire area that was on fire, it may go to the adjacent fire area and access the seal from the other (nonfire) side of the barrier. Even if a particular seal is not physically accessible, one or both sides of a fire barrier penetration seal is generally accessible to a fire hose stream. Therefore, the brigade could control any fire involving the seal with a hosestream until it can gain physical access to the seal. If a seal is completely inaccessible, the fire brigade would isolate the fire areas in which the seal is located and take action to prevent the fire from spreading beyond the area of the seal until it could take action to gain direct access to the seal. (e.g., remove obstructions).

NRC Exemptions to Penetration Seal Regulations

QUESTION 1. On what basis did the NRC issue exemptions affecting the critically important control room sprinklers and penetration seals at the Pilgrim plant?

ANSWER.

The bases for the exemptions are documented in a safety evaluation dated March 17, 1988. They are as follows:

Combustible loading in the Cable Spreading Room (CSR) is primarily cable insulation (jacketing), most of which is equivalent to the fire resistance criteria of IEEE Standard 383. Most of the cable, including all of the non-fire-retardant cable, has been coated with fire-retardant material.

Alternative safe shutdown systems that are independent of both the Control Room and the CSR have been installed. The alternative safe shutdown systems, complete with detailed emergency operating procedures, are available for use in the event of a fire in either or both rooms, and exceed the requirements of Appendix R, both in redundancy and in plant functions provided.

Although the Control Room and the CSR are listed as separate Appendix R fire areas, a major fire in either area would disable the safe shutdown components in the other, regardless of the fire barrier between them.

The Control Room floor/CSR ceiling is a twelve-inch-thick slab of concrete.

Structural steel under the Control Room floor/CSR ceiling has been covered with a fire-resistant coating at all accessible points.

Upgrading of the seals (approximately 25 of 250 in the wall) was not deemed as feasible due to the congestion under the CSR ceiling. Upgrading these seals would have required the disruption of many circuits with a potential negative impact on safety.

Thus, the staff concluded that the existing penetration seals in the CSR ceiling/Control Room floor assembly were satisfactory and did not need to be upgraded to a full 3-hour fire resistance rating. The staff also reaffirmed the 1981 exemption from the requirements of Appendix R to 10 CFR 50 for automatic suppression (sprinklers) in the control room.

NRC Exemptions to Penetration Seal Regulations

QUESTION 2. Please list all exemptions NRC has granted for penetration firestops, the reactors for which they were granted, and the basis for each exemption.

ANSWER.

The table attached as Appendix D, provides the requested information.

NRC Exemptions to Penetration Seal Regulations

"In 1984, the NRC Annual Planning and Program Guidance document recommended that 'existing regulatory requirements that have marginal importance to safety should be eliminated.' The NRC then initiated a program to identify those requirements. In 1991, NRC SECY-91-224, a communication that reported on whether any of the NRC regulations placed substantial regulatory burdens on licensees while providing only 'marginal' importance to safety concluded that 'no 10 CFR Part 50 regulations were identified that are so burdensome on operating reactors and so marginal to safety that would warrant the expenditure of additional staff resources to rectify [and that] no further action should be taken at this time.' The report also stated that there is considerable uncertainty as to whether licensees would take advantage of the flexibility offered by non-prescriptive regulations."

QUESTION 3a. Why did the NRC begin to consider non-prescriptive regulation in regards to fire protection only two years later?

ANSWER.

As documented in the same SECY paper, the Commission had directed the staff to consider non-prescriptive regulations. Specifically, the SECY paper states:

> In light of resource constraints and the number of high priority rulemakings actions currently underway, the staff believes that no further action should be taken to pursue this approach at this time. However, as directed by the Commission in the Staff Requirements Memorandum dated March 8, 1991 on revisions to the charter of the Committee to Review Generic Requirements, the staff will evaluate the feasibility of defining performance-based requirements in proposing regulatory initiatives and new regulations if it determines that would be appropriate. (emphasis added.)

In response to the Commission direction, the staff continued to consider eliminating requirements marginal to safety and to define performance-based requirements. In SECY-92-263, dated July 24, 1992, the staff informed the Commission of public comments received on NRC's initiatives to eliminate requirements marginal to safety. As reported in that paper, based on very positive feedback in the comments received, the staff planned to initiate rulemaking to modify and make less prescriptive, for decreasing burden without an adverse impact on safety, Appendix R to 10 CFR Part 50. The main aim of the performance-based regulatory approach was to allow licensees flexibility to use cost-effective methods for implementing the objectives of the regulation. In addition, a performance-based regulatory approach should provide incentives for innovation and improvements in safety.

NRC Exemptions to Penetration Seal Regulations

QUESTION 3b. Why did the NRC write a new test procedure for fire barrier envelope systems (86-10 Supplement 1) which resulted in a defined weaker hose stream test previously called for in earlier test procedure, especially when the fire procedures followed by the new Watts Bar plant call for switching from the weaker fog nozzle to the stronger solid stream to ensure that the fire is out?

ANSWER.

Generic Letter 86-10, "Implementation of Fire Protection Requirements," established that Chapter 7 of National Fire Protection Association (NFPA) Standard 251, "Standard Methods of Fire Tests of Building Construction and Materials," provided the basis for the staff position for qualification testing of raceway fire barriers. NFPA 251, Chapter 7, "Fire Test Acceptance Criteria for Nonbearing Partition Walls," allows the hose stream tests for a nonbearing wall to be performed on a duplicate test specimen after the specimen has been exposed to the standard test fire for a period equal to one-half of the fire resistance rating desired, but not for more than 1-hour (e.g., after a 30-minute fire exposure to qualify a 1-hour fire barrier and after a 1-hour fire exposure to qualify a 3-hour fire barrier). After the fire exposure, the test specimen is subjected to a solid hose stream test. The NRC staff position accepts this hose stream test method.

The staff also accepts the application of the hose stream test after the completion of the full fire endurance test period. If this method is used, one of the following hose stream test options can be applied:

- A solid hose stream applied at random to all exposed surfaces of the test specimen through a 2 ½ -inch national standard playpipe with a 1 1/8-inch orifice at a pressure of 30 psi at a distance of 20 feet from the specimen. The duration of the hose stream application is 1 minute for a 1-hour barrier and 2 ½ minutes for a 3-hour barrier; or

- A fog hose stream applied at random to all exposed surfaces of the test specimen through a 1 ½ -inch fog nozzle set at a discharge angle of 30 degrees with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle a maximum of 5 feet from the test specimen. The duration of the hose stream is 5 minutes for both 1-hour and 3-hour barriers; or

- A fog hose stream applied at random to all exposed surfaces of the test specimen through a 1 ½ -inch fog nozzle set at a discharge angle of 15 degrees with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle a maximum of 10 feet from the test specimen. The duration of the hose stream is 5 minutes for both 1-hour and 3-hour barriers.

NRC staff guidance in NUREG-0800, Standard Review Plan (SRP), Section 9.5.1, "Fire Protection for Nuclear Power Plants," specifies these hose stream methods for fire barrier penetration seal fire endurance tests. Therefore, the application to these hose stream test

options to fire barrier systems used to separate safe shutdown functions within the same fire area is consistent with the existing staff guidance. Furthermore, the staff believes that a fog hose stream test (after a full-duration fire test) satisfies the same fire safety objectives for fire barrier penetration tests as raceway fire barrier systems.

The staff accepts a fog hose stream test (after the full duration fire test) based on the following considerations:

(1) Nuclear power plant fire protection programs are based on the defense-in-depth concept, in which fires are prevented through administrative control of transient combustibles and ignition sources. Installed plant fire protection features also provide fire separation between safe shutdown trains and enable the plant staff to rapidly detect, control, and suppress fires that occur despite the prevention efforts.

(2) The staff recognizes the fire-resistive construction of nuclear power facilities, the defense in depth of the fire protection program, and the low combustible fire loads in nuclear power plants. Thus the staff does not expect significant fire-related structural challenges (e.g., collapse of cable trays) to the integrity of the raceway fire barriers before the fire is controlled and suppressed by either automatic fire suppression systems or the in-plant fire brigade.

(3) In-plant fire brigades apply water through fog streams to control fires in areas with energized electrical equipment (most areas with raceway fire barriers).

(4) The pressures and the discharge rates from fog stream hose streams provide sufficient cooling and eroding effects to evaluate the fragility of the barrier system after the full-duration fire exposure.

Fire fighting schools instruct trainees to use fog streams on fires involving energized electrical cables or equipment until the electrical hazard can be electrically isolated. If the redundant safe shutdown train is protected by a raceway fire barrier system, including fire penetration seals, and the other train is on fire, the fire would be cooled and controlled by either an automatic suppression system or the plant fire brigade. After the affected train has been electrically isolated and flaming combustion has been eliminated, the fire brigade can complete the final phase of fire extinguishment. This phase will require quenching burning embers by saturating deep seated smoldering fires, such as a cable fire, with water. By this phase of the extinguishment, the room temperatures will be sufficiently cooled to the point that they will not affect the protected train of safe shutdown functions, and will not challenge any penetration seals that are present. The fire brigade under these conditions may use a narrow fog pattern or a straight stream to complete the final extinguishment.

Model Building Code Fire Regulations

QUESTION 1. Why did NRC issue NUREG 0800 instead of utilizing model fire code regulations employed for other industrial structures?

ANSWER.

The staff could not find historical NRC documentation that addressed the question. Presumably, the NRC exercised its authority and responsibilities under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended, for licensing and regulating nuclear facilities. The staff notes that the regulations and review guidance have been specifically tailored to application in nuclear power plants. Model building codes, in contrast, are not specifically tailored for application for nuclear power plants. In addition, the regulations and guidance issued by the NRC are designed to address the unique safety concerns in the construction and operation of nuclear power plants, whereas model building codes are not.

Model Building Code Fire Regulations

QUESTION 2. How many of the current operating reactors' designs were approved by the NRC based on NUREG 0800? Please provide detailed documentation as to which plants are committed to a specific fire code regulation which can be enforced if they are out of compliance, as well as details of that code regulation for each plant.

ANSWER.

The staff evaluated the following plants against the guidance of NUREG 0800 Section 9.5.1:

Beaver Valley Unit 2
Braidwood 1/2
Byron 1/2
Callaway
Catawba 1/2
Clinton
Hope Creek
Limerick 1/2
Nine Mile Point Unit 2
Perry 1
River Bend 1
Seabrook 1
Shearon Harris 1
Vogtle 1/2
Washington Nuclear Power 2
Wolf Creek 1

The basic fire protection regulation for nuclear power plants is Section 50.48, "Fire protection," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. It requires, in part, that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion (GDC) 3, "Fire protection." It also references Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50 and several NRC fire protection guidance documents. For example, Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976; and its appendix, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," Appendix A, February 24, 1977. In addition, each operating reactor has a license condition that requires that the licensee implement and maintain the NRC-approved fire protection program. The NRC can take enforcement action against any nuclear power plants, including those listed above, for failing to comply with the fire protection regulation or the fire protection license condition. For specific enforcement actions, the staff follows the guidance of NUREG-1600, "General Statement of Policy and Procedures for NRC Enforcement Actions."

Model Building Code Fire Regulations

QUESTION 3. If the nuclear power plants are not bound or committed to the NUREG 0800 guidance document and are not bound by the model building codes, are they, in your opinion, providing proper fire barrier code regulation compliance enforceable by your agency? Please justify your response.

ANSWER.

Yes. All operating reactors are required to comply with the basic fire protection regulation: Section 50.48, "Fire protection," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. It requires, in part, that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion (GDC) 3, "Fire protection." It also references Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50 and several NRC fire protection guidance documents. For example, Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976; and its appendix, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," Appendix A, February 24, 1977. In addition, each operating reactor has a license condition that requires that the licensee implement and maintain the NRC-approved fire protection program. The guidance documents provide guidance for fire barrier penetration seals. For a limited number of plants, Appendix R provides requirements for fire barrier penetration seals. The NRC can take enforcement action against any nuclear power plants for failing to comply with the fire protection regulation or the fire protection license condition. For specific enforcement actions, the staff follows the guidance of NUREG-1600, "General Statement of Policy and Procedures for NRC Enforcement Actions."

Model Building Code Fire Regulations

QUESTION 4a. Please provide a spreadsheet of building materials utilized in all existing nuclear power plants and the maximum flammability regulation levied by the NRC as relevant to fire protection. Include, as a minimum, the following: firestops, spray fireproofing, board fireproofing, wall assemblies, and ceiling assemblies.

ANSWER.

Nuclear power plants use a wide variety of building materials from a wide variety of vendors and suppliers. The NRC staff does not maintain a list or spreadsheet of these materials.

Model Building Code Fire Regulations

QUESTION 4b. Does NRC currently have a publication detailing nuclear power generating facility building and fire code that is free of site-specific information? Please provide a copy. If not, is the publication of such a document currently being planned? If not, why not?

ANSWER.

NRC requirements and guidelines for fire barrier penetration seals are contained in various NRC documents, including 10 CFR Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operation Prior to January 1, 1979;" Branch Technical Position APCSB 9.5-1, Appendix A, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976;" and NUREG-0800, "Standard Review Plan." These documents do not contain site specific information. The extent to which these requirements or guidelines are applicable to a specific nuclear power plant depends on plant age, commitments established by the licensee in developing the fire protection plan, the staff safety evaluation reports and supplements, and the license conditions pertaining to fire protection. The purpose of these requirements and guidelines is to ensure that fire barrier penetration seals will remain in place and retain their integrity when exposed to a fire. By so doing, there is reasonable assurance that the effects of a fire will be limited to discrete fire areas and that one division of safe-shutdown-related systems will remain free of fire damage. A copy of each document is included as Appendices E, F and G.

Fire Safety Testing Agencies

QUESTION 1. In the absence of independent third-party certification as mandated by model building codes, what procedures does the NRC use to verify the validity of test reports and ensure continued third party follow-up of fire barrier testing?

ANSWER.

The staff reviews fire test reports on a case-by-case basis. During its assessment of fire barrier penetration seals, the staff did not find technical issues or problems regarding fire testing laboratories. However, there has been confusion about NRC regulatory requirements and review guidance regarding such laboratories. It has been suggested, for example, that fire endurance tests that are not performed by a nationally recognized testing laboratory cannot meet NRC fire protection regulatory requirements.

NRC fire protection regulations do not cover either fire endurance testing or fire test laboratories. NRC fire protection guidance documents address these topics in a limited fashion. For example, they define "fire barrier" as "components of construction...that are rated by approving laboratories." They also define "approved" as "tested and accepted for a specific purpose or application by a nationally recognized testing laboratory." However, there is no regulatory requirement that fire tests be conducted by a nationally recognized testing laboratory. Historically, during licensing reviews, the staff had accepted the use of fire barriers without reviewing the fire test results if the barriers were tested and approved by Underwriters Laboratories (UL) or Factory Mutual (FM). Such barriers included fire doors, fire walls, and penetration seals. The NRC guidance documents present approaches that are acceptable to the staff for meeting regulatory requirements. However, licensees can use approaches that differ from those specified in the guidance document. Therefore, the staff had also accepted barriers that were tested by organizations other than UL and FM. In such cases, the staff may have reviewed the fire test results.

The mission of the National Fire Protection Association, which was organized in 1896, is to safeguard people, property, and the environment from fire using scientific and engineering techniques and education. More than 225 NFPA committees, which are represented by affected interests, develop and publish standards intended to minimize the possibility and effects of fires. NFPA is the principal source of fire protection standards and codes in the United States. When the staff developed its fire protection guidance documents in the 1970s, it adopted a large number of NFPA standards by reference in its guidance documents. At that time, the staff adopted the term "nationally recognized testing laboratory" from NFPA. Neither NFPA nor NRC defined the term. Consequently, there has been recurring confusion about what constituted a nationally recognized testing laboratory. In the fifteenth edition of the *Fire Protection Handbook*, 1981, NFPA stated that it had dropped the term "nationally recognized testing laboratory" from documents it published because there was always a doubt about the definition of a nationally recognized testing laboratory. The staff plans to update its guidance documents to reflect this NFPA position.

NRC does not certify or accredit testing laboratories and has not issued guidance for evaluating or assessing the acceptability of fire testing laboratories to perform fire tests. In the 17th edition

of the *Fire Protection Handbook*, 1991, NFPA stated that there are many laboratories in the United States capable of performing fire-related research and fire testing. These include private and industrial laboratories, university laboratories, and government laboratories. NFPA indicated that evaluations of laboratories should be based on criteria that generally focus on their overall operation, including organization and technical direction, ethical and professional business practices, and the quality control system used by the laboratory. Other more specific criteria focus on the personnel, equipment, facility, procedures, and recordkeeping for performing and reporting test results. The industry fire test standards also provide guidance for the conduct and documentation of fire endurance tests.

The term "nationally recognized testing laboratory" is undefined and obsolete. In addition, national prominence is not needed to conduct valid fire endurance tests. Finally, satisfactory ways of selecting suitable test facilities are available within the fire protection engineering community.

Fire Safety Testing Agencies

QUESTION 2. Please provide a copy of the NRC's response (if any) to [Name]'s April 16, 1992 allegation entitled "Fire Test Problem," as well as a summary of the findings of any investigations the NRC has performed into those allegations. Has the NRC established that [Name]'s allegation of the absence of independent third party testing of any kind was unfounded? If so, please explain, providing all documentation the NRC used to reach its conclusion. If no inquiries were undertaken in response to this allegation, please explain the reason for the NRC's failure to examine the substance of these safety allegations.

ANSWER.

The staff has responded to [Name]'s April 16, 1992, allegations as well as numerous follow-up allegations. A copy of all written correspondence that the NRC staff has had with [Name] will be forwarded to you under separate cover.

There is no regulatory requirement that fire tests be conducted by a nationally recognized testing laboratory or an independent test laboratory (see response to Question 1, above, for additional information). Nevertheless, the NRC conducted an investigation to determine if a penetration seal vendor made deliberate material false statements in reporting of qualification testing conducted on its fire penetration seals which were sold to the nuclear power industry. On the basis of the evidence developed during the investigation, the staff concluded that the vendor did not make material false statements. NRC documentation used to support this finding is enclosed as Appendix H.

Fire Safety Testing Agencies

QUESTION 3. What criteria does the NRC use to designate a recognized nationally accredited testing facility.

ANSWER.

The National Fire Protection Association (NFPA) has determined that "nationally recognized testing laboratory" is undefined and obsolete. It has dropped the term from documents it publishes (See answer to Question 1, above, for additional information). The NRC does not certify or accredit testing laboratories and has not issued guidance for evaluating or assessing the acceptability of fire testing laboratories to perform fire tests.

Fire Safety Testing Agencies

QUESTION 4. What specific regulation determines the specific testing criteria and testing agency protocol?

ANSWER.

The NRC fire protection regulations do not specify fire endurance testing, fire test criteria, or fire test laboratory protocol. Rather, such NRC fire protection guidance documents as the branch technical positions and Standard Review Plan address these topics by reference to national consensus standards. The staff has accepted the following standards for qualifying penetration seals: (1) American Society for Testing and Materials (ASTM) E-119, "Standard Test Methods for Fire Tests of Building Construction and Materials; (2) National Fire Protection Association (NFPA) 251, "Standard Methods of Fire Tests of Building Construction and Materials"; (3) ASTM E-814, "Standard Method of Fire Tests of Through-Penetration Fire Stops"; and (4) Institute of Electrical and Electronics Engineers (IEEE) 634, "Standard Cable Penetration Fire Stop Qualification Test." In addition, UL tests and approves penetration seals in accordance with American National Standards Institute/UL 1479, "Fire Tests of Through-Penetration Firestops," and other organizations, such as American Nuclear Insurers (ANI) and Factory Mutual (FM) also have test methods and standards for conducting penetration seal fire endurance tests. The staff has also accepted the installation of penetration seals that had been qualified in accordance with these test standards.

LIST OF APPENDICES
LETTER TO REPRESENTATIVE MARKEY REGARDING
FIRE BARRIER PENETRATION SEALS IN NUCLEAR POWER PLANTS

Appendix A: Dow Corning Corporation, "Flammability Characteristics of a New Silicone RTV Foam," Kathy M. Kelly, Society of Plastics Engineers, Progress in Plastics through Education, 34th Annual Technical Conference, April 26–29, 1976, Atlantic City, New Jersey.

Appendix B: "Penetration Seal Fire Resistance Tests, 3-Hour Qualification," October 26, 1995.

Appendix C: Examples of station fire fighting manuals, other training materials and training records.

Appendix D: Table of exemptions the NRC has granted for penetration seals.

Appendix E: 10 CFR Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979."

Appendix F: Appendix A to Branch Technical Position APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," August 23, 1976.

Appendix G: NUREG-0800, "Standard Review Plan," Section 9.5-1, "Fire Protection Program," Rev. 3, July 1981.

Appendix H: USNRC Report of Investigation, "Brand Industrial Services Company (BISCO)," Case No. 3-94-068, December 14, 1995.

[Copies of attachments may be obtained from Rep. Markey's office.]