RULEMAKING ISSUE
(Notation Vote)

December 22, 2004 SECY-04-0233

FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations /RA/

SUBJECT: PROPOSED RULEMAKING—POST-FIRE OPERATOR MANUAL ACTIONS (RIN 3150 AH-54)

PURPOSE:

To obtain Commission approval to publish the proposed rule, including the issue of the need for an interim enforcement discretion policy and make available the draft regulatory guide and other supporting documents for public comment.

BACKGROUND:

In SECY-03-0100, "Rulemaking Plan on Post-Fire Operator Manual Actions," dated June 17, 2003, the staff recommended revising the existing fire protection regulation in paragraph III.G.2 of Appendix R to 10 CFR Part 50 to include operator manual actions. These actions are needed to ensure that a redundant train of systems necessary to achieve and maintain hot shutdown conditions located within the same area outside the primary containment is free of fire damage. In an SRM dated September 12, 2003, the Commission approved the staff's recommendation to revise the fire protection program requirements in Appendix R and the associated guidance. The Commission also approved the staff's plan to develop an interim enforcement policy to deal with compliance issues until the guidance and final rule are implemented.

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DISCUSSION:

10 CFR Part 50.48, “Fire protection,” requires operating power plants to have a fire protection plan that satisfies Criterion 3 of Appendix A to 10 CFR Part 50. Criterion 3 requires structures, systems, and components important to safety be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. The specific fire protection requirements for safe shutdown capability are further discussed in paragraph G of Section III of Appendix R to 10 CFR Part 50. The more specific 10 CFR Part 50.48 and Appendix R requirements were added following a significant fire that occurred in 1975 at the Browns Ferry nuclear power plant. The fire damaged electrical cables for control, instrumentation, and power cables for redundant trains of equipment necessary for safe shutdown.

In response to the fire, an NRC investigation found serious design inadequacies in fire protection at Browns Ferry. The investigators specifically noted that the independence of redundant equipment at Browns Ferry was negated by lack of adequate separation between cables for redundant trains of safety equipment. The investigators subsequently recommended that a suitable combination of electrical isolation, physical distance, fire barriers, and sprinkler systems should be used to maintain the independence of redundant safety equipment. In response to these recommendations, the NRC worked with reactor licensees for several years to identify and implement necessary plant fire protection improvements.

In 1980, NRC promulgated 10 CFR 50.48 to establish fire protection requirements. Appendix R to 10 CFR Part 50 included paragraph III.G, fire protection of safe shutdown capability. The requirements for separation of cables and equipment associated with redundant safe shutdown trains were promulgated in paragraph III.G.2.

Paragraph III.G.2 of Appendix R requires that cables and equipment of redundant trains of safety systems in the same fire area be separated by either:

a. a 3-hour fire barrier, or
b. a horizontal distance of more that 20 feet with no intervening combustibles in conjunction with fire detection and automatic fire suppression, or
c. a 1-hour fire barrier combined with fire detection and automatic fire suppression.

Appendix R applies to only those licensees who received operating licenses before January 1, 1979. Plants licensed after January 1, 1979, are not required to meet Appendix R. These plants were licensed to meet Branch Technical Position CMEB 9.5-1, “Guidelines for Fire Protection for Nuclear Power Plants,” that contains criteria similar to the Appendix R requirements. Specific licensing basis information for these plants is usually contained in license conditions issued at time of licensing.

Because the Appendix R rule was to apply to facilities which were already built, the NRC was aware that compliance with various parts of the requirement might be difficult at some facilities. Accordingly, the NRC included a provision which allowed licensees to submit alternative acceptable methods for protecting redundant equipment for NRC review and approval. During the implementation of the Appendix R requirements, the NRC reviewed and approved a large number of exemptions for 60 licensees who proposed alternative acceptable methods of compliance in various areas for protecting redundant equipment.

In the early 1990s, generic problems arose with Thermolag[1] fire barriers, which many licensees were using to comply with paragraph III.G.2 of Appendix R. Licensees were ultimately required to replace Thermolag material with other fire barriers. Several years later, fire protection inspectors began to notice that many licensees had not upgraded or replaced Thermolag fire barrier material (or had not otherwise provided the required separation distance between redundant safety trains) used to satisfy the paragraph III.G.2 criteria. Some licensees compensated by relying on operator manual actions which had not been reviewed and approved by the NRC via the exemption process. Operator manual actions are not an alternative specified in paragraph III.G.2 of Appendix R. However, they may be a means of achieving safe shutdown in an event of a fire under certain conditions.

In 2002, the NRC met with nuclear industry licensees and informed them that the use of unapproved manual actions was not in compliance with paragraph III.G.2. During a meeting on June 20, 2002, the Nuclear Energy Institute (NEI) stated that there was widespread use of operator manual actions throughout the industry based on industry understanding of past practice and existing NRC guidance. The industry also stated that licensees' use of unapproved manual actions had become prevalent even before the concerns with Thermolag material surfaced. Shortly thereafter, the NRC developed criteria for inspectors to use in evaluating the acceptability of operator manual actions pending the final rulemaking. The criteria were based on the past practice and experience of NRC inspectors performing review of operator manual actions used to comply with Appendix R, paragraph III.G.3, on alternate shutdown. Licensees were familiar with these criteria through their interactions with the NRC inspection process. These criteria were issued in the revision to Inspection Procedure 71111.05, "Fire Protection," in March 2003. While unapproved manual actions are still violations, actions meeting the interim criteria are viewed to have relatively low safety significance and can be dealt with under the current enforcement discretion policy.

Stakeholder Feedback on Staff Published Interim Acceptance Criteria

The staff published a *Federal Register* notice (68 FR 66501), dated November 26, 2003, that requested comments on acceptance criteria for operator manual actions to be considered for use in the development of the interim enforcement policy for certain violations of fire protection program requirements.

The staff received more than 460 comments from stakeholders. NEI and several other industry stakeholders objected to a provision in the notice that fire detection and automatic fire suppression systems must be installed in the area where the fire occurs in order to credit operator manual actions as a means of complying with paragraph III.G.2. NEI and a number of industry representatives requested that "... acceptance criteria should state NRC's current expectations for feasibility of all manual actions. This maintains the maximum consistency with existing NRC guidance, and avoids the creation of a separate set of standards only applicable to III.G.2 manual actions."

[1]Thermolag is a brand-name for a particular type of material used to construct fire barriers typically for protecting electrical conduits and cable trays. In the early 1990's, issues arose regarding the testing and qualification process used for this material. It was determined that barriers made of this material would not provide protection for the required periods of time.

Nearly all of the remaining comments, including those from public interest groups such as the Union of Concerned Scientists (UCS) and the Nuclear Information and Resource Service (NIRS), firmly objected to the proposed addition of operator manual actions as a means of compliance with paragraph III.G.2. These public interest groups indicated that the NRC should enforce regulations promulgated after the Browns Ferry fire to minimize the chances of recurrence. They believed the proposed rule would reward licensees who do not meet the current safety regulations and punish those who have spent resources to comply with the regulations. These objections were confirmed at a public meeting on June 23, 2004.

In addition, on December 7, 2004, the staff received a letter from NEI responding to the staff's draft rule language that was placed on the NRC external web site in October 2004. In the letter, NEI indicated that staff added additional criteria, which would result in significant expense for plant changes, or exemption requests, with no significant safety improvement. NEI requested that proposed rule language be revised before it is published in the *Federal Register* for public comment. The staff intends to respond to the NEI letter as part of the staff review and disposition of public comments during the proposed rule process. The NEI letter is included for Commission information (Attachment 5).

Proposed Rule

The proposed rule would revise existing fire protection program requirements in paragraph III.G.2 of Appendix R to 10 CFR Part 50 to allow licensees to implement acceptable operator manual actions combined with detection and suppression capability, as an acceptable method for ensuring the capability of a licensee to bring a reactor to, and maintain it in, a safe hot shutdown condition. Detection and suppression requirements, along with the criteria for feasible and reliable operator manual actions, were included to maintain the overall defense-in-depth approach. The staff's justification is discussed in detail in Section III.C of the attached draft *Federal Register* notice (Attachment 1).

Another key feature of the proposed rule is a time margin concept. The basic idea is to identify a realistic time margin for fire-related local operator manual actions that would ensure that the actions would be successful. The time margin ensures not only that operator manual actions are feasible (can be performed in the time available), but also reliable (yield the same or compatible results in different experiments or statistical trials or is dependably repeatable). Section III.B of the attached draft *Federal Register* notice discusses the time margin concept.

The interactions between operators performing manual actions to respond to an in-plant fire and the types of actions taken by plant responders during a fire as a result of a security event were considered during the development of this rule. However, given that physical security overarches many aspects of plant operations, it was determined that security considerations should be considered in a broader context. As discussed in a Memorandum from the EDO to the Commissioners, "Status of Staff Activities on a Proposed Rule for a Risk-Informed Redefinition of the Large Break Loss-Of-Coolant-Accident," dated October 22, 2004, the staff is evaluating the merits of a more global approach to establishing safety-security interface regulatory requirements. In a November 19, 2004, letter to the Chairman dealing with this rulemaking, the ACRS concurred on this approach.

The proposed rule solicits stakeholder comments regarding application of operator manual actions acceptance criteria being applied to paragraphs III.G.1 and III.G.3. Information on potential regulatory impacts that might arise if the criteria were applied to these paragraphs is also solicited. The staff also solicits comments on how best to define an appropriate time margin safety factor that would ensure a low probability of failure for the operator manual actions. In addition, comments are sought on the application of a fixed versus an automatic fire suppression system in the fire area.

Enforcement Considerations

In SECY-03-0100, "Rulemaking Plan on Post-Fire Operator Manual Actions," dated June 17, 2003, the staff recommended development of an interim enforcement policy relying on preliminary acceptance criteria for manual actions. The staff proposed this strategy based on a belief that interim acceptance criteria could be developed that would be consistent with the manual actions acceptance criteria in the final rule. The Commission had previously approved a similar enforcement discretion policy related to a fitness-for-duty proposed rulemaking. In an SRM dated September 12, 2003, the Commission approved the staff's recommendation.

In March 1998, the staff issued EGM 98-02, "Enforcement Guidance Memorandum - Disposition of Violations of Appendix R, Sections III.G and III.L Regarding Circuit Failures," that provides enforcement guidance for issues related to fire-induced circuit failures, which encompasses the vast majority of manual actions as compensatory measures to satisfy the regulatory requirements. This EGM was developed based on an apparent widespread misunderstanding of the requirements on the part of licensees and remains in effect until December 31, 2005. The EGM provides guidance for disposition of noncompliances involving fire-induced circuit failures, which could prevent operation or cause maloperation of equipment needed to achieve and maintain post-fire safe shutdown. Among the enforcement conditions, discretion will be given for cases where licensees do not dispute that a violation of regulatory requirements has occurred with respect to a nonconformance and that licensees take prompt compensatory actions and also take corrective action within a reasonable time. The expectations of this EGM have been incorporated into the current NRC Enforcement Manual. In addition, the Office of Nuclear Reactor Regulation issued a revised Inspection Procedure (IP)71111.05 in March 2003 incorporating interim operator manual actions acceptance criteria. The inspection procedure provides guidance to assess and ensure that plant specific operator manual actions meet the interim acceptance criteria and that corrective actions taken by the plants will achieve and maintain safe shutdown condition.

On November 26, 2003, the staff published a *Federal Register* notice soliciting public comments on specific acceptance criteria for operator manual actions to be considered for use in developing an interim enforcement discretion policy for post-fire operator manual actions. In addition, as part of the proposed rule development, the staff has had numerous interactions with industry and public stakeholders to discuss rule requirements and the more developed operator manual actions acceptance criteria. Based on these meetings and comments in response to the November 26, 2003, *Federal Register* notice, the staff realizes that the proposed rule's acceptance criteria and detection and suppression requirements are still evolving, such that the new interim enforcement guidance developed in conjunction with the proposed rule may not be consistent with the requirements eventually specified in the final rule.

The current applications of EGM 98-02 and IP 71111.05 are effective to ensure and maintain the overall plant safety by licensees through the use of adequate and appropriate compensatory measures in the form of operator manual actions implemented in accordance with the licensee's Fire Protection Program. Manual actions that fail to meet the criteria in the inspection procedure are not considered to be feasible or to be adequate compensatory measures. Such manual actions will result in the non-compliance being entered into the enforcement process.

The new interim enforcement policy for the post-fire operator manual actions would utilize a disputed set of acceptance criteria and trigger additional reviews (by licensees and inspectors) of past findings, with the prospect of a third review being necessary upon issuance of the final rule. Issuing such enforcement discretion policy at this time could also have the unintended consequence of preempting the rulemaking process without a clear safety benefit.

Based on the above, the staff proposes to continue using the current enforcement discretion policy of EGM 98-02 and the guidance provided in IP 71111.05 and that a revision or additional policy to include specific operator manual actions acceptance criteria is not needed.

Implementation Plan

To fully implement the Commission-approved final rule, the staff will revise IP 71111.05 to ensure that inspection criteria are consistent with the final rule, finalize supporting regulatory guides, and conduct fire protection inspection training. NRC fire protection inspectors would conduct inspections and verify that the licensees' documented manual actions met the NRC fire protection regulation through the existing triennial inspection process. The licensees would be required to retain the fire protection plan and each change to the plan as a record in accordance with 10 CFR 50.48.

Contents of the Proposed-Rulemaking Package

This rulemaking package provides a comprehensive set of documents for Commission consideration. It consists of the proposed rule, the regulatory analysis (Attachment 2), the draft regulatory guide (draft Regulatory Guide (DG)-1136, "Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire") (Attachment 3), and the information collection supporting statement (Attachment 4).

ACRS and CRGR Reviews

The staff provided a draft proposed rule package to the Advisory Committee on Reactor Safeguards (ACRS) and Committee to Review Generic Requirements (CRGR) for consideration. On November 19, 2004, the ACRS recommended in its letter to the Chairman that the proposed rule be published for public comments. The CRGR agreed to defer review of the documents until the final rule stages.

RESOURCES:

The resource requirements of 1.0 FTE for NRR, 0.2 FTE for RES, 0.2 FTE for OGC for FY 2005, and 0.5 FTE for NRR for FY 2006 have been budgeted for a completion of the final rule.

RECOMMENDATIONS:

That the Commission:

1. *Approve* the proposed rule for publication.

2. *Approve* the staff's recommendation to terminate development of an additional interim enforcement policy with specific acceptance criteria.

3. *Certify* that this rule, if promulgated, will not have a negative economic impact on a substantial number of small entities. This action is needed to satisfy the requirements of the Regulatory Flexibility Act, 5 U.S.C. 605(b).

4. Note:

a. The following documents will be published in the *Federal Register* with a 75-day public comment period:

Proposed Rule, including the Environmental Assessment
Notice of Availability in *Federal Register* of (a) Regulatory Analysis and (b) Draft Regulatory Guide
OMB clearance package, and
NEI letter dated December 7, 2004

b. The Chief Counsel for Advocacy of the Small Business Administration will be informed of the certification regarding economic impact on small entities and the basis for it, as required by the Regulatory Flexibility Act.

c. Copies of the *Federal Register* notice of proposed rulemaking will be distributed to all affected Commission licensees.

d. A OMB supporting statement was prepared and the change in reports and records indicated a net reduction of 745 hours annually.

e. A public announcement will be issued.

f. Appropriate Congressional Committees will be informed.

COORDINATION:

The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has reviewed this Commission paper for resource implications and has no objections. The CRGR has waived its review of this proposed rule and will review the final rule. The ACRS has no objection to the publication of the proposed rule.

The rule contains changes in information collection requirements that must be submitted to the Office of Management and Budget (OMB) no later than the date the proposed rule is forwarded to the *Federal Register* for publication.

/RA Ellis W. Merschoff Acting For/

Luis A. Reyes
Executive Director
for Operations

Attachments:
1. Federal Register Notice
2. Regulatory Analysis
3. Regulatory Guide (DG-1136, Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions In Response to Fire)
4. OMB Supporting Statement
5. NEI letter dated December 7, 2004

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 50

RIN 3150 AH-54

Fire Protection Program - Post-Fire Operator Manual Actions

AGENCY: U.S. Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) proposes to amend its fire protection regulations in 10 CFR Part 50, Appendix R, paragraph III.G.2 for nuclear power facilities operating prior to January 1, 1979. The amendment would allow nuclear power plant licensees to use manual actions by plant operators as an alternative method to achieve hot shutdown conditions in the event of fires in certain plant areas, provided that the actions are evaluated against specified criteria and determined to be acceptable and that fire detectors and an automatic fire suppression system are provided in the fire area. The Commission's proposed action would provide realistically conservative regulatory acceptance criteria for operator manual actions taken under paragraph III.G.2 of Appendix R to achieve and maintain safe shutdown conditions. The NRC is also proposing and requesting comments on a draft regulatory guide to support this proposed rulemaking.

DATES: Submit comments on the proposed rule and the issue of an interim enforcement discretion policy by (insert date 75 days after publication in the *Federal Register*). Submit comments specific to the information collections aspects of this rule (insert date 30 days after publication in the *Federal Register*). Comments received after these dates will be considered if

it is practical to do so, but assurance of consideration cannot be given to comments received after these dates.

ADDRESSES: You may submit comments on the proposed rule by any one of the following methods. Please include the following number RIN 3150 AH-54 in the subject line of your comments. Comments on rulemaking submitted in writing or in electronic form will be made available for public inspection. Your comments will not be edited to remove any identifying or contact information. The NRC cautions you against including any information in your submission that you do not want publicly disclosed.

Mail comments to: Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, ATTN: Rulemakings and Adjudications Staff.

E-mail comments to: SECY@nrc.gov. If you do not receive a reply e-mail confirming that we have received your comments, contact us directly at (301) 415-1966. You may also submit comments via the NRC's rulemaking web site at http://ruleforum.llnl.gov. This site provides the capability to upload comments as files (any format), if your web browser supports that function. Address questions about our rulemaking website to Carol Gallagher (301) 415-5905; email cag@nrc.gov. Comments can also be submitted via the Federal Rulemaking Portal http://www.regulations.gov.

Hand deliver comments to: 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 am and 4:15 pm Federal workdays. (Telephone (301) 415-1966).

Fax comments to: Secretary, U.S. Nuclear Regulatory Commission at (301) 415-1101.

Publicly available documents related to this rulemaking may be viewed electronically on the public computers located at the NRC's Public Document Room (PDR), O1 F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland. The PDR reproduction contractor will

copy documents for a fee. Selected documents, including comments, may be viewed and downloaded electronically via the NRC rulemaking web site at http://ruleforum.llnl.gov.

Publicly available documents created or received at the NRC after November 1, 1999, are available electronically at the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/adams.html. From this site, the public can gain entry into the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC Public Document Room (PDR) Reference staff at 1-800-397-4209, 301-415-4737 or by email to pdr@nrc.gov.

You may submit comments on the information collections by the methods indicated in the Paperwork Reduction Act Statement.

For further information contact: David T. Diec, 301-415-2834, dtd@nrc.gov or Alexander Klein, 301-415-3477, ark1@nrc.gov

SUPPLEMENTARY INFORMATION:

I. Background

Section 50.48, Fire Protection, requires that each operating power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A to 10 CFR part 50. Criterion 3 requires that structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. The specific fire protection requirements for safe shutdown capability of plant are further discussed in paragraph G of Section III of Appendix R to 10 CFR Part 50. The more specific Section 50.48 and Appendix R requirements were added following a significant fire that occurred in 1975 at the Browns Ferry nuclear power plant. The fire damaged control,

instrumentation, and power cables for redundant trains of equipment necessary for safe shutdown.

In response to the fire, an NRC investigation was conducted and it was found that the independence of redundant equipment at Browns Ferry was negated by lack of adequate separation between cables for redundant trains of safety equipment. The investigators subsequently recommended that a suitable combination of electrical isolation, physical distance, fire barriers, and sprinkler systems should be used to maintain the independence of redundant safety equipment. In response to these recommendations, the NRC worked with reactor licensees for several years to identify and implement necessary plant fire protection improvements. In 1980, NRC promulgated Section 50.48 to establish fire protection requirements and Appendix R to 10 CFR Part 50 for certain generic issues, including paragraph III.G, fire protection of safe shutdown capability. The requirements for separation of cables and equipment associated with redundant safe shutdown trains were promulgated in paragraph III.G.2.

Paragraph III.G.2 of Appendix R requires that cables and equipment of redundant trains of safety systems in the same fire area be separated by either:

a. a 3-hour fire barrier, or

b. a horizontal distance of more than 20 feet with no intervening combustibles in conjunction with fire detectors and an automatic fire suppression system, or

c. a 1-hour fire barrier combined with fire detectors and an automatic fire suppression system.

Appendix R applies to only those licensees who received operating licenses before January 1, 1979. Plants licensed after January 1, 1979, are not required to meet Appendix R.

These plants were licensed to meet Branch Technical Position CMEB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," that contains criteria similar to the Appendix R requirements. Specific licensing basis information for these plants is usually contained in license conditions issued at time of licensing.

Because the rule was to apply to facilities which were already built, the NRC knew that compliance with various parts of Appendix R might be difficult at some facilities. Accordingly, the NRC included a provision which allowed licensees to submit alternative acceptable methods for protecting redundant equipment for NRC review and approval through an exemption process. When implementing the Appendix R requirements, the NRC reviewed and approved a large number of exemptions for 60 licensees who proposed alternative acceptable methods of compliance in various areas, including numerous exemptions from paragraph III.G.2.

In the early 1990s, generic problems arose with Thermolag[1] fire barriers, which many licensees were using to comply with paragraph III.G.2 of Appendix R. Licensees were ultimately required to replace Thermolag material with other fire barriers. Several years later, fire protection inspectors began to notice that many licensees had not upgraded or replaced Thermolag fire barrier material (or had not otherwise provided the required separation distance between redundant safety trains) used to satisfy the paragraph III.G.2 criteria. Some licensees compensated by relying on operator manual actions[2] which had not been reviewed and approved by the NRC via the exemption process. Operator manual actions are not an

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[1]Thermolag is a brand-name for a particular type of material used to construct fire barriers typically for protecting electrical conduits and cable trays. In the early 1990's, issues arose regarding the testing and qualification process used for this material. It was determined that barriers made of this material would not provide protection for the required periods of time.

[2]Operator manual actions are those integrated set of actions needed to ensure that a redundant train of systems necessary to achieve and maintain hot shutdown conditions located within the same area outside the primary containment is free of fire damage.

alternative specified in paragraph III.G.2 of Appendix R. However, they may be a means of achieving safe shutdown in the event of a fire under certain conditions.

In 2002, the NRC met with nuclear industry licensees and informed them that the use of unapproved manual actions was not in compliance with paragraph III.G.2. During a meeting on June 20, 2002, the Nuclear Energy Institute stated that there was widespread use of operator manual actions throughout the industry based on industry understanding of past practice and existing NRC guidance. The industry also stated that licensees' use of unapproved manual actions had become prevalent even before the concerns arose with Thermolag material. Shortly thereafter, the NRC developed criteria for inspectors to use in assessing the safety significance of violations resulting from unapproved operator manual actions. The criteria were based on past practice and experience by NRC inspectors when reviewing operator manual actions used to comply with Appendix R, paragraph III.G.3, on alternate shutdown. Licensees were familiar with these criteria through their interactions with the NRC inspection process. These criteria were issued in the revision to Inspection Procedure 71111.05 in March 2003. While unapproved operator manual actions are still violations, actions meeting these interim criteria are viewed to have low or no safety significance.

The interactions between operators performing manual actions to respond to an in-plant fire and the types of actions taken by plant responders during a fire as a result of a security event were considered during the development of this rule. However, given that physical security overarches many aspects of plant operations, it was determined that security considerations should be considered in a broader context. The Commission is evaluating the merits of a more global approach to establishing regulatory requirements for safety-security interface.

II. Rulemaking Initiation

Instead of continuing the current practice of requiring all noncompliant licensees to submit individual exemption requests for staff review to determine if their operator manual actions are acceptable, the Commission has determined that amending Appendix R to 10 CFR Part 50 would be the most orderly and efficient way to provide an option for licensees to utilize acceptable operator manual actions in lieu of the separation or barrier requirements in paragraph III.G.2. In this way the NRC would codify conservative acceptance criteria for licensees to use in evaluating operator manual actions to ensure that the actions were both feasible and reliable. These criteria would maintain safety by ensuring that licensees perform thorough evaluations of the operator manual actions comparable to evaluations a licensee would provide to NRC for review and approval of an exemption request. The staff developed a rulemaking plan (SECY-03-0100) and the Commission approved the staff plan on September 12, 2004. The rule change would revise 10 CFR Part 50, Appendix R, paragraph III.G.2 to allow licensees to implement acceptable operator manual actions after documenting that the actions met the regulatory acceptance criteria. Through the established Reactor Oversight Process (ROP), the NRC will continue to inspect licensees' methodologies for achieving and maintaining hot shutdown conditions in accordance with the requirements set forth in Section III.G.2 of Appendix R to 10 CFR Part 50. The NRC fire protection inspectors would verify that the licensees' operator manual actions met the NRC acceptance criteria and will evaluate the licensee's analysis, procedures and training, implementation, and demonstration of operator manual actions to ensure the licensee has adequately demonstrated the feasibility and reliability of a manual action.

III. Proposed Action

The Commission proposes to allow the use of operator manual actions coincident with fire detectors and an automatic fire suppression system as an additional alternative method for compliance with paragraphs III.G.2(a), (b) or ©) of Appendix R[3]. The Commission has determined that implementing any one of the alternatives in paragraph III.G.2 will provide reasonable assurance that at least one method for achieving and maintaining the hot shutdown condition will remain available during and after a postulated fire anywhere in the plant. The Commission proposes to add a new subparagraph G.2.(c-1) and a subpart P to paragraph III of Appendix R to 10 CFR Part 50. The new subparagraph G.2.(c-1) would establish operator manual actions, in conjunction with fire detectors and an automatic fire suppression system, as a fourth compliance option with paragraphs III.G.2(a), (b) or ©), provided that the operator manual actions satisfy the acceptance criteria in the new subpart P. The new subpart P would define operator manual actions and set forth the required acceptance criteria which must be met before a licensee could use operator manual actions outside the containment to comply with paragraphs III.G.2 of Appendix R. Compliance with these acceptance criteria is necessary to provide reasonable assurance of the feasibility and the reliability of the operator manual actions.

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[3] The requirements in Appendix R are applicable only to licensees who received operating licenses before January 1, 1979. Post-January 1, 1979, licensees were licensed to meet GDC-3, §50.48(a), and Branch Technical Position 9.5-1, which contain criteria that are similar to the Appendix R requirements. Post-January 1, 1979 licensees who use operator manual actions without NRC approval may or may not be in compliance with applicable fire protection requirements. Compliance depends on the specific licensing commitments (usually specified in license conditions for these licensees), the change control process, and how the change was justified and analyzed to demonstrate that the operator manual actions are feasible and reliable and thus do not adversely affect the ability to achieve or maintain safe shutdown.

A. Operator Manual Actions Alternative

The Commission proposes to add a new subparagraph ©-1) to paragraph III.G.2 of 10 CFR Part 50 to codify operator manual actions, with fire detectors and an automatic fire suppression system, as an additional alternative compliance method set forth in paragraph III.G.2. The Commission has determined that implementing any of the alternatives in III.G.2 will provide reasonable assurance that at least one method for achieving and maintaining hot shutdown condition will remain available during and after a postulated fire. The basis for this determination is provided below.

The Commission's fire protection requirements constitute a defense-in-depth approach to protect safe shutdown functions. The overall objectives of the NRC's fire protection regulations are to minimize the potential for fires and explosions; to rapidly detect, control, and extinguish fires that do occur; and to ensure that the fires will not prevent the accomplishment of necessary safe shutdown functions and will not significantly increase the risk of radioactive releases to the environment. The NRC has concluded if these objectives are met, there is reasonable assurance that a licensed facility is providing adequate protection of public health and safety. These objectives are met by a set of NRC requirements for control of combustible materials and ignition sources, fire detection and suppression systems, fire brigade procedures and training, and physical separation of cables and equipment of redundant trains of safe shutdown equipment.

The physical separation requirements in paragraph III.G.2 of Appendix R are one component of the NRC's overall fire protection objectives. In paragraph III.G.2, the NRC specified three different methods for providing separation of cables and equipment of redundant trains of equipment located in the same fire area. These three options for compliance with paragraph III.G.2 offer sufficient but varying levels of protection. In general,

the 3–hour passive fire barrier is judged to offer more protection than either of the other options (i.e., the 1–hour passive fire barrier or 20 feet of horizontal separation with no intervening combustibles, in combination with fire detectors and an automatic fire suppression system installed in the fire area). *Federal Register* notice 45 FR 76602 stated that redundant trains of safe shutdown systems are best protected by 3-hour passive fire barriers that provide ample time for manual fire suppression activities to control any fire. The proposed operator manual action offers protection comparable to the latter two options, both of which require the additional layer of defense-in-depth protection provided by having fire detection and automatic suppression capability. The basis for automatic suppression capability in III.G.2 is found in *Federal Register* notice 45 FR 76602 which stated, "The use of 1-hour barrier in conjunction with automatic fire suppression and detection capability . . . is based on the following considerations. Automatic suppression is required to ensure prompt, effective application of a suppressant to a fire that could endanger safe shutdown capability." The prompt, effective application of a suppressant to a fire also applies to III.G.2.b with 20 feet of horizontal separation with no intervening combustibles. Accordingly, the NRC proposes to allow use of operator manual actions only in conjunction with fire detectors and an automatic fire suppression system.

In issuing the current Appendix R, paragraph III.G.2, requirements on physical separation of safe shutdown systems, the Commission recognized that strict compliance with the III.G.2 criteria might be difficult for certain licensees at existing facilities. At that time, the Commission was aware that other fire protection alternatives might exist that could provide adequate fire protection at these facilities. For this reason, the Commission included an

exemption provision in Section 50.48[4] to allow licensees to propose alternative fire protection methods to the Commission for review and approval. Under the exemption process, the Commission has used its fire protection engineering experience and judgment to review and grant (or in some cases deny) exemptions to licensees who, because of plant physical limitations, sought to implement operator manual actions in lieu of complying with the paragraph III.G.2 separation requirements.

The NRC recognized in the SECY-03-0100 rulemaking plan that "[r]eplacing a passive, rated, fire barrier . . . with human performance activities can increase risk. For some simple operator manual actions, the risk increase associated with human performance may be minimal. For other actions, unless the operator manual actions are feasible, the risk increase could be significant . . . However, if the operator manual actions are feasible, the overall risk increase is minimal."

On the basis of inspection experience, the NRC has concluded that certain manual actions can be accomplished and provide an adequate level of safety to satisfy the underlying purpose of the fire protection rule for the areas set forth in Section III.G.2. In addition, the NRC has reviewed and granted certain exemption requests for the use of manual actions in lieu of the separation criteria of Section III.G.2 . This experience demonstrates that properly analyzed and implemented manual actions provide an adequate level of assurance that a nuclear power plant could achieve and maintain hot shutdown conditions.

Due to misunderstanding of acceptable past practice and existing fire protection guidance that led licensees to implement unapproved operator manual actions, the NRC may be faced with a large number of operator manual action exemption requests from licensees. To

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[4]The exemption provision no longer exists in 10 CFR 50.48. It has been subsumed by the exemption provisions in 10 CFR 50.12, which apply to all sections of 10 CFR Part 50.

provide a more efficient and effective process and to ensure more uniform and consistent regulatory treatment of these cases, the NRC decided to codify conservative, state-of-the-art acceptance criteria for licensees to use in evaluating operator manual actions to ensure that they are both feasible and reliable. Codifying this alternative in the rule will be more efficient than using the exemption process, and will provide for enhanced safety by allowing resources to be focused on safety rather than administrative compliance.

Something that is “feasible” is “capable of being accomplished or brought about; possible.” Something that is “reliable” will “yield the same or compatible results in different experiments or statistical trials; dependably repeatable.” To credit operator manual actions under III.G.2 for outside containment, the licensee must prove to the satisfaction of the NRC not only that the actions can be successfully accomplished, but also that they successfully accomplished repeatedly by all personnel who are required to perform the actions. Together, proof that the operator manual actions are both feasible and reliable provides the level of reasonable assurance necessary for credited operator manual actions to be in compliance with III.G.2.

If shown to be feasible and reliable, operator manual actions are likely to be successfully achieved, any potential increases in risk to the public due to their use will be minimal. Requiring the operator manual actions to meet the conservative set of acceptance criteria provides the NRC with reasonable assurance that such operator manual actions can be accomplished to safely shut down the plant in the event of fire. These criteria maintain safety by ensuring that licensees perform thorough evaluations of the required operator manual actions and pre-plan equipment needs. NRC fire protection inspectors will verify the licensees’ documented operator manual actions that meet the NRC acceptance criteria through the existing triennial inspection process. The use of operator manual actions does not diminish the other defense-in-depth

objectives of the NRC fire protection program (i.e., the requirements that minimize the potential for fires and explosions and those which provide for rapid controlling and extinguishing of fires that do occur). To support the objective for rapidly controlling and extinguishing fires, the NRC is requiring fire detectors and an automatic fire suppression system as part of the new operator manual actions option. Accordingly, the NRC has determined that the proposed rulemaking provides reasonable assurance that the public health and safety are protected, consistent with the assurance provided by compliance with the current three options in paragraphs III.G.2(a), (b) or ©).

B. Addition of Paragraph III.P, Operator Manual Actions Acceptance Criteria

The proposed paragraph III.P specifies the required acceptance criteria which must be met before a licensee may utilize operator manual actions to comply with paragraph III.G.2 of Appendix R. A detailed discussion of each criterion is provided further in this Statement of Consideration. These criteria are as follows:

III.P Operator Manual Actions.

1 For purposes of this section, operator manual actions means the integrated set of actions needed to ensure that a redundant train of systems necessary to achieve and maintain hot shutdown conditions located within the same area outside the primary containment is free of fire damage.

2 A licensee relying on operator manual actions must meet all of the following acceptance criteria:

(a) Analysis. The licensee shall prepare an analysis for each operator manual action which demonstrates its feasibility and reliability.

(1) The analysis must contain a postulated fire time line showing that there is sufficient time to travel to action locations and perform actions required to achieve and maintain the plant in a hot shutdown condition under the environmental conditions expected to be encountered without jeopardizing the health and safety of the operator performing the manual actions. The fire timeline shall extend from the time of initial fire detection until the time when the ability to achieve and maintain hot shutdown is reached, and shall include a time margin that accounts for all variables, including (I) differences between the demonstrated and actual conditions and (ii) human performance uncertainties that may be encountered.

(2) The analysis must address the functionality of equipment or cables that could be adversely affected by the fire or its effects but still utilized to achieve and maintain hot shutdown.

(3) The analysis must identify all equipment required to accomplish the operator manual action under the postulated timeline, including (but not limited to (I) all indications necessary to show the need for the operator manual actions, enable their performance, and verify their successful accomplishment, and (ii) any necessary communications, portable, and life support equipment.

(b) Procedures and training. Plant procedures must include each operator manual action required to achieve and maintain hot shutdown. Each operator must be appropriately trained on those procedures.

(c) Implementation. The licensee shall ensure that all systems and equipment needed to accomplish each operator manual action are operable and readily

accessible consistent with the analysis required by paragraph 2(a). The number of operating shift personnel required to perform the operator manual actions shall be on site at all times.

(d) Demonstration. Periodically, the licensee shall conduct demonstrations using an established crew of operators to demonstrate that operator manual actions required to achieve and maintain the plant in a hot shutdown condition can be accomplished consistent with the analysis in paragraph 2(a) of this section. The licensee may not implement operator manual actions until they have been established by a demonstration to be consistent with the analysis. The licensee shall take prompt corrective action if any subsequent periodic demonstration determines that the operator manual actions can no longer be accomplished consistent with the analysis.

The above acceptance criteria for operator manual actions are intended to assure the safe shutdown goals and objectives for operating reactors as required in Section 50.48. The primary objective for safe shutdown is to maintain fuel integrity (i.e., fuel design limits are not exceeded). For alternative or dedicated shutdown capability, the reactor coolant system process variables should be maintained within those predicted for a loss of normal ac power and fission product boundary integrity should not be affected.

The applications of these acceptance criteria are as follows. First, the criteria are the means by which the NRC will establish standards that provide a reasonable level of assurance that operator manual actions will be satisfactorily and reliably performed to bring the plant to a hot shutdown condition, thus protecting public health and safety. Second, a standard set of acceptance criteria will permit both the licensees and NRC to establish consistency as to what operator manual actions will be allowed. Third, the criteria will provide the parameters which

both the licensees and NRC will use to conduct evaluations and inspections in a thorough manner. The supporting basis for each criterion is discussed in detail below.

The acceptance criteria in the proposed rule are structured to ensure both feasibility and reliability of the operator manual actions. To credit operator manual actions, the licensee must prove not only that the actions can be successfully accomplished (are feasible), but also that they can be done so repeatedly (are reliable). Central to the approach is the preparation of an analysis that determines what actions must be taken in order to reach a safe shutdown condition. This analysis would also identify the time available (timeline) for successful performance of such actions. A demonstration of the accomplished operator manual actions within the established timeline verifies the feasibility of such actions. In order to also achieve reliability of the actions, the Commission is proposing a criterion for a time margin needed to complete the actions because of potential variations in fire characteristics, plant conditions, and human performance that the Demonstration cannot adequately address. This concept is further described in the sections below.

Timeline Analysis

The Commission will require that a licensee perform an analysis to determine the feasibility and reliability of operator manual actions. As part of the analysis, there shall be a fire timeline, which extends from the initial fire detection to the achievement of maintainable hot shutdown conditions, to define the time boundaries of the analysis for the fire scenario in which the operator manual actions will be performed. The analysis must identify all actions that must be completed, the equipment needed, the number of people needed, the communications equipment required, and the time available to perform the actions before unsafe plant conditions occur (i.e., before exceeding safe shutdown goals and objectives). The proposed rule has more specific requirements on each of these aspects that are discussed in subsequent sections of this

notice. The Commission will require a licensee to show that a sufficient amount of extra time would be available for the required operator manual actions and that the process for determining the time available particular for such actions adequately addressed the potential variations in fire characteristics, plant conditions, and human performance. This concept is referred to in this statement as a “time margin.”

Proper demonstration requires that the licensee meet all operator manual action acceptance criteria other than Time Margin (this is evaluated after all other criteria, including requirements in Section 2(d), have been met) and show that at least one randomly-selected, established crew can successfully perform the actions within an acceptable time frame. For example, if there are questions about whether operators can reach the locations where they must perform the manual actions, these questions should be addressed to the extent practicable during the demonstration. However, successful demonstration does not fully dertermine reliability for the operator manual actions.

Additional factors must be considered to show that the actions can be performed reliably under the variety of conditions that could occur during a fire. For example, factors that the licensee may not be able to recreate in the demonstrations could cause further delay under real fire conditions (i.e., the demonstration would likely fall short of actual fire situations). Furthermore, typical and expected variability among individuals and crews could lead to variations in operator performance. Finally, variations in the characteristics of the fire and related plant conditions could alter the time available for the operator actions.

In order to ensure that a particular action could be performed reliably, licensees must show that a sufficient amount of extra time (i.e., a time margin) would be available for the action and that the process for determining the time available for the action adequately addressed the potential variations in fire characteristics and plant conditions. The time margin ensures that

operator manual actions can be performed reliably: (1) through well-thought out demonstrations that the actions are feasible, (2) by ensuring that there is extra time available for given actions with respect to the fire scenario, and (3) by adequately addressing all other related acceptance criteria.

The analysis should reflect consideration of realistically conservative scenarios and such variables as environment and human performance uncertainties should be accounted for and considered in the time margin. These variables are applied through the demonstration to show that there is ample time, including a margin consistent with the requirement in Section 2(a) above, available to complete an action before serious equipment damage would occur and affect safe shutdown. For example, a licensee may perform a worst case demonstration that requires the operator to wear a self-contained breathing apparatus (SCBA), if there is a reasonable expectation that the operators will need to pass through a zone containing smoke in order to reach the location where the operator manual action is to be carried out.

The NRC considers the use of a time margin as an appropriate safety factor for ensuring realistically reliable operator manual actions (i.e., there is a high confidence of a low probability of failure). The rule would require time margin to account for all variables including differences between the demonstrated and actual conditions and for human performance uncertainties that may be encountered.

The factors necessitating the time margin are:

1. The time margin should account for what the licensee is not likely to be able to recreate in the demonstration that could cause further delay (i.e., where the demonstration falls short).

2. The time margin should account for the variability of fire and related plant conditions.

3. The time margin should account for the variability in human performance among individuals and between different crews and for the effects of human-centered factors that could become relevant during fire scenarios.

These factors are important considerations for the time margin for the following reasons:

1. They address likely limitations of the demonstration.

2. The demonstration can replicate only a subset of all possible fires and resulting variability in fire and plant conditions.

3. Some degree of human performance variability is to be expected, some of which could further delay the times to perform the desired actions during real fire situations.

In order to establish a standard to show time margin, it was necessary to establish a time margin (or margins) for fire-related operator manual actions to ensure that they would be successful a very high percentage of the time. In other words, if the licensee can meet all of the operator manual action acceptance criteria, which include demonstrating that at least one randomly-selected, established crew can successfully perform the actions, and show that the actions can be performed within an acceptable time frame that allows for adequate time margin to cover potential variations in plant conditions and human performance, then the operator manual action rule would be met. For example, as long as it can be shown that there is an “X-percent” time margin to perform the particular operator manual action, plant damage or an

undesirable plant condition will still be avoided and all of the other criteria have been met, then there is confidence to conclude that the action will be performed reliably.

The establishment of an appropriate time margin requires a supported technical basis. While the best technical basis for a time margin would be empirical data from which it could be derived, a database search was unable to find relevant data that could be used directly for or generalized to the operator manual actions of interest. To further develop this concept, the NRC convened an initial expert panel to identify a time margin for inclusion in this proposed rule statement for further stakeholder consideration and feedback.

The expert panel members concluded that a time margin factor of at least 2 would allow for a "high confidence of a low probability of failure" for operator manual actions in response to fire. For example, if the operator manual action can be shown typically to take less than 15 minutes, then at least 30 minutes (15x2) should be available to achieve and maintain safe shutdown. A time margin factor of at least 2 is assumed to absorb delays that might be caused by the following set of factors (1) the need to recover from or respond to unexpected difficulties or random problems associated with instruments or other equipment, or communication devices; (2) environmental and other effects that are not easily replicated in a demonstration, such as radiation, smoke, toxic gas effects, and increased noise levels; (3) limitations of the demonstration to account for all possible fire locations that may lend the need for such operator manual actions; (4) inability to show or duplicate the operator manual actions because of safety considerations while at power; and (5) individual operator performance factors, such as physical size and strength, cognitive differences, time pressure, and emotional responses. In addition, the time margin includes adequate time for personnel to recover from any initial errors in conducting the actions. Section C.3.2 of DG-1136, “Guidance for Demonstrating the Feasibility

and Reliability of Operator Manual Actions in Response to Fire" provides further details about the Commission's vision of how the time margin provision would be implemented.

For purposes of this proposed rule, the Commission is using the time margin recommended by the expert panel as discuss in DG-1136. This serves as a basis for obtaining stakeholder input. It is for this reason that the panel's opinion is included in this statement and in the draft Regulatory Guide, but the Commission is open to other proposals for determining time margin. The factor of 2 should not to be construed as a final decision.

The Commission recognizes that the time margin concept could also consist of a range of multiplicative values. For example, instead of a single multiplicative value of 2, perhaps a range of multiplicative values (e.g., 2-4 times) could determine adequate time margin. This may be appropriate where additional factors were identified that may influence the time line. These factors may be those unknown and not considered by the expert elicitation panel and which may result in a lower or higher multiplicative factor. The Commission can also foresee situations where a licensee may be able to define a different multiplicative value for different scenarios. For example, an operator manual action consisting of a single action by one plant operator could have a different multiplicative value than a scenario that involves more than one plant operator or where several sequential actions are necessary.

As with the discussion of the range of multiplicative values above, the time margin concept may have to include a minimum additive time (predetermined minimum a mount time added to the demonstrated time) necessary for certain situations. For example, the time in the demonstration is shown to be short (e.g., <5 minutes for a single operator manual action), a single multiplicative value of 2 is applied resulting in an additional time of <5 minutes. There may be situations where the resulting <5 minutes of margin may not be adequate to address the factors that may cause a delay as identified above. In such situations it may be more

appropriate to apply a minimum additive time (e.g., 10 minutes) to account for factors that may cause a delay with the operator manual action.

Request for Comment 1: (Time Margin)

The time margin factor is offered in this statement as a best estimate and basis for obtaining stakeholder feedback. The Commission requests opinions specifically on the time margin aspects because of stakeholder interest in this subject and the Commission's desire to consider all stakeholders' input for this important criterion.

Specifically, the Commission asks the following questions:

(A) Considering the factors for time margin discussed above (including the conditional dependence on a worst-case demonstration meeting all the other acceptance criteria), should the time margin consist of a single multiplicative factor (e.g., 2 times), or a range of multiplicative factors (e.g., 2-4 times)? Please provide a basis for your proposed time frames or factors.

(B) If a range is appropriate, what should the range be and what parameters or variables should be considered in determining which part of the range is applicable in a given situation? Please provide a basis for your proposed time frames or factors.

©) Should there be a minimum additive time (e.g., 10 minutes) for situations where the time in the demonstration is so short that a multiplicative factor would not properly account for the required time margin (e.g., a time in the demonstration of < 5 minutes). Please provide a basis for your proposed time frames or factors.

(D) Are there other means of establishing margin (e.g., through consideration of conservative assumptions in the thermal hydraulic timeline)? Please provide a technical basis.

Environmental Factors

Subsection 2(a)(1) of the proposed criteria requires that the fire timeline include a time margin that accounts for differences between the demonstrated and actual conditions. Adverse environmental factors are one area of concern that must be considered because they affect the operator's mental or physical performance. The environmental factors must be weighed with respect to the location where the operator manual actions will be performed, as well as the access and egress routes to and from this location. Operators' performance may be impeded by their inability to reach the required location and by the difficulty of performing the action in the conditions existing at the required location. The environment along the egress route after completion of the operator manual action must also be considered to ensure personnel health and safety throughout. These environmental factors are considered in the analysis via preparation and planning thereby ensuring there is sufficient time to travel to the location(s) and perform the action(s) required to achieve and maintain the plant in a hot shutdown condition.

Equipment Performance

Subsection 2(a)(2) of the criteria requires the analysis to address the functionality of equipment or cables that could be adversely affected by the fire but still utilized to achieve and maintain hot shutdown. For example, operators may rely upon valves to achieve and maintain hot shutdown conditions. If the functionality of the valves is adversely affected by the fire then it may degrade or prevent the performance of the required operator manual actions. As identified in Information Notice 92-18 for motor-operated valves, bypassing thermal overload protection devices (discussed in Regulatory Guide 1.106) could jeopardize completion of the safety function or cause degradation of other safety systems due to sustained abnormal circuit currents that can arise from fire-induced "hot shorts." Even if these overload protection devices are not bypassed, hot shorts can cause loss of power to motor-operated valves by tripping the devices. If an operator manual action requires the manual manipulation of a depowered motor-operated

valve, such fire–induced damage could make the manipulation physically impossible. Therefore, if equipment to be used during operator manual actions could be affected by fire, the licensee must determine that the functionality of that equipment will not be adversely affected.

Plant systems, structures and components (SSCs) are used to achieve and maintain hot shutdown conditions. SSCs often require active intervention, through either automatic or manual means, to perform their required function. The analysis of the fire timeline must identify all such SSCs needed to achieve maintainable hot shutdown conditions from the time of initial fire detection, particularly those that require operator manual actions to perform their safe shutdown function and explain how active equipment will be operated. Diagnostic indications relevant to the SSCs' safety function may be critical to specific operator manual actions and interaction with this equipment. Diagnostic indications are the alerting, information, control, and feedback capability provided through instrumentation. They also provide sufficient information that determines if and when these interfaces must be effected. These indications would typically be needed to: (1) enable the operators to determine which manual actions are appropriate for the fire scenario; (2) direct the personnel as to the proper performance of the operator manual actions; and (3) provide the necessary feedback to the operators verifying that the manual actions have had their expected results. Diagnostic indications are considered in the analysis via identification of the SSCs necessary to accomplish the operator manual action and evaluation of their availability under the fire and environmental conditions expected. Guidance on identifying needed indication is provided as per paragraph c.2 of the regulatory guide DG-1136, "Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire."

Communications Equipment

Subsection 2(a)(3)(ii) of the proposed criteria requires the analysis to identify all communications equipment necessary to accomplish the operator manual actions. Communications equipment may be needed to provide feedback between operators in and personnel outside the main control room to ensure that any activities requiring coordination between them are clearly understood and correctly accomplished. The unpredictability of fires can force staff to deviate from planned activities, hence the need to consider constant and effective communications. Communications may be needed in the performance of sequential operator manual actions (where one action must be completed before another can be started) and provide verification that procedural steps have been accomplished, especially those that must be conducted at remote locations. Communications must be considered in the analysis by identifying the necessary communications equipment and ensuring their availability to the plant operators for the time needed to achieve and maintain hot shutdown. For example, if portable radios are to be used for communications then the analysis should list the equipment and confirm that the equipment can be used in the plant areas (i.e., capable of receiving and transmitting in the necessary plant areas) and are available for the time required (e.g., battery power life has been considered for the time period necessary). Such communications should be identified and addressed as per paragraph c.2 of the regulatory guide DG-1136, “Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire.”

Portable Equipment

Subsection 2(a)(3)(ii) of the proposed criteria requires the analysis to identify all portable equipment necessary to accomplish the operator manual actions. Portable equipment, especially tools such as keys to open locked areas, ladders to reach high locations, torque devices to turn valve handwheels, and electrical breaker rackout tools, can be essential to

access and manipulate SSCs in the successful accomplishment of required operator manual actions. Similarly, life support equipment, such as self-contained breathing apparatuses (SCBA), may need to be worn to permit access to and egress from the locations where the operator manual actions must be performed since the routes could be negatively affected by fire effects, such as smoke, that propagate beyond the fire-involved area. Portable equipment must be considered in the analysis by identifying necessary equipment and ensuring their availability to the plant operators during the time needed to achieve and maintain hot shutdown. For example, if SCBA is necessary then the analysis should list the equipment and confirm that the equipment can be used in the plant areas (i.e., access and egress to tight areas are not impeded by the use of SCBA) and are available for the time required (e.g., portable bottle air supply provides sufficient time to perform the action). Such equipment should be identified and addressed as per paragraph c.2 of the regulatory guide DG-1136, "Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire."

Procedures and Training

Subsection 2(b) of the proposed criteria requires plant procedures to include all manual actions that each operator receive training on these manual actions. The role of written plant procedures in the successful performance of operator manual actions is three-fold: (1) assist the operators in correctly diagnosing the type of plant event that the fire may trigger, usually in conjunction with indications, thereby permitting them to select the appropriate operator manual actions (or prescribe actions to be taken should a fire occur in a given fire area); (2) direct the operators as to which preventive and mitigative manual actions are appropriate to place and maintain the plant in a stable hot shutdown condition; and (3) minimize the potential confusion that can arise from fire-induced conflicting signals, including spurious actuations, thereby minimizing the likelihood of personnel error during the required operator manual actions. Written

procedures should contain the steps to be performed, how the operator manual actions are performed and the tools and equipment needed to successfully perform the actions. Training on these procedures serves three supporting functions: (1) establishes familiarity with the procedures, equipment, and potential (simulated) conditions in an actual event; (2) provides the level of knowledge and understanding necessary for the personnel performing the operator manual actions to be well-prepared to handle departures from the expected sequence of events; and (3) provides the personnel with the opportunity to practice their response without exposure to adverse conditions, thereby enhancing confidence that they can reliably perform their duties in an actual event. Determining that operators are appropriately trained on procedures entails establishing, implementing, and maintaining a training program that incorporates the instructional requirements necessary to provide qualified operators to perform the manual actions. Licensees are already required to establish training programs for licensed operator and nuclear plant personnel in accordance with Sections 55.59 and 50.120 of Part 50, respectively. The procedures and training provided to operators and nuclear plant personnel will ensure that the supporting functions and roles discussed above can be met. Such procedures and training should be identified and addressed as per paragraph c.2 of the regulatory guide DG-1136, "Guidance for Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire." The Commission expects plant procedures to be available at or near the locations where the operator manual actions are to occur so that they are easily accessible to the operators.

Implementation and Staffing

Subsection 2©) of the proposed criteria requires that equipment and personnel necessary for feasible and reliable operator manual actions must be readily available and accessible. The equipment is operable when its functionality is not adversely affected by the fire

or its effects. Accessible means that the personnel should be able to find and reach the locations of the components and be able to manipulate the components. Accessibility and operability of equipment must be considered in the analysis by identifying necessary equipment, ensuring operators are knowledgeable of equipment locations, determining that accessibility of such equipment, and that the equipment will not be adversely affected by a fire or its effects. For example, operators may rely upon valves to achieve and maintain hot shutdown conditions. If the functionality of the valves is adversely affected by the fire or if the valves are not accessible for manipulation then the functionality of such valves may be degraded, thereby preventing the performance of the required operator manual actions.

The intent of the staffing requirement is to ensure that qualified personnel will be on site at all times such that hot shutdown conditions can be achieved and maintained in the event of a fire. An individual expected to perform the operator manual actions may not have collateral duties, such as fire fighting or security, during the evolution of the fire scenario. This individual should be exclusively available for the performance of required operator manual actions. Therefore, operating shift staffing levels should include enough personnel on watch for the performance of any operator manual actions that could arise as a result of a fire. The fire brigade would not be expected to perform actions other than those associated with fire fighting. Otherwise, the potential for interfering with either their fire fighting activities or the operator manual actions could exist, such that successful performance of one or the other, or both, could be impaired. For example, during a fire, an individual who is part of the five-person fire brigade could not perform the required operator manual actions because that individual is expected to participate in the fire fighting efforts.

Demonstration

The concepts of feasibility and reliability were examined under Criterion 2(a) of the paragraph III.P in connection with the fire timeline and time margin. Demonstration and time margin development complement each other. Subsection 2(d) of the proposed criteria requires demonstration in order to establish the feasibility of operator manual actions. The demonstration criterion provides reasonable assurance that the operator manual actions can be performed in the analyzed time period for a range of conceivable fire situations.

The use of such demonstrations is supported, for instance, by NUREG-1764, “Guidance for the Review of Changes to Human Actions” and NUREG-0711 “Human Factors Engineering Program Review Model,” cited in NUREG-0800, Section 18.0 *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*. NUREG-1764 states that “... [a] walk-through of the human actions under realistic conditions should be performed...The scenario used should include any complicating factors that are expected to affect the crews[’] ability to perform the human actions...” NUREG-0711 states that “... an integrated system design (i.e., hardware, software, and personnel elements) is evaluated using performance-based tests...Plant personnel should perform operational events using a simulator or other suitable representation of the system to determine its adequacy to support safety operations...”

There are several important elements to the demonstration criterion. First, licensees may take credit for operator manual actions only after a successful demonstration. To continue taking credit for operator manual actions, licensees must complete demonstrations such that all operating crews successfully perform the coordinated sets of operator manual actions taken as a result of a fire in a specific fire area. Periodic demonstrations, at a frequency consistent with that established by the licensee in compliance with 10 CFR 50.120, provide valuable training and experience for licensee personnel and also serve to verify that plant configuration and conditions

(access, egress, etc.) have not changed over time such that the operator manual actions can no longer be accomplished in accordance with the analysis performed pursuant to subparagraph III.P.2(a). Should a licensee be unable to successfully complete a subsequent demonstration, the Commission expects prompt corrective action to retrain the operators, or to modify the operator manual actions, or modify the plant conditions so that the demonstration yields successful results.

Second, the demonstration verifies an action can be completed within the analyzed fire timeline. This can be done utilizing an established crew of operators to show in the demonstration that operator manual actions can be accomplished to achieve and maintain hot shutdown for the entire fire scenario. This serves as a benchmark for the development of a time margin, which is an application of the reliability concept. Another means of establishing time margin is through consideration of conservative assumptions in the thermal-hydraulic time line (e.g., end-state).

Third, the demonstration must be completed by an established crew. An established crew is a group of operators that normally work as a team during any one shift. Conducting the demonstration with an established crew instead of a crew assembled just for the demonstration will provide a more valid basis for the fire timeline determination, as well as provide the established crew with the training necessary to work as a team.

Fourth, operator manual actions may not be credited until those actions have been shown in the demonstrations to be feasible by satisfying all the acceptance criteria. The demonstration should ensure that all relevant aspects of the criteria are met and that important characteristics of those criteria are included in the demonstration to the extent possible. For example, environmental conditions must be considered and should be simulated where possible. This may include, but is not limited to, such considerations as expected lighting levels, protective

clothing, and noise levels. This is important because it validates the demonstration by conducting it under conditions that are as realistic as possible.

Fifth, prompt corrective actions are required if any demonstration determines that the operator manual action may not be accomplished consistent with the analysis. Prompt corrective actions should be implemented at the first available opportunity consistent with the guidelines of Generic Letter 91-18, Revision 1, Information to Licensees Regarding NRC Inspection Manual Section on Resolution of Degraded and Nonconforming Conditions.

As with training, the demonstration provides the crew with practical experience. All elements of the fire scenario, including the use of equipment and procedures, adequacy of staffing levels, and response to indications, should be integrated into the demonstration to develop this benchmark. In this way, any complexities, such as the number of required operator manual actions and their dependence upon one another, are evaluated and identified for appropriate consideration in the development of the time margin. Failure of an initial demonstration to show that the operator manual actions can be accomplished consistent with the analysis indicates that the manual actions are not feasible. In such cases, the licensee could modify the actions (e.g., different access/egress routes, redeployment of critical equipment by placing it at the location where the operator manual actions will be performed vs. carrying it to that location), retrain the crew, such that a new demonstration satisfies the analysis, or the licensee could conclude that operator manual actions are not feasible and opt to comply with paragraph III.G.2.

C. Response to Stakeholder Comments on Operator Manual Action Acceptance Criteria

As part of the development of this proposed rule, the NRC considered stakeholder comments that provided additional insights. A number of stakeholder comments were made in response to the draft acceptance criteria intended for use in the interim enforcement discretion

policy published for comment (68 FR 66501 and 69730) and in a subsequent public meeting on June 23, 2004. The comments on these criteria involved the demonstration using the same personnel/crews who are required to perform the manual actions during the fire; the application of plant procedures; the application of a fire detection and suppression system; and the application of operator manual actions criteria in all provisions of paragraph III.G.

Demonstration Criterion

A number of public comments indicated that the demonstration to use "the same personnel/crews who will be required to perform the actions during the fire" is unnecessarily restrictive. The Commission agrees that requiring all crews to demonstrate performance under all conditions is unnecessarily restrictive. The intent is to provide reasonable assurance that whatever crew is on duty at the time of a fire can reliably perform the required actions, allowing for variabilities and uncertainties. The Commission considers it sufficient that an established crew (i.e., one that typically works as a team) shows the ability to perform the required operator manual actions through documented demonstration. This demonstration should show that the crew can successfully perform all operator manual actions required by the entire fire scenario within the analyzed fire timeline. The demonstration should be part of the periodic operator training. To reasonably assure that the remaining crews (i.e., the ones that receive training but do not perform the demonstration during a particular training cycle) can reliably perform the actions, the "time margin" addressed in the analysis criterion is used to offset the variability among crews. In this way, the demonstration by the established crew with an appropriate margin, will reasonably assure that any of the crews could likewise perform the required actions. Another means of determining margin is through consideration of conservative assumptions in the thermal-hydraulic time line (e.g., end-state).

Procedural Guidance vs. Guidance

A number of public comments suggested that the phrase “procedural guidance” be replaced by “guidance” (e.g., pre-fire plan). The Commission considers this term insufficient to provide feasible and reliable operator manual actions. In fact, the Commission has strengthened the wording from the original “procedural guidance” to “plant procedures” to reflect the need for formal written steps. Typically, plant operators should be capable of performing noncomplex manual actions without detailed instructions. However, there are fire scenarios which could conceivably be atypical such that what would “normally” be non-complex could prove to be difficult in an actual situation. The reading of procedures from the control room to direct remote activities could be impeded by communication difficulties or other control room activities. In addition, operators who perform actions outside the control room may require immediate feedback from the control room, and vice versa, to determine if certain actions have produced the intended results. The Commission expects plant procedures to be available at or near the locations where the operator manual actions are to occur so that they are easily accessible to the operators.

Need for Detection and Suppression Where Fire Occurs

There appeared to be some confusion on the part of a few commenters regarding where fire detection and automatic suppression would be required in conjunction with the addition of the option for operator manual actions in complying with paragraph III.G.2. Some thought they would be required in the areas where the operator manual actions would occur. The requirement for fire detectors and an automatic fire suppression system applies only to the area where the fire occurs, not to the area(s) where the operator manual actions will take place.[5]

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[5] Only in the presumably rare case where the operator manual actions would also occur in the same fire area as the fire itself would fire detectors and an automatic fire suppression system have to be installed “in the area where the operator manual actions are taken” for these operator manual actions to receive credit. This is envisioned only if a very large fire area experiences a very localized fire such that the fire effects do not preclude access to, egress from, and operator manual actions in, a distant location within the very large area.

A few commenters questioned whether the requirement for fire detection and automatic suppression installed in the area where the fire occurs should accompany the proposed compliance option for operator manual actions, and why this could not be left to the discretion of the licensees and review by the NRC, depending on the specific conditions to be encountered in that fire area. As discussed in the staff's proposed Appendix R, dated May 29, 1980, protective features shall be provided for fire areas that contain cables or equipment of redundant systems important to achieving and maintaining safe shutdown conditions to ensure that at least one means of achieving said conditions survive postulated fires. The protective features may consist of a combination of automatic and manual fire suppression capability, fire propagation retardants, physical separation, partial fire barriers, or alternative shutdown capability independent of the room. The Commission believes that the proposed operator manual action option in conjunction with fire detectors and an automatic fire suppression system is consistent with the requirement of protective features and maintains a similar defense-in-depth concept as with a 1-hr passive fire barrier or a 20-ft separation with no intervening combustibles.

The III.G.2 compliance option of a 3-hr passive fire barrier requires no fire detection or automatic suppression to be installed in the area where the fire occurs. To consider the option for operator manual actions as providing reasonable assurance at a level comparable to this, one must be convinced that the implementation of operator manual actions by itself is a sufficient level of defense-in-depth without the additional level of protection provided by fire detectors and an automatic fire suppression system. The reason that the 3-hr barrier was "exempted" from the additional need of fire detection and automatic suppression was the prevalent acknowledgment that a fire lasting longer than three hours, without intervention, is highly unlikely, if not incredible. Therefore, unlike a 1-hr barrier or a 20-ft separation without intervening combustibles, this compliance option was viewed sufficient unto itself without the

additional level of defense-in-depth provided by the fire detection and automatic suppression. Experience in both the nuclear and non-nuclear industry clearly indicates that human reliability is not at a level approaching that provided by a 3-hr barrier as the sole level of defense-in-depth. Therefore, it is not reasonable to consider the implementation of operator manual actions by itself sufficient as a compliance option to III.G.2 without the additional level of defense-in-depth provided by fire detection and automatic suppression.

A few commenters indicated that requiring fire detection and automatic suppression in conjunction with operator manual actions if creditable under III.G.2 “does not enhance the ability of the operator to perform a manual action in another area of the plant that is unaffected by the fire ... [Furthermore], this new ‘requirement’ is also more severe than Appendix R, Section III.G.3 because III.G.3 only requires a ‘fixed’ suppression system, either manual or automatic, but does not require an ‘automatic’ suppression system . . . ”

With regard to the first claim, the Commission believes that requiring fire detectors and an automatic fire suppression system in the fire area under consideration would enhance the ability of the operator to achieve and maintain safe shutdown from an unaffected area. The activation of detection and automatic suppression as indicated in the staff’s statements of consideration for Appendix R to 10 CFR Part 50 (as amended 45 FR79409) would ensure prompt and effective application of suppressant to a fire that could endanger safe shutdown capability. As a result, the Commission believes that the time until a fire could adversely affect the ability of the plant to achieve and maintain a safe shutdown may be extended, thereby enhancing the ability to perform feasible and reliable operator manual actions.

While a proposed requirement of automatic suppression for operator manual actions under paragraph III.G.2 may appear to be more severe than that of fixed suppression under paragraph III.G.3, this difference is minor in practicality. Part 50, Paragraph 48(a)(1), *Fire*

Protection, of 10 CFR states that "each operating nuclear power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A to this part." Appendix A, Criterion 3, *Fire Protection*, states that "Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety." If a non-water, fixed suppression system (i.e., a gaseous suppression system) is used to comply with III.G.3, the governing standards from the NFPA essentially dictate that the system be automatic, unless an exception is granted.[6] If a fixed water system is used to comply with III.G.3, it can be non-automatic (i.e., manually activated). However, the requirement that it be "fixed" means that its infrastructure is essentially the same as an automatic system, such that the practical difference between automatic and fixed suppression in areas III.G.2 and III.G.3 is minimal.

Finally, in both paragraphs III.G.2 and III.G.3, the requirement for fire detection and suppression (automatic or fixed) provides a degree of "defense-in-depth" to the passive fire protection features already in place (except in the case of the 3-hr fire barrier, where this is deemed sufficient without detection or suppression). Defense-in-depth is a recognized cornerstone in NRC policy to protect the public health and safety. Therefore, maintaining defense-in-depth is recognized as providing safety benefit in and of itself.

When the NRC proposed the original "Fire Protection Program for Nuclear Power Plants Operating Prior to January 1, 1979" (45 FR 36082), it specified that "the following minimum fire protective features shall be provided: (a) an early warning detection system; (b) manual fire

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[6] NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, Section 1-8.1.1, requires use of "automatic detection and automatic actuation," with the exception that "manual-only actuation can be used if acceptable to the authority having jurisdiction [the NRC] where automatic release could result in an increased risk." NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, Section 2-3.1.1, similarly states that "automatic detection and automatic actuation shall be used," with a similar exception that "manual-only actuation shall be permitted to be used if acceptable to the authority having jurisdiction [again, the NRC]." NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, Section 2-3.1.1, parallels NFPA 12A exactly.

suppression capability; and ©) fixed fire suppression systems and alternative shutdown capability as shown on Table 1." In Table 1, the need for fixed fire suppression systems, automatic or manual, was based on four factors: (1) does the fire/water disable normal shutdown capability; (2) is shutdown available from the control room; (3) is shutdown required from an alternate panel (if not available in the control room); and (4) is the access for manual fire fighting "good" or "poor." A fixed fire suppression system was required whenever shutdown had to be performed at an alternate panel, except if (a) the only in-situ combustible was cable insulation; (b) measures were provided to retard propagation; and ©) separation between redundant systems was at least 10 feet horizontal and vertical of clean air space. These requirements were enhanced when they subsequently became Paragraphs 1, 2 and 3 of Section III.G in the final rule. It should be noted that even during the original rulemaking for Appendix R, the need for at least fixed fire suppression was recognized when shutdown operations would consist of ex-control room operator manual actions (which include those performed at an alternate panel).

In developing Appendix R, Section III.G, the NRC originally considered fire detection and automatic suppression, if not as the primary level of defense-in-depth, at least as an equal level of defense-in-depth in conjunction with fire-retardant coatings, and subsequently their successors, fire barriers and/or physical separation, as per the "Statements of Consideration, 10 CFR Part 50, Fire Protection Program for Operating Nuclear Power Plants," November 19, 1980:

> "... [T]he NRC staff has indicated to the Commission that there are requirements . . . in which the protection afforded by Appendix R over and above that previously accepted, may be desirable. The Commission has decided that these requirements should be retroactively applied to all facilities . . . to take fully into account the increased knowledge and experience developed on fire protection matters over the last several years. The first of these [requirements] . . . is

related to fire protection features for ensuring that systems and associated circuits used to achieve and maintain a safe shutdown are free from fire damage. Appendix A to BTP CMEB 9.5-1 permits a combination of fire-retardant coatings and fire detection and suppression systems without specifying a physical separation distance to protect redundant systems, and such arrangements were accepted in some early fire protection reviews. As a result of some separate effects tests, the staff changed its position on this configuration, and subsequent plans have been required to provide additional protection in the form of fire barriers or substantial physical separation for safe shutdown systems. No credit for such coatings as fire barriers is allowed by Section III.G of Appendix R."

The NRC originally characterized fire-retardant coatings, and subsequently their successors, fire barriers and/or physical separation, as "additional," implying that detection and suppression were intended to be primary. The requirement that detection and suppression (automatic) be included with Appendix R, Paragraph III.G.2, operator manual actions is not only consistent with the corresponding options currently there, but also is consistent with NRC's original intent in developing Appendix R, Section III.G.

The NRC exemption process in Section 50.12 or the specific license conditions will remain available to those licensees who wish to demonstrate compliance that operator manual actions in particular situations provide a reasonable assurance that the public health and safety can be maintained without fire detection or automatic suppression.

Request for Comment 2:

After considering technical implications and historical background of the proposed criteria as discussed above, the Commission decided that the proposed operator manual actions rulemaking will require fire detectors and an automatic fire suppression system in the fire area to

permit operator manual actions as a compliance option under paragraph III.G.2, provided the acceptance criteria delineated in a new paragraph III.P are satisfied. The basis for the requirement is discussed above. However, because of the stakeholder interest in this subject, the Commission is asking specific feedback and opinions from stakeholders on requiring an automatic versus fixed fire suppression system in the fire area.

The Commission asks the following specific question:

(A) Under the proposed option of using operator manual actions under III.G.2©-1), when redundant trains are located in the same fire area, should the requirement for a suppression system in the fire area be automatic or fixed? Automatic suppression system is required in III.G.2(b) and ©). However, a fixed system is specified in III.G.3. Provide your rationale for why requiring fixed or automatic suppression would provide the appropriate level of protection.

Application of Operator Manual Actions Acceptance Criteria to Paragraphs III.G.1 and III.G.3

The proposed operator manual actions rulemaking would modify requirements in paragraph III.G.2 to permit operator manual actions as a compliance option under this paragraph, provided the acceptance criteria delineated in a new paragraph III.P are satisfied. The proposed rule language would not apply to paragraphs III.G.1 or III.G.3, although the term “operator manual actions” may be construed as applicable to the same types of actions taken under these paragraphs. This issue has been raised by stakeholders during discussions conducted thus far, and therefore, the Commission is providing background information about this subject and a specific request for comment.

Appendix R to 10 CFR 50, section III.G.1. requires fire protection features capable of limiting fire damage so that one train of systems necessary to achieve and maintain hot

shutdown conditions from either the control room or emergency control station(s)[7] is free of fire damage. The NRC considers redundant trains located in completely separate fire areas to comply with III.G.1. Paragraph III.G.1 also allows a licensee to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s).

Where redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located in the same fire area, paragraph III.G.2. requires one of three means to ensure that one of the trains is free of fire damage. Through this rulemaking, the Commission is proposing to add a fourth means.

Where the protection of systems required to function properly for hot shutdown does not satisfy the requirement of paragraph III.G.2, or where redundant trains of systems required for hot shutdown may be subject to damage as a result of fire suppression activities or the inadvertent actuation of fire suppression systems, paragraph III.G.3 requires that an alternative or dedicated shutdown capability must be provided and must be independent of cables, systems or components in the area, room, or zone under consideration. In addition, paragraph III.G.3 further requires that fire detection and a fixed fire suppression system must be installed in the area, room, or zone under consideration. Specific criteria for implementing this capability are contained in Appendix R, paragraph III.L, “alternative and dedicated shutdown capability,”

including such features as the performance goals for specific functions (e.g., maintaining RCS process variables within those predicted for a loss of normal AC power, with makeup function capable of maintaining the reactor coolant level above the top of the core for BWRs and within level of pressurizer indication for PWRs), and to achieve cold shutdown within 72 hours.

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[7] RG 1.189 Fire Protection for Operating Reactors defines an “emergency control station” as a “location outside the MCR where actions are taken by operations personnel to manipulate plant systems and controls to achieve safe shutdown of the reactor.”

Feedback from the stakeholders on the *Federal Register Notice* [68 FR66501], November 26, 2003 made clear that some stakeholders believe that acceptance criteria for operator manual actions should be expanded to other provisions of paragraph III.G of Appendix R to 10 CFR Part 50. For example, one commenter stated that *"[R]ather than changing Appendix R, Section III.G.2, we recommend that the NRC issue generic industry guidance clarifying that manual actions are permissible to satisfy all subsections of Appendix R, Section III.G, and that manually operating equipment locally satisfies the "emergency control stations" provision of Appendix R, Section III.G.1. This approach maintains maximum consistency with existing NRC guidance and avoids the creation of a separate set of standards that are only applicable to "III.G.2" manual actions. Otherwise, establishing criteria specifically applicable to Appendix R, Section III.G.2, will lead to new disputes when manual actions previously credited to satisfy Sections III.G.1 and III.G.3 are reviewed during the inspection process."*

Another commenter stated that "*This [sic - These] proposed interim acceptance criteria should state NRC's current expectations for feasibility of all manual actions. This maintains the maximum consistency with existing NRC guidance, and avoids the creation of a separate set of standards only applicable to "III.G.2" manual actions. Establishing criteria specifically applicable to "III.G.2 manual actions" will lead to unnecessary confusion about whether an action is a "III.G.1.a action" or a "III.G.2 action."*

In addition to the written public comments stated above, the NRC received comments during a June 23, 2004, Category 3 public meeting in Rockville, Maryland discussing application of operator manual actions criteria to paragraphs III.G.1 and III.G.3. During this meeting the industry stated that it will conduct a survey of licensees shortly following issuance of the proposed rule to determine their position and consensus on the application of operator manual action criteria to 10 CFR Part 50, Appendix R, paragraphs III.G.1 and III.G.3.

There were two issues identified by stakeholders relative to operator manual actions. The first was specific operator manual actions within each individual paragraph III.G.1, III.G.2, and III.G.3. The second was the applicability of the proposed operator manual actions acceptance criteria to all provisions of paragraph III.G.

Operator manual actions, as currently outlined in the proposed rule, would be utilized as an additional option to satisfy paragraph III.G.2 requirements. However, based on stakeholder comments as discussed above, the NRC is asking feedback from stakeholders on the advantages and disadvantages of also applying operator manual action acceptance criteria to paragraphs III.G.1 and III.G.3.

The NRC determined that there are technical and backfit considerations associated with expanding the applicability of operator manual action acceptance criteria to paragraphs III.G.1 and III.G.3 as discussed below.

A III.G.3-compliant Fire Area contains redundant trains of shutdown equipment or cables and one train has not been ensured to remain free of fire damage (per III.G.2 criteria), or redundant trains are vulnerable to damage as a result of fire suppression activities or the inadvertent actuation of fire suppression systems. As noted, paragraph III.L contains specific provisions concerning this alternate or dedicated shutdown capability. For instance, it contains criteria such as III.L.3 “Procedures shall be in effect . . . ,” and III.L.4 “The number of operating shift personnel . . . required to operate such equipment shall be on site at all times.” However, they are not as comprehensive as the proposed acceptance criteria in paragraph III.P. The NRC believes that if it applied the acceptance criteria to paragraph III.G.3, it may be necessary to modify paragraph III.L.

In addition, the NRC believes that operator manual actions previously approved for paragraph III.G.3 would need to be revisited in order to ensure that they satisfy the acceptance criteria as proposed for paragraph III.G.2.

Applying the same new acceptance criteria to all fire protection manual actions in paragraph III.G may require a generic backfit analysis since the current rule allows the use of manual actions at emergency control stations in III.G.1 with no codified acceptance criteria and in III.G.3 with less specific acceptance criteria. Section 50.109 (a)(3) provides the standard for a backfit analysis that must show "a substantial increase in the overall protection . . . and that the direct and indirect costs of implementation . . . are justified in view of this increased protection." The extent of licensees' usage of manual actions is highly plant specific and the associated costs and benefits of backfitting are therefore difficult to quantify. Furthermore, applying the acceptance criteria to all paragraph III.G manual actions could invalidate the use of some existing manual actions. The subsequent hardware/fire barrier/program modifications that would then be needed could be very expensive. Thus, value-impact analyses in many cases would probably show that backfitting is not cost-beneficial.

Alternatively, if a generic analysis cannot justify the backfit under 10 CFR 50.109(a)(3), the NRC may be able to justify the backfitting as necessary for "adequate protection" under 10 CFR 50.109(a)(4)(ii). The NRC concludes that recent inspection experience has not shown major issues with respect to the use of operator manual actions, thus, not providing significant support to justify that the backfit is needed for adequate protection. Further, NRC inspections of potentially risk-significant ("greater than green") findings on such manual actions are already handled by the Reactor Oversight Process (ROP) corrective action program or are evaluated as plant-specific backfits, as applicable.

Regardless of the applicable section under 10 CFR 50.109, a backfit may ultimately enhance safety, as a result of a consistent set of rules. However, backfitting the operator manual actions' acceptance criteria to all plants may cause plants with existing operator manual actions previously approved under a different set of criteria to resubmit exemption requests for staff review and approval.

Applying new acceptance criteria on a forward-fit basis for operator manual actions under III.G.3 might be a means of addressing this backfit concern. Under this approach, application of the new acceptance criteria to III.G.3 would apply to operator manual actions that resulted from future licensing basis changes after the effective date of the new rule. The new acceptance criteria would thus apply to all III.G.2 operator manual actions, but to only a small percentage of the manual actions credited under III.G.3. This approach, however, may increase the regulatory complexity and burden associated with fire protection inspections and further complicate the fire protection licensing basis of each facility.

Applying the new acceptance criteria to all operator manual actions in III.G.2 and III.G.3, would make fire protection implementation and inspections more consistent, reliable and predictable. However, the NRC also notes that the existing requirements vary among plants for several reasons (as for instance that post-1979 plants were not specifically licensed to Appendix R), and thus these provisions would not apply to them absent other regulatory action, which would tend to offset the possible consistency gain.

Request for Comment 3:

After considering a number of technical and regulatory implications, the Commission decided to limit the applicability of this proposed rule on operator manual actions to paragraph III.G.2. However, because of the stakeholder interest in this subject, the Commission is also asking for specific feedback and opinions from stakeholders on applying operator manual

actions acceptance criteria to paragraphs III.G.1 and III.G.3. Depending on the comments received, the Commission may extend application of the criteria to paragraphs III.G.1 and III.G.3.

The Commission asks the following specific question:

(A) Should the operator manual action acceptance criteria developed for III.G.2 also be applied to operator manual actions for III.G.1 and III.G.3? Are there advantages or disadvantages not noted by the Commission that should be considered? Please provide a discussion outlining the basis for your response taking into account the considerations outlined above.

IV. Interim Enforcement Discretion Policy

In SECY-03-0100, “Rulemaking Plan on Post-Fire Operator Manual Actions,” dated June 17, 2003, the staff recommended development of an interim enforcement policy relying on preliminary acceptance criteria for manual actions. The staff proposed this strategy based on a belief that interim acceptance criteria could be developed that would be consistent with the manual actions acceptance criteria in the final rule. The Commission had previously approved a similar enforcement discretion policy related to a fitness-for-duty proposed rulemaking. In an SRM dated September 12, 2003, the Commission approved the staff’s recommendation.

In March 1998, the staff issued EGM 98-02, "Enforcement Guidance Memorandum - Disposition of Violations of Appendix R, Sections III.G and III.L Regarding Circuit Failures," that provides enforcement guidance for issues related to fire-induced circuit failures, which encompasses the vast majority of manual actions as compensatory measures to satisfy the

regulatory requirements. This EGM was developed based on an apparent widespread misunderstanding of the requirements on the part of licensees and remains in effect until December 31, 2005. The EGM provides guidance for disposition of noncompliances involving fire-induced circuit failures, which could prevent operation or cause maloperation of equipment needed to achieve and maintain post-fire safe shutdown. Among the enforcement conditions, discretion will be given for cases where licensees do not dispute that a violation of regulatory requirements has occurred with respect to a nonconformance and that licensees take prompt compensatory actions and also take corrective action within a reasonable time. The expectations of this EGM have been incorporated into the current NRC Enforcement Manual. In addition, the Office of Nuclear Reactor Regulation issued a revised Inspection Procedure (IP) 71111.05 in March 2003 incorporating interim operator manual actions acceptance criteria. The inspection procedure provides guidance to assess and ensure that plant specific operator manual actions meet the interim acceptance criteria and that corrective actions taken by the plants will achieve and maintain safe shutdown condition.

On November 26, 2003, the staff published a *Federal Register* notice soliciting public comments on specific acceptance criteria for operator manual actions to be considered for use in developing an interim enforcement discretion policy for post-fire operator manual actions. In addition, as part of the proposed rule development, the staff has had numerous interactions with industry and public stakeholders to discuss rule requirements and the more developed operator manual actions acceptance criteria. Based on these meetings and comments in response to the November 26, 2003, *Federal Register* notice, the Commission believes that the proposed rule's acceptance criteria and detection and suppression requirements are still evolving, such that the

new interim enforcement guidance developed in conjunction with the proposed rule may not be consistent with the requirements specified in the final rule.

The current applications of EGM 98-02 and IP 71111.05 are effective to ensure and maintain the overall plant safety by licensees through the use of adequate and appropriate compensatory measures in the form of operator manual actions implemented in accordance with the licensee's Fire Protection Program. Manual actions that fail to meet the criteria in the inspection procedure are not considered to be feasible or to be adequate compensatory measures. Such manual actions will result in the non-compliance being entered into the enforcement process. The new interim enforcement policy for the post-fire operator manual actions would utilize a disputed set of acceptance criteria and trigger additional reviews (by licensees and inspectors) of past findings, with the prospect of a third review being necessary upon issuance of the final rule. Issuing such an enforcement discretion policy at this time could also have the unintended consequence of preempting the rulemaking process without a clear safety benefit.

Based on the above, the Commission considers continuing use of the current enforcement discretion policy of EGM 98-02 and the guidance in IP 71111.05 and that a revision or additional policy to include specific operator manual actions acceptance criteria is not warranted.

V. Section-by-Section Analysis of Substantive Changes

Part 50, Appendix R, paragraph III.G.2. Add an "*or*" at the end of the subparagraph c. The change is necessary for the introduction of a new option that recognizes operator manual actions as an alternative method to satisfy the requirements set forth in paragraph III.G.2.

Part 50, Appendix R, paragraph III.G.2. Add subparagraph c-1, "*Operator actions that satisfy the acceptance criteria in paragraph III.P. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.*" This subparagraph would codify use of operator manual actions in conjunction with fire detectors and an automatic suppression system installed in the fire area, as an additional alternative compliance method. The licensees implementing this voluntary alternative or any of the existing alternatives currently set forth in this paragraph would provide reasonable assurance that at least one method for achieving and maintaining hot shutdown condition would remain available during and after a postulated fire anywhere in the plant. This paragraph numbering was chosen to preserve the numbering of subsequent requirements within paragraph III.G.2.

Part 50, Appendix R. Add paragraph III.P [*Acceptance Criteria for Operator Manual Actions*]. The new subpart P would define operator manual actions and set forth the required acceptance criteria which must be met before a licensee may utilize operator manual actions to comply with paragraph III.G.2 of Appendix R.

Proposed subparagraph III.P.1 [*Definition*]. Subparagraph III.P.1 adds a definition for operator manual actions.

Proposed subparagraph III.P.2. Subparagraph III.P.2 sets forth the requirements and acceptance criteria for relying on operator manual actions.

Proposed subparagraph III.P.2.a requires that an analysis be performed for operator manual actions and that the feasibility and reliability of these actions be demonstrated. The analysis must also address the fire timeline and identify all manual actions that must be completed; the equipment needed; the number of operators needed; the communication equipment needed; and the time available, including time-margin, for the operators to perform the actions before unsafe plant conditions occur.

Proposed subparagraph III.P.2.b contains requirements for plant procedures that must include each operator manual action required to achieve and maintain hot shutdown. It also includes operator training requirements for those procedures.

Proposed subparagraph III.P.2.c contains requirements that systems and equipment needed to accomplish operator manual actions are operable and equipment is readily accessible consistent with the analysis required by subparagraph III.P.2(a). It also includes a requirement that the number of operating shift personnel required to perform the operator manual actions must be on site at all times.

Proposed subparagraph III.P.2.d contains requirements for periodic demonstrations of the operator manual actions and corrective actions.

VI. Plain Language

A June 1, 1988, presidential memorandum entitled “Plain Language in Government Writing” directed that the Government’s writing be in plain language. This memorandum was published on June 10, 1998 (63 FRN 31883). In compliance with this directive, editorial changes have been made in the proposed revision to improve the organization and readability of the existing language of the paragraph being revised. These types of changes are not discussed further in this document. The NRC requests comments on the proposed rule specifically with respect to the clarity and readability of the language used. Comments should be sent to the address listed under the ADDRESSES heading of the preamble.

VII. Voluntary Consensus Standards

The National Technology Advancement and Transfer Act of 1995, Public Law 104-113, requires that Federal agencies use technical standards that are developed or adopted by voluntary consensus standards bodies, unless the use of such standards is inconsistent with applicable law or otherwise impractical. The NRC is aware of the guidance on operator manual actions contained in ANSI/ANS Standard 58.8 (1994), "Time Response Design Criteria for Safety-Related Operator Actions." This standard contains criteria that establish time requirements for use in the design of safety-related systems for nuclear power plants. The objective of the criteria is to determine whether sufficient time exists for operators to perform the required operator manual actions to operate safety-related systems or whether automatic actuation is required. The scope of the standard is "limited to safety-related operator actions associated with design basis events (DBEs) that result in a reactor trip and is required to be analyzed in safety analysis reports (SARs)." The NRC considers this industry consensus standard relevant to the proposed rulemaking but not acceptable as a replacement for it. Operator manual actions performed for the purpose of fire protection are beyond the intended application of this standard. However, the principles and methods contained in the standard may be adaptable to the proposed rulemaking and have been considered as part of the NRC's effort to develop generic operator manual actions acceptance criteria.

The NRC is further aware of draft guidance for review of license amendment requests that contain risk-important human actions. The NRC staff issued NUREG-1764, "Guidance for the Review of Changes to Human Actions," as a draft report for public comment with the comment period closing on March 31, 2003. This NUREG proposes a risk-informed methodology for the review of the human performance aspects of licensees' proposed changes to plant systems and operations in license amendment requests. In addition to using risk insights to help the staff determine the level of regulatory review expended on licensees'

submittals relying on human actions, the NUREG provides deterministic review criteria for evaluating the acceptability of human actions proposed by licensees.

The NRC notes that a separate rulemaking for 10 CFR 50.48©), " National Fire Protection Association Standard NFPA 805," has recently been completed which permits nuclear power plant licensees to develop a risk-informed, performance-based fire protection program consistent with voluntary consensus standard NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants." Appendix B of NFPA 805 specifies a method for assessing the feasibility of operator manual actions. The NRC believes that licensees who choose to implement the NFPA 805 approach could alternatively, with appropriate analysis and documentation, use it to justify the acceptability of certain operator manual actions in their fire protection programs.

In preparing the proposed rule, the NRC considered the applicability of the risk-informed approach and the deterministic review criteria presented in NUREG-1764 and Appendix B of NFPA 805 to help refine the regulatory requirements and the implementation guidance. The NRC is not aware of any other consensus standard that could be adopted to provide guidance or criteria for the use of operator manual actions, but will consider using an alternative standard if one is identified during the rulemaking process.

VIII. Finding of No Significant Environmental Impact: Environmental Assessment

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that this rule, if adopted, would not be a "major" Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not required. The basis for this determination is as follows:

This action would establish regulations that allow nuclear power plant licensees to use manual actions by plant operators as an alternative method to achieve hot shutdown conditions in the event of fires in certain plant areas, provided that the actions are evaluated against specified criteria and determined to be feasible and reliable, and that fire detectors and an automatic fire suppression system are provided in the fire area. This proposed action also provides conservative and thorough regulatory acceptance criteria for operator manual actions taken under Paragraph III.G.2 of Appendix R to achieve and maintain safe shutdown conditions.

The proposed action will not significantly increase the probability or consequences of an accident. No changes are being made in the types or quantities of radiological effluents that may be released off site, and there is no significant increase in public radiation exposure since there is no change to facility operations that could create a new or affect a previously analyzed accident. The staff believes there will be no net change in occupational radiation exposure. Any potential increase in exposure to personnel performing or demonstrating operator manual actions will likely be offset by a reduction of occupational radiation exposure since fewer personnel will be required to install or maintain fire barriers in or near radiologically controlled areas.

With regard to nonradiological impacts, no changes are being made to nonradiological plant effluents and there are no changes in activities that could adversely affect the environment. Therefore, there are no significant non-radiological impacts associated with the proposed action.

The primary alternative to this action is the no-action alternative. The no-action alternative would result in licensees submitting exemptions to authorize the use of acceptable operator manual actions. The NRC's approval of these exemptions would have the same environmental impacts as the proposed action.

The determination of this environmental assessment is that this action will have no significant offsite impact on the public. Comments on any aspect of the environmental assessment may be submitted to the NRC as indicated under the ADDRESSES heading.

The NRC has sent a copy of this proposed rule to all State Liaison Officers and requested their comments on the environmental assessment.

IX. Paperwork Reduction Act Statement

This proposed rule contains new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq). This rule has been submitted to the Office of Management and Budget for review and approval of the information collection requirements.

Type of submission, new or revision: Revision

The title of the information collection: 10 CFR Part 50, “Fire Protection Program - Post Fire Operator Manual Actions” (Proposed Rule)

The form number if applicable: Not applicable.

How often the collection is required: As needed.

Who will be required or asked to report: Licensees for nuclear power plants licensed to operate before January 1, 1979, who wish to implement fire protection manual actions.

An estimate of the number of annual responses: 8.

The estimated number of annual respondents: 8.

An estimate of the total number of hours needed annually to complete the requirement or request: A reduction of 745 hours annually (-2,880 hours reporting plus 2,135 hours recordkeeping, or a reduction of 93 hours per respondent.

Abstract: The NRC is proposing to amend its regulations pertaining to fire protection under 10 CFR Part 50, Appendix R, Paragraph III.G.2, to allow the voluntary use of manual actions by operators of nuclear power plants licensed to operate prior to January 1, 1979, to achieve hot shutdown conditions in the event of fires in certain plant areas, provided the actions are evaluated against specific criteria that have been determined to be acceptable by the NRC.

The U.S. Nuclear Regulatory Commission is seeking public comment on the potential impact of the information collections contained in this proposed rule and on the following issues:

1. Is the proposed information collection necessary for the proper performance of the functions of the NRC, including whether the information will have practical utility?

2. Is the estimate of burden accurate?

3. Is there a way to enhance the quality, utility, and clarity of the information to be collected?

4. How can the burden of the information collection be minimized, including the use of automated collection techniques?

A copy of the OMB clearance package may be viewed free of charge at the NRC Public Document Room, One White Flint North, 11555 Rockville Pike, Room O-1 F21, Rockville, MD 20852. The OMB clearance package and rule are available at the NRC worldwide Web site: http://www.nrc.gov/public-involve/doc-comment/omb/index.html for 60 days after the signature date of this notice and are also available at the rule forum site, http://ruleforum.llnl.gov.

Send comments on any aspect of these proposed information collections, including suggestions for reducing the burden and on the above issues, by (INSERT DATE 30 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER) to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet electronic mail to INFOCOLLECTS@NRC.GOV and to the Desk Officer, John A. Asalone, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011), Office of Management and Budget, Washington, DC 20503. Comments received after this date will be considered if it is practical to do so, but assurance of consideration cannot be given to comments received after this date. You may also e-mail comments to John_A._Asalone@omb.eop.gov or comment by telephone at (202) 395-4650.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

X. Regulatory Analysis

The Commission has prepared a draft regulatory analysis on this proposed regulation. The analysis examined the costs and benefits of Commission alternatives for updating the existing rule to accommodate technological advances.

The analysis examined two baselines. The Main baseline reflects the effects of the rule as of the date of publication, that is, full compliance with all existing regulations. The Industry Practices baseline reflects a more “real world” assessment of compliance.

The regulatory alternatives examined under each baseline were No Action, under which no regulatory changes would be undertaken; Regulatory Guidance, under which Section 50.48 and Appendix R would not be modified but regulatory guidance would be updated; and the Proposed Alternative, under which the proposal outlined above would be implemented.

The regulatory analysis showed that the proposed alternative was the most cost beneficial of the three alternatives. The benefit is the greatest under the Industry Practices baseline because fourteen reactors would take immediate advantage of the proposed rule with corresponding savings to industry.

Option 3, the Proposed Alternative, was determined to be the most preferable based on best professional judgment and quantitative analysis because it (1) improves effectiveness and efficiency of the NRC regulatory process by assuring adequate and uniform operator manual

actions; (2) eliminates the need for some licensees to request exemptions from Paragraph III.G.2 or make equipment modifications; and (3) reduces NRC costs by reducing the number of exemption requests to be reviewed. Under Option 3, public health and safety would be maintained at the current level.

The results of the analysis are summarized in the following table.

Net Present Value of Regulatory Alternatives

Baseline	Option 1 No Action	Option 2 Regulatory Guidance	Option 3 Proposed Alternative
Main	--	($42,240)	$13,992,793
Industry Practices	--	($42,240)	$16,839,000

The Commission requests public comment on the draft regulatory analysis. The regulatory analysis may be viewed and downloaded, and comments may be submitted at the NRC Rulemaking Web site. Single copies of the analysis are also available from David T. Diec, Office of Nuclear Reactor Regulation, (301) 415-2834, e-mail dtd@nrc.gov or Alexander Klein, Office of Nuclear Reactor Regulation, (301) 415-3477, e-mail ark1@nrc.gov. Comments on the draft analysis may be submitted to the NRC as indicated under the ADDRESSES heading.

XI. Regulatory Flexibility Certification

As required by the Regulatory Flexibility Act, as amended, 5 U.S.C. 605(b), the Commission certifies that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. This proposed rule would affect only licensees authorized to operate nuclear power reactors. These licensees do not fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act or the Size Standards established by the Nuclear Regulatory Commission (10 CFR 2.810).

XII. Backfit Analysis

Section 50.109 (a)(1) defines backfitting as “the modification of or addition to systems, structures, components, or design of a facility . . . any of which may result from a new or amended provision in the Commission rules or the imposition of a regulatory staff position interpreting the Commission rules that is either new or different from a previously applicable staff position.” The requirements in Appendix R are only applicable to licensees who received operating licenses before January 1, 1979. To resolve an existing regulatory compliance issue for these licensees under paragraph III.G.2 of Appendix R, the proposed rule represents a voluntary alternative to the current requirements. The proposed rule would allow the use of operator manual actions for achieving and maintaining safe shutdown during a fire in an area where redundant shutdown trains are located as an additional method beyond the three presently provided. Licensees who currently have approved operator manual actions will not be required to perform any additional actions (such as analysis or documentation). Licensees who employ operator manual actions but have not received NRC approval are in violation of paragraph III.G.2 of Appendix R. There is no backfitting as defined in 10 CFR 50.109(a)(1) because licensees may choose to continue to meet paragraph III.G.2 through other provisions.

Post-January 1, 1979 licensees who use operator manual actions without NRC approval may or may not be in compliance with applicable fire protection requirements (GDC-3, §50.48(a), applicable license conditions, or current fire protection programs). Compliance for plants licensed after January 1, 1979, depends on the specific licensing commitments, the change control process, and how the change was justified and analyzed to demonstrate that the operator manual actions are feasible and reliable and do not adversely affect the ability to achieve or maintain safe shutdown. This rule is not applicable to these licensees as they are not required to meet Appendix R.

Based on the above discussion, the NRC has concluded that the proposed rule would not constitute a backfit as defined in 10 CFR 50.109(a)(1).

List of Subjects

10 CFR Part 50

Antitrust, Classified information, Criminal penalties, Fire protection, Intergovernmental relations, Nuclear power plants and reactors, Radiation protection, Reactor siting criteria, Backfitting, Reporting and record keeping requirements.

For the reasons set forth in the preamble and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 553, the NRC is proposing to adopt the following amendments to 10 CFR Part 50.

PART 50–DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

1. The authority citation for Part 50 continues to read as follows:

AUTHORITY: Secs. 102, 103, 104, 105, 161, 182, 183, 186, 189, 68 Stat. 936, 937, 938, 948, 953, 954, 955, 956, as amended, sec. 234, 83 Stat. 444, as amended (42 U.S.C.

2132, 2133, 2134, 2135, 2201, 2232, 2233, 2236, 2239, 2282); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note).

Section 50.7 also issued under Pub. L. 95-601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5841).

Section 50.10 also issued under secs. 101, 185, 68 Stat. 955, as amended (42 U.S.C. 2131, 2235); sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332).

Sections 50.13, 50.54(dd), and 50.103 also issued under sec. 108, 68 Stat. 939, as amended (42 U.S.C. 2138).

Sections 50.23, 50.35, 50.55, and 50.56 also issued under sec. 185, 68 Stat. 955 (42 U.S.C. 2235).

Sections 50.33a, 50.55a and Appendix Q also issued under sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332).

Sections 50.34 and 50.54 also issued under sec. 204, 88 Stat. 1245 (42 U.S.C. 5844).

Sections 50.58, 50.91, and 50.92 also issued under Pub. L. 97-415, 96 Stat. 2073 (42 U.S.C. 2239).

Section 50.78 also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152).

Sections 50.80 - 50.81 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234).

Appendix F also issued under sec. 187, 68 Stat. 955 (42 U.S.C. 2237).

2. In Appendix R to Part 50, Section III.G.2.c. is revised and a new Section III.G.2.c-1 and Section III.P. are added to read as follows :

Appendix R to Part 50-Fire Protection Program For Nuclear Power Facilities Operating Before January 1, 1979

* * * * *

III. Specific Requirements

* * * * *

G. * * *

2. * * *

c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire areas; or

c-1. Operator manual actions that satisfy the acceptance criteria in paragraph III.P. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

* * * * *

P. 1. For purposes of this section, operator manual actions means the integrated set of actions needed to ensure that a redundant train of systems necessary to achieve and maintain hot shutdown conditions located within the same area outside the primary containment is free of fire damage.

2. A licensee relying on operator manual actions must meet all of the following requirements:

(a) Analysis. The licensee shall prepare an analysis for each operator manual action which demonstrates its feasibility and reliability.

(1) The analysis must contain a postulated fire time line showing that there is sufficient time to travel to action locations and perform actions required to achieve and maintain the plant in a hot shutdown condition under the environmental conditions expected to be encountered without jeopardizing the health and safety of the operator performing the manual action. The fire time line shall extend from the time of initial fire detection until the time when the ability to achieve and maintain hot shutdown is reached, and shall include a time margin that accounts for all variables, including (I) differences between the demonstrated and actual conditions, and (ii) human performance uncertainties that may be encountered.

(2) The analysis must address the functionality of equipment or cables that could be adversely affected by the fire or its effects but still utilized to achieve and maintain hot shutdown.

(3) The analysis must identify all equipment required to accomplish the operator manual actions under the postulated time line, including (but not limited to) (I) all indications necessary to show the need for the operator manual actions, enable their performance and verify their successful accomplishment, and (ii) any necessary communications, portable, and life support equipment.

(b) Procedures and training. Plant procedures must include each operator manual action required to achieve and maintain hot shutdown. Each operator must be appropriately trained on those procedures.

©) Implementation. The licensee shall ensure that all systems and equipment needed to accomplish each operator manual action are operable and readily accessible consistent with the analysis required by paragraph 2(a). The number of operating shift personnel required to perform the operator manual actions shall be on site at all times.

(d) Demonstration. Periodically, the licensee shall conduct demonstrations using an established crew of operators to demonstrate that operator manual actions required to achieve and maintain the plant in a hot shutdown condition can be accomplished consistent with the analysis in paragraph 2(a) of this section. The licensee may not implement operator manual actions until they have been established by a demonstration to be consistent with the analysis. The licensee shall take prompt corrective action if any subsequent periodic demonstration determines that the operator manual actions can no longer be accomplished consistent with the analysis.

Dated at Rockville, Maryland, this___ day of ___, 2004.

For the Nuclear Regulatory Commission.

_____

Annette Vietti-Cook,

Secretary of the Commission.

Regulatory Analysis of Post-Fire Operator Manual Actions Proposed Rule - 10 CFR Part 50 - Appendix R

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

December 2004

Executive Summary

The NRC is considering amending its fire protection regulations in 10 CFR Part 50, Appendix R, Paragraph III.G.2, to allow the use of manual actions by nuclear power reactor operators to achieve hot shutdown conditions in the event of fires in certain plant areas, provided the actions are evaluated against specific criteria developed by NRC staff that have been determined to be acceptable.

The fire protection regulations applicable to currently licensed nuclear power plants depend on when the reactor was licensed. The requirements of Appendix R, Paragraph III.G.2, are only applied to all reactors licensed to operate prior to January 1, 1979, by 10 CFR 50.48 (b). For reactors licensed to operate on or after January 1, 1979, the requirements of GDC-3 and 10 CFR 50.48 (a) apply; for these reactors, the staff uses regulatory guidance in Branch Technical Position CMEB 9.5-1 to review licensees' fire protection programs.

10 CFR Part 50, Appendix R, Paragraph III.G.2 specifies three acceptable methods for protecting the safe shutdown capability of one of the redundant shutdown trains from a fire when located in the same fire area as its redundant train:

- Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

- Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

- Enclosure of the cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

Currently, licensees relying on operator manual actions which have not been reviewed and approved by NRC under the exemption provisions contained in § 50.12 are generally considered to be in non-compliance with NRC regulations. However, the NRC believes that certain manual actions relied upon by licensees are safe and effective when performed under appropriate conditions.

The NRC considered three alternatives to address the use of operator manual actions to ensure at least one means of achieving and maintaining safe shutdown conditions during or after any postulated fire for reactors licensed before January 1, 1979.

Option 1 (No Action). Licensees would conform to the existing requirements of 10 CFR Part 50 Appendix R, Paragraph III.G.2. The NRC staff would notify nuclear power plant licensees that using operator manual actions to achieve and maintain a safe shutdown condition is not permitted as an alternative to providing fire barrier or separation protection from a fire in a location where redundant trains are located in the same fire area unless a licensee has an exemption under the provisions of § 50.12. All unapproved operator manual actions would be considered violations of 10 CFR Part 50, Appendix R, Paragraph III.G.2.

Option 2 (Regulatory Guidance). Under this option, the existing regulations at 10 CFR Part 50, Appendix R, Paragraph III.G.2 would remain unchanged, but the regulatory guidance would be clarified. NRC would issue a regulatory information summary in conjunction with an update of the applicable regulatory guidance and inspection guidance on the use of operator manual actions. However, the criteria of Paragraph III.G.2 would still need to be met unless a licensee had an NRC-approved exemption under the provisions of § 50.12. All operator manual actions not covered by an approved exemption would be considered a violation.

Option 3 (Proposed). The existing fire protection regulations at 10 CFR Part 50, Appendix R, Paragraph III.G.2 would be revised to explicitly permit the use of operator manual actions in lieu of using fire barrier or separation protection to achieve and maintain safe shutdown in the event of a fire where redundant trains are located in the same fire area. The regulations and associated guidance would include generic acceptance criteria on the use of operator manual actions. Use of operator manual actions would be predicated on the requirement that the area where the fires occur has fire detectors and an automatic fire suppression system installed in the fire area and if the manual actions relied upon are consistent with all of the criteria.

To determine the impacts of the three options above, the staff proposed two baselines. The Main baseline reflects the effects of the rule on the date of publication, that is, full compliance with all existing regulations. The Industry Practices baseline reflects a more “real world” assessment of compliance.

Table ES-1 summarizes the net present values associated with each alternative and baseline analyzed.

Table ES-1. Net Present Value of Regulatory Alternatives

Baseline	Option 1 No Action	Option 2 Regulatory Guidance	Option 3 Proposed Alternative
Main	--	($42,240)	$13,992,793
Industry Practices	--	($42,240)	$16,839,000

Option 3, the Proposed alternative, was determined to be the most preferable based on best professional judgment and quantitative analysis because it (1) improves effectiveness and efficiency of the NRC regulatory process by assuring adequate and uniform operator manual actions; (2) eliminates the need for some licensees to request exemptions from Paragraph III.G.2 or make equipment modifications; and (3) reduces NRC costs by reducing the number of exemption requests to be reviewed.

This regulatory analysis does not consider enforcement discretion specific to operator manual actions. Generic enforcement discretion associated with fire-induced circuit failures, including manual actions, are being considered as compensatory measures pending the final rule.

TABLE OF CONTENTS

1.0 Introduction

The NRC is considering amending its fire protection regulations in 10 CFR Part 50, Appendix R, Paragraph III.G.2, to allow the use of manual actions by nuclear power plant operators to achieve hot shutdown conditions in the event of fires in certain plant areas, provided the actions are evaluated against specific criteria developed by NRC staff that have been determined to be acceptable.

Currently, licensees relying on operator manual actions which have not been reviewed and approved by NRC under the exemption provisions contained in § 50.12 are generally considered to be in non-compliance with NRC regulations. However, the NRC believes that certain manual actions relied upon by licensees are safe and effective when performed under appropriate conditions.

The NRC considered three alternatives to address the use of operator manual actions to ensure at least one means of achieving and maintaining safe shutdown conditions during or after any postulated fire for reactors licensed before January 1, 1979. This Regulatory Analysis (RA) is part of the Commission's analysis of the options being considered and is a supporting document for the proposed rule. The purpose of this RA is to evaluate the costs and benefits associated with the regulatory changes being considered by the Commission. The NRC considers the regulatory analysis process an integral part of its statutory mission to ensure reasonable assurance for the protection of public health and safety, property, environmental quality, and national defense and security from civilian uses of nuclear materials. This document presents background material, describes the objectives of the proposed rule, outlines the alternatives being considered, and evaluates the values and impacts of the regulatory alternatives.

This regulatory analysis does not consider enforcement discretion specific to operator manual actions. Generic enforcement discretion associated with fire-induced circuit failures, including manual actions, are being considered as compensatory measures pending the final rule.

1.1 Background

Nuclear power plant fire protection regulations and associated guidelines prescribe fire protection features to ensure that at least one means of achieving and maintaining safe shutdown conditions will remain available during or after any postulated fire. The fire protection regulations applicable to currently licensed nuclear power plants depend on when the reactor was licensed. The requirements of Appendix R, Paragraph III.G.2, were only applied to reactors licensed to operate prior to January 1, 1979, by 10 CFR 50.48 (b). For reactors licensed to operate on or after January 1, 1979, the requirements of GDC-3 and 10 CFR 50.48 (a) apply; for these reactors the NRC staff reviewed the fire protection programs against the regulatory guidance in Branch Technical Position CMEB 9.5-1 or the Standard Review Plan (NUREG-0800), which incorporated provisions of Appendix R, Paragraph III.G.2. Most licensees committed in their fire protection plans to meet the Appendix R, Paragraph III.G. 2 equivalent regulatory guidance. These commitments are part of the licensing basis for reactors licensed on or after January 1, 1979, and are specified in a license condition.

10 CFR Part 50, Appendix R, Paragraph III.G.2 specifies three acceptable methods for protecting the safe shutdown capability of one of the redundant shutdown trains from a fire when located in the same fire area as its redundant train:

- Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

- Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

- Enclosure of the cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

During recent inspections of licensee fire protection programs, concerns have arisen among NRC staff about licensee compliance with fire protection of redundant safe shutdown systems that are located in the same fire areas. NRC staff believes that instead of pursuing expensive and burdensome upgrading or replacement of the Thermo-Lag fire barriers that were originally installed to comply with Appendix R requirements, many licensees utilized operator manual actions to make available a second train of safe shutdown equipment. Such changes must be approved through the exemption or deviation process. Since the fire protection regulations were promulgated, the staff has approved numerous exemptions to the technical requirements of Appendix R (for pre-January 1, 1979, reactors) and deviations from associated guidance (for reactors licensed on or after January 1, 1979) that permitted specific operator manual actions as an acceptable alternative to the fire protection separation requirements.

However, NRC had not envisioned that licensees would implement a broader use of operator manual actions without NRC approval. Since the regulation cannot be reasonably interpreted to permit reliance upon operator manual actions with respect to redundant safe shutdown trains in Paragraph III.G.2. of Appendix R., any reactor licensed prior to January 1, 1979, which is using operator manual actions in lieu of fire barrier separation without an NRC-approved exemption is not in compliance with the regulations. Compliance with Appendix R, Paragraph III.G.2 (or equivalent) is not legally binding for reactors licensed on or after January 1, 1979. However, because of the lack of regulatory criteria on the use of operator manual actions for post-fire safe shutdown, reactors licensed on or after January 1, 1979, would have to develop and defend the criteria governing use of operator manual actions on a case-by-case basis, and demonstrate that they would not adversely impact the licensee's ability to achieve or maintain safe shutdown in the event of a fire.

In addition to the compliance issue, NRC staff is also concerned that some unapproved operator manual actions may not be feasible. Because there is no generic guidance on acceptable operator manual actions, it is unclear how each licensee established the feasibility and reliability of needed operator manual actions. The industry believes that most operator manual actions used by licensees for operation of a safe shutdown train during a fire do not involve any safety significant feasibility or reliability concerns and would likely be approved by the NRC if processed as an exemption or deviation request. The results from NRC fire protection inspections to date indicate that there is insufficient evidence that the generic use of these manual actions poses a safety concern. Thus the staff believes that use of unapproved manual actions (for all reactors) is typically a compliance issue and is not a significant safety issue.

1.2 Objectives of the Proposed Rulemaking

10 CFR Part 50, Appendix R, Paragraph III.G.2 currently specifies three acceptable methods for protecting the safe shutdown capability of one of the redundant shutdown trains from a fire when located in the same fire area as its redundant train. The proposed change to Appendix R, Paragraph III.G. 2 is intended to (1) maintain safety and increase public confidence by defining technically acceptable generic criteria for operator manual actions which can be used to assess the feasibility and reliability of existing or future operator manual actions employed by licensees; (2) provide quality and uniformity in licensee assessments and documentation of the acceptability of plant-specific operator manual actions; (3) reduce unnecessary regulatory burden associated with the exemption or deviation process; and (4) result in more efficient use of resources by both licensees and the NRC with respect to resolving existing manual action compliance issues encountered during plant-specific inspections.

2.0 Identification and Preliminary Analysis of Alternative Approaches

The NRC is considering three options in its rulemaking to address this regulatory issue:

Option 1 (No Action). The fire protection requirements would continue to conform to the existing requirements of 10 CFR Part 50 Appendix R, Paragraph III.G.2. The staff would notify nuclear power plant licensees that using operator manual actions to operate a safe shutdown train is not permitted as an alternative to providing fire barrier protection from a fire in a location where redundant trains are located unless such changes have specifically received an NRC exemption under § 50.12. All operator manual actions not covered by an exemption would be considered a violation.

Option 2 (Regulatory Guidance). Under this option, the existing regulations at 10 CFR Part 50, Appendix R, Paragraph III.G.2 would remain unchanged, but the regulatory guidance would be clarified. NRC would issue a regulatory information summary in conjunction with an update of the applicable regulatory guidance and inspection guidance on the use of operator manual actions. However, the criteria of Paragraph III.G.2 would still need to be met unless a licensee had an NRC-approved exemption under the provisions of § 50.12. All operator manual actions not covered by an approved exemption would be considered a violation.

Option 3 (Proposed Alternative). Revise the existing regulations and associated guidance. The existing fire protection regulations at 10 CFR Part 50, Appendix R, Paragraph III.G.2 would be revised to explicitly permit the use of operator manual actions in lieu of using passive fire barrier or separation protection to achieve and maintain safe shutdown in the event of a fire where redundant trains are located in the same fire area. The regulations and associated guidance would include generic acceptance criteria on the use of operator manual actions. Use of operator manual actions would be predicated on the requirement that the area where the fires occur has fire detectors and an automatic fire suppression system installed in the fire area and if the manual actions relied upon are consistent with all of the criteria listed in Table 1.

Under the proposed rule, licensees would have to analyze and document that the use of operator manual actions would comply with the acceptance criteria and demonstrate that the operator manual actions are feasible, reliable, and do not adversely affect the ability to achieve or maintain safe shutdown. This documentation would not require prior review and approval by NRC, but could be subject to a review as an element of a comprehensive site inspection.

Table 1. Proposed Generic Acceptance Criteria for Operator Manual Actions

Available Indications	Diagnostic indication, if credited to support operator manual actions, shall be capable of: • Confirming that the action is necessary; • Being unaffected by the postulated fire; • Providing a means for the operator to detect whether spurious operation of safety-related equipment has occurred; and • Verifying that the operator manual action accomplished the intended objective.
Environmental Considerations	Environmental conditions encountered while accessing and performing operator manual actions shall be demonstrated to be consistent with the following human factor considerations for visibility and habitability: • Emergency lighting shall be provided as required in Appendix R, Section III.J, or by the licensee's approved fire protection program, [*e.g.*, lit with 8-hr battery-backed emergency lighting], and sufficient lighting shall be provided for paths to and from locations requiring any actions. • Radiation shall not exceed 10 CFR Part 20, Section 20.1201, limits. • Temperature and humidity conditions shall be evaluated to ensure that temperature and humidity do not adversely affect the capability to perform the operator manual action (See, *e.g.*, NUREG/CR–5680, Vol. 2, "The Impact of Environmental Conditions on Human Performance") or the licensee shall provide an acceptable rationale for why temperature/humidity do not adversely affect performing the manual actions. • Fire effects shall be evaluated to ensure that smoke and toxic gases from the fire do not adversely affect the capability to access the required equipment or to perform the operator manual action.
Staffing and Training	There shall be a sufficient number of plant operators, under all staffing levels, to perform all of the required actions in the times required for a given fire scenario. The use of operators to perform actions shall be independent from any collateral fire brigade or control room duties they may need to perform as a result of the fire. Operators required to perform the manual actions shall be qualified and continuously available to perform the actions required to achieve and maintain safe shutdown. A training program on the use of operator manual actions and associated procedures during a postulated fire shall demonstrate that operators can successfully achieve these objectives.
Communications	To achieve and maintain safe shutdown, adequate communications capability shall be demonstrated for operator manual actions that must be coordinated with other plant operations, with this communications capability continuously available.
Special Equipment	Any special equipment required to support operator manual actions, including keys, self-contained breathing apparatus (SCBA), and personnel protective equipment, shall be readily available, easily accessible and demonstrated to be effective.
Procedures	Procedural guidelines on the use of required operator manual actions shall be readily available, easily accessible and demonstrated to be effective.
Local Accessibility	All locations where operator manual actions are performed shall be assessed as accessible without hazards to personnel, with controls needed to assure availability of any special equipment, such as keys or ladders, being demonstrated.

Table 1. Proposed Generic Acceptance Criteria for Operator Manual Actions

Demonstration	The capability to successfully accomplish required operator manual actions within the time allowable using the required procedures and equipment shall be demonstrated using the same personnel/crews who will be required to perform the actions during the fire; documentation of the demonstration shall be provided.
Complexity and Number	The degree of complexity and total number of operator manual actions required to effect safe shutdown shall be limited such that their successful accomplishment under realistically severe conditions is assured for a given fire scenario. The need to perform operator manual actions in different locations shall be considered when sequential actions are required. Analyses of the postulated fire time line shall demonstrate that there is sufficient time to travel to each action location and perform the action required to support the associated shutdown function(s) such that an unrecoverable condition does not occur.
Equipment Pre-conditions	Possible failure modes and damage that may occur to equipment used during a fire shall be considered to the extent that the equipment's subsequent use could be prevented, or at least made difficult. Credit for using equipment whose operability may have been adversely affected by the fire due to smoke, heat, water, combustion products or spurious actuation effects shall account for such possibilities (*e.g.*, over-torquing an MOV due to a spurious signal, as discussed in Information Notice 92–18).

The NRC staff believes that amending Appendix R and associated guidance is a safe and acceptable method for protecting safe shutdown capability from a fire (in lieu of fire barrier separation). The criteria should provide a reasonable assurance that post-fire operator manual actions are uniformly evaluated by the licensee and should reduce variability and ambiguity in the licensing basis justifications for operator manual actions. By codifying the use of operator manual actions that meet feasibility and reliability criteria, the NRC will define what operator manual actions can be utilized without adversely affecting the ability to achieve and maintain safe shutdown in the event of a fire. Upon establishment of generic criteria, licensees could then use their fire protection program change control process to adopt operator manual actions without NRC approval. This course of action would permit licensees that currently rely on unapproved operator manual actions to achieve compliance through appropriate analysis and documentation against the feasibility and reliability acceptance criteria without NRC review and approval.

3.0 Analysis of Values and Impacts

This section describes the analysis conducted to identify and evaluate the benefits (values) and costs (impacts) of the proposed rule. Section 3.1 identifies the attributes that the proposed rulemaking is expected to affect. Section 3.2 describes the methodology used to analyze the benefits and costs associated with changes to the affected attributes. Section 3.3 presents the results of the analysis.

3.1 Identification of Affected Attributes

This section identifies the factors that affect the public and private sectors as a result of the proposed rulemaking. These factors are classified as "attributes" using the list of potential attributes provided in Chapter 5 of the NRC's "Regulatory Analysis Technical Evaluation Handbook."[1] Each attribute listed in Chapter 5 was evaluated, and the basis for selecting those attributes expected to be affected by the potential action is presented in the balance of this section.

- *Industry Operation.* The proposed action would decrease the number of exemption requests submitted by licensees.

- *Industry Implementation.* The proposed action would require licensees to prepare documentation of compliance with the proposed criteria.

- *NRC Operation.* The proposed action would significantly reduce NRC review of licensee exemption requests.

- *NRC Implementation.* Under some alternatives the NRC would need to prepare a guidance document.

- *Regulatory Efficiency.* The proposed action would enhance regulatory efficiency by establishing the process for using operator manual actions. The proposed action will also clarify which manual actions will be acceptable to NRC by codifying the generic acceptance criteria. Consequently, licensees will face less uncertainty in determining appropriate operator manual actions.

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[1] NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook: Final Report," U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, January 1997.

- *Other Considerations.* The proposed rule could affect public confidence in the NRC. Although NRC believes that operator manual actions meeting the generic acceptance criteria will maintain an adequate level of safety (as do the three alternatives in Paragraph III.G.2), the public may perceive operator manual actions as providing less assurance of safe shutdown. Consequently, the public may perceive NRC to be unnecessarily relaxing safety standards.

The proposed rulemaking is *not* expected to affect the following attributes:

- *Environmental Considerations*
- *Public Health (Routine)*
- *Public Health (Accidental)*
- *Other Government*
- *Occupational Health (Accidental)*
- *Occupational Health (Routine)*
- *Offsite Property*
- *Onsite Property*
- *General Public*
- *Improvements in Knowledge*
- *Antitrust Considerations*
- *Safeguards and Security Considerations*.

3.2 Analytical Methodology

This section describes the methodology used to analyze the benefits and costs associated with the proposed rule. The benefits of the rule include any desirable changes in affected attributes while the costs include any undesirable changes in affected attributes.

This analysis relies on a qualitative (rather than quantitative) evaluation of several of the affected attributes (regulatory efficiency and other considerations) due to the difficulty in quantifying the impact of the proposed rulemaking. These attributes would be affected by the proposed regulatory option through the greater efficiency of the rule and public perceptions of the protectiveness of the regulatory option.

The remaining attributes (industry implementation and NRC implementation) are evaluated quantitatively. Quantitative analysis requires a baseline characterization of factors such as the number of pre-January 1, 1979, reactors, the number of these licensees using operator manual actions, the cost to prepare and review an exemption request, the cost to document compliance with the proposed generic acceptance criteria, and a range of other current licensee practices. Sections 3.2.1–3.2.6 describe the most significant analytical data, variables, and assumptions used in the quantitative analysis of these attributes.

3.2.1 Licensee Baselines for Analysis

This regulatory analysis measures the incremental benefits and costs of the proposed rulemaking relative to a baseline, which is how the world would be if the proposed regulation were not imposed. The baseline used in this analysis assumes full licensee compliance with existing NRC requirements. This is consistent with NUREG/BR-0058, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” Rev. 3, which states that, “...in evaluating a new requirement for existing plants, the staff should assume that all existing NRC

and Agreement State requirements have been implemented." Section 3.3.1 presents the estimated incremental benefits and costs associated with the proposed rule relative to this baseline. Unless otherwise noted, the estimated benefits and costs presented in this document reflect this baseline and are referred to as the "Main Analysis."

This regulatory analysis also contains several sensitivity analyses prepared in accordance with NRC's regulatory analysis guidelines. The purpose of the primary sensitivity analysis is to account for the fact that some licensees are currently not in full compliance with existing Paragraph III.G.2 provisions. NRC staff believes that instead of pursuing expensive and burdensome upgrading or replacement of the Thermo-Lag fire barriers that were originally installed to comply with Appendix R requirements, many licensees are utilizing operator manual actions to make available a second train of safe shutdown equipment, under the impression that these operator manual actions are sufficient to comply with existing regulations. Such changes, however, must be approved through the exemption or deviation process at § 50.12. Therefore, this sensitivity analysis considers an alternative baseline that reflects industry practices, that is, in accordance with licensees' current practices.

Finally, in accordance with OMB Circular No. A-4, each analysis is evaluated at both a 3 percent and a 7 percent discount rate. The two discount rates are applied to each of the baselines over a period of 30 years, which is the average estimated remaining life of pre-January 1, 1979, licensed facilities. The results of the discount rate analysis are presented after the results of each analysis.

3.2.2 Affected Universe

Only the 52 nuclear power reactors licensed before January 1, 1979, are subject to the requirements of 10 CFR Part 50 Appendix R, Paragraph III.G.2. However, the universe (i.e., number of licensees) affected by this rulemaking varies depending on the baseline considered. Under the Main analysis baseline, full compliance with existing regulations is assumed, so only licensees making modifications in the future will be affected. For the Main Analysis, five licensees per year are assumed to make such modifications. Under the Industry Practices baseline, all 52 reactors licensed before January 1, 1979, could be affected by this proposed rulemaking. Whether a licensee is affected under the Industry Practices baseline depends on the licensee's current practices under the existing regulations.

Under each of the baseline analyses described in section 3.2.1, NRC implementation and operation activities may be affected. The effects on NRC resulting from the behavior of licensees under each of the baselines are described separately below.

3.2.3 Types of Costs Incurred

There are five types of costs that might be incurred by either licensees or the NRC in the baseline or regulatory alternatives.

- A licensee may have to prepare and submit an exemption request. Based on industry information, it is assumed that each exemption request would require 2,500 hours to prepare.[2] Using an estimated average labor rate of $88/hour, the total cost for a licensee to prepare an exemption request is $220,000.

- For every exemption request submitted, NRC review is required. This analysis assumes that it will take 110 hours to review an exemption request, at an average rate of $88/hour, for a total cost of $9,680 to review each exemption request.

- A licensee may have to document compliance with the new generic acceptance criteria. Based on industry information, it is assumed that it would take 300 hours to prepare the documentation.[2] Using an estimated average labor rate of $88/hour, the total cost for a licensee to document compliance with the generic acceptance criteria is $26,400.

- A licensee may have to make equipment modifications to come into compliance with 10 CFR Part 50 Appendix R, Paragraph III.G.2. Although the costs of such modifications are likely to vary, this analysis assumes that the average cost is approximately $250,000 per licensee for equipment modifications.

- NRC may have to prepare regulatory guidance. Excluding the cost of deriving the criteria (which are assumed to be developed as part of the rulemaking process and thus not counted), this analysis assumes that it would take approximately 320 contractor hours and 160 NRC staff hours to prepare such guidance. The overall cost of preparing such guidance, assuming an average labor rate of $88/hour is $42,240.

To determine the benefits or costs associated with a regulatory alternative, incremental costs (the cost relative to the baseline) are calculated. These costs are equal to the costs for all affected entities under the regulatory alternative less the costs for all entities under the baseline. Section 7.0 (p.15) contains calculations that support the costs used in the paragraphs and tables that follow. In the next section, the expected behavior of each distinct group is described under both the baselines and regulatory alternatives.

3.2.4 Assumptions and Methodology for Main Analysis

In the Main Analysis, all licensees are assumed to be in compliance with existing requirements, in 10 CFR Part 50, Appendix R, Paragraph III.G.2. Thus, the addition of a new option for complying with Paragraph III.G.2 is not expected to result in a change in behavior. However, over time, some licensees may need to make modifications to their procedures or equipment. This analysis assumes that in the future, five reactors per year will make changes using operator manual actions that will meet the criteria in the preferred alternative. Table 2 presents assumed behavior for these licensees under the baseline and each regulatory alternative.

[2] NEI provided estimates for the hours required by licensees to prepare an exemption request and to document compliance under the proposed rule.

Table 2. Expected Future Licensee Behavior Under the Main Analysis

Number of Reactors	Baseline	Option 1 No Action	Option 2 Regulatory Guidance	Option 3 Proposed Alternative
2/year	Make equipment modifications to meet III.G.2	Make equipment modifications to meet III.G.2	Make equipment modifications to meet III.G.2	Document compliance with new criteria
3/year	Submit exemption request	Submit exemption request	Submit exemption request	Document compliance with new criteria

For two reactors per year, it is assumed that changes could be addressed using operator manual actions through an exemption process in the No Action or Regulatory Guidance alternatives except that approval of the request will not be received quickly enough to implement the planned operator manual actions according to outage schedules or other schedule requirements. In order to meet their schedule, these licensees would have to implement costly plant equipment modifications to comply with Paragraph III.G.2. However, these facilities would also have to make the costly plant modifications in the baseline, and thus incur no incremental costs or savings. Under the Proposed alternative, these licensees will have to document compliance with the new criteria, and thus will incur a total savings of $447,200/year relative to the baseline.

It is assumed that three reactors per year would have submitted an exemption request under the baseline, No Action alternative and Regulatory Guidance alternative, but will document compliance under the Proposed alternative. These licensees will incur a total net savings of $580,800. NRC will experience a savings of $29,040/year because it will not have to review those requests under the Proposed alternative.

Under the Regulatory Guidance and Proposed alternatives, NRC will incur a one-time cost of $42,240 to prepare the regulatory guidance.

3.2.5 Assumptions and Methodology for Industry Practices Analysis

All of the costs and savings incurred under the Main Analysis will be incurred in the Industry Practices baseline. However, in addition to those costs, there could be additional costs for the industry to come into full compliance with the regulations. This analysis assumes, based on NRR technical staff input, that the 52 reactors licensed before January 1, 1979, can be divided into the following five groups:

- Group A consists of five reactors assumed to be in full compliance with the provisions of Paragraph III.G.2 directly or have been granted an exemption.

- Group B consists of 14 reactors that use operator manual actions that will comply with the new generic acceptance criteria.

- Group C consists of 14 reactors that use equipment or procedures that do not meet either the requirements of Paragraph III.G.2 or the new generic acceptance criteria, but would be judged to provide an adequate level of safety under the exemption procedures currently in place.

- Group D consists of 14 reactors that believe their procedures would be approved by NRC through the exemption process. However, NRC would reject their exemption request and equipment modifications would be needed to comply with Paragraph III.G.2.

- Group E consists of five reactors that would not submit an exemption request, but would need to make equipment modifications to come into compliance with III.G.2.

Table 3 presents the expected behavior for the 52 reactors built before 1979, subject to this rulemaking using the groups described above.

Table 3. Expected Immediate Licensee Behavior Under Industry Practices Analysis

Group	Number of Reactors	Baseline	Option 1 No Action	Option 2 Regulatory Guidance	Option 3 Proposed Alternative
A	5	NA	NA	NA	NA
B	14	Submit exemption request	Submit exemption request	Submit exemption request	Document compliance with new criteria
C	14	Submit exemption request	Submit exemption request	Submit exemption request	Submit exemption request
D	14	Submit exemption request and make equipment modifications to meet III.G.2	Submit exemption request and make equipment modifications to meet III.G.2	Submit exemption request and make equipment modifications to meet III.G.2	Submit exemption request and make equipment modifications to meet III.G.2
E	5	Make equipment modifications to meet III.G.2	Make equipment modifications to meet III.G.2	Make equipment modifications to meet III.G.2	Make equipment modifications to meet III.G.2

As can be seen, although all 52 reactors built before 1979 are subject to the rule, only the fourteen reactors in group B will experience a change in behavior and have a resulting savings under the Proposed alternative. For all groups under the No Action alternative, Regulatory Guidance alternative, and groups A, C, D, and E under the Proposed alternative, licensee behavior is the same as in the baseline. So although these licensees will incur costs to come into compliance with Paragraph III.G.2, they will not incur any incremental costs associated with the proposed alternative. Under the proposed alternative, these 14 reactors in Group B will incur a net savings of $193,600 each or a total one-time savings to industry of $2,710,400. NRC will incur a one-time savings of $135,520 from not having to review these 14 exemption requests. However, NRC will incur a one time cost of $42,240 to prepare the regulatory guidance in the Regulatory Guidance and Proposed alternatives.

3.3 Results

This section presents the analytical results, which are organized into three separate sections as follows:

- Section 3.3.1 presents findings on the overall benefits and costs of the proposed rulemaking under the Main Analysis.
- Section 3.3.2 discusses a sensitivity analysis addressing recent industry practices.
- Section 3.3.3 presents a summary of the incremental values and impacts of each alternative and baseline considered.

3.3.1 Main Analysis

Option 1: No Action Alternative

Under the No Action alternative (Option 1), NRC would not modify 10 CFR Part 50, Appendix R, Paragraph III.G.2. There are no costs or savings associated with this option. Thus, relative to existing requirements, no values or impacts would result from Option 1.

Option 2: Regulatory Guidance Alternative

Under the Regulatory Guidance alternative (Option 2), NRC would not modify 10 CFR Part 50, Appendix R, Paragraph III.G.2, but would issue regulatory guidance. This option would qualitatively improve regulatory efficiency (by describing in guidance the types of operator manual actions NRC would approve through the exemption process). NRC would incur a one-time cost of $42,240.

Option 3: Proposed Alternative

Under this option, new criteria would be established outlining acceptable operator manual actions, as a new option for complying with 10 CFR Part 50, Appendix R, Paragraph III.G.2. Industry would incur an annual savings of $1,028,000 from not having to implement plant modifications or prepare exemption requests and NRC would incur a savings of $29,040 from not having to review these requests. NRC would incur a one-time cost of $42,240. Thus, the total net present value using a 7 percent discount rate is $13,992,793. Using a discount rate of 3 percent, the net present value would be $21,297,764.

3.3.2 Industry Practices Analysis

Option 1: No Action Alternative

Under the No Action alternative (Option 1), NRC would not modify 10 CFR Part 50, Appendix R, Paragraph III.G.2. Thus, relative to existing requirements, no values or impacts would result from Option 1.

Option 2: Regulatory Guidance Alternative

Under the Regulatory Guidance alternative (Option 2), NRC would not modify 10 CFR Part 50, Appendix R, Paragraph III.G.2 but would issue regulatory guidance. This option would

qualitatively improve regulatory efficiency (by describing in guidance the types of operator manual actions NRC would approve through the exemption process). NRC would incur a one-time cost of $42,240.

Option 3: Proposed Alternative

Under this option, new criteria would be established outlining acceptable operator manual actions, as a new way to comply with 10 CFR Part 50, Appendix R, Paragraph III.G.2. Industry would experience savings of $1,028,000 per year. NRC would experience savings of $29,040 per year. In addition, industry would experience a one-time savings of $2,710,400 and NRC would experience a one time savings of $93,280. The total net present value using a 7 percent discount rate is $16,839,000. Using a discount rate of 3 percent, the net present value would be $24,144,000.

3.3.3 Summary of Values and Impacts

Tables 4 and 5 summarize the values of the Regulatory Guidance alternative and the Proposed alternative for each of the analyses described above. Numbers in parentheses indicate impacts (costs) rather than values (benefits).

Table 4. Values of the Regulatory Guidance Alternative

Analysis	Values to Industry		Values to NRC		Net Present Value
	One Time	Annual	One-Time	Annual	
Main	--	--	($42,240)	--	($42,240)
Industry Practices	--	--	($42,240)	--	($42,240)

Table 5. Values of the Proposed Alternative

Analysis	Values to Industry		Values to NRC		Net Present Value
	One Time	Annual	One-Time	Annual	
Main	--	$1,028,000	($42,240)	$29,040	$13,992,793
Industry Practices	$2,710,400	$1,028,000	$93,280	$29,040	$16,839,000

4.0 Backfit Analysis

To resolve an existing regulatory compliance issue, the proposed rule represents a voluntary alternative to the current requirements. The proposed rule would allow the use of operator manual actions for achieving and maintaining safe shutdown during a fire in an area where redundant shutdown trains are located. Licensees that meet existing Paragraph III.G.2, or currently have approved operator manual actions should not be required to perform any additional actions (such as analysis or documentation). Pre-January 1, 1979, reactors that employ operator manual actions but have not received NRC approval are in violation of the current regulations. The NRC position on the use of operator manual actions under Appendix R, Paragraph III.G.2 has not changed. There is no backfitting as defined in 10 CFR 50.109

(a)(1) with respect to pre-January 1, 1979, reactors who are currently relying on operator manual actions to comply with Paragraph III.G.2 and who have not previously received an exemption approving such use.

Reactors licensed on or after January 1, 1979, that use operator manual actions without NRC approval may or may not be in compliance with GDC-3, § 50.48 (a), the license condition or licensees' current fire protection program. Compliance for such reactors depends on the specific licensing commitments, the change control process, and how the change was justified and analyzed to demonstrate that the operator manual actions are feasible and do not adversely affect the ability to achieve or maintain safe shutdown. For non-compliant reactors (licensed on or after January 1, 1979), the proposed rule would provide another possible option that could be used to demonstrate compliance. Therefore, licensees relying on operator manual actions would have regulatory certainty that they are in compliance with applicable NRC requirements provided that they have documentation that demonstrates the acceptability of operator manual actions in accordance with established acceptance criteria. While such documentation of manual action acceptability in the fire hazards analysis would represent additional requirements, they are strictly voluntary for non-compliant licensees. Licensees could elect to comply with the currently specified physical fire barrier separation requirements. Therefore, it has been determined that the proposed rule would not constitute a backfit as defined in 10 CFR 50.109 (a)(1).

5.0 Decision Rationale

For each of the options identified, the values and impacts associated with amending the fire protection requirements in 10 CFR Part 50, Appendix R, Paragraph III.G.2 have been considered. Option 3 was determined to be the most preferable based on best professional judgment and quantitative analysis because it (1) improves effectiveness and efficiency of the NRC regulatory process by assuring adequate and uniform operator manual actions; (2) eliminates the need for licensees to request exemptions from Paragraph III.G.2 or make equipment modifications and thereby reduces licensees' costs; and (3) reduces costs for the NRC by eliminating the need to review exemption requests.

6.0 Implementation

This action would be enacted through a Proposed Rule Notice, public comments, and a Final Rule, with promulgation of the Final Rule by approximately one year after publication of the Proposed Rule. No impediments to implementation of the recommended alternatives have been identified.

A revision to associated regulatory guidance such as Branch Technical Position CMEB 9.5-1, the Standard Review Plan (NUREG-0800), and possibly Regulatory Guide 1.189, "Fire Protection for Operating Nuclear Power Plants) would be required. Revisions to fire protection inspection plans and enforcement guidance may also be required.

The estimated resources entailed in this rulemaking would be on the order of 3 FTEs. These resources will come principally from NRR and RES. These resources are within FY 2004 budget allocations and the proposed FY 2005 budget.

NRR . . . 2.5 FTE
Other . . 0.5 FTE

7.0 SUPPORTING CALCULATIONS

One Time Savings

Licensees:

Exemption Effort 14 reactors x 2500 hours x $88.00/hour	= $ 3,080,000
Minus Documentation 14 reactors x 300 hours x $88.00/hour	=($ 369,600)
Savings to Licensees	= **$2,710,400**

NRC:

Exemption Reviews 14 reactors x 110 x $88.00/hour	= $ 135,520
Minus Develop Reg. Guide (160 hrs+320 contractor hrs) x $88.00/hour	=($ 42,240)
Savings to NRC	= **$ 93,280**

Annual Savings

Licensees:

Equip. Mod Savings 2 reactors x $250,000	= $ 500,00
Minus Documentation 2 reactors x 300 hours x $88.00/hour	=($ 52,800)
Savings to Licensees	= $ 447,200
Exemption Requests 3 reactors x 2500 hours x $88.00/hour	= $ 660,000
Minus Documentation 3 reactors x 300 hours x $88.00/hour	=($ 79,200)
Savings to Licensees	**= $ 580,800**
Total Annual Savings to Licensees (5 reactors)	**= $ 1,028,000**

NRC:

Exemption Reviews 3 reactors x 110 hours x $88.00/hour	= **$ 29,040**

Net Present Value Over 30 Years (Including One Time Savings)

With a 7% discount rate	**= $ 16,838,712**
With a 3% discount rate	= $ 24,143,684

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DRAFT REGULATORY GUIDE

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DEMONSTRATING THE FEASIBILITY AND RELIABILITY OF OPERATOR MANUAL ACTIONS IN RESPONSE TO FIRE

A. INTRODUCTION

The primary objective of fire protection programs at U.S. nuclear plants is to minimize both the probability of occurrence and the consequences of fire. To meet this objective, fire protection programs for operating nuclear power plants are designed to provide reasonable assurance, through defense-in-depth, that a fire will not prevent the performance of necessary safe shutdown functions, and radioactive releases to the environment in the event of a fire will be minimized.

The U.S. Nuclear Regulatory Commission (NRC) recently revised the fire protection program requirements in Paragraph III.G.2 of Appendix R to Title 10, Part 50, of the *Code of Federal Regulations* (10 CFR Part 50). At issue was the reliance of many licensees on local operator manual actions (i.e., outside the main control room), rather than on fire barriers or separation (plus fire detection and automatic suppression, where required), to maintain safe shutdown capability. That is, licensee operators either take preventive, local manual actions upon detecting a fire to protect critical safety equipment that might be failed or spuriously affected and rendered unavailable by the fire, or they locally and manually align critical safety equipment to perform its function when needed. Appendix R, Paragraph III.G.2, originally specified only three methods, any of which was acceptable, to provide reasonable assurance that at least one means of achieving and maintaining safe shutdown conditions will remain available during and after any postulated fire in the plant.

The following three methods were considered acceptable to protect at least one shutdown train during a postulated fire when redundant trains are located in the same fire area:

(1) separation of the redundant system by a passive barrier able to withstand a fire for at least 3 hours

(2) separation of the redundant system by a distance of 20 feet containing no intervening combustible material, together with fire detectors and an automatic fire suppression system

(3) separation of the redundant system by a passive barrier able to withstand a fire for 1 hour, coupled with fire detectors and an automatic fire suppression system

After significant study, the NRC and industry came to believe that, in most cases, operator manual actions are a reasonable alternative to separation requirements and that most operator actions used by licensees for operation of a safe shutdown train during a fire would not involve any safety significant concerns. Thus, the rule was modified to allow a fourth acceptable method in lieu of separation requirements:

(4) Operator manual actions that satisfy the acceptance criteria in Paragraph III.P [of Paragraph III.G.2(c)(1) of Appendix R to 10 CFR Part 50], combined with fire detectors and an automatic fire suppression system installed in the fire area.

It was recognized that certain criteria would have to be met in order to ensure that significant increases in risk did not occur as a result of the generic use of operator manual actions as an alternative to separation. Licensees would have to perform thorough evaluations of the manual actions to ensure that safety was maintained. In particular, it was noted that such actions would have to be shown to be both feasible and reliable. The resulting codified acceptance criteria are included as part of the rule change in Paragraph III.P of Paragraph III.G.2(c)(1) of Appendix R to 10 CFR Part 50, and are summarized in Section C, below. The purpose of this regulatory guide is to provide acceptable practices that licensees can follow to meet the acceptance criteria. In other words, this guide will provide licensees with an acceptable approach for achieving adequate assurance that operator manual actions are feasible and can reliably be performed under a wide range of plant conditions that an operator might encounter when attempting to perform the actions.

Section B, "Discussion," of this guide provides a brief history and discussion of the need for the operator manual actions rule and the development of the associated acceptance criteria.

Section C, "Regulatory Position," consists of (1) a summary of the acceptance criteria as documented in Appendix R, Paragraphs III.G.2 and III.P, of 10 CFR Part 50, (2) a discussion of the technical basis and an explanation of the acceptance criteria, and (3) specific guidance for meeting the acceptance criteria.

Section D, "Implementation," describes how the NRC staff will use this guide. This guide has been developed to provide a comprehensive discussion of acceptable activities that can be performed by licensees to meet the acceptance criteria and will provide a basis for NRC fire protection inspectors to evaluate the adequacy of those activities.

Regulatory guides are issued to describe to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. Regulatory guides are issued in draft form to solicit public comment and involve the public in developing the agency's regulatory positions. Draft regulatory guides have not received complete staff review; therefore, they do not represent official NRC staff positions.

This draft regulatory guide contains information collections that are covered by the requirements of 10 CFR Part 50, which the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Background

10 CFR 50.48, "Fire Protection," requires that each operating power plant must have a fire protection plan that satisfies General Design Criterion (GDC) 3 of Appendix A to 10 CFR Part 50. GDC 3 requires that structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. The specific fire protection requirements for safe shutdown capability of plant are further discussed in Paragraph III.G of Appendix R to 10 CFR Part 50. The NRC added the more specific 10 CFR 50.48 and Appendix R requirements following a significant fire that occurred in 1975 at the Browns Ferry nuclear power plant. The fire damaged electrical cables for control and instrumentation. Nonetheless, plant operators, were able to safely shut down the unit using alternative backup systems.

In response to the fire, an NRC investigation revealed that the independence of redundant equipment at Browns Ferry was negated by lack of separation between cables of redundant trains of safety equipment. The investigators subsequently recommended that a suitable combination of electrical isolation, physical distance, fire barriers, and sprinkler systems should be applied to maintain the independence of redundant safety equipment. In response to these recommendations, the NRC worked with reactor licensees for several years to identify and implement necessary plant fire protection improvements. In 1980, NRC promulgated 10 CFR Part 50.48 to establish fire protection requirements and Appendix R to 10 CFR Part 50 for certain generic issues, including Paragraph III.G, fire protection for safe shutdown capability. The requirements for separation of cables and equipment associated with redundant safe shutdown trains were promulgated in Paragraph III.G.2 of the Appendix R fire protection regulations.

Appendix R applies only to those licensees who received operating licenses before January 1, 1979.[1] Paragraph III.G.2 of Appendix R requires that cables and equipment of redundant trains of safety systems in the same fire area must be separated by one of the following:

d. a 3-hr fire barrier

e. a horizontal distance of more than 20 ft with no intervening combustibles combined with fire detection and automatic fire suppression

f. a 1-hr fire barrier combined with fire detection and automatic fire suppression

[1] Plants licensed after January 1, 1979, are not required to meet Appendix R. These plants were licensed to meet Branch Technical Position APCSB 9.5-1 which contains criteria similar to the Appendix R requirements. Specific licensing basis information for these plants is usually contained in license conditions issued at the time of licensing.

Because the rule was to apply to facilities that were already built, the NRC knew that compliance with the strict, prescriptive requirements of Paragraph III.G.2 might be very difficult at some facilities. Accordingly, the NRC included a provision which allowed licensees to submit alternative acceptable methods for protecting redundant equipment to the NRC for review and approval under the exemption process. When implementing the Appendix R requirements, the NRC reviewed and approved exemptions for 60 licensees who provided acceptable alternative methods of compliance in various areas, including numerous exemptions from Paragraph III.G.2.

In the early 1990s, generic problems were discovered in Thermolag[2] fire barriers, many of which were used to comply with Paragraph III.G.2 of Appendix R. Licensees were ultimately required to replace Thermolag material with other fire barriers. Several years later, fire protection inspectors began to notice that many licensees had not upgraded or replaced Thermolag fire barrier material used to satisfy the Paragraph III.G.2 criteria (or had not otherwise provided the required separation distance between redundant safety trains). Some licensees compensated by relying on operator manual actions which had not been reviewed and approved by the NRC via the exemption process. In 2002, the Committee To Review Generic Requirements and the Office of the General Counsel determined that reliance on "operator manual actions" does not comply with the requirements as given in Appendix R, Paragraph III.G.2, unless approved as an "exemption" or "deviation" from the plant fire protection program.

In 2002, the NRC met with nuclear industry licensees and informed them that the use of unapproved manual actions was not in compliance with Paragraph III.G.2. During a meeting on June 20, 2002, the Nuclear Energy Institute stated that operator manual actions were widely used throughout the industry based on industry understanding of past practice and existing NRC guidance. The industry also stated that licensees' use of unapproved manual actions had become prevalent even before the concerns arose about Thermolag material. Shortly thereafter, the NRC developed criteria for inspectors to use in assessing the safety significance of violations resulting from unapproved operator manual actions. The criteria were based on past practice and experience by NRC inspectors when reviewing operator manual actions used to comply with Appendix R, Paragraph III.G.3, on alternate shutdown.[3] Licensees were familiar with these criteria through their experience with the NRC inspection process. These criteria were issued in the March 2003 revision of Inspection Procedure, Attachment 71111.05 (*Fire Protection*), by adding Enclosure 2 (*Inspection Criteria for Fire Protection Manual Actions*). While unapproved manual actions were still violations, actions meeting the interim criteria were considered to have low safety significance.

Because of the potentially large number of exemption requests and the anticipated low level of risk imposed by the operator manual actions, instead of continuing the staff's previous

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[2] Thermolag is a brand-name for a particular type of material used to construct fire barriers for protecting electrical conduits and cable trays. In the early 1990s, issues arose regarding the testing and qualification process used for this material. It was determined that barriers made of this material would not provide protection for the required periods of time.

[3] Note that the "time margin" criterion, discussed later in this document, is an extension of part of the March 2003 "verification and validation" criterion, which required that the "licensee [have] adequately evaluated the capability of operators to perform the manual action in the time available before the plant will be placed in an unrecoverable condition."

practice (requiring all noncompliant licensees to submit individual exemption requests for staff review to determine if their operator manual actions were acceptable), the staff determined that amending Appendix R to 10 CFR Part 50 would be the most orderly and efficient way to provide an option for licensees to utilize acceptable operator manual actions in lieu of the separation requirements stated in Paragraph III.G.2. In this manner the staff would codify acceptance criteria for licensees to use in evaluating operator manual actions to ensure that the actions were both feasible and reliable. These criteria would maintain safety by ensuring that licensees perform thorough evaluations of the manual actions in a manner that would be equivalent to NRC review and approval of an exemption request.

The staff developed a rulemaking plan and provided it to the Commission on June 17, 2003 (SECY-03-0100). The rule change would revise 10 CFR Part 50, Appendix R, Paragraph III.G.2, to allow licensees to implement acceptable operator manual actions after documenting that they met the regulatory acceptance criteria. NRC fire protection inspectors would verify that the licensees' manual actions met the NRC's acceptance criteria. The Commission approved the rulemaking plan on September 12, 2003, and after several public meetings with industry and receipt of public comments, the NRC staff updated the draft acceptance criteria. The rule was established on [to be determined].

The rule specifies that licensees can use operator manual actions as an additional alternative method for compliance with Paragraph III.G.2 of Appendix R[4] if, coincident with fire detection and automatic suppression capability, they satisfy the acceptance criteria. Thus, the NRC determined that implementing any one of the four alternatives of the rule will provide reasonable assurance that at least one method for achieving and maintaining the hot shutdown condition will remain available during and after a postulated fire anywhere in the plant.

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[4] The requirements in Appendix R are applicable only to licensees who received operating licenses before January 1, 1979. Post-January 1, 1979, licensees who use operator manual actions without NRC approval may or may not be in compliance with applicable fire protection requirements (GDC-3, §50.48[a], applicable license conditions, or current fire protection programs). Compliance for the post-January 1, 1979, plants depends on the specific licensing commitments, the change control process, and how the change was justified and analyzed to show that the operator manual actions are feasible and reliable and thus do not adversely affect the ability to achieve or maintain safe shutdown.

Purpose of this Regulatory Guide

Most of the acceptance criteria defined in the operator manual action rule are based on reviews of existing work related to the modeling of human behavior in responses to fires and other accident conditions in nuclear power plants. For example, most of the factors listed were derived from reviews of selected Individual Plant Evaluation of External Events (IPEEE) fire analyses and the IPEEE summary report (NUREG-1742 [Ref. 1]), previous reviews of fire-related operational events to identify important factors influencing human performance in fires [e.g., Refs. 2–4], lessons learned from the development of human reliability analysis (HRA) criteria for use in the ongoing joint NRC/Electric Power Research Institute (EPRI) fire requantification studies, and general human reliability analysis methods such as SPAR-H [Ref. 5] and ATHEANA [Ref. 6]. Examples of the general factors covered by the acceptance criteria (discussed in detail in Section C) include the availability of indications for the actions, environmental considerations, staffing and training, communications, the availability of necessary equipment, and the availability of procedures.

While the importance of such factors is generally obvious, determining exactly how to evaluate the factors to ensure that the acceptance criteria are met can be somewhat less straightforward. For example, what things should be covered by procedures appropriate for operator manual actions and what type of training is appropriate? One of the main purposes of this regulatory guide is to provide licensees using operator manual actions with the information necessary for them to ensure that they have adequately addressed all of the issues related to the factors listed in the Paragraph above and stipulated in the acceptance criteria.

Furthermore, in developing the acceptance criteria, it was recognized that in addition to addressing the factors listed above, steps would have to be taken to ensure that operator manual actions are both feasible (can be performed in the time available) and reliable (yield the same or compatible results in different experiments or statistical trials, are dependably repeatable). The operator manual action rule stipulates that there must be time-authenticated *demonstrations* of the manual actions (involving actual execution of the actions to the extent possible) and that there must be sufficient time available to complete the actions before serious equipment damage occurs and affects safe shutdown. Showing, with a demonstration, that actions that meet the acceptance criteria, can be completed in the available time documents the feasibility of the actions, but additional issues must be considered to show that the actions can be performed reliably under the variety of conditions that could occur during a fire.

For example, factors that licensees may not be able to recreate in the demonstrations could cause further delay under real fire conditions (i.e., the demonstration would likely fall short of actual fire situations). Furthermore, typical and expected variability among individuals and crews could lead to variations in operator performance (human-centered factors). Finally, variations in the characteristics of the fire and related plant conditions could alter the time available for the operator actions. These issues led to the conclusion that in order to ensure that actions could be performed reliably, licensees would have to show in a demonstration that a sufficient amount of extra time would be available for the actions (i.e., a time margin) and that the process for determining the time available for the actions adequately addressed the potential variations in fire characteristics and plant conditions.

Through a series of analyses, the NRC determined that a factor of approximately 2 as a time margin would (under certain conditions) provide "a high confidence of a low probability of failure" for the operator manual actions (see Appendix A for a discussion of the determination of the factor of 2 time margin).[5] However, the NRC determined that in order for a 100-percent time margin to be appropriate and help ensure reliable performance of actions, the demonstration of actions needs certain characteristics, as would the approach for determining the time available for actions. In other words, as long as licensees meet the rule criteria for the actions, perform sound demonstrations of the actions at the plant, perform reasonable calculations of the time available for the various actions, and can show that the time available is at least 100 percent greater than the time obtained in the demonstration, then local operator manual actions in response to fire can be reasonably assumed to be both feasible and reliable. Thus, another important purpose of this regulatory guide is to provide guidance to licensees on how to adequately perform the demonstration of the actions (what should be covered) and on what to consider in calculating the time available.

[5] The factor of 2 represents a consensus minimum based on the expert opinion elicitation discussed in Appendix A. There may be situations in which a value greater than 2 is appropriate (e.g., where the demonstration falls short of the guidance provided in this regulatory guide).

Scope of this Regulatory Guide

This regulatory guide provides guidance to aid licensees in meeting the acceptance criteria for local operator manual actions in response to fire stipulated in 10 CFR Part 50, Appendix R, Paragraph III.P in conjunction with Paragraph III.G.2(c-1). While the guide strives to provide enough information and guidance to allow licensees to be confident that their activities will meet the acceptance criteria for operator manual actions, it does not contain everything that might be known about how to meet the criteria. The guide focuses on *unique* aspects of the hazard involved (fire) and the potentially unique characteristics of subsequent manual actions during the operators' response. Hence, for instance, it is not the intent of this regulatory guide to specify in detail what constitutes "adequate procedures." Many other guidance documents and an evolving consensus address this issue. Additionally, each licensee has an already well-established program for identifying, writing, reviewing, issuing, and changing procedures. What is provided here is guidance on the unique aspects of fire and operator manual actions.

Finally, with respect to the types of local operator manual actions that licensees have been crediting, it was determined that there are basically two general types of actions: (1) preventive or event-based actions and (2) reactive or symptom-based actions. Preventive actions are those actions which, upon entering a fire plan/procedure, the licensee expects (without needing further diagnosis) to take to prevent spurious actuations or other fire-related failures so that adequate equipment is protected and can be used to reach safe shutdown. For these actions, it is generally assumed that once the fire has been detected and located, per procedure, the control room crew will direct personnel to execute a number of actions that will prevent fire-related damage to equipment and thereby ensure the availability of the equipment to achieve its function during the given fire scenario.

Also by procedure, the only criterion for initiating these actions is the presence of the fire itself (event-based). Reactive or symptom-based actions, on the other hand, are actions taken by a licensee during a fire in response to an undesired change in plant condition. In reactive actions the plant staff detects the undesired change and diagnoses the correct actions to be taken. Thus, with reactive actions, the plant staff responds to indications of changing equipment conditions caused by the fire, and then takes the steps necessary to ensure that the equipment will function when needed (e.g., manually reopen a spuriously closed valve). The plant staff does not initiate the actions until the procedure indicates that, given the relevant indications, the actions must be performed.

It should be noted that the acceptance criteria for the rule apply to both types of actions and, therefore, both types of actions are covered by this regulatory guide. However, in some cases, the differences in the nature of the actions prompt somewhat different considerations. These are addressed in the guidance.

C. REGULATORY POSITION

This section contains the NRC's current expectations, criteria, and guidance for determining that operator manual actions in response to fire are acceptable under Appendix R, Paragraph III.G.2. Using this guidance to meet these criteria provides an acceptable approach for achieving adequate assurance that operator manual actions are feasible and can be performed reliably under a wide range of plant conditions that the operator might encounter when attempting to perform the actions.

Section C.1 summarizes the rule. Section C.2 provides additional discussion about the NRC's expectations in meeting the rule as well as justification for the criteria imposed by the rule. Section C.3 provides guidance on acceptable approaches for meeting the rule.

C.1 Rule Acceptance Criteria

Operator manual actions are those actions taken by operators to perform manipulation of components and equipment from outside the main control room to achieve and maintain post-fire safe shutdown. These actions are performed locally by operators, typically at the equipment. Operator manual actions comprise an integrated set of actions needed to ensure that a redundant train of systems necessary to achieve and maintain hot shutdown conditions located within the same area as the fire and outside the primary containment is free of fire damage. A licensee relying on operator manual actions for compliance with Appendix R, Paragraph III.G.2, must have fire detectors and an automatic fire suppression system installed in the fire area.

Appendix R, Paragraph III.G.2(c)(1), provides a means of compliance using operator manual actions as long as the "operator manual actions… satisfy the acceptance criteria in Paragraph III.P." Those acceptance criteria include a number of requirements for an acceptable operator manual action. The requirements are summarized below. The italicized words are discussed in Sections C.2 and C.3 of this regulatory guide:

- An analysis should be prepared for operator actions to evaluate the action's feasibility and reliability. The analysis should contain a postulated fire *time line* showing *sufficient time* to travel to action locations and perform the actions. The time line should extend from the time of initial fire detection until the licensee is able achieve and maintain hot shutdown.
- The time line should include a *time margin* that accounts for all variables, including (a) differences between the conditions present during the demonstration and actual conditions and (b) human performance uncertainties.
- It should be shown that the actions can be performed under the expected *environmental conditions* that will be encountered.

- The *functionality of equipment and cables* needed to achieve and maintain hot shutdown cannot be adversely affected by the fire; the equipment is to be *operable* and readily *accessible* consistent with the analysis. Besides the structures, systems, and components (SSCs) needed to directly perform the desired functions, the necessary equipment also includes:
  - < *indications* necessary to show the need for the manual actions, enable their performance, and verify their successful accomplishment
  - < *communications* as necessary
  - < *portable equipment* as necessary
  - < *life support equipment* as necessary.
- There are to be plant *procedures* covering the actions and *training* on the procedures.
- The *number of personnel (staffing)*, exclusive of fire brigade members, needed to perform the actions are to be on site at all times.
- There are to be time-authenticated *demonstrations* of the manual actions, consisting of actual executions of the relevant actions to the extent possible.

C.2 Discussion and Technical Bases for Acceptance Criteria

The above acceptance criteria for III.G.2 operator manual actions satisfy three purposes:

(1) Provide a means by which the NRC can provide reasonable assurance that the actions are feasible and can be performed reliably to protect the public health and safety.

(2) Permit both the licensees and the NRC to establish consistency in what operator manual actions will be allowed.

(3) Provide the parameters under which both licensee evaluations and NRC inspections can be conducted in a thorough manner.

The overall requirement is that the actions must be shown to be both feasible and reliable. By "feasible," the NRC means that the actions must be shown to be capable of being accomplished. However, this is not sufficient. The NRC also requires licensees to show that the actions are reliable. That is, the actions must yield the same or compatible results in different experiments or statistical trials (be dependably repeatable). It is the NRC's intent that there must be a "high confidence of low probability of failure" associated with the operator manual actions. Meeting the acceptance criteria will prove that the actions can be both successfully accomplished and accomplished repeatedly by all personnel who perform the actions under a variety of conceivable fire and plant conditions.

The following subsections elaborate on the basis for each of the acceptance criteria. Section C.3 of this regulatory guide provides guidance for acceptably meeting each criterion.

C.2.1 Time Line Showing Sufficient Time To Perform the Actions

This criterion addresses the need for a fire time line extending to the point where hot shutdown cannot only be achieved, but can also be maintained. This criterion is based upon regulations requiring that a nuclear power plant always be maintained in a safe condition, even following accidents, consistent with the additional restriction that a hot shutdown state be reached and maintained, as per 10 CFR Part 50, Appendix R, Section III.G. 10 CFR Part 50, Section 72, Paragraph (b)(3)(v)(A), addresses "any event or condition that at the time of discovery could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition." Implicit in these requirements is the analysis of the plant's thermal-hydraulic response, including the time needed to fulfill the listed safety functions.

This criterion is also an extension of past NRC practice in approving exemptions to III.G.2. Previous NRC staff reviews and approvals of post-fire operator manual actions included the consideration of whether there was adequate time for the operator manual actions, based on the progression of the fire and the thermal-hydraulic conditions of the plant.

Additionally, this criterion is consistent with current inspection criteria for fire protection manual actions under the verification and validation criterion, ensuring that licensees have adequately evaluated the capability of operators to perform the manual actions in the time available.

C.2.2 Time Margin

This criterion addresses the reliability of the operator manual actions. The time margin is a surrogate for addressing two sources of uncertainty inherent in the time line analysis:

(1) Factors that the licensee likely may be unable to recreate in the demonstrations that could cause further delay in performing the operator manual actions under real fire conditions (i.e., where the demonstration would likely fall short of actual fire situations). For example:

- The need to recover from/respond to unexpected difficulties or random problems (i.e., not related to the fire), such as problems with instruments or other equipment (e.g., a stiff handwheel or difficulty with communication devices).
- Environmental and other effects not easily simulated in the demonstration, such as radiation; smoke and toxic gas effects; increased noise levels from the fire and the operation of suppression equipment and from personnel shouting instructions; water on the floor; fire hoses in the way; or too many people getting in each others way.

- Limitations of the demonstration to account for (or envelop) all possible fire locations where the actions are needed and for all the different travel paths and distances to where the actions are to be performed. A similar limitation concern is that the location and activities of needed plant personnel when the fire starts could delay their participation in executing the operator manual actions (e.g., they may be on the opposite side of the plant and may need to restore certain equipment before being able to participate).
- Inability to execute relevant actions during the demonstration because of normal plant status and/or safety considerations while at power (e.g., operators cannot actually operate the valve using the handwheel, but can only simulate doing so).

(2) Typical and expected variability among individuals and crews leading to variations in operator performance (i.e., human-centered factors). For example:

- physical size and strength differences
- cognitive differences (e.g., memory ability, cognitive style differences)
- different emotional responses to the fire/smoke
- different responses to wearing self-contained breathing apparatuses (SCBAs) to accomplish a task (i.e., some people may be less comfortable with a mask over their face than other people)
- differences in individual sensitivities to "real-time" pressure
- differences in team characteristics and dynamics

Further, ANSI/ANS-58.8-1994 [Ref. 7] on time response design criteria for safety-related operator actions established "time response criteria… [that] adopt time intervals… to ensure that adequate safety margins are applied to system and plant design and safety evaluations." The standard recognized that "in actual practice, the operator should be capable of reacting to design-basis events correctly and performing the safety-related operator actions in less time than specified by the criteria in this standard." This is the essence of the role of the time margin concept in ensuring the reliability of operator manual actions.

To account for the above variables and uncertainty, it is prudent to establish a time margin on the postulated fire time line. This ensures that the operator manual actions can be performed reliably under a wide range of conceivable conditions by different plant crews.

C.2.3 Environmental Conditions

This criterion addresses the issue that environmental conditions may affect personnel's mental or physical performance of operator manual actions to the extent that, if the actions are not entirely precluded, they are severely degraded. The environmental conditions expected when performing the manual actions therefore need to be considered in both the locations where the operator manual actions will be performed and along the access and egress routes. Personnel performance can be degraded, if not precluded, by the inability to reach the location as well as the inability to perform the action in the conditions existing at the location. The environment along the egress route after completion of the operator manual action should also be considered to ensure personnel health and safety throughout.

Environmental factors are those factors that could negatively impact the ability to perform the manual actions, including radiation, lighting, temperature, humidity (for instance, water on the floor from sprinkler operation), smoke, toxic gases, and noise.

That these factors must be considered follows from such requirements as 10 CFR 20.1201 governing radiation exposure in responding to fires. As stated in 10 CFR Part 50, Appendix A, "anticipated operational occurrences mean those conditions of normal operation which are expected to occur one or more times during the life of the nuclear power unit…" Fires fall into this category and, therefore, are subject to regulations governing "normal operation," such as 10 CFR 20.1201. Similarly, ANSI/ANS-51.1 [Ref. 8] and its counterpart, ANSI/ANS-52.1 [Ref. 9], consider that a "fire limited to one fire area" (corresponding to "plant condition 2") occurs with a frequency of at least once per year. An event in this frequency range is considered part of "normal operation."

Further, NUREG-0800, Section 9.5.1 [Ref. 10], states that "the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment… should designate… potential radiological and toxic hazards in fire zones; …ventilation system operation that ensures desired plant air distribution when the ventilation flow is modified for fire containment or smoke clearing operation; …most favorable direction from which to attack a fire in each area in view of the ventilation direction, access hallways, stairs, and doors that are most likely to be free of fire, and the best station or elevation for fighting the fire."

Emergency lighting is addressed in Appendix R, Section III.J, or by the licensee's approved fire protection program, as well as in NUREG-800, Section 9.5.1 [Ref. 10], where it is stated that "[l]ighting… [is] vital to safe shutdown and emergency response in the event of a fire."

Studies such as NUREG/CR-5680 [Ref. 11] attest to the impact on human performance of such variables as heat and cold, noise, lighting, and vibration. NUREG-1764 [Ref. 12], cited in NUREG-800, Section 18.0 [Ref. 10], notes that "…[q]ualitative assessment [of the human actions] addresses… the environmental challenges… that could negatively affect task performance…" Experimental studies, such as the ones cited as references 22 and 23, provide further evidence of the effects of heat and cold stresses on the performance of various physical and cognitive human tasks. NUREG-0711 [Ref. 13], also cited in NUREG-800, Section 18.0 [Ref. 10], states that "[human-system interface] characteristics should support human performance under the full range of environmental conditions, e.g., normal as well as credible extreme conditions…" Accordingly, it needs to be ensured that such habitability issues (including those that may be unique to fire conditions such as additional heat concerns, smoke, toxic gases, effects of ventilation shutdown, the possibility of having to pass through areas and/or manipulate electrical equipment with water on the floor, etc.) will not adversely impact the operator manual actions in the locations where the actions are to be taken and along access and egress routes. Experimental studies, such as those cited in references 24 and 25, provide further evidence of the effects of carbon dioxide, for example, on various measures of human performance.

The importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under the environmental considerations criterion, ensuring that licensees have addressed radiation levels per 10 CFR Part 20, lighting, temperature and humidity, and fire effects such as smoke and toxic gases.

C.2.4 Equipment Functionality (Operability) and Accessibility

This criterion addresses the need to ensure that the equipment that is necessary to achieve and maintain post-fire hot shutdown is accessible, operable, and not damaged or otherwise adversely affected by the fire and its effects (such as heat, smoke, water, combustible products, spurious actuation). Plant SSCs are the means by which hot shutdown conditions are achieved and maintained. Systems and components often require active intervention, through either automatic or manual means, to perform their function. Hence, equipment that may involve operator manual actions to perform its safe shutdown function needs to be identified and be both accessible and operable.

The necessary equipment should be based on the general design criteria for nuclear power plants from Appendix A to 10 CFR Part 50. These general design criteria establish minimum requirements for water-cooled nuclear power plants in terms of the SSCs important to safety (i.e., SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public). To provide this level of assurance, a nuclear power plant must always be maintained in a safe condition, even following accidents, consistent with the additional restriction that a hot shutdown state must be reached and maintained, as per 10 CFR Part 50, Appendix R, Section III.G. SSCs that provide this level of reasonable assurance are listed in 10 CFR Part 50, Appendix A, and 10 CFR 50.72. It is intended that this equipment must also include fire detection and suppression equipment to the extent the equipment contributes to the assurance of safe shutdown under fire conditions.

Information Notice 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire" [Ref. 14], identifies the type of functionality issue that should be considered. For example, the bypassing of thermal overload protection devices for motor-operated valves (MOVs) (discussed in Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on MOVs" [Ref. 15]) could jeopardize completion of the safety function or degrade other safety systems due to sustained abnormal circuit currents that can arise from fire-induced "hot shorts." Even if the overload protection devices are not bypassed, hot shorts can cause loss of power to MOVs by tripping the devices. If an operator manual action involves the manual manipulation of a powered MOV, such fire-induced damage (e.g., over-torquing an MOV) could render manipulation physically impossible. Other equipment, such as even manual valves, could have fire-susceptible parts such as valve packing. Therefore, if equipment (including cabling and power and cooling to support the equipment) that could be affected by the fire or its subsequent effects is planned for use via operator manual actions, the licensee should determine that the operability and performance of that equipment will not be adversely affected and the function can be successfully accomplished by manual actions.

Accessibility to these systems and equipment is necessary to enable personnel to perform the operator manual actions on the components. Not only must the personnel be able to find and reach the locations of the components, but they also must be able to manipulate the components.

The importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under the accessibility criterion and other criteria, ensuring, for instance, that the necessary equipment is available and protected from fire effects.

C.2.5 Available Indications

Besides the SSCs needed to directly perform the desired functions, the equipment must also include diagnostic indications relevant to the desired operator manual actions. These indications are needed to (a) enable the operators to determine which manual actions are appropriate for the fire scenario, (b) direct the personnel performing the manual actions, and (c) provide feedback to the operators to verify that the manual actions have had their expected results. These indications include indications necessary to detect and diagnose the location of the fire. As necessary equipment, indications should meet the operability and accessibility requirements provided in the proposed rule.

This indication criterion extends to III.G.2 the guidance in Generic Letter (GL) 81-12 regarding manual actions for associated circuit resolution for alternative shutdown (Paragraph III.G.3) [Ref. 16]. "For circuits of equipment and/or components whose spurious operation would affect the capability to safely shutdown… provide a means to detect spurious operations and then [provide] procedures to defeat the maloperation of equipment (i.e., closure of the block valve if [a power-operated relief valve (PORV)] spuriously operates, opening of the breakers to remove spurious operation of safety injection)."

Section IX of Attachment I to IN 84-09 [Ref. 17] lists the minimum monitoring capability to achieve safe shutdown: (1) diagnostic instrumentation for shutdown systems; (2) level indication for all tanks used; (3) pressurizer (PWR) or reactor water (BWR) level and pressure; (4) reactor coolant hot leg temperatures, or core exit thermocouples, and cold leg temperatures (PWR); (5) steam generator pressure and level (wide range, PWR); (6) source range flux monitor (PWR); (7) suppression pool level and temperature (BWR); (8) emergency or isolation condenser level (BWR). However, annunciators, indicating lights, pressure gages, and flow indicators are among the instruments typically not protected under the guidance in IN 84-09 [Ref. 17], although these instruments may be needed to detect that a maloperation or other trigger for action has occurred. IN 84-09 [Ref. 17] does not exclude other alternative methods of compliance. A licensee may employ alternative instrumentation to comply with the regulation (e.g., boron concentration indication).

The importance of providing more indication than recommended in IN 84-09 [Ref. 17] was recognized when the NRC updated its inspection guidance in March 2003 for operator manual actions. "Determine whether adequate diagnostic instrumentation,[6] unaffected by the postulated fire, is provided for the operator to detect the specific spurious operation that occurred." Suppose the licensee has protected only the instrumentation needed to conform to IN 84-09 [Ref.17]. If due to lack of circuit protection, the licensee has to respond to a maloperation (e.g., decreasing pressurizer level), additional diagnostic instrumentation must be sufficient for the operator to direct the correct response. For example, the decreasing pressurizer level could be due to spurious closure of an in-line MOV. If so, which one? The licensee's fire protection safe shutdown analysis should consider the means to determine which one (i.e., additional indication).

The importance of available indication is also covered in such documents as NUREG-1764 [Ref. 12] and NUREG-0711 [Ref. 13], which are cited in NUREG-800, Section 18.0 [Ref. 10]. NUREG-1764 [Ref. 12] states that "…a description should be provided for… parameters that indicate that the high-level function is available… operating[, and]… achieving its purpose… [C]onsider not only the personnel role of initiating manual actions but also responsibilities concerning automatic functions, including monitoring the status of automatic functions to detect system failures…" NUREG-0711 [Ref. 13] discusses the need to "…provide evidence that the integrated system adequately supports plant personnel in the safe operation of the plant… The objectives should be to… validate that, for each human function, the design provides adequate alerting, information, control, and feedback capability for human functions to be performed under normal plant evolutions… [and] transients."

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[6] Defined in GL 86-10 [Ref. 18] as 'instrumentation beyond that previously identified in IN 84-09 [Ref. 17] needed to ensure proper actuation and functioning of safe shutdown and support equipment (e.g., flow rate, pump discharge pressure)

C.2.6 Communications

Besides the SSCs needed to directly perform the desired functions, there must also be communications equipment. Such equipment is essential to providing feedback between operators in and personnel outside the main control room to ensure any activities requiring coordination between them are clearly understood and correctly accomplished. The unpredictability of fires can force staff to deviate from planned activities (hence, the need for constant, effective communications). Communications permit the performance of sequential operator manual actions (where one set of actions must be completed before another set can be started) and provide verification that procedural steps have been accomplished, especially those that must be conducted at remote locations. Therefore, communications should be continuously available and meet the operability and accessibility requirements provided in the proposed rule.

The need to emphasize communications equipment is cited, for instance, in NUREG-0800, Section 9.5.1 [Ref. 10]: "…two-way voice communication… [is] vital to safe shutdown and emergency response in the event of a fire. Suitable… communication devices should be provided…" Further, NUREG-0800, Section 18.0 [Ref. 10], references NUREG-1764 [Ref. 12], NUREG-0711 [Ref. 13], and NUREG-0700 [Ref. 19], which state that "qualitative assessment [of the human actions] addresses… the level of communication needed to perform the task… When developing functional requirements for monitoring and control capabilities that may be provided either in the control room or locally in the plant, the following… should be considered: …communication, coordination… workload [, and] feedback." Examples cited include "loudspeaker coverage… page stations… personal page devices suitable for high-noise or remote areas… [and] communication capability… for personnel wearing protective clothing [such as] voice communication with masks…" Experimental studies, such as the ones cited in Reference 26, provide further evidence of the effect of respirators on human task performance.

The importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under the communications criterion, which ensure that the communications capability will be protected from the effects of a postulated fire.

C.2.7 Portable Equipment

Besides the SSCs needed to directly perform the desired functions, the necessary equipment must also include portable equipment relevant to the operator manual actions. Portable equipment, especially unique or special tools (such as keys to open locked areas or manipulate locked controls, flashlights, ladders to reach high places, torque devices to turn valve handwheels, and electrical breaker rackout tools), can be essential to access and manipulate SSCs in the successful accomplishment of operator manual actions. Hence, these are an extension of the equipment needed to achieve and maintain safe shutdown. It is NRC's intent that this equipment must be "staged" so that its location is known and constant, ensuring that the equipment is readily available. Access to this equipment must be unimpeded so that it will not unduly delay the operator manual actions, and this equipment needs to be in working order (operable).

The importance of this criterion is recognized in current inspection criteria for fire protection manual actions under the special tools criterion ensuring that such equipment is dedicated and available.

C.2.8 Life Support Equipment

Besides the SSCs needed to directly perform the desired functions, the necessary equipment must also include life support equipment relevant to the operator manual actions such as protective clothing, gloves, and SCBAs. Such equipment may need to be worn to permit access to and egress from locations where the operator manual actions must be performed since the routes could be negatively affected by fire effects, such as smoke, that propagate beyond the immediate fire area. Hence, this equipment is an extension of the equipment needed to achieve and maintain safe shutdown. Access to this equipment must be unimpeded so that it will not unduly delay the operator manual actions, and this equipment needs to be in working order (e.g., an SCBA must provide a tight seal against any smoke ingress, be in working order when donned, and not malfunction while being used).

NUREG-0800, Section 18.0 [Ref. 10], references NUREG-0700 [Ref. 19], which supports the need to consider this equipment: "[t]he operation of controls should be compatible with the use of protective clothing, if it may be required… The likelihood of operators requiring protection… is greater outside the control room."

Further, current inspection guidance treats this equipment as subject to the special tools criterion cited previously.

C.2.9 Procedures and Training

This criterion reflects the need for written plant procedures and associated training for the operator manual actions. The role of written plant procedures in the successful performance of operator manual actions is threefold: (1) they assist the operators in correctly diagnosing the type of plant event that the fire may trigger (usually in conjunction with indications), thereby permitting the operators to select the appropriate operator manual actions; (2) they tell the operators which manual actions are appropriate to place and maintain the plant in a stable, hot shutdown condition; and (3) they minimize the potential confusion that can arise from fire-induced conflicting signals, including spurious actuations, thereby minimizing the likelihood of personnel error during the operator manual actions. Written procedures contain the steps of what needs to be done, how and where it should be done, and what tools or equipment should be used.

Training on these procedures serves three supporting functions: (1) it establishes familiarity with the procedures, equipment, and potential (simulated) conditions in an actual event; (2) it provides the level of knowledge and understanding necessary for the personnel performing the operator manual actions to be well-prepared to handle departures from the expected sequence of events; and (3) it gives personnel the opportunity to practice their response without exposure to adverse conditions, thereby enhancing confidence that they can reliably perform their duties in an actual event.

Appendix B to 10 CFR Part 50 requires quality assurance procedures for nuclear power plants. "Activities affecting quality shall be prescribed by documented instructions [or] procedures… of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions [or] procedures… shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished." Appendix A to Regulatory Guide 1.33 [Ref. 20] on quality assurance programs for power operation describes a method acceptable to the NRC staff for complying with these Appendix B requirements. Appendix A of the regulatory guide identifies the following as typical safety-related activities that should be covered by written procedures: (1) the plant fire protection program (administrative procedures); (2) mode change from plant shutdown to hot standby and operation at hot standby (general plant operating procedures); (3) changing modes of operation for a wide range of safety-related PWR and BWR systems (specific plant operating procedures); and (4) plant fires (procedures for combating emergencies and other significant events). In addition, there should be procedures for abnormal, off-normal, and alarm conditions, with each safety-related annunciator having its own written procedure. In conformance with the above, it is NRC's intent that the procedures covering operator manual actions in response to fire must be controlled procedures like those covering other plant operations.

The training portion of this criterion is an extension of the requirement of 10 CFR 50.120 that nuclear power plant personnel be trained and qualified. "Each nuclear power plant licensee… shall establish, implement, and maintain a training program derived from a systems approach to training as defined in 10 CFR 55.4 [Operators' Licenses — Definitions]… The training program must incorporate the instructional requirements necessary to provide qualified personnel to operate and maintain the facility in a safe manner in all modes of operation."

Some fire brigade training expectations from Appendix R, Paragraph III.I, have been extrapolated to apply to operator manual actions. Just as fire brigade training is to consist of an initial classroom instruction program followed by periodic classroom instruction, fire fighting practice, and fire drills, the personnel performing operator manual actions (operators, maintenance staff, electrical technicians) need to undergo parallel training for their individual responsibilities. The instruction is to be provided by qualified individuals who are knowledgeable, experienced, and suitably trained. Instruction is expected to be provided to all personnel who perform operator manual actions. Practice sessions are expected to be held for each operating crew to provide the crews with experience in performing the operator manual actions under conditions as closely approximating actual fire situations as reasonably achievable (see the Demonstration criterion).

Analogous to the fire brigade drills, drills for operator manual actions are expected to include assessment of alarm effectiveness; operator time response; use of portable equipment, including communication devices and life support; each operator's knowledge of his or her role; and conformance with established plant procedures.

The importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under both the procedures and the training criteria. Under these criteria, inspectors are to (a) ensure that operators do not have to study procedural guidance at length to operate the equipment in the manner intended, and (b) ensure that training on the manual actions and the procedure is adequate and current.

C.2.10 Staffing

The intent of the staffing criterion is that qualified personnel be on site at all times so that hot shutdown conditions can be achieved and maintained in the event of a fire. Individuals dedicated to the performance of operator manual actions may not have collateral duties, such as fire fighting or control room operation, during the evolution of the fire scenario in that they must be dedicated to the performance of operator manual actions during a fire situation. Therefore, all operating shift staffing levels must include enough dedicated personnel to perform any operator manual actions that could arise since any fire could occur at any time.

NUREG-0800, Section 18.0 [Ref. 10], cites NUREG-1764 [Ref.12] and NUREG-0711 [Ref.13], which in turn provide general expectations with regard to staffing. NUREG-1764 [Ref. 12] states that "[s]taffing levels should be evaluated based on… [r]equired actions… [t]he physical configuration of the work environment… [a]vailability of personnel considering other activities that may be ongoing and for other possible responsibilities outside the control room…" NUREG-0711 [Ref. 13] states that "[t]he basis for staffing and qualifications should…

address… the knowledge, skills, and abilities needed for personnel tasks… availability of personnel… crew coordination concerns that are identified during the development of training." Also, "validate that the shift staffing, assignment of tasks to crew members, and crew coordination (both within the control room as well as between the control room and local control stations and support centers) is acceptable. This should include validation of nominal shift levels, minimal shift levels, and shift turnover…" In addition, "address… personnel response time and workload… the job requirements that result from the sum of all tasks allocated to each individual both inside and outside the control room… the requirements for coordinated activities between individuals… [and] the interaction with auxiliary operators… [V]alidate that specific personnel tasks can be accomplished within time and performance criteria, with a high degree of operating crew situation awareness, and with acceptable workload levels that provide a balance between a minimum level of vigilance and operator burden…"

The subject of staffing has also been addressed many times before with regard to NRC's intent in this area. For instance, in Information Notice 91-77 [Ref. 21] it is stated that "[t]he number of staff on each shift is expected to be sufficient to accomplish all necessary actions to ensure a safe shutdown of the reactor following an event… Licensees may wish to carefully review actual staffing needs to ensure that sufficient personnel are available to adequately respond to all events. This is especially relevant to the backshift when staffing levels are usually at a minimum…"

This criterion on staffing is an extension to Appendix R, Paragraph III.G.2, of Paragraph III.L for Alternative or Dedicated Shutdown Capability (Paragraph III.G.3). "The number of operating shift personnel, exclusive of fire brigade members, required to operate the equipment and systems comprising the means to achieve and maintain the hot standby or hot shutdown conditions shall be on site at all times." The NRC contends that, if the fire brigade could be expected to perform actions other than those solely involved with fire fighting, the potential exists for interfering with either their firefighting activities or the operator manual action, such that successful performance of one or the other, or both, could be impaired. Although it may seem redundant to require an operator, independent of any firefighting responsibility, to perform an action that could simply be performed by a member of the fire brigade, one can conceive of situations where this dual responsibility could be a problem. Hence the requirement that operators be independent of the fire brigade duties and even control room duties since operator manual actions take place outside the control room.

Further, the importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under the staffing criterion to determine whether adequate qualified personnel are available to perform the operator manual actions.

C.2.11 Demonstrations

This criterion provides a degree of overall assurance that the operator manual actions indeed can be performed in the analyzed time period for a range of conceivable fire situations (i.e., the actions are feasible). This criterion provides a "test" (by at least one randomly selected crew initially and by the rest of the crews with a frequency consistent with that established by the licensee in compliance with 10 CFR 50.120) that all the other criteria have been and continue to be met. As a result, the desired operator manual actions are shown to be accomplishable within the constraints, including the analyzed time, using the minimum staffing levels, with the expected operable equipment, under the expected environmental conditions, using the procedures and training provided for the manual actions.

This criterion and the time margin criterion complement each other. The demonstration serves as a benchmark against which the time margin, which more directly addresses the reliability concept, can be developed. As with training, the demonstration provides the crew with practical experience. All elements of the fire scenario, including the use of equipment and procedures, adequacy of staffing levels, response to indications, etc., must be integrated into the demonstration to develop this benchmark. In this way, any complexities, such as the number of operator manual actions and their dependence upon one another, and the handling of multiple procedures [emergency operating procedures (EOPs), as well as fire plans and procedures] at the same time, are evaluated and identified for appropriate consideration in the development of the time margin. Failure to show in a demonstration that the operator manual actions can be accomplished in a manner that is consistent with the analysis indicates that the manual actions are not feasible. In such cases, the licensee could try modifying the actions (e.g., different access/egress routes, redeployment of critical equipment by placing it at the location where the manual action will be performed vs. carrying it to that location, dividing the activities among a greater number of staff, etc.), such that a new demonstration satisfies the analysis. Alternatively, the licensee could conclude that operator manual actions are not feasible and, therefore, opt for compliance via Paragraph III.G.2(a), (b), or (c).

Licensees may determine that operator manual actions are feasible after an initial demonstration has been successfully accomplished. Subsequent demonstrations should be performed eventually by all the crews at a frequency consistent with that established by licensees for their plant training programs in compliance with 10 CFR 50.120. Subsequent periodic demonstrations provide valuable training and experience for licensee personnel and also serve to verify that plant configuration and conditions (access, egress, etc.) have not changed over time so that the manual actions may no longer be accomplished in accordance with the required fire time line analysis. If a licensee is unable to successfully complete a subsequent demonstration, the licensee must take prompt corrective action to modify the manual action or the plant conditions so that the demonstration is successful. This agrees with Criterion XVI of Appendix B to 10 CFR Part 50, which requires corrective action measures for conditions averse to quality. If a licensee is unable to complete a successful demonstration, the licensee must take prompt actions to otherwise comply with Paragraph III.G of Appendix R.

The intent of this criterion is to provide reasonable assurance that any crew that might be on duty at the time of a fire can reliably perform the operator manual actions, allowing for variability and uncertainties. The NRC considers it sufficient that "an established crew" illustrate the ability to perform the operator manual actions through time-authenticated demonstrations of the relevant actions, the results of which are documented. Such demonstrations would become part of periodic operator training. To reasonably ensure that all crews (i.e., the ones only receiving training but not performing the demonstration during a particular training cycle) could reliably perform the actions, the "time margin" criterion would be applied to account for variability that exists among crews as well as for likely shortcomings of the demonstration as discussed previously. In this way, the demonstration by the established crew, with an appropriate time margin, would reasonably assure that any of the crews could likewise perform the operator manual actions under a wide range of fire situations.

The use of such demonstrations is supported, for instance, by NUREG-1764 [Ref.12] and NUREG-0711 [Ref. 13], cited in NUREG-0800, Section 18.0 [Ref. 10]. NUREG-1764 [Ref. 12] states that "…[a] walkthrough of the human actions under realistic conditions should be performed… The scenario used should include any complicating factors that are expected to affect the crews['] ability to perform the human actions…" NUREG-0711 [Ref. 13] states that "…an integrated system design (i.e., hardware, software, and personnel elements) is evaluated using performance-based tests… Plant personnel should perform operational events using a simulator or other suitable representation of the system to determine its adequacy to support safety operations…"

For this criterion, some fire brigade training expectations from Appendix R, Paragraph III.I, have been extrapolated to apply to operator manual actions. Just as fire brigade training includes fire fighting practice and fire drills, the personnel performing operator manual actions must participate in a similar program of practice and drills for their actions under fire conditions. "Practice sessions shall be held for each shift [crew] to provide them with experience in [performing the operator manual actions] under strenuous conditions encountered [during the fire]. These practice sessions shall be provided at least once per year for each [operating crew]…[and] performed in the plant so that the [crew] can practice as a team." It is impractical for all the operating crews, unlike the plant fire brigades, to perform the operator manual action demonstrations within a 12-month training cycle. As an alternative, feasibility will be shown through time-authenticated demonstrations utilizing an established crew at a frequency that is consistent with the licensee's training program in compliance with 10 CFR 50.120 until all the crews eventually demonstrate all the credited actions. However, since only one crew actually performs the demonstration within a training cycle, additional considerations are needed to provide reasonable assurance that the credited operator manual actions can be performed reliably (i.e., repeated successfully by any crew at any time). Also, the demonstration cannot simulate all the conditions that might be encountered in an actual situation, making it necessary to extrapolate the demonstration to the expected fire conditions. These concerns are addressed via the time margin criterion.

Additionally, the importance of this criterion is also recognized in current inspection criteria for fire protection manual actions under the verification and validation criterion to determine whether the manual actions have been verified and validated by simulating the actions using the current procedure.

C.3 Additional Guidance for Meeting the Acceptance Criteria

The overall goal to be met for operator manual actions under Paragraph III.G.2 of Appendix R to 10 CFR Part 50 to be considered acceptable can be succinctly stated as follows:

"As long as licensees meet all the rule criteria for the actions (individually addressed below), they perform sound demonstrations of the actions at the plant (addressed below), they perform reasonably bounding calculations of the time available for the various actions (addressed below), and they can show that the time available relative to the time to perform the actions includes an appropriate time margin to address uncertainties (addressed below), then local operator manual actions in response to fire can be credited."

This section provides additional guidance for specifically meeting the acceptance criteria that are in the rule and summarized in Section C.1 above. As discussed in Section B regarding the scope of this regulatory guide, this guidance focuses on the *unique* aspects of the hazard involved (fire) and the potentially unique characteristics of subsequent manual actions during the operators' response.

C.3.1 Guidance Regarding the Time Line Showing Sufficient Time To Perform the Actions

For all the manual actions to be credited under Appendix R, III.G.2, the analyses must contain a time line or lines showing there is sufficient time to diagnose the need for the actions, travel to action locations, perform the actions, and confirm the expected response. An acceptable time line should have the following elements, as illustrated in Figure C.3-1:

(1) The time of fire detection (T_0), which begins the time line and represents the first indication that a fire may exist, or at least suspect that a fire has begun. Detection may be via alarms, indicators, an observation from a roving operator, etc.

(2) An expected diagnosis time (that is, the expected time to confirm the fire and determine its location). This time is to be obtained from the demonstration (see the demonstration criterion discussion later) and T_1, the end of the diagnosis time, is to be marked on the time line.

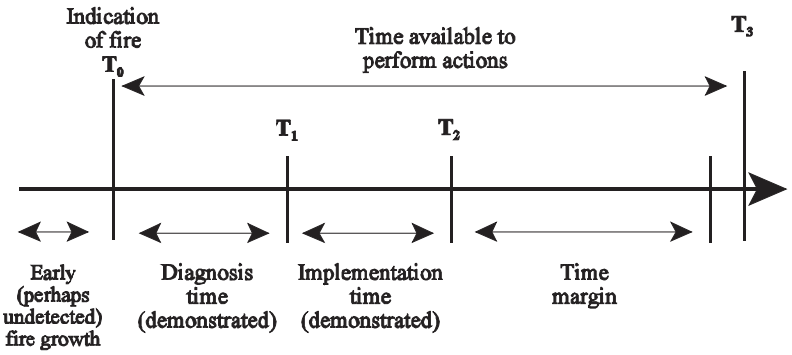

Figure C.3-1. A time line

(3) An expected implementation time that is the expected time to implement the desired action or actions. This time is to be obtained from the demonstration (see the demonstration criterion discussion later) and includes such activities as main control room staff pulling out the correct fire plan and procedures once the fire location is confirmed; informing the plant staff of the fire; calling for fire brigade assembly and actions; calling for and/or communicating with local staff responsible for taking the desired local manual actions; providing instructions to the responsible local staff for the manual actions; having the local staff collect any procedures, checking out communications equipment, and obtaining any special tools or clothing necessary to perform the actions; traveling to the necessary locations; implementing the desired actions (some actions may have to be done sequentially, i.e., cannot start until prior actions are completed)and communicating with the main control room staff or others as necessary, who in turn may be simultaneously dealing with the fire brigade, handling multiple procedures (EOPs and fire procedures), etc.; and telling the main control room staff and others as necessary that the actions have been completed and the expected effect has been achieved. The implementation time ends at T_2, as shown in the figure. Hence, the total time to be obtained from the demonstration begins at T_0 and ends at T_2.

Note that after the initial diagnosis time, subsequent actions may or may not include subsequent diagnosis times. For instance, in the case of performing proceduralized preventive actions, no other diagnosis time may be needed for some actions. Alternatively, if the desired action is a reactive action in the sense that it can be taken only after diagnosis of an undesired equipment status (e.g., loss of feedwater after a valve spuriously closes), then that diagnosis time needs to be included (e.g., deciding what action to take and by whom) as illustrated in Figure C.3-2. The time available (T_3) for these reactive actions will need to be measured from the worst-case point at which the equipment could be affected. In other words, since spurious effects caused by the fire could, in principle, occur at any time, licensees will need

to determine the point at which the least amount of time would be available to complete the reactive action and successfully restore the availability of the equipment. As illustrated in Figure C.3-2, the starting point for the reactive actions will not necessarily be tied to the time associated with detecting and diagnosing the fire (T_1 in the figures). The symptoms for the reactive actions will occur whenever the fire affects the relevant equipment, which could be before T_1 is reached or anytime after that point. Thus, to repeat, the time available for the reactive actions will have to be determined assuming the worst-case point for the spurious effects.

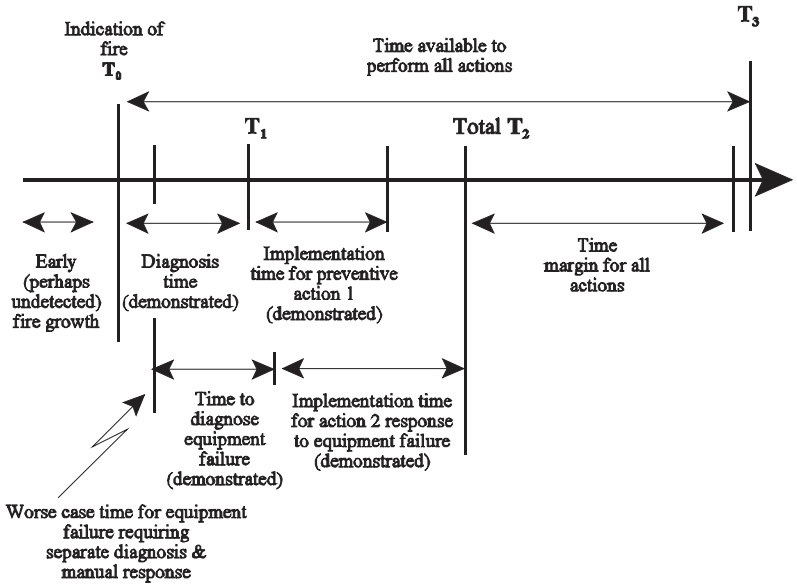

Figure C.3-2. Initial fire detection and multiple action (one action dependent on a separate diagnosis of an undesired equipment failure) with a single overall time margin and T_3

Another consideration is relevant to the case of preventive actions. If it is reasonably possible that the fire could negatively affect the relevant equipment before the preventive actions are completed, then the implementation time (T_2) should also include the time it will take plant personnel to take the reactive actions necessary to manually place the affected equipment in the desired state. In other words, when reasonable, licensees should assume the worst-case for the time to complete preventive actions, which in fact may involve reactive actions if the fire effects occur before the preventive actions are completed. This issue is addressed further in the guidance for performing the demonstration.

(4) An added "time margin" as discussed later under the time margin criterion.

(5) The time available for performing the actions to ensure hot shutdown can be achieved and maintained (T_3). To be acceptable, T_2 plus the time margin should be less than or equal to T_3.

The acceptability of the time margin and the demonstration are discussed in detail later. In calculating an acceptable T_3, the licensee must show that the available time is the most conservative (generally the shortest) time, considering the fire, its location and anticipated growth rate, the fire effects, and expected plant and operator responses to the fire effects, including thermal-hydraulic calculations as necessary. To determine the most conservative T_3, the analyst needs to consider what failures (including spurious events) may occur and when they may occur. For example, if it is most conservative to assume the equipment failure occurs at the quickest possible time for the fire being analyzed (which may be even before any preventive actions could be taken for the fire, requiring subsequent response-type actions instead), then T_3 should be based on that assumption. For instance, loss of the feedwater function is generally more severe if it happens early in the scenario than if it happens later after a period of successful decay heat removal. If instead it is most conservative to assume the equipment failure occurs at some later time in the scenario, that time should be assumed in deriving T_3 (e.g., if failure of service water to a diesel after the diesel has been running and loaded is more severe than before the diesel is demanded because the diesel could fail in 3 minutes without cooling, so that the operator would likely prevent diesel operation, thereby "saving" it for future use if service water is restored).

As shown in Figure C.3-3, when developing any time line showing multiple actions, any interdependence among actions need to be accounted for, such as when actions by one operator cannot start before another action or actions are completed by another operator, or when multiple actions are to be performed by a single operator who must travel to multiple locations to perform his/her assigned actions in a sequential manner, etc.

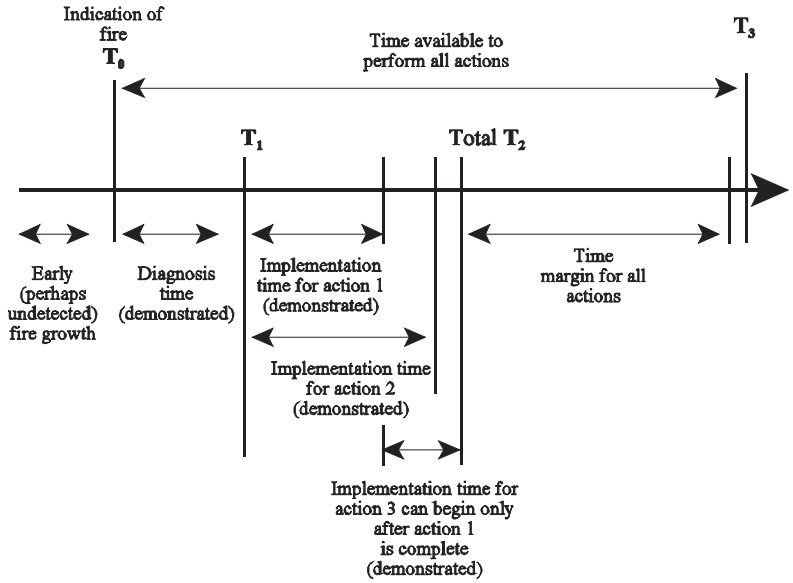

Figure C.3-3. Initial fire detection and multiple actions (one action dependent on completion of a prior action) with a single overall time margin and T_3

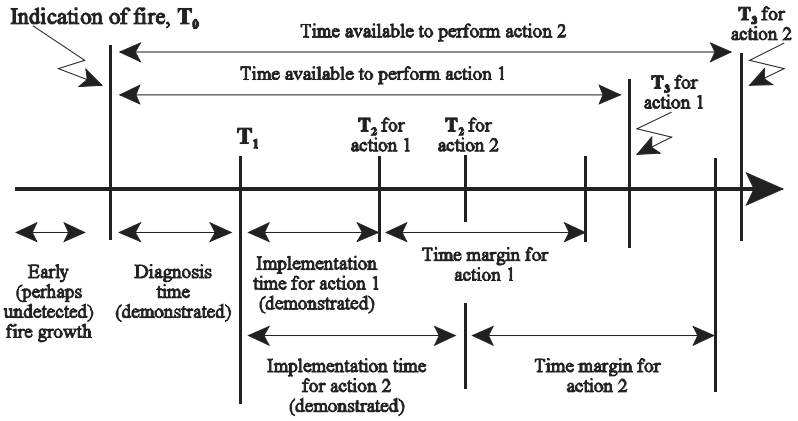

Figure C.3-4. Initial fire detection and multiple actions illustrating the application of multiple time margins and T_3s

Depending on the desired actions, one overall time margin or multiple time margins and T_3s (as illustrated in Figure C.3-4) may be necessary or appropriate to show that individual actions are performed before their specific analyzed T_3 times and that the collective set of actions to fully achieve and maintain hot shutdown are successfully performed considering the fire and its effects. Also, the licensee may wish to use a "most conservative" time line for a range of fires, locations, and effects (in which case the time line must envelop the needs of all the fires) or to develop separate time lines for different fire locations or even different fires in the same location.

Key inputs and assumptions associated with the time line should be evident in the analysis documentation.

C.3.2 Guidance Regarding the Time Margin

The main reason for including a time margin in the acceptance criteria is to help ensure that the operator manual actions can be performed reliably. If licensees can show (a) through well-thought out demonstrations that the actions are feasible, (b) that relatively conservative assumptions will allow extra time for the actions with respect to the fire scenario time line, and (c) that the actions meet all of the other acceptance criteria, then it is likely that unexpected delays can be absorbed and that the actions can be performed reliably.

This regulatory guide provides guidance for how to perform acceptable demonstrations, how to calculate acceptable time lines, and how to address the other relevant acceptance criteria. By assuming that an appropriate set of conditions will be adequately addressed in the demonstration, in the determination of the fire scenario time line, and in the other criteria, the NRC has determined that a factor of 2 time margin (or greater) would provide "a high confidence of a low probability of failure" for given operator manual actions in response to fire (see Appendix A for a discussion of the determination of the factor of 2 time margin).

The factor of 2 represents a consensus minimum based on the expert opinion elicitation discussed in Appendix A. There may be situations in which a value greater than 2 is appropriate (e.g., where the demonstration falls short of the guidance provided in this regulatory guide). The factor of 2 time margin is assumed to absorb delays that might be caused by the following set of factors (also listed in Section C.2.2).

(1) Factors that the licensee likely may not be able to recreate in the demonstration that could cause further delay under real fire conditions (i.e., where the demonstration would likely fall short of actual fire situations). For example:

- The need to recover from or respond to unexpected difficulties or random problems (i.e., not related to the fire), such as a stiff handwheel or a problem with a communication device.
- Environmental and other effects not easily simulated as part of the demonstration, such as radiation, smoke and toxic gas effects, increased noise levels (due to the fire and suppression equipment operation and personnel shouting instructions), water on the floor, fire hoses in the way, and too many people in the way.
- Limitations of the demonstration to account for (or envelop) all possible fire locations that may call for the actions, resulting in different travel paths and distances to where the actions need to take place. A similar limitation is that the location and activities of needed plant personnel at the time the fire starts could delay their participation in executing the operator manual actions (e.g., they may be on the opposite side of the plant and may need to restore certain equipment before being able to participate).
- Inability to execute relevant actions during the demonstration because of safety considerations while the plant is at power (e.g., personnel cannot actually handwheel the valve, can only simulate doing so).

(2) Typical and expected variability among individuals and crews that could lead to variations in operator performance (i.e., human-centered factors). For example:

- physical size and strength differences
- cognitive differences (e.g., memory ability, cognitive style differences)
- emotional response differences to the fire/smoke
- different responses to having to wear an SCBA to accomplish a task (i.e., some people may be less comfortable with a mask over their face than other people)
- differences in individual sensitivities to “real-time” pressure
- differences in team characteristics and dynamics.

The factor of 2 time margin is also intended to allow personnel enough time to recover from any initial errors in performing the actions. Since it is not realistic for licensees to model such recoveries in their demonstrations, it was determined that an adequate time margin would have to account for delays caused by recovering from mistakes. Thus, to ensure the acceptability of operator manual actions in response to fire, the NRC recommends that licensees show that the time available for actions is at least 100 percent greater than the time

obtained from the demonstration (hence the factor of 2 mentioned above). Assuming all other factors are met satisfactorily, providing such a time margin will allow the NRC to conclude that the desired manual actions are acceptable.

C.3.3 Guidance Regarding Environmental Conditions

Environmental conditions encountered by operators while traveling to and from action-related areas, accessing the areas, and performing the operator manual actions should be shown to be consistent with established human factor considerations, including the following:

- Emergency lighting shall be provided as required in Appendix R, Section III.J, or by the licensee's approved fire protection program.
- Radiation shall not exceed 10 CFR Part 20, Section 20.1201, limits.
- Temperature and humidity conditions shall not prevent successful performance of the operator manual actions or jeopardize the health and safety of the operator. Heat stress analysis should be performed as necessary.
- Smoke and toxic gases from the fire shall not prevent accessing the necessary equipment or hinder successful performance of the operator manual actions nor jeopardize the health and safety of the operator. Licensees should do a careful analysis of expected smoke and toxic gas levels to ensure that they will not affect performance.

If these environmental conditions are present where the relevant activities need to take place, the criterion will generally be easily met. However, several other issues also need to be considered:

- The donning and wearing of special gear such as SCBAs, fire suits, gloves, or other protective items to accomplish the operator manual actions in the fire-impacted environment can slow personnel down because of limited visibility or loss of manual dexterity and may hinder their ability to communicate effectively. Reliable communication may be essential if multiple personnel are involved. As discussed in Section C.3.11, if such special gear might be needed in order to successfully complete the operator manual actions, then the gear should be used during the demonstration to substantiate its effectiveness and its impact on the time to complete the actions. While it is possible to perform the desired actions by meeting in "clear" areas to communicate or by going to clear areas where communication devices are located, at a minimum, time delays during the response should be considered. Certainly such activities should be included in the demonstration if they are going to be used.
- Licensees should make certain that any special equipment related to environmental conditions, such as protective clothing or flashlights that might be needed for activities in especially dark areas, are staged in the area or else that personnel pick up the equipment in a common area per the relevant procedure. These types of activities should always be included as part of the demonstration and included in the time to complete the actions.
- Another concern is the potential effect of environmental conditions on personnel's mental state. Although it might be determined that the environmental conditions fall within acceptable limits with respect

to individuals' physical well-being, the licensee should ensure that none of the personnel expected to support the operator manual actions have specific fears associated with the actions (e.g., strong fear of fire or problems with wearing SCBAs). Relevant training in these areas should be conducted.

C.3.4 Guidance Regarding Equipment Functionality (Operability) and Accessibility

This criterion addresses the need to ensure that the equipment that is necessary to achieve and maintain post-fire hot shutdown is accessible, operable, and not damaged or otherwise adversely affected by the fire and its effects, so that the desired operator manual actions can be successfully performed per the applicable procedures and training.

In crediting the functionality (operability) of the equipment, the following should be considered:

- Consider unique fire effects (In addition to those normally encountered such as heat, smoke, water, combustible products), and spurious operation that may render the component inoperable by manual or remote manipulation.
- No credit for operator manual actions and the related equipment should be taken involving the use or manipulation of equipment located where it could be exposed to the fire and its effects. If crediting the use of equipment potentially exposed to the fire and its effect is necessary [and this should occur only in rare and exceptional circumstances (e.g., using equipment in an area well after the fire is extinguished)], the licensee should provide justification as to the continued operability of the component or components for the intended manipulation and use.
- All the needs of the equipment are to be met for the equipment to be "operable." For instance, if the operator manual actions involve the use of a switch and subsequent control signal to a component, the supporting electrical power and signals and associated cabling need to be operable. Further, if the equipment's functionality relies on certain supports (e.g., cooling, ventilation, power, air from a nearby tank, etc.) to be manipulated and continue to function (if needed) in the desired manner, those equipment support functions must also be functional and available.

Knowledgeable personnel must have adequate accessibility to all the necessary equipment and other aids (e.g., diagnostic indications, components to be manipulated, clothing, special tools, keys, procedures, communication equipment, etc.), and be able to readily locate the equipment and use or otherwise manipulate the equipment in the desired manner per the procedures and training under the anticipated range of fire-related conditions. Considerations in meeting the adequate accessibility criterion should include the following:

- the range of conceivable environmental conditions (see the environmental considerations criterion) under which the actions will be performed, especially radiation and fire-related conditions such as abnormal temperature, radiant energy, and smoke,
- physical access or manipulation constraints, especially for locations likely to be congested or where routine operations do not occur or for manipulations not normally performed
- the possibility that preferred access/egress routes may become inaccessible and alternate routes may need to be used
- the possibility that security doors or similar restraints could be physically or electrically affected by the fire

Consistent with guidance for equipment operability, no credit for operator manual actions should be taken in locations exposed to the fire and its effects except in justifiable rare cases.

An example of the type of functionality issue that should be considered was discussed in Section C.2.4 with regard to Information Notice 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire" [Ref. 14]. The information notice concerned motor-operated valves (MOVs). The bypassing of thermal overload protection devices (discussed in Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on MOVs" [Ref. 15]) could jeopardize completion of the safety function or degradation of other safety systems due to sustained abnormal circuit currents that can arise from fire-induced "hot shorts." Even if these overload protection devices are not bypassed, hot shorts can cause loss of power to MOVs by tripping the devices. If equipment (including cabling and other support needs such as power and cooling) that could be affected by the fire or its subsequent effects is to be used for operator manual actions, the licensee should determine that the operability and performance of that equipment will not be adversely affected so that the function can be successfully achieved by the manual actions.

C.3.5 Guidance Regarding Available Indications

Diagnostic indicating instrumentation should be among the equipment identified as needed to (a) enable the operators to determine which manual actions are appropriate for the fire scenario, (b) tell the personnel how to properly perform the manual actions, and (c) provide feedback to the operators to verify that the manual actions have had their expected results. The available indications should include those indications necessary to detect, and diagnose the location of, the fire. As part of the necessary equipment, indicating instruments should meet the operability and accessibility requirements provided in the proposed rule and guidance discussed earlier, especially in light of the possible harsher than-normal conditions in which the indications may need to operate. In addition:

- The available indications should be any that are needed, either in the main control room or in local areas, to meet a, b, and c above, including annunciators, indicating lights, pressure gauges, flow indicators, and local valve position indicators.
- A review to identify the needed indications should include where there are no alarms for potential spurious equipment operations nor any other compelling signal that the equipment status has changed and is detrimental to the safety functions (e.g., a valve shutting changes the indication of an open lit light to a closed lit light). In such cases, the operator is more likely to miss the change in status and, therefore, not respond to it. To the extent feasible, compensatory measures should be provided. For example, a local operator observes the equipment (part of the staffing requirement), or there are warnings in the procedure to watch for and frequently check specifically identified equipment status relevant to the fire.
- The available indications, where necessary, should be sufficiently redundant or diverse that the operators will suspect potential faulty indications as a result of the fire (such as may be caused by failure or spurious operation due to the fire or due to loss of power caused by the fire and the subsequent plant trip) and can determine the true plant status by viewing other indications or by getting other independent local operators to verify the suspect indication. Such redundancy and/or diversity considerations need to address where multiple indications could be affected by one spurious fault or failure, such as the loss of a common power supply or a cascading circuit (e.g., a faulty wide range reactor coolant system pressure signal will affect not only the pressure indication but also the subcooling indication because the signal is used to calculate subcooling). Such erroneous indications could be particularly troublesome since, taken together, they may appear appropriate.
- The indications should be maintained to ensure adequate configuration control and proper protection.

C.3.6 Guidance Regarding Communications

Adequate communications capability should be illustrated for operator manual actions that must be coordinated with other plant operations and personnel. Any necessary communications capability should be routinely and continuously available for all personnel involved in the actions and should be protected from the effects of a postulated fire. It should be noted that the unpredictability of fires can force staff to deviate from planned activities (hence, the need for constant, effective communications). In addition, communications permit the performance of sequential operator manual actions (where one action must be completed before another can be started) and provide verification that procedural steps have been accomplished, especially those that must be conducted at remote locations. More guidance on communications follows:

- For the fire and actions of interest, it should be shown that a potential fire will not damage or disable communications equipment (e.g., electrical interference, burning of cables), and that the ability of personnel to successfully use that equipment given other factors introduced by the fire (e.g., the need to wear protective clothing) will not be adversely affected.
- There should be confirmation that the desired means of communication will work in particularly noisy environments (best done by testing under the noisy condition).
- Personnel should have substantial training on activities that involve coordination and communication, including how to clearly state important information. Further, as the means of communication must be set up or otherwise made available, the time to do so should be considered in the time to implement the desired actions.
- As noted in other sections of this regulatory guide, the licensee should have shown the ability to communicate while wearing protective gear such as SCBAs during the demonstration.

C.3.7 Guidance Regarding Portable Equipment

Portable equipment is also needed for operator manual actions. Portable equipment, especially unique or special tools (such as keys to open locked areas or manipulate locked controls, flashlights, ladders to reach high locations, torque devices to turn valve handwheels, and electrical breaker rackout tools), can be essential to access and manipulate SSCs in accomplishing operator manual actions. Therefore, portable equipment should also meet the operability and accessibility requirements provided in the proposed rule as discussed earlier. The criteria for crediting the use of portable equipment are as follows:

- The portable equipment should be "staged" so that its locations are known by those who need to use the equipment, the locations are constant, and the equipment is readily available.
- The portable equipment should be under configuration control and it should be routinely verified that the portable equipment is indeed located where it is supposed to be and has not been misplaced or otherwise moved.

- Personnel should be trained to use the special tools and equipment in the planned application.
- If the use of the portable equipment may slow down action implementation, the delay should be considered in the time estimated (and subsequently included in the demonstration) to implement the desired actions.

C.3.8 Guidance Regarding Life Support Equipment

The necessary equipment must also include life support equipment as it is needed to successfully perform the manual actions and prevent harm to personnel. Such equipment could include protective clothing, gloves, and SCBAs. Therefore this component also needs to meet the operability and accessibility requirements and guidance discussed earlier. The criteria for crediting the use of life support equipment are as follows:

- Consideration needs to be given not only to the locations for the operator manual actions, but also to access and egress paths to and from the locations, considering the fire and its effects.
- The life support equipment should be readily available so that its locations are known by those who need to use it, and there will be no undue delay in obtaining and donning the life support equipment.
- Personnel should be trained to use the life support equipment in the planned application.
- If the use of the life support equipment may slow down action implementation because of limited visibility, loss of manual dexterity, making it difficult to communicate, etc., the delay should be considered in the time estimated (and preferably included in the demonstration) to implement the desired actions. Use of SCBAs, including any credit for communication while they are being worn, can only be credited if their capability has been illustrated by trained personnel. While it may still be possible to perform the desired actions by meeting in clear areas to communicate or by going to clear areas where communication devices are located, at a minimum, time delays during the response should be considered and such activities should be included in the demonstration if life support equipment is going to be used.

C.3.9 Guidance Regarding Procedures and Training

Procedures

To help ensure that operator manual actions are performed successfully, procedural guidance for the actions should be readily available, easily accessible, and contained in an emergency procedure. Operators should not have to rely on having adequate time to locate, review, and implement seldom used plant procedures to know when and how to operate plant equipment during a fire event. The procedures should accomplish the following:

- Assist the operators (usually in conjunction with indications) in correctly diagnosing the type of plant event that the fire may trigger, thereby permitting them to select the appropriate operator manual actions.
- Direct the operators as to which manual actions are appropriate to place and maintain the plant in a stable, hot shutdown condition for a fire in a given area.
- Minimize the potential confusion that can arise from fire-induced conflicting signals, including spurious actuations, thereby minimizing the likelihood of personnel error when personnel are performing the operator manual actions.

In addition, the written procedures should contain the steps of the manual actions, how and where they should be done, using what tools or equipment, and what kinds of personnel and how many are needed to accomplish them. For infrequently visited locations or when the fire or fire fighting activities might interfere with normal routes, directions for the most efficient ways to reach the action locations should be provided.

The procedural guidance, especially for the desired operator manual actions, should be as specific as possible (e.g., not just “align the train”) unless it can be justifiably claimed that the available guidance is sufficient for the ”average” operator with typical skill-of-the-craft to implement the guidance without step-by-step instructions. Such skill-of-the-craft should be illustrated on a periodic basis (see training section below).

Given the variety of conditions that can occur during a fire, the procedures should alert personnel to any potentially hazardous conditions that might be generated by fires in particular locations (e.g., expected hazards such as water on the floor caused by firefighting activities in nearby areas). Furthermore, during the development of the procedures, the licensee should try to identify any potential “informal rules” that might exist in the plant or biases that might be held by plant personnel about fire conditions and make sure they are addressed in the procedures and during training (e.g., conditions under which personnel should be concerned about interactions between water and electricity).

Due to the unusual demands that can be associated with a plant fire, it is possible that unrealized conflicts between procedures may exist. That is, certain conditions may make certain actions incompatible. In particular, operator manual actions taken earlier in a scenario may render actions to be taken later more difficult or inappropriate. Thus, the entire set of procedures that may be used during a given scenario should be reviewed for potential conflicts. Adequate demonstrations of the operator manual actions should help in revealing such conflicts. The review of procedures should watch for and address the following items:

- ambiguous, unclear, or non-detailed steps for the desired actions in the context of the sequence of interest
- situations in which the operators, under ceratin conditions, may have trouble identifying a way to proceed forward
- situations in which operators rely heavily on memory
- situations in which operators must perform calculations, especially in a rush

Talk-throughs with operations and training staff can be helpful in uncovering difficulties in using the relevant procedures.

Finally, there are special considerations for the two general types of operator manual actions in response to fire.

- In the case of preventive actions (i.e., actions that the licensee expects to take on the basis of the occurrence of a particular fire, without needing further diagnosis, in order to prevent spurious actuations or other fire-related failures), the procedures should be written to cover the possibility that the fire effects occur before the preventive actions are completed. For such cases, the procedures should direct the operators to verify equipment state and position and manually align the equipment as necessary to reach safe shutdown.
- For reactive or symptom-based actions (that is, actions taken by plant staff during a fire in response to an undesired change in plant status when the staff must diagnose the need for the actions), relevant procedures should clearly describe the indications on which the actions should be initiated. If redundant cues are available, they should also be addressed in the procedure to aid the operators when the fire causes spurious effects. Crews should be aware that the cues for such actions can, in principle, occur at any time during a fire. If necessary due to timing considerations, such actions may need to be made “continuous action statements” in the fire procedures.

Training

Since plant procedures must include operator manual actions credited to achieve and maintain hot shutdown, each operator must be appropriately trained on those procedures. Training on the procedures should accomplish three goals:

- Establish familiarity with the procedures, equipment/controls, and potential (simulated) conditions in an actual event, including the necessary indications and human-machine interfaces.
- Provide the level of knowledge and understanding necessary to prepare the personnel performing the operator manual actions to handle departures from the expected sequence of events.
- Give the personnel the opportunity to practice their response without exposure to adverse conditions, thereby enhancing confidence that they can reliably perform their duties in an actual event.

Such training should involve both classroom activities and related plant exercises. In addition to initial and regular training on the actions, since acceptable demonstrations are one of the criteria that must be met in order to credit operator manual actions and they must be performed under as realistic conditions as possible, each operator should participate in the periodic demonstrations with a frequency consistent with that established by the licensee in compliance with 10 CFR 50.120. It is important that personnel practice the full set of actions, including interacting with the main control room crew while they are performing the related activities in the simulator. In other words, participating in as complete as possible a simulation of the fire scenario should be part of training.

There are several areas in which special (but not unusual) training will be needed to support operators' ability to complete the manual actions:

- All plant personnel that may need to wear protective clothing to perform the actions should receive training in donning the clothing, traveling to the action locations while wearing the clothing, and conducting the relevant actions while wearing the clothing.
- Personnel should train on the use of SCBAs and should practice all aspects of the relevant operator manual actions while wearing the SCBAs. They should wear the SCBAs for as long as the SCBAs would be needed in an actual fire.
- If communication among personnel is necessary to accomplish the actions, the communications should be part of the training on the actions and should be practiced under as realistic conditions as possible (e.g., at the expected noise levels). The personnel should also be well trained on the range of communication equipment that might be necessary. In addition, licensees should provide guidance and practice on how to best state the relevant information to be understood.

- Along similar lines, if personnel must work as a team to accomplish certain actions, they should be given guidance on how to perform effectively as a team to achieve the particular actions and they should practice the actions as a team. Since it is unlikely that "fixed" teams will always be available for specific actions, individuals should have the opportunity to train on the range of activities to achieve the actions.
- The training should include any technical knowledge regarding fires that will be important to ensure adequate response to the fire scenario.

The training program on the use of operator manual actions and associated procedures during a postulated fire should be shown to be in effect, current, and adequate. Training on the desired actions should be done in a classroom context on a regular basis consistent with other types of operator training during the licensee's regular plant training cycle. With a frequency consistent with that established by the licensee in compliance with 10 CFR 50.120, the licensee should conduct time-authenticated demonstrations of the actions with established crews of operators, showing that the manual actions needed to achieve and maintain the plant in a hot shutdown condition can be accomplished under conditions closely resembling those anticipated in a real fire event.

Note that if it is assumed that "skill-of-the-craft" will be adequate to ensure performance of certain actions, then that skill should be illustrated on a periodic basis.

C.3.10 Guidance Regarding the Staffing Criterion

To meet the staffing criterion, it is important that the persons involved in performing the operator manual actions be numerous enough and sufficiently qualified to collectively perform the desired actions to achieve and maintain hot shutdown in the event of a fire. Per the rule:

- These persons are to be on site at all times.
- Individuals performing the operator manual actions need to be exclusively dedicated to the performance of the manual actions during a fire.

Acceptable staffing largely depends on the activities that need to be performed in accordance with the time line analysis discussed earlier. Besides the above rule requirements, the following should be considered in determining the acceptability of the staffing for the performance of operator manual actions:

- The number of persons should be sufficient to meet the workload assumed in the time line analyses and, as shown under the demonstration criterion, successfully achieve and maintain hot shutdown. Decisions about staffing levels should take into account all of the operator manual actions that are expected in a particular fire scenario. Since different scenarios may involve different sets of operator manual actions, staffing levels should meet the worst-case scenario in terms of the number of staff needed to meet the time line requirements.

- The staff should be trained and qualified in their assigned duties for performing the operator manual actions. This should be performed per the licensee's normal training practices and include special considerations given the desired actions will need to be carried out during a fire (see the procedure and training criterion). Special considerations may include verification of the availability and reliability of instrumentation and equipment, assessing damage to equipment, de-energizing critical equipment to protect it, re-energizing buses, manually manipulating equipment that normally is automatically controlled, implementing fire-specific procedures (including important plant site and offsite notifications), assisting or supporting firefighting activities, and potentially dealing with injuries to plant personnel.
- No single individual should have task assignments nor a task load that results in excessive physical or mental stresses, nor coincident tasks that unduly challenge each person's ability to perform the desired actions in the analyzed times under the range of reasonably anticipated conditions. Licensees should be able to defend their assumptions regarding the ability of the relevant staff to perform under the expected conditions.

C.3.11 Guidance for How To Perform an Acceptable Demonstration

The acceptance criterion for operator manual actions in response to fire is that "periodically (consistent with that established by the licensee in compliance with 10 CFR 50.120), the licensee shall conduct time-authenticated demonstrations of the relevant actions, utilizing an established crew of operators to show that manual actions required to achieve and maintain the plant in a hot shutdown condition can be accomplished consistent with the analysis…"

An important purpose of the demonstration of the actions per the acceptance criteria and showing that they can be completed in the time available is to document the feasibility of the actions. However, for the demonstration to be valid, it must be conducted under conditions that are as realistic as possible. Of course, it is clear that in spite of licensees' best efforts, there may be conditions that are very difficult, if not impossible, to simulate. This is one of the reasons the time margin was developed (i.e., to provide a way to account for potential shortcomings in the ability of licensees to adequately simulate the actual plant conditions during the demonstration).

The validity of the time margin relies on an acceptable demonstration being performed, along with an acceptable time line analysis and adequate consideration of the remaining criteria. This section provides guidance on what must be considered and how to ensure that an acceptable demonstration is done.

One of the first steps of performing an acceptable demonstration is to ensure that all relevant aspects of the other acceptance criteria are met and that the important characteristics of those criteria are included in the demonstration to the extent possible. In other words, all aspects that could influence the outcome of the actions should be included in the demonstration if it is reasonable to do so. Things to consider under each of the criteria are discussed below.

Before proceeding, it should be noted that, to the extent possible, an entire accident scenario should be simulated for the demonstration, including all the expected main control room activities, if the response to the fire is expected to credit operator manual actions. More details on the nature of the simulation are given below.

Furthermore, as will be discussed in the section on developing a time line, all actions associated with detecting and diagnosing the presence of the fire (T_1) and diagnosing the need for and executing the relevant manual actions (T_2), should be timed during the demonstration. Obviously, this information will be important in determining whether there will be enough time available to perform the actions.

Environment

Once it is determined (per the guidance in this document) that the relevant actions will be possible under the environmental conditions expected to be present in the areas which operators will have to go to complete the actions, as well as in the locations of the actions, then those conditions should be simulated to the extent possible. For example, the following conditions should be simulated in all relevant areas, including areas through which the operators may have to travel:

- The lighting levels expected to be present during the actual fire
- If the environmental conditions are assumed to involve the use of SCBAs at any time in the scenario, then they should be donned and worn during those periods.
- If protective clothing will be needed at any time, it should be donned and worn during those periods.
- If SCBAs may be needed, then any communications anticipated during those periods will need to be simulated when the SCBAs are worn. Personnel who use SCBAs must receive training in their use.
- The noise levels expected to be present during the fire scenario

Equipment Functionality (Operability) and Accessibility

Accessibility to the relevant systems and equipment is necessary to enable the personnel to perform the operator manual actions. To the extent possible, the personnel participating in the demonstration should literally carry out the actions if the actions can be done without affecting the safety of the plant (e.g., manually open a valve with the handwheel). If the demands of the task and the time to complete the actions must be based on the judgments of plant personnel, then a process should be used to help ensure that the estimates are reasonable (e.g., get multiple independent judgments). A preferred approach is to obtain estimates of the time to execute specific actions when safety is not be a concern (e.g., during shutdown or when the system is out of service for some reason).

In addition, if the plant history indicates that certain equipment tends to have persistent types of problems (e.g., a tendency for valve hand wheels to be stiff), then those conditions should be assumed for the demonstration and not “pre-conditioned” solely for the demonstration.

Available Indications (and Main Control Room Response)

In conducting the demonstration, to the extent possible the actual effects of the fire conditions should be simulated in the plant training simulator and the operators should diagnose the need for the relevant actions based on the expected pattern of indications. In other words, the presence of the cues needed to detect the fire should be simulated, and the crew should have to respond accordingly. The main control room response to the scenario should be the same as during an actual fire. The main control room crew should enter the relevant procedures based on the expected indications and take the necessary steps to respond to the fire and reach safe shutdown. The parameters indicating the need for the operator manual actions in response to the fire should also be simulated, and the crew should have to summon the staff necessary for the manual actions, retrieve the relevant procedures, provide the necessary guidance, and interact with the individuals as necessary while they complete the actions for the demonstration. In addition, the personnel executing the actions should have to check relevant indications of successful completion of the actions and verify completion. These indications should be accurately simulated to the extent possible.

All aspects of the scenario associated with diagnosis and the execution of the actions should be timed. This will provide information relevant to determining the time to diagnose the need for the actions (T_1) and the time needed to implement the actions (T_2). If any aspects of the scenario cannot be simulated, their potential impact on the time should be estimated.

Communications

The communications necessary to complete the operator manual actions should be part of the demonstration. This should include communications necessary from the detection of the fire through completion of the actions. Examples of conditions that should be included in the demonstration include the following.

- If it cannot always be assumed that the personnel expected to perform the actions will be in the control room at the time they will be needed, then worst-case scenarios for where the personnel might be with respect to being able to communicate with the control room should be included in the demonstration. If personnel might be in areas where someone would have to be sent to go get them, then this activity should be simulated.
- If personnel must be able to communicate with each other and with the control room, then those communications should be part of the demonstration.

Portable Equipment

Any portable equipment that will be needed to conduct the operator manual actions during a real fire should also be accessed and used to the extent possible during the demonstration. Portable equipment includes unique or special tools, such as keys to open locked areas or manipulate locked controls, flashlights, ladders to reach high places, torque devices to turn valve handwheels, and electrical breaker rackout tools. Such equipment should be located where it would be expected to be located during a real fire. The equipment should not be gathered together and made easily accessible just for purposes of the demonstration (i.e., no "pre-conditioning").

Life Support Equipment

Similar to the portable equipment noted above, any life support equipment such as protective clothing, gloves, and self-contained breathing apparatuses (SCBAs) should be located, accessed, and donned as during an actual fire.

Procedures and Training

All activities associated with the use of procedures should be addressed in the demonstration, including the following:

- detection of the entry conditions for the procedures
- their retrieval
- the potential need for multiple copies
- usability of the procedures under the expected condition (e.g., lighting levels, a place to put them during their execution if they must be closely followed)

In addition, if training on the actions occurs only periodically, then variability in terms of how recently a crew received training should be considered in selecting participants for the demonstration (i.e., the most recently trained crew should not automatically be selected for the demonstration, as this could be considered pre-conditioning).

Staffing

All staff that will have duties associated with successful completion of the actions (including diagnosis and execution of the actions) should participate. Staffing issues such as the following should be considered in the demonstration:

- If personnel will have to be summoned from outside the main control room, the worst reasonable case in terms of how long it will take them to get to the control room should be assumed for the demonstration. To the extent possible, licensees should consider the potential for the personnel to be in remote locations from which it is difficult to egress and that the personnel may have to complete some actions before they can leave an area. These considerations should be included in the demonstration.

- If the actions will involve multiple staff in certain sequences, then these activities, their coordination, and their associated communication aspects should be included.
- If the main control crew is likely to be directing and coordinating multiple teams involved in executing manual actions, these activities should be simulated. Furthermore, if the individuals in the main control room coordinating these activities will have other significant responsibilities, those responsibilities should also be simulated.

Other Aspects Important to the Demonstration

There are several other important issues or aspects that licensees should consider in conducting an acceptable demonstration:

- If the operator manual actions being examined are preventive actions and it is reasonably possible that the fire could negatively affect the relevant equipment before the preventive actions are completed, then the participating personnel should verify equipment state and position and manually align the equipment as necessary. Thus, the implementation time (T_2) for the actions will include the time it would take plant personnel to complete the reactive actions necessary to manually place the affected equipment in its desired state.
- If the operator manual actions being examined are reactive actions, then the licensee should be aware that the cues for the need for such actions and the associated effects could, at least in principle, occur at any time after the fire starts. Thus, the effects could occur early, during the diagnosis stage of the scenario, or sometime after that. For purposes of the demonstration, licensees should try to determine when the worst-case timing for the occurrence of the spurious fire effects on the relevant equipment would be with respect to the level of activity in the main control room and the plant in general. Other factors to consider are the decay heat levels present and potential interactions with and effects on other equipment.
- If the fire or other factors could affect where personnel have to travel (e.g., what routes they have to take) and where they have to enter various rooms, then reasonable worst case effects should be modeled in the demonstration.
- If the conditions that could be generated by the fire have the potential to vary significantly, in general the worst reasonable case should be included in the demonstration.
- If smoke could significantly affect visibility, the action should not be credited.

To perform an acceptable demonstration, in general licensees should strive to make the demonstrations as realistic as possible and make conservative assumptions as necessary. If this is done and the above guidance is followed, then the resulting demonstrations, in conjunction with the time margins, should help achieve the goal of crediting only feasible and reliable operator manual actions.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this draft regulatory guide. No backfitting is intended or approved in connection with the issuance of this guide.

The NRC has issued this draft guide to encourage public participation in its development. Except when an applicant or licensee proposes or has previously established an acceptable alternative method for complying with specified portions of the NRC's regulations, the methods to be described in the active guide will reflect public comments and will be used in evaluating (1) submittals in connection with applications for construction permits, design certifications, operating licenses, and combined licenses, and (2) submittals from operating reactor licensees who voluntarily propose to initiate system modifications that have a clear nexus with this guidance.

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REGULATORY ANALYSIS

TBD

BACKFIT ANALYSIS

TBD

APPENDIX A

SUMMARY OF EXPERT OPINION ELICITATIONS TO DETERMINE TIME MARGINS FOR OPERATOR MANUAL ACTIONS IN RESPONSE TO FIRE

(April 1–2 and May 4–5, 2004)

A.1 Introduction

This appendix summarizes the results from two expert opinion elicitation meetings held at NRC headquarters in Rockville, Maryland, to develop quantitative criteria to support the operator manual actions rulemaking [Ref. 1]. The NRC has developed these criteria to ensure that *feasible* operator manual actions could also be accomplished *reliably*, even when considering different levels of complexity, number of actions, etc. Based on an initial meeting held on January 22-23, 2004, among NRC staff and contractors to discuss potential options for quantitative criteria, it was agreed that the use of "time margins" was appropriate as a surrogate for ensuring a high reliability in the credited local operator manual actions. As a result of that meeting, a plan was implemented to derive the best approach for providing defensible time margins.

The basic idea was to identify a time margin (or margins) for fire-related operator manual actions to ensure that they would be successful a very high percentage of the time (i.e., there is a high confidence of a low probability of failure). In other words, if the licensee can meet all of the operator manual action acceptance criteria, which includes showing in a demonstration that at least one randomly-selected, established crew can successfully perform the actions, and show that the actions can be performed within an acceptable time frame that allows for adequate time margin to cover potential variations in plant conditions and human performance, then the operator manual action rule would be met. For example, as long as the licensee can show there is an "X-percent" time margin to perform a particular set of operator manual actions (e.g., the actions are shown during the demonstration to take less than 15 minutes, but even if they were assumed to take 30 minutes [or 100-percent time margin], plant damage or an undesirable plant condition will still be avoided) and all of the other criteria have been met, then we can be confident that the actions can be done reliably. Another approach may be to add a prescribed time (e.g., "Y" minutes) to the time obtained in a demonstration of any actions as a means to produce the desired increase in reliability.

The use of the time margin concept involves the derivation of appropriate time margins and a technical basis to support them. While the best technical basis would be empirical data from which the time margins could be derived, a database search was unable to find relevant data that could be used directly or generalized to the operator manual actions of interest. One potential exception was ANSI/ANS Standard 58.8 [Ref. 2], which addresses time response design criteria for safety-related operator actions. However, it was determined that the data in ANS 58.8 relevant to operator manual actions were limited and too broad to generalize well, they were probably overly conservative for most of the types of fire-related operator manual actions being considered, and they lacked clear and sufficient technical basis for our purposes.

Note that just one time margin was not necessarily being advocated; that is, the time margin could vary with the fire scenario, such that different margins may apply to different cases, regardless of whether the margins are measured in absolute (e.g., minutes) or relative (e.g., percent) time. Since varying time margins would most likely depend upon considerations such as fire frequency, magnitude, and consequences, this could be viewed as a form of "risk-informing" the criteria.

Thus, it was decided that an expert panel would be convened and that a facilitator-led, expert judgement process following the Direct Numerical Estimation approach discussed in NUREG/CR-2743 [Ref. 3] and NUREG/CR-3688 [Ref. 4], in conjunction with the guidance and examples found in NUREG/CR-6372 [Ref. 5], would be used to identify the appropriate time margins. The premise is that experts in the areas of nuclear power plant safety, risk assessment, inspection, fire safety and analysis, fire-related plant operations, human factors, and human reliability analysis could, in the context of a structured expert opinion elicitation process, make reasonable estimates of appropriate time margins.

A.2 First Expert Elicitation Meeting

A panel of six experts met at the NRC in Rockville, Maryland, on April 1 and 2, 2004. One week prior to the meeting, each expert was provided with a description of the goals of the meeting, which discussed many of the issues that would be addressed to generate the desired time margins.

A.2.1 Expert Panel and Qualifications

The six experts were as follows:

(1) A Team Leader, Plant Engineering Branch, Division of Reactor Safety, in Region IV of the NRC; also serving as a project manager and inspector (covering plant engineering and maintenance) for the NRC over the past 14 years.

(2) A Reliability and Risk Engineer in the Probabilistic Risk Analysis Branch in the NRC Office of Nuclear Regulatory Research (RES); formerly a Principal Engineer (Supervisor) and Senior Reactor Operator at a commercial nuclear power plant licensee.

(3) A Senior Level Advisor for Probabilistic Risk Assessment, Division of Systems Safety and Analysis, NRC Office of Nuclear Reactor Regulation (NRR); formerly a Project Manager in the Energy Risk and Reliability Department at a contractor for the nuclear power industry.

(4) A principal of an independent contracting firm, especially contracting to Sandia National Laboratories, and recognized expert in the probabilistic analysis of fire and flood risk for nuclear and non-nuclear facilities; also a published author of numerous articles on this subject.

(5) An Engineering Psychologist in NRR/NRC with expertise in the area of human factors for more than 20 years; also serving as an NRC human factors expert on a national standards development committee in the area of Human Reliability Analysis.

(6) A Senior Operations Engineer in NRR/NRC; formerly an NRC inspector for 20 years, starting as a region-based construction and fire protection inspector and including 8 years as a resident and senior resident at pressurized-water reactors (PWRs).

A.2.2 Summary of Topics Discussed During the First Meeting

Much of the first day, the discussion among the expert panel members and other meeting participants from NRR, RES, and RES contractors, including the elicitation facilitators, covered the following topics:

(7) What is this expert opinion elicitation all about?

(8) What are the operator manual actions for which we are considering time margins?

(9) What are the human performance influences that should be accounted for by the time margins?

(10) What empirical data or other expert knowledge or experience may be relevant to developing the time margins and their bases?

(11) How will the elicitation process work?

A.2.2.1 *What Is this Expert Opinion Elicitation All About?*

With regard to topic 1, it was agreed that the overall goal was to derive time margins that would provide reasonable assurance that local operator manual actions in response to fire, in general, can be achieved with a high confidence of a low probability of failure (e.g., 95 percent confidence of a 0.01 failure probability). While it was thought that specific numerical goals on confidence and probability were not practical, the experts were easily able to understand the intent of what we wanted to achieve. Further, so that all the experts' conception of the time margin was the same, the "model" shown in Figure A-1 was agreed upon as generally representative of the time margin concept.

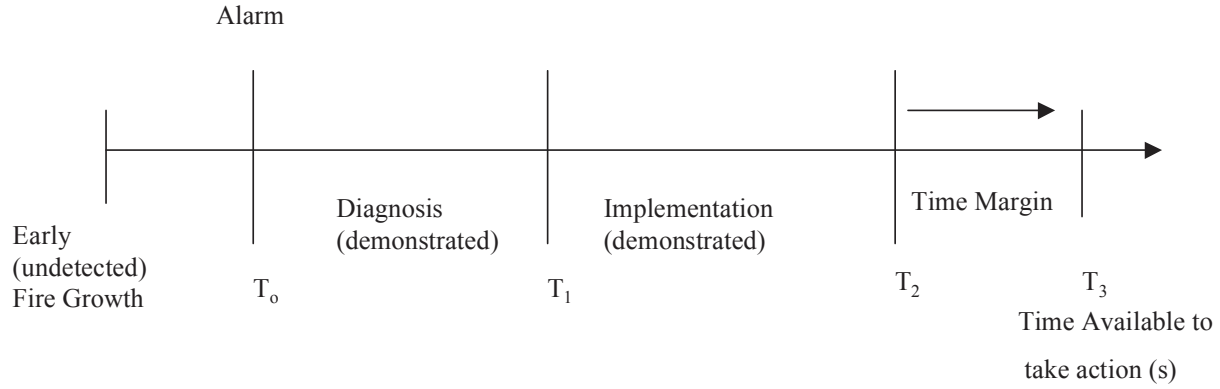

Figure A-1. Conceptual illustration of a time margin

A.2.2.2 *What Are the Operator Manual Actions for Which We Are Considering Time Margins?*

There was much discussion on topic 2. In particular, while it was agreed that we were addressing local (ex-control room) operator manual actions in lieu of meeting the current requirements of Appendix R, Section III.G.2, there was confusion as to whether only licensee preventive actions were included or whether licensee symptom-based response (reactive) actions were also included. Further, there were clearly some differences in opinion as to when an action is a "repair." Preventive actions are those which, upon entering a fire plan/procedure, the licensee expects (without needing further diagnosis) to take to prevent spurious actuations or other fire-related failures so that adequate equipment is protected and safe shutdown can be achieved. Reactive actions constitute those taken by a licensee during a fire in response to an undesired change in plant status and for which there is more of an element of detection of the undesired plant status and a diagnosis as to the correct actions to be taken. Further, there is precedence that repairs not be allowed for achieving hot shutdown.

While the expressed differences were not completely resolved, it was agreed that, in general, the following types of actions were *illustrative* of the types of actions we were concerned about:

- pulling fuses
- disconnecting power leads
- performing breaker manipulations (e.g., tripping, opening drawers, closing, changing switch positions) related to buses as well as individual loads such as valves, pumps, fans
- opening/closing/throttling of valves (e.g., with local switches, governor devices, handwheels)
- starting/stopping equipment, such as pumps and fans by either local switches/pushbuttons or breaker control
- installing jumpers or temporary power cables
- verifying or monitoring plant equipment or parameter status (and taking other actions as may be necessary based on these monitoring activities)

It was not the intent of this panel to define specifically what actions would or would not be allowed per the rulemaking. Therefore, the list above should not be construed as a list of acceptable operator manual actions. Nevertheless, it was agreed that the list was useful to generally define the typical kinds of actions for which time margins were to be considered, and that at least for purposes of the elicitation, both preventive and reactive actions would be addressed.

A.2.2.3 *What Are the Human Performance Influences That Should Be Accounted for by the Time Margins?*

With regard to topic 3, a number of observations were made. First, the rulemaking staff offered the following suggestions for the criteria:

- It should perhaps be made clear that the Available Indications criterion includes those indications necessary to detect and diagnose the location of the fire.
- It should perhaps be made clear that the Staffing and Training criterion allows both operators and maintenance staff to be involved as long as they are trained to take the desired actions.
- It should perhaps be made clear that the Communications criterion not only specifies that the communications systems must be adequate, but also that they must be readily available.
- It should perhaps be made clear that the Portable Equipment criterion specifically notes that such equipment includes what would be commonly referred to as "tools," such as keys, ladders, flashlights, gloves, and that these should be "staged" so that their locations are known and constant.
- It should perhaps be made clear that the Procedures criterion requires the use of *controlled* procedures.
- It should perhaps be made clear that, when multiple procedures will be required to be used simultaneously during a real fire (e.g., emergency operating procedures [EOPs] and the fire procedures), their simultaneous use will need to be part of the Demonstration of operator manual actions in response to fires.

The staff offered these suggestions because it was clear that, in order to reasonably bound what the time margin was to account for, it was desirable that the other criteria be as specific and encompassing as possible. In this way, the time margin did not have to address potential inadequacies in meeting the other criteria and could focus on just those likely differences between what is expected in a typical demonstration of the actions vs. what might be experienced in a real fire situation (this became the basic premise for the time margin).

With this basic premise for the time margin, the discussion further elaborated upon what the time margin needed to account for. Three possibilities were considered:

(1) The time margin should account for what the licensee is not likely to be able to recreate in the demonstration that could cause further delay (i.e., where the demonstration falls short). Examples include:

- Random problems (i.e., not related to the fire) with instruments, indications, or other equipment such as a stiff handwheel or faulty communications device.

- Environmental and other effects not easily included in the demonstration, such as smoke and toxic gas effects, increased noise levels due to the fire (e.g., alarms), water on the floor, fire hoses in the way, or too many people getting in each others way.
- Limitations of the demonstration to account for (or envelop) all possible fire locations where the operator manual actions are needed, resulting in different travel paths and distances to these locations. A similar limitation concerns the location and activities of needed plant personnel at the time the fire starts that could delay their participation in executing the operator manual actions (e.g., they may be on the opposite side of the plant and may need to restore certain equipment before being able to participate).
- Inability to execute relevant actions during the demonstration because of normal plant status or safety considerations while at power.

(2) The time margin should account for the fact that fire and related plant conditions can vary (e.g., fast energetic fire failing equipment quickly vs. slow-developing fire with little or no equipment failures for some time, variable fire detector response times and sensitivities, variable air flows affecting the fire and its growth, specific fire initiation location relative to important targets, presence [or not] of temporary transient combustibles, possible communication problems in some fires or in some noisy areas).

(3) The time margin should account for the typical variability in human performance among individuals and among different crews and for the effects of human-centered factors that could become relevant during fire scenarios, such as stress, issues related to human factors and ergonomics (e.g., height at which task is performed), time pressure, and fear of fire. Examples include:

- physical size and strength differences
- cognitive differences (e.g., memory ability, cognitive style differences)
- emotional response to the fire/smoke
- response to wearing a self-contained breathing apparatus (SCBA) to accomplish a task (i.e., some people may be very uncomfortable with masks over their faces)
- individual sensitivity to real-time pressure
- team characteristics

Further, it was agreed that these items did need to be part of the time margin for the following reasons:

- They address likely shortcomings of the demonstration (e.g., operators may not actually do the demonstration while wearing SCBAs or they may not perform the demonstration with full replication of environmental conditions, such as propagation of water on the floor into the rooms where the actions are to take place as a result of suppression system actuation in the room with the fire). [*It was felt such shortcomings could result in potentially significant differences between times for actions during a demonstration and the times during real fires.*]
- The demonstration can attempt to replicate only a small subset of all possible fires and resulting variability in fire and plant conditions (see examples cited under item 2 above), some of which could be worse than assumed in the demonstrations. *[It was felt such variability could result in potentially significant differences between times for actions during a demonstration and the times during real fires.]*
- It was recognized that some degree of human performance variability is to be expected, some of which could further delay the times to perform the desired actions during real fire situations. [*It was felt such variability needed to be estimated and included in any derivation of time margins.]*

Beyond this, it was agreed that the illustrative influences provided below, considering the categories mentioned above, were indeed representative of the influences that should be accounted for in the time margin.

- wearing SCBAs to complete the actions, which could affect performance in many ways, including the ability to communicate, etc. (use of SCBAs is not explicitly addressed by the rule criteria)
- substantial amounts of water on the floor from fighting the fire
- visibility problems due to smoke that is worse than assumed by the licensee for the location of a given set of actions
- individual differences in the psychological effects of having to perform actions in proximity to a fire (even if the fire is not, in reality, physically threatening)
- inability to perform all of the sub-actions related to an "action" during a demonstration (e.g., the plant was "at-power" during the demonstration and certain actions could not be completely conducted while maintaining safety)
- time pressure (not sensed during demonstrations)
- the presence of less experienced staff, even though trained
- the need to identify alternate routes to and from the location of the operator manual actions because of the fire and its effects

- unexplained or unexpected equipment problems, e.g., a stuck handwheel, failures in communication equipment, misplaced tools, loss of lighting, loss of instrumentation
- shortcomings in training not revealed during the demonstration
- inaccuracies in procedures for certain unique situations not previously identified (i.e., simply not thought of and not detected during the demonstration because the actual process could not be fully conducted)
- cases where the fire is larger than expected and less time is available

Further, it was agreed that there could potentially be delays in either or both the diagnosis and decision to execute operator manual actions in response to fire as well as in the implementation of the desired manual actions; hence both effects should be considered when deciding on appropriate time margins.

While there was some discussion about how the analyzed time available (T_3) could be ascertained when it cannot be precisely known when a spurious or other fire-induced failure might occur, those discussions are not reproduced here since it was agreed that concerns about the appropriateness of T_3 (particularly as related to how to measure the time available for preventive actions) were not critical to the specific task before the experts. That is, determining the relevant time margins does not depend on the calculation of T_3.[7]

A.2.2.4 *What Empirical Data or Other Expert Knowledge or Experience May Be Relevant to Developing the Time Margins and Their Bases?*

Regarding topic 4, literature searches of easily available sources (only a short-time frame was available prior to the first elicitation) were performed in preparation for this meeting to seek any additional information that may be helpful to establish defensible time margins. Unfortunately, little was found. The following observations are provided to the extent they may be useful, but none of them are directly relevant to how to derive an appropriate time margin.

Actual events, recent inspections, and analytical processes suggest that, in spite of attempts to anticipate actual fire conditions and their effects, and then provide procedures, training, tools, communication devices, etc., so as to be able to perform the necessary or desired actions within expected time periods, the times to actually take the actions are often longer than prejudged estimates. The panel was prepared to discuss examples of this as may be desirable during the meeting. In some cases the difference between the actual time to perform the actions and the estimated time to take the actions has been small.

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[7] But the time margin is certainly relevant when evaluating whether the operator manual actions satisfy the time line determined by T_3.

However, in extreme cases as high as a threefold increase has been observed (i.e., it was estimated the actions could be taken within 30 minutes and the somewhat realistic time from a demonstration took nearly 90 minutes) for complex actions such as aligning, starting, and controlling a whole train of an injection system. In NUREG/CR-1278 [Ref. 6], it is noted that judgmental estimates are often low compared with actual times and that *a factor of 2 difference should not be unexpected*.

The above observations should be moot from our standpoint since the actions and their execution times are supposed to be obtained using the demonstration criteria. That is, the differences between judgmental estimates and times from the demonstration should not be an issue. Nevertheless, the above findings indicate that there may be time-delaying factors that are difficult to foresee, especially when other things can (and often do) go wrong. Thus, to the extent that the times from the demonstrations are still not entirely representative of all relevant actual fire situations (and demonstrating the actual times may be difficult, if not impossible, to achieve), it should not be surprising that the real times may still be even longer than what is obtained in a demonstration.

It was also observed that with regard to assessing risk significance, NEI-00-01 [Ref. 7] cites potential types of scenarios that should not be screened out as unimportant during the preliminary screening step of the guidance. Such a scenario includes one involving operator actions where both time is short (less than 1 hour) and the estimated time to perform the actions is greater than 50 percent of the available time. While not directly useful to deriving a defensible time margin, this step does seem to recognize that there may be factors that could make the time to perform the actions longer than estimated. The guidance implies that *a factor of up to 2 increase is desirable between the estimated time and the available time in order to provide adequate comfort that the actions can easily be performed in the available time*.

For the same reasons as cited earlier, this observation was not directly helpful as to how to derive a defensible time margin for action times obtained from a demonstration; however, it did support the idea that there are probably factors that can delay action times. Thus, a time margin is desirable to ensure that the actions can be reliably implemented.

A.2.2.5 *How Will the Elicitation Process Work?*

With regard to topic 5, the following process was used as initial expert opinion elicitations were performed on some sample cases:

- The facilitators summarized the relevant characteristics for which the time margin was being elicited (particularly, the types of actions and any relevant contexts for which the time margin applies, the relevant influences to be captured by the time margin, other applicable knowledge, experience, data, etc., and the form of the time margin). This was done in a facilitator-led discussion allowing experts to clarify these characteristics as necessary.
- Each expert privately estimated an appropriate recommended time margin.

- The experts' time margins were shared among the group and the experts were given the opportunity to provide their rationale for their estimates in a facilitator-led discussion. This identified legitimate considerations that were not accounted for by some experts, and it uncovered considerations that should not have been included by other experts. In either case, the results of the discussion caused some experts to provide a revised estimate.
- The experts were given a second (final) opportunity to privately arrive at a revised time margin.
- While we strove to reach a consensus on the identified time margins, the final elicited time margins from the experts were recorded and, as feasible, subsequently treated in a statistical manner to arrive at a single recommended time margin. [Following the completion of both expert opinion elicitation sessions, the facilitators decided that a strict statistical analysis could not be warranted based on the limited results.]

Notes were taken during the entire meeting to subsequently and properly document the entire meeting's key discussions and decisions.

To support the experts in determining how best to derive their estimates of appropriate time margins, to help them decide what the forms of the time margins should be, and to determine how many different time margins were needed, the experts agreed that it would be helpful to consider a few sample operator manual actions and associated scenarios. The general goal was to see what could be learned by thinking about specific examples. From trying to determine appropriate time margins for a couple of specific cases, the experts thought they might be able to see trends, improve their understanding of the issues and drawing some general conclusions about time margins. In addition, it was proposed that, by examining specific cases of the types of fire operator manual actions being addressed and by considering the different types of influences thought to be important, the panel would better understand the nature of operator manual actions in response to fire and the ways in which the different influences might affect crew performance.

With these thoughts in mind, and with the remaining time available for the meeting, expert opinion elicitations were conducted on two example cases.

A.2.3 Example Elicitation Cases Addressed at the First Meeting

Two scenarios and related actions and timing were described to the experts for the example elicitations. One involved a preventive, or event-based, action that would be initiated as soon as the fire was detected, while the other was a reactive, or symptom-based, action that would be diagnosed on the basis of plant symptoms and relevant procedures. However, the cases were similar in that they both concerned the inappropriate opening of power-operated relief valves (PORVs) as a result of the fire. This is an important issue because the unexpected opening of the PORVs in a PWR can result in a significant loss-of-coolant accident (LOCA).

A.2.3.1 *First Scenario/Action Case*

In the first example scenario, a fire starts in an area that has the potential to cause inappropriate opening of the PORVs. Per the procedure associated with a fire in this area, once the fire is detected and located, a plant equipment operator (PEO) is summoned to the main control room (MCR) if necessary (although PEOs generally report to the MCR when events such as fires occur), provided with the relevant procedure, and directed to travel to the correct cabinet, find the correct terminal block, and pull the appropriate fuses to prevent the PORVs from opening. The PEO was assumed to then need to inform the MCR to provide verification that the PORVs were de-energized.

For purposes of the exercise, it was assumed that, during the plant's demonstration of this fire-related operator manual action (actually a set of sub-actions), likely fires in this area would normally be detected and located within approximately 5 minutes. Since by procedure the presence of the fire indicates the need for the appropriate fuses to be pulled, it was assumed that under most conditions the diagnosis for the need for the actions and the retrieval of the relevant procedures would be made in the same time frame. Thus, T_1 was assumed to take about 5 minutes.

With respect to the time to execute the operator manual actions (T_2), it was assumed that the demonstration conducted at the plant revealed that a randomly-selected, established crew accomplished the actions within about 4 minutes. That is, the responsible MCR person assigns a PEO and gives him the relevant procedure and instructions (about 1 min.), the PEO travels to the appropriate cabinet (1 min.), identifies and pulls the relevant fuses (1 min.), and notifies the MCR that the action was completed (1 min.), for a total of 4 minutes. (The experts at the meeting [including a former operator] agreed that this was a reasonable estimate of the time necessary to complete such an action for many plants.) The analyzed time available to complete the action before a problem would occur (T_3) was assumed to be approximately 20 minutes.

Given this scenario, it was the experts' job to identify and consider the factors that might delay performance of this task under realistic plant fire conditions. Per the guidelines discussed above, it was assumed that all of the operator manual action criteria had been met by the plant.

For this initial exercise, the panel members considered the three influence factors from Section A.2.2.3, focusing mainly on the factors that might not be covered adequately during the demonstration (i.e., aspects of the rule criteria that would not be easily addressed during the demonstration and could cause delays if problems arose). However, and especially during their modified responses, the experts also considered variations in plant conditions and human-centered factors in determining their time margins.

Table A-1 displays the increases in the time that were suggested by the experts to account for factors that might not be covered completely by the demonstration, as well as potential variability in plant conditions and fire scenarios and additional human influences. The suggested time increases cover factors that could reasonably delay the performance of the preventive actions associated with pulling fuses to prevent the PORVs from inadvertently opening due to the fire.

Table A-1. Initial and Revised Additional Times Added to Combined T_1 and T_2

Panel Member	Increase (Added to Original 9 min.)		Factor (Total Time to Original 9 min.)	
	Initial Estimate	Revised Estimate	Initial Estimate	Revised Estimate
#1	23 min	10 min	3.5	2.1
#2	6 min	10 min	1.7	2.1
#3	11 min	12 min	2.2	2.3
#4	6.5 min	9 min	1.7	2
#5	30 min	18 min	4.3	3
#6	1 min	10 min	1.1	2.1

A review of Table A-1 reveals a significant amount of variability in initial estimates of the amount of time that should be added to T_1 and T_2 to account for uncovered influences. After the panel members had the opportunity to discuss their results and share their reasoning with one another, much closer agreement was reached and, for the most part, the expert panel was converging on a factor of approximately 2 as an acceptable time margin for this case. That is, if the licensee assumed that the time to pull the fuses to prevent the opening of the PORVs might be twice as long as was obtained in the demonstration and still fall within T_3, then it would be appropriate to credit the action. In this case, since T_3 was assumed to be 20 minutes, and increasing the original time from the demonstration of 9 minutes by a factor of two results in a total of 18 minutes, then the time margin criterion would be met.

However, it should be remembered that, as discussed at the end of Section A.2.2.5, the goal of the exercise was to see what could be learned by thinking about specific example cases. It was hoped that the exercise would support the experts' determination of how best to derive their estimates of appropriate time margins, to help them decide what the forms of the time margins should be, to familiarize them with the different types of influences thought to be important and how to consider their effects, and to determine how many different time margins might be needed.

A.2.3.2 *Second Scenario/Action Case*

The second scenario and action case examined at the meeting essentially served the same purpose as the first. That is, the goal was to continue to familiarize the panel members with the process and the factors to be considered to identify reasonable time margins for operator manual actions in response to fire.

For the second example (as with the first), the scenario involved a fire that starts in an area with the potential to lead to inappropriate opening of the PORVs. However, in this case, it was assumed that the licensee relies on a reactive process to deal with the potential opening of the PORVs. That is, the crew waits until there are some indications that the PORVs have opened, and then they send personnel out to pull the fuses to allow the PORVs to close (as a backup to the likely attempted closure of the PORV block valves).

For purposes of the exercise, it was once again assumed that it would take approximately 5 minutes to detect and locate the fire. In addition, it was assumed that another 2 minutes would pass before the fire caused the PORVs to open. Once the PORVs opened, it was assumed that the plant was able to show in the demonstration that diagnosis of the presence of the opened PORVs and contacting personnel to perform the needed actions could be done in about 1.5 minutes. Moreover, as in the preventive case, 3 minutes were assumed to travel to the cabinet, pull the fuses, and verify completion of the task with the MCR. Thus, in this case it was assumed that 4.5 minutes would be necessary to diagnose the need for the actions and to complete them, such that $T_1 + T_2 = 4.5$ minutes for the reactive case.

A difference between the reactive case and the preventive case is that the detection and location of the fire is not part of the assessment of the time margin.[8] Since the time between the start of the fire and the opening of the PORVs can be quite variable, the plant will be concerned with ensuring that, regardless of when the PORVs open, the PORVs will be closed in time to prevent any serious damage. Thus, the analyzed time available (T_3) is the worst-case time between the opening of the PORVs and the point at which serious damage would occur.

The only time that the activities associated with detecting and locating the fire would be relevant in the reactive case would be when the PORVs opened within the first 5 minutes after the fire starts. However, for this example it was assumed that the PORVs did not open until 2 minutes after the fire was located and detected. Thus, the panel focused on how much time they would need to add to the 4.5 minutes of T_1 and T_2 in order to account for the three influence factors discussed in Section A.2.2.3.

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[8] Note that not all the panelists dismissed this time as irrelevant and included time margins in their overall assessment to account for influences that could arise during this specific interval.

However, two caveats are relevant to this second example exercise. First, only a short period of time was available at the end of the second day of the elicitation session to perform the exercise, compelling the expert panel members to rush their judgments somewhat. Furthermore, based on discussions with the panel members, at least some did not agree that, for the case we were addressing, the activities occurring before the PORVs opened would not be relevant to the crew's performance in diagnosing the open PORVs and ensuring their closure by pulling the fuses. Thus, some panel members included adjustments to the fire location and detection phase and added that to their time adjustments, while others did not. Due to the limited time available for this example exercise, it was not possible in all cases to separate these extra time additions from the panel's estimates. In addition, there was not time for the panel to revise their initial estimates.

Table A-2 displays the increases in the time that were suggested by the experts to account for factors that might not be covered completely by the demonstration, as well as potential variability in plant conditions and fire scenarios, and additional human influences. The suggested time increases cover factors that could reasonably delay the performance of the reactive actions associated with pulling fuses to allow the PORVs to go closed before serious damage occurs.

Table A-2. Initial Time Added for Diagnosing the Need and Successfully Closing Open PORVs

Panel Member	Increase (Added to Original 4.5 min.)	Factor (Total Time to Original 4.5 min.)
#1[9]	13 min	2.1
#2	7.5 min	2.7
#3	7.5 min	2.7
#4	7.5 min	2.7
#5	25 min	6.6
#6	8.5 min	2.9

Despite some potential confounds with this example as discussed earlier in this section, it is worth noting that several experts were fairly close in their estimates. Based on the discussions with the expert panel members and the results above, it was considered possible that the time margin for reactive operator manual actions could be higher than for preventive actions.

[9] Panelist 1 added time for fire detection and location as well as to diagnosis of the open PORVs. Thus, the 13 additional minutes were compared relative to a total original time of 11.5 minutes rather than 4.5 minutes.

A.2.4 Conclusion from First Meeting

As a result of the meeting, considerable insight was gained into reasons why it may be necessary to add a time margin to licensee demonstration times and how large that time margin may need to be. At the end of the meeting, it was agreed that an additional elicitation meeting was necessary to pursue other representative examples of scenarios and actions to further learn what time margins would be appropriate for local operator manual actions in response to fire.

A.3 Second Expert Elicitation Meeting

The same panel of six experts (described in Section A.2.1) participated in the second expert opinion elicitation session held at the NRC in Rockville, Maryland, on May 4 and 5, 2004. Approximately two weeks prior to the second meeting, each expert was provided with a summary of the first meeting and given the opportunity to review the report, verify its contents (in particular the results of the example expert opinion elicitations), and make recommendations for changes. All panel members concurred with the summarized results of the first meeting as presented. In addition, a few days prior to the second meeting, an agenda for the second meeting was sent to the expert panel. The agenda noted the general steps planned for the meeting, reviewed important results from the first meeting, discussed the goals of the second meeting, outlined outstanding issues related to the time margins still to be addressed, and provided initial discussions of two possible examples for the second meeting.

A.3.1 Summary of Topics Discussed During the Second Meeting

In the first meeting, two general types of local operator manual actions in response to fire were addressed and issues associated with the two types were discussed. The two types were preventive (event-based) and reactive (symptom-based) actions. Because some panel members and the facilitators had given additional thought to these types of actions since the last meeting, it was decided that the second meeting would begin by returning to a discussion of these types of actions.

A.3.1.1 *Preventive Actions*

It was repeated that for the preventive actions, it is generally assumed that once the fire has been detected and located, per procedure, the MCR crew directs someone to execute a number of actions that will prevent fire-related damage to equipment to ensure its availability to achieve its function during the fire scenario. Also by procedure, the only criterion for initiating these actions is the presence of the fire itself (event-based). However, in reality it is possible that crews may delay initiation of the actions for some period just to make sure that the fire is significant enough to initiate the actions. Moreover, it may take time for the appropriate crew member to retrieve the relevant procedures and assign plant personnel to complete the actions, etc.

During the second meeting some additional points were discussed about the preventive actions relevant to crediting them under the operator manual action rule. First, it was noted that there are no guarantees that all preventive actions can be completed before the relevant equipment might be affected by the fire. There are many different kinds of fires in terms of initial size, growth rate, etc., and they can start in different locations within a room. Thus, while in many cases it may be relatively unlikely that a fire would spuriously affect equipment before the equipment could be protected by the operator manual actions, it is probably impossible to say that given actions can always be completed prior to the relevant equipment being affected by the fire. This being the case, it was argued that to take credit for such actions, licensees would need to assume that they may have to perform reactive actions to restore the equipment to its functional state.

While panel members noted that plant procedures for preventive actions generally include steps to verify that the actions were successful, and if not, to take actions to ensure the equipment is placed in the appropriate state, they also noted that when demonstrating the feasibility of the actions as required by the rule and measuring the time it takes to complete the actions, these potential additional steps should be included. In other words, all preventive actions have the potential to involve reactive actions to ensure the availability of the equipment and, therefore, those additional steps should be included in demonstrating the actions and measuring the time to complete the action. The panel pointed out that while the resulting time estimates to complete the actions may be conservative for the cases where the preventive actions are successful, if such aspects are included in the plant demonstration, then they should not have to be accounted for in the time margin.

The latter point became a critical aspect of the second expert elicitation meeting. The panel members argued that to be able to develop a reasonable time margin for operator manual actions in response to fire, the demonstrations of the actions should cover as many potential influences on performance as possible. Furthermore, the most reasonably conservative cases for the various conditions that could influence the ability of crews to complete the actions should be incorporated into the demonstration. In this way, the more extreme and less frequent variations in performance may be accounted for in the identified time margins, thereby making their development simpler and easier to justify.

It was argued that the appropriate range of conditions to be included in the plant demonstrations should be described in the operator manual action regulatory guide. The result would be that the applicability of the time margins identified from this exercise would be contingent on licensees demonstrating the actions as specified in this regulatory guide. Aspects to be included in the demonstration are discussed in Section A.3.1.4.

A final aspect about preventive actions discussed by the panel concerned how to measure the time to complete the actions (T_3). If there are at least some fire events that could affect important equipment before the preventive actions could be completed, then the time available to complete the actions (before serious equipment damage could occur and affect safe shutdown) should be measured from the earliest point at which the relevant equipment could be affected. Thus, if it is at all reasonable, licensees should assume that the fire could start exactly in the area where the equipment of concern would be affected at the earliest possible time. This may result in less time being available for preventive actions than might normally be assumed, which should be considered when licensees develop their time lines for operator manual actions in response to fires.

A.3.1.2 *Reactive Actions*

For the reactive actions, operators do not initiate the actions until they have detected and diagnosed that the relevant equipment has been affected by the fire and that it may be needed for safe shutdown. That is, they do not initiate the actions until the procedure, given the relevant indications, calls for the reactive actions (i.e., symptom-based actions). However, the panel noted that the symptoms indicating that the equipment has been affected could occur very early in the scenario when the crew is still in the process of detecting and locating the fire, entering initial EOPs, and possibly entering abnormal procedures. Alternatively, the symptoms could occur later in the scenario after the crew has been responding to the situation for a while and fire-specific procedures have been initiated. It was argued that, since the effect on the equipment could occur very early (e.g., as a result of an explosive switchgear fire), potential delays due to initial competing activities should be considered in determining the time margins. However, the panel was unable to conclude that the activities occurring during early stages of a fire scenario would necessarily be any more demanding that those occurring somewhat later in a scenario. It would seem that the demands of a given scenario across time would be plant- and scenario-specific; thus, this would be a factor that should be addressed by each plant for reactive actions, and the most reasonably conservative case with respect to potentially competing tasks should be modeled in the plant demonstration. If this is done, then any developed time margins would not have to take such effects into account.

The panel acknowledged that crews may find themselves dealing with "dueling procedures" at any point in a fire scenario and that the effects of possibly being in multiple procedures should be modeled to the extent possible during the demonstration of operator manual actions in response to fire.

Regarding the time available to complete reactive actions, T_3 would be determined by how much time would be available to restore the critical equipment after the fire effects had occurred in the context of the accident scenario.[10] Licensees should assess the worst case for when the effects could occur and calculate the time available on that basis. In many instances, it would seem that fire damage occurring as early as possible in the scenario would be the most serious (due to more time to build up to the expected high heat levels), but there may be some scenarios where this would not be the case. Again, licensees should consider such aspects in developing their time lines for the actions.

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[10] However, time zero would still be measured at initial fire detection, such that a licensee with symptom-based procedures would not necessarily have as much time to take actions as one with event-based procedures, due to the time delay between fire detection and initiation of operator manual actions.

A.3.1.3 *Other Types of Actions*

Two other general categories of actions were considered by the panel. They included simple vs. complex actions and short-term vs. long-term actions. With respect to the latter, it was argued that essentially all local operator manual actions in response to fire would be relevant only in the short-term case (i.e., within the first hour of the scenario). Thus, it was decided that this distinction would not be relevant for developing the time margin.

However, over the 1.5 days of the meeting, the simple vs. complex distinction was discussed on several occasions. The issue was whether separate time margins would be needed for simple actions, such pulling a fuse, vs. more complex actions, such as multiple-task actions that involve coordination and communication among plant personnel. After examining the potential ways in which complexity might vary, it was decided that the nature of the specific actions being carried out by plant personnel would not vary significantly. That is, the actions being conducted by individuals would be of the general types of actions on which plant personnel are trained and perform routinely as part of their jobs. Thus, the complexity would more likely come from the coordination and communication associated with some activities and the associated time aspects.

The panel eventually concluded that, since both simple and complex actions would have to meet the same criteria in the rule, and because time differences between tasks could be accounted for by using a common multiplier (e.g., a factor of 2 as a "time margin" multiplier on the demonstration) across all tasks, separate time margins as function of complexity would not be needed. In fact, the panel eventually concluded that, *as long as all the rule criteria were met, the operator manual action demonstrations were performed appropriately (as described in this regulatory guide), and the time available for the various tasks was calculated appropriately, then a single time margin could be adopted*. The single time margin would cover all the remaining influences unaccounted for by the demonstration and could be applied generally to all types of operator manual actions in response to fire, including preventive and reactive actions. The influences on performance to be covered by the time margin and those to be covered by the demonstration are discussed below.

A.3.1.4 *Influences on Performance*

Based on the results of the first meeting, the three influence factors listed in Section A.2.2.3 were again assumed to be relevant to identifying an appropriate time margin. That is, it was thought that there were three factors that could lead to variations in the performance of the operator manual actions that would not generally be accounted for by meeting the rule criteria. Thus, it would be necessary to account for such influences in the time margin.

After further consideration of these sets of influences during the second meeting, the panel agreed that many of the aspects of the influence factors could be covered by assuming "worst-case" scenarios in both the conditions associated with a plant's demonstration of actions and in their calculation of how much time would be available to complete actions before serious equipment damage would occur and affect safe shutdown. As discussed above, such conservatism would limit the number of influence aspects that would have to be covered by the time margin.

The panel ultimately agreed that influence factor 2 (variability in fire and related plant conditions) should be addressed in the licensee's calculation of the time available for actions (T_3). Licensees should assume the worst-case reasonable variations in fire characteristics and plant conditions that could affect the time available to complete actions in that calculation. In addition, the panel agreed that some aspects of influence factor 1 (where the demonstration falls short) could be adequately addressed by making certain assumptions or simulating certain conditions during the demonstration. The demonstration should address the following aspects (among others):

- If it is reasonably likely that operators will wear SCBAs to complete actions, then they should wear them during the demonstration. Furthermore, if communication is necessary between operators under conditions where they would wear SCBAs, then the communication should be achieved while wearing the SCBAs.
- If normal plant noise levels could affect communication in some areas, the demonstrations should be conducted under those conditions.
- If smoke could significantly affect visibility, then actions should not be credited.
- If it is possible that needed operator manual actions will involve plant personnel (e.g., plant equipment operators) being summoned from other locations in the plant to obtain instructions and relevant procedures and proceed to the area of the actions, then the worst-case reasonable time for them to travel to the various locations, which may include traveling to the MCR, should be included in the time to execute the actions. In other words, in conducting the demonstration, necessary personnel should be located as far away as reasonable at the start of the simulation. In addition, the potential for such personnel to have to complete what they were doing before responding should also be considered in the demonstration and, therefore, in the time to complete the actions.
- If the fire or other factors could affect where personnel have to travel (e.g., what routes they have to take) and where they have to enter various rooms, then the worst-case reasonable effects should be modeled in the demonstration.
- If multiple actions (or multiple sets of actions) will have to be performed and coordinated and potential interference could occur, then all should be simulated in the demonstration.

The main point is that licensees should carefully analyze the potential context for given operator manual actions in response to fire and strive to model the worst-case, reasonable scenarios in their demonstrations. That is, they should do a good job of setting up their demonstrations to avoid being overly optimistic. For example, they should not select their most recently trained crew and then allow them to prepare for the demonstration (i.e., no "pre-conditioning"). Inspectors will be looking for licensee failures to simulate reasonable influences and conditions that might delay performance in the plant demonstrations.

A.3.1.5 *Impact of Human Errors*

Another topic of discussion concerned the impact of potential human errors in performing operator manual actions and the associated recovery actions. It was pointed out that, while the main goal of developing a time margin for local operator manual actions in response to fire was to cover the range of influences that could delay performance of the various actions, it is also possible that personnel could make errors in performing the actions. Although the probabilities of such errors may be relatively low, when they do occur, operators should identify that an error has occurred and recover from the failure. Since verification is required for the operator manual actions (the rule requires that there be reliable indications available that actions have been completed), then it is reasonable to expect that the existence of any incorrectly performed actions or omissions to be detected. However, since it is probably not realistic to assume that licensees will model such recoveries in their demonstrations, the panel agreed that there should be at least some time built into the time margin to cover recovery actions (even if the likelihood of such errors occurring and not being caught immediately would be relatively low).

A.3.2 *Determination of Time Margin*

In order to determine an acceptable time margin, as in the first meeting, the panel thought that the process of stepping through reasonable examples of local operator manual actions in response to fire for estimating time margins was a useful exercise. By examining the various actions in some detail and thinking about how much delay could occur due to specific influences, it was thought that a good sense of what a reasonable time margin would be obtained.

For this exercise in the second meeting, a somewhat more complex example of a preventive action (set of sub-actions) was addressed. This scenario was the third addressed across the two expert opinion elicitation meetings.

A.3.2.1 *Third Scenario/Action Case*

In this scenario, a fire starts in an area that has the potential to lead to inappropriate alignment or otherwise failure of the component cooling water (CCW) system. Per the procedure associated with a fire in this area, once the fire is detected and located, and in order to prevent CCW failure (the fire can supposedly affect all the equipment in Division A [Div-A] CCW, which is supposed to keep running, and the fire can potentially affect the Division B [Div-B] CCW valves, but not the Div-B pump, which does not start unless the Div-A train malfunctions), two PEOs are summoned to the MCR if necessary (PEOs generally report to the MCR when events such as fires occur). They are provided with the relevant fire procedure and are directed to travel to two locations; PEO 1 goes to the East Switchgear Room (ESWGR) and PEO 2 travels to the Div-B CCW room (the division to be protected). These rooms should not be affected by smoke from the fire, but the Div-B CCW room could, in a real fire, have a little water on the floor from nearby sprinkler operation if drains become partially plugged and some overflow occurs (this cannot be part of the demonstration).

Upon reaching their respective locations, PEO 1 is to communicate via radio with the MCR supervisor. The MCR staff then manually starts the Div-B CCW train and, after ensuring it is operating properly, the MCR staff shuts down the Div-A CCW train and pulls-to-lock the Div-A CCW pump. To protect the continued operability of the Div-B CCW train, PEO 1 is to pull three of many specifically-labeled breakers (two breakers in one electrical cabinet at one end of the ESWGR and one breaker in a different cabinet at the other end of the ESWGR) that remove power from three Div-B CCW valves so they will stay in the proper position. PEO 1 is then to confirm with the MCR supervisor (via radio) that this is done and that Div-B CCW is continuing to adequately handle heat removal from the various loads. The MCR then informs PEO 2 (who has been listening in on his radio from the Div-B CCW room) that the Div-B CCW train is operating and that the manual crosstie valve between the CCW trains needs to be closed. PEO 2 then closes the manual crosstie valve in the Div-B CCW room and contacts the MCR and PEO 1 to confirm closure of the valve.

In the meanwhile, PEO 1 moves to the West Switchgear Room (WSWGR) and pulls the Div-A CCW pump breaker to ensure the pump cannot spuriously operate. PEO 1 then informs the MCR supervisor that the alignment is complete. The MCR supervisor verifies the alignment of the system via indicator lights, flows, and temperature indications and then releases the PEOs so they can attend to other matters.

Steps of the actions and times from the demonstration (or assumed times) are as follows:

Step 1. For purposes of the exercise, it was assumed that, during the plant's demonstration of this fire and the operator manual actions, it was simulated that likely fires in this area would normally be detected and located within approximately 5 minutes.

Step 2. Three additional minutes are expended for the PEOs to have reached the MCR and obtained the procedure and directions for the CCW manipulations (so now 8 total minutes have passed).

Step 3. PEO 1 and PEO 2 reach their locations (travel time) and call in on the radios to ensure communication with each other and the MCR: 4 minutes (so total time is now 12 min).

Step 4. MCR staff starts Div-B CCW train, shuts down Div-A CCW train, pulls-to-lock the CCW A pump, and tells PEO 1 it is OK to pull breakers: 1 minute (so total time is now 13 min).

Step 5. PEO 1 pulls the breakers in the ESWGR and communicates with the MCR who ensure continued operation, and the MCR then informs it is OK to close the manual CCW valve: 3 min (so the total time is now 16 min).

Step 6. PEO 2 closes the manual valve and informs the MCR and PEO 2 of its closure: 4 min (so the total time is now 20 min)

Step 7. PEO 1 travels to the WSWGR, opens pump breaker, and communicates to MCR that this act is complete: 3 min (so the total time is now 23 min).

Step 8. MCR verifies all is OK and communicates to PEOs that they are released: 1 min (so the total time is now 24 min).

Table A-3 summarizes the expert panel's judgments for this scenario. In particular, the table shows the various steps of the actions being addressed, the time (assumed) for the actions obtained during the demonstration, and each panel member's judgment regarding what the total time for each step would be after adding time to account for various influence factors. Note that, at this point during the meeting, firm conclusions had not yet been reached regarding which factors should be addressed by licensees during the demonstration in calculating available time, as opposed to what should be included in the time margin. In fact, much of that information came out of discussions held during and after the scenario exercise. Which of the three general influences from Section A.2.2.3 that the panel considered potentially relevant for each step of the action is noted in the table?

Table A-3. Total Time for Each Step of the Action for the Third Scenario, by Panel Member (Base Time Plus Time Added for Influence Factors)

Step and (Base Time)	Relevant Influence Factors	Panel Members' Total Times for Each Step (min.)					
		#1	#2	#3	#4	#5	#6
1 - (5 min.)	**#3**	5	5	5	5	5	5
2 - (3 min.)	**All**	4	5	4	4	3	3
3 - (4 min.)	**All**	6	4	6	6	7	5
4 - (1 min.)	**#1, #3**	1.5	1	2	2	2	1.5
5 - (3 min.)	**All**	5	5	5	6	5	4.5
6 - (4 min.)	**All**	7	5	8	14	7	5
7 - (3 min.)	**All**	5	3	3	7	3	3
8 - (1 min.)	**All**	1.5	2	1	2	3	1
Total (24 min.)		35	30	34	46	33	28

Each panel member considered how he or she thought the different influence factors might lead to increases in the time to complete each step of the action. A review of the table indicates that the total increases range from a factor of 1.25 to about 2, with an average of about 1.5, or an increase of 50 percent in the time. After the panel members had discussed the reasons for their additions, many thought that a factor of 1.5 to 2 might be a reasonable time margin for operator manual actions. However, they also recalled that, in working through the earlier examples, some panel members had identified greater relative time increases and had been considering significantly larger time margins.

A.3.2.2 *Fourth Scenario/Action Case*

By the time the fourth scenario was addressed, several discussions had taken place and the panel had agreed that influence factor 2 associated with fire characteristics and plant conditions should be addressed by licensees in determining the time available to complete the actions (as discussed in Section A.2.2.3). Similarly, they had identified several important factors that might lead to significant variation in performance that should also be addressed by licensees in conducting the demonstrations and noted that this should be made clear. Thus, in the final exercise, there were two major goals. One was to assess actions assuming the plant had performed a proper demonstration. The second was to address a preventive action that included the situation in which the equipment was affected by the fire before the preventive measures were completed, requiring the operators to perform the relevant reactive actions. The idea was that by addressing a hybrid, they would have the opportunity to assess a range of potential influences under conditions different from those considered before.

The example used was similar to that used for the third scenario, except that in this case, in addition to PEO 1 having to pull the breakers for the Div-B CCW valves in the ESWGR and communicating with the MCR and PEO 2, PEO 1 will have to travel to the relevant room and verify and check on the valve positions of the Div-B CCW valves and readjust as necessary. In this case, it is assumed that the Div-B CCW system has been affected by the fire and the operators enter a more reactive mode. For the exercise, it was assumed that three alignment valves in Div-B CCW have spuriously closed. PEO 1 will need to reopen the valves and take the steps necessary to restore flow.

The steps considered in the elicitation were the same as before (Section A.3.2.1) with the following exceptions:

Step 5. Normally, PEO 1 pulls the breakers in the ESWGR and communicates with the MCR crew, who ensure continued operation, and the MCR then informs PEO 2 that it is OK to close the manual CCW valve: 3 min (so the total time is normally 16 min). However, now PEO 1 discovers that three of the valves have spuriously closed and need to be repositioned. PEO 1 needs to reopen the valves, restore flow to the Div-B CCW system, and inform the MCR: 12 minutes added (so now the total is 28 minutes).

Step 7. Deleted (small effect; limited time remaining to panelists).

Step 8. Deleted (small effect; limited time remaining to panelists).
For this exercise the scenario was ended after Step 6, so the total time was 32 minutes (previous 24 total minutes plus additional 12 minutes from Step 5 minus 4 minutes from Steps 7 and 8).

For this final exercise, the expert elicitation was done in a manner slightly different from the other examples. This was partially attributable to the limited time remaining on the second day; it was viewed as an approximate but expedited way to combine both the initial and revised estimation steps. In this case, each member decided how much time he or she thought needed to be added to each step of the operator manual action based on the influences, and the panel discussed the basis for the selected times among themselves. Finally, each member settled on a value he or she thought was reasonable and the facilitators documented the range of values proposed by the panel. In cases where several panel members were in agreement about the values, the mode (most repeated value) was also identified.

Table A-4 presents the results of the final elicitation, displaying the times added by panel members from considering influence factors that could not be covered in the demonstration (influence factor 1 in Section A.2.2.3) and the times added by considering human-centered influences (influence factor 3 in Section A.2.2.3). As noted above, aspects associated with fire characteristics and plant conditions (influence factor 2 in Section A.2.2.3) were assumed to be addressed by the plant and were not covered in the example.

Table A-4. Time Added to Each Step of the Manual Action for the Fourth Scenario (Hybrid Case of a Preventive and a Reactive Action)

Step and (Base Time)	Influence Factor 1 (Demonstration Shortfalls)	Influence Factor 3 (Human-Centered Factors)
1 - Fire detected and verified (5 min.)	No time added	No time added
2 - PEOs to MCR (3 min.)	1 min. (panel agrees) - minor smoke, obstacles, etc.	0.5–1.5 min.
3 - PEOs to remote locations (4 min.)	1–2 min. - minor smoke, communications delays	0.5–2 min.
4 - MCR starts CCW B train and stops the A train (1 min.)	0.2–1 min. - MCR activities (fire distractions)	0–0.5 min.
5 - PEO 1 initially pulls breakers (3 min.)	0–0.5 min.	1–3 min (mode = 1.5 min.)
5a - PEOs 1 and 2 determine that three valves on Div-B CCW have already spuriously closed. Re-open valves and restore system (12 min.)	2–6 min.	2–3 min. (mode = 3 min.)
6 - PEO 2 closes cross-tie (4 min.)	2–4 min. (assumed water on the floor, etc.)	1–3 min. (mode = 2 min.)
Total (32 min.)	Total of 6.2–14.5 min. added	Total of 5–13 min. added

When the total time added for the two influences categories are combined, the range of times to be added to cover their impact is 11.2–27.5 min. When these times are added to the base times (in the first column), the range is 43–60 minutes, which once again would represent an increase in the base time of roughly 50–100 percent.

A.4 Identification of Time Margin and Conclusion

Based on their reviews of the influence factors, the results of the example elicitations, and the need to allow some time for potential recovery actions, the panel members agreed that *a time margin factor of at least 2 would allow for a "high confidence of a low probability of failure" for local operator manual actions in response to fire*. The implication is that, as long as licensees meet the rule criteria for the actions, they perform sound demonstrations of the actions at the plant (as described in this regulatory guide), perform reasonable calculations of the time available for the various actions (guidance for which is discussed in this regulatory guide), and can show that the time available is at least 100 percent greater than the time obtained in the demonstration, then local operator manual actions in response to fire can be credited.

A.5 References

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6. A.D. Swain and H.E. Guttman, "Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications — Final Report," Washington, DC, NUREG/CR-1278, U.S. Nuclear Regulatory Commission, 1983.

7. Nuclear Energy Institute, "Guidance for Post-Fire Safe Shutdown Analysis," Washington, DC, NEI 00-01, Revision 0, May 2003.

OMB SUPPORTING STATEMENT FOR PROPOSED RULE
10 CFR PART 50, APPENDIX R
FIRE PROTECTION MANUAL ACTIONS
(3150-0011)

Description of the Information Collection

The NRC is proposing to amend its fire protection regulations in 10 CFR Part 50, Appendix R, Paragraph III.G.2, to allow the use of manual actions by nuclear power plant operators to achieve hot shutdown conditions in the event of fires in certain plant areas, provided the actions are evaluated against specific criteria that have been determined to be acceptable by the NRC.

Nuclear power plant fire protection regulations and associated guidelines prescribe fire protection features to ensure that at least one means of achieving and maintaining safe shutdown conditions will remain available during or after any postulated fire. The fire protection regulations applicable to currently licensed nuclear power plants depend on when the plant was licensed. The requirements of Appendix R, Paragraphs III.G, were backfit onto all reactors licensed to operate prior to January 1, 1979, by 10 CFR 50.48(b). The requirements of Appendix R, Paragraphs III.G, do not apply to reactors licensed to operate on or after January 1, 1979; instead, the requirements of GDC-3 and 10 CFR 50.48(a) apply.

10 CFR Part 50, Appendix R, Paragraph III.G.2 specifies three acceptable methods for protecting the safe shutdown capability of one of the redundant shutdown trains from a fire when located in the same fire area as its redundant train by enclosure or separation of cables and equipment. During recent inspections of licensee fire protection programs, concerns have arisen among NRC staff about licensee compliance with fire protection of redundant safe shutdown systems that are located in the same fire areas. NRC staff believes that instead of pursuing upgrading or replacing the Thermo-Lag fire barriers that were originally installed to comply with Appendix R requirements, many licensees utilized operator manual actions to make available a second train of safe shutdown equipment. Such changes must be approved through the exemption process. Since the fire protection regulations were promulgated, the staff has approved a number of exemptions to the technical requirements of Appendix R for pre-January 1, 1979, plants to permit specific operator manual actions as an acceptable alternative to the fire protection requirements.

Under the proposed rule, the existing fire protection regulations at 10 CFR Part 50, Appendix R, Paragraph III.G.2 would be revised to explicitly permit the voluntary use of operator manual actions in lieu of using fire barrier or separation protection to achieve and maintain safe hot shutdown in the event of a fire where redundant trains are located in the same area. The regulations and associated guidance would include generic acceptance criteria on the use of operator manual actions. Use of operator manual actions would be predicated on the requirement that the area where the fires occur has fire detectors and an automatic fire suppression system installed in the fire area and the manual actions relied upon are consistent with all of the proposed criteria. Records documenting compliance with the new optional criteria would be required to be maintained in accordance with 10 CFR 50.48.

The licensee also has the option of complying with the fire protection requirements by employing one of the other three acceptable methods for fire suppression currently contained in Appendix R, Paragraph III.G.2.

The proposed rule would also clarify that the use of operator manual actions would not require NRC approval provided that compliance with the acceptance criteria is documented and demonstrates that the operator manual actions are feasible, reliable, and do not adversely affect the ability to achieve or maintain safe shutdown. The documentation prepared and maintained by the licensee would include: (1) an analysis for each operator manual action which demonstrates its feasibility and reliability, (2) plant procedures for each operator manual action required to achieve and maintain hot shutdown, (3) appropriate training on these procedures for each operator, (4) assurance that all systems and equipment needed to accomplish each operator manual action are operable and readily accessible prior to implementation, and (5) demonstration that each operator manual action required to achieve and maintain the plant in hot shutdown condition can be accomplished consistent with the analysis in (1) above.

A. JUSTIFICATION

1. Need for and Practical Utility of the Collection of Information

Section 50.12

This section specifies that the Commission may, upon application by any interested person or upon its own initiative, grant an exemption from the requirements of 10 CFR Part 50. Because licensees would be allowed to use operator manual actions as specified in the proposed rule without applying for an exemption under 10 CFR Section 50.12, fewer exemption requests from the requirements of 10 CFR Part 50 are expected.

Part 50, Appendix R, III.P

A licensee relying on manual actions must:

> 2.(a). Prepare an analysis for each operator manual action which demonstrates its feasibility and reliability. The analysis should address all variables that may affect the fire time line, methods to ensure functionality of equipment or cables affected by the fire and needed for hot shutdown, and all equipment and communications needed to accomplish operator manual actions.
>
> 2.(b). Prepare and maintain plant procedures for each operator manual action required to achieve and maintain hot shutdown.
>
> 2.(d). Demonstrate that the analysis can be relied upon by conducting and documenting time-authenticated walkdowns demonstrating that each operator manual action can be accomplished and implementing corrective actions if the walkdown demonstrates that the operator manual actions are not consistent with the analysis. Corrective actions may require revisions to the procedures and/or analysis.

Section 50.48

Section 50.48(b) requires that licensees assess the fire protection program on a regular basis and revise it as appropriate. The requirement is unchanged and only captures the burden for

the proposed recordkeeping. A licensee must document walkdowns and implement corrective actions for those manual actions that are not consistent with the analysis as required by Appendix R. III.P.2.(d). Each change to the manual actions documentation will be maintained by the licensee until the Commission terminates the license. Each superceded revision of the manual actions will be maintained by the licensee for three years from the date that the procedure was superceded.

2. Agency Use of Information

The analysis and documentation associated with operator manual actions and the required annual demonstrations would be reviewed by the NRC inspection staff to ensure the provision of an adequate level of protection of public health and safety, common defense and security, and the environment.

3. Reduction of Burden Through Information Technology

There are no legal obstacles to reducing the burden associated with this information collection. The NRC encourages licensees to maintain electronic records associated with operator manual actions.

4. Efforts to Identify Duplication and Use Similar Information

The records maintained by licensees associated with operator manual actions would not be duplicated by other Federal information collection requirements and would not be available from any other source.

5. Effort to Reduce Small Business Burden

The NRC has determined that the affected entities are not small entities or businesses as those terms are used in the Regulatory Flexibility Act.

6. Consequences to Federal Programs or Policy Activities if the Collection is Not Conducted or is Collected Less Frequently

This information is required so that the NRC can determine that operator manual actions will be adequate in the event of a fire emergency. The analysis of and procedures for each operator manual action will be required only when such an action is implemented or revised. The training and demonstration documentation would be required to ensure the continued effectiveness of operator manual actions. The health and safety of the public could be affected adversely if this information is not available as specified.

7. Circumstances which Justify Variation from OMB Guidelines

Licensees must retain the fire protection plan until the NRC terminates the license in order to ensure the health and safety of the public.

8. Consultations Outside the NRC

The staff consulted with the Nuclear Energy Institute (NEI) to develop an estimate for the

number of hours that would be required to comply with the proposed rule. NEI responded by e-mail to NRC on June 10, 2004. NEI's burden estimate is indicated in the footnote to Table 1.

9. Payment or Gift to Respondents

Not applicable.

10. Confidentiality of Information

Information identified as proprietary or confidential would be handled in accordance with 10 CFR 2.790 of the NRC regulations. However, this information is not usually considered confidential.

11. Justification for Sensitive Questions

This regulation does not request sensitive information.

12. Estimated Industry Burden and Burden Hour Cost

See Table 1 for reporting of the net reporting burden and Table 2 for the net recordkeeping burden.

Table 1: Annual Reporting Requirements

Section	Number of Respondents	Responses per Respondent	Total Annual Responses	Burden Hours per Response	Total Annual Burden	Annual Cost @ $157/hr
10 CFR 50.12 (Existing Rule)	(8)	1	(8)	360[1]	(2,880)	($452,160)
Annual Burden					(2,880)	($452,160)

[1] The December 2003 OMB submission by NRC indicates that an estimated 400 hours (360 hours for reporting and 40 hours for recordkeeping) would be required by a licensee to prepare and maintain exemption requests under 10 CFR 50.12. This estimate was based on responses from power reactor licensees. NEI's estimate of 2,500 hours for the preparation of a fire protection exemption request was based on discussions with licensees and was provided to NRC via e-mail on 6/10/04 (ML043140427). Note: A number in parentheses indicates a decrease in burden.

Table 2: Annual Recordkeeping Requirements

Section	Number of Recordkeepers	Burden Hours per Recordkeeper	Total Burden Hours	Annual Cost @ $157/hr
10 CFR 50.12	(8)	40	(320)	($50,240)
Appendix R: Section III.P 2.(a), (b), and	8[1]	275	2,200	$345,400
Appendix R: Section III.P 2.(d)	8[1]	20	160	$25,120
10 CFR 50.48 (Additional Records)	19	5	95	$14,915
Total Annual Burden			2,135	$335,195

[1] The proposed rule applies to the 52 reactors that were licensed prior to January 1, 1979. Of these reactors, the staff estimates that 8 reactors annually (14 reactors in the first year, 5 reactors in the second year, and 5 reactors in the third year) will take advantage of the rule and develop documentation indicating compliance with regulatory criteria. Some of these plants will apply multiple times as technical and physical improvements are implemented and as regulatory criteria change.
Note: A number in parentheses indicates a decrease in burden.

Total Annual Burden: (745) hours (-2,880 hours reporting + 2,135 hours recordkeeping)

13. Estimate of Other Additional Costs

None.

14. Estimated Annualized Cost to the Government

NRC estimates that the NRC costs associated with review of requests for exemptions under 10 CFR Part 50.12 will decrease 110 staff hours per plant annually, for an annual cost savings to the Government of $138,160 (8 plants x 110 staff hours/plant = 880 staff hours; 880 staff hours x $157/hr).

15. Reasons for Changes in Burden or Cost

As a result of implementing the proposed rule, the combined estimated burden for 10 CFR 50.12 and 10 CFR Part 50, Appendix R would be a net decrease of 800 hours annually. The proposed rule would reduce the number of exemption requests resulting in a burden reduction of 3,200 hours. The burden to licensees who choose to use operator manual actions in lieu of current Appendix R requirements would be 2,400 hours annually; this effort would be expended in the analysis and documentation of compliance with the proposed rule and annual walkdowns

to demonstrate feasibility and reliability of the procedures.

16. Publication for Statistical Use

The collected information is not published for statistical use.

17. Reason for not Displaying the Expiration Date

The requirement is contained in a regulation. Amending the Code of Federal regulations to display information that, in an annual publication, could become obsolete would be unduly burdensome and too difficult to keep current.

18. Exceptions to the Certification Statement

None.

B. COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS

Statistical methods are not used in this collection of information.

NUCLEAR ENERGY INSTITUTE

Marvin S. Fertel
SENIOR VICE PRESIDENT AND
CHIEF NUCLEAR OFFICER

December 7, 2004

Mr. Luis Reyes
Executive Director for Operations
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

PROJECT NUMBER: 689

Dear Mr. Reyes:

Recently, the NRC staff outlined the proposed rule language for changes to 10 CFR 50 Appendix R Section III.G.2. The purpose of this rulemaking is to permit the use of operator manual actions for redundant shutdown in the event of fire without the need for prior NRC approval. While we agree that a rule change can accomplish this goal, the specific language proposed by the staff will result in expensive plant changes or exemption requests that do not improve safety. This will defeat the purpose of allowing the use of manual actions without exemptions to Section III.G.2. We propose that the rule language be revised to better accomplish this purpose before it is published in the Federal Register for public comment.

In late 2001, NRC inspectors began to identify concerns that manual actions for III.G.2 fire areas had not received prior NRC approval. In a January 2002 letter to NRC, NEI indicated that manual actions for these areas should not require prior NRC approval if the licensee could demonstrate feasibility. In June 2002, NEI presented to NRC numerous examples of licensees using manual actions in III.G.2 areas that had been reviewed without comment by NRC inspectors. NRC then agreed that a safety focus was appropriate and initiated steps toward a rulemaking. In March 2003, NRC included in its inspection guidance reasonable criteria for determining the feasibility of manual actions. Later, however, NRC added additional criteria that will result in significant expense for plant changes, or exemption requests, with no significant safety improvement. These criteria include requirements for:

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- Automatic suppression in the area of the fire
- An arbitrary time margin factor that is not consistent with the use of operator actions in other areas of plant operation.

Implementing these criteria into the proposed rule will not appreciably improve safety, reliability, or feasibility of the manual actions, and will result in either expensive modifications or numerous exemption requests that do not improve safety. This clearly was not the intent of the original rulemaking, and these provisions would not likely pass the criteria of 10 CFR 50.109. We offer specific comments in the enclosure.

The following is a summary of our recommendations:

- Provide a concise rule change to effect rulemaking goals, and place appropriate acceptance criteria for manual actions in a Regulatory Guide
- Address security events in 10 CFR 73 rulemaking rather than in manual actions rulemaking (we note the staff's stated intent to separate security issues from the manual actions rulemaking)
- Eliminate the requirement for additional automatic suppression in the area of the fire
- Treat manual actions consistently with other operator actions and eliminate the requirement for time margin factor
- Improve stakeholder participation in the process of developing reasonable acceptance criteria and in addressing other concerns about the rulemaking

We would welcome the opportunity to meet with you to discuss this issue further. If you have any questions about these comments, please contact me (202-739-8125; msf@nei.org), Alex Marion (202-739-8080; am@nei.org), or Fred Emerson (202-739-8086; fae@nei.org).

Sincerely yours,

Marvin S. Fertel

Enclosure

c: Mr. James Dyer, NRR
Ms. Suzanne Black, NRR
Mr. John Hannon, NRR
Document Control Desk

Enclosure

Industry Comments on the Proposed Manual Actions Rule

1. The language of the rule should be simplified and a revised version of the currently proposed Section III.P language be placed in a Regulatory Guide. The currently proposed language in Section III.P is far too detailed for the rule itself. A cumbersome rulemaking process would be necessary to make adjustments as new information on manual action feasibility and reliability emerges. We recommend modifying the NRC-proposed III.G.2 paragraph c-1 as follows:

   "Operator manual actions that, in concert with other fire protection features, maintain one train of safe shutdown equipment free of fire damage."

   This would be the entire addition to Section III.G.2. We also recommend placing a revised version of the proposed Section III.P (see comments below) in a Regulatory Guide.

2. The Regulatory Guide should contain the acceptance criteria for gauging the reliability and feasibility of operator manual actions described in the new paragraph c-1 in Section III.G.2. The version of these criteria presented in NRC Inspection Manual 71111.05 (March 6, 2003) provided a reasonable approach, and the Regulatory Guide should reflect these criteria.

   NEI provided detailed comments on subsequent staff changes to some of these criteria in our letter of January 27, 2004. We expressed particular concern about the new requirements for detection and suppression in the area of the fire and for equipment preconditions." These comments were not reflected in the proposed rule language provided recently to the ACRS. Additional requirements have also been added; these are addressed in comments below.

3. The requirement for automatic suppression in the area of the fire adds nothing to the operator's ability to carry out a manual action <u>in a different area</u>, and should be removed from the proposed rule (or Regulatory Guide) language. Adequate suppression is already provided in fire areas based on fire hazards analysis results, in accordance with current regulations. The proposed requirement would enhance neither the feasibility nor the reliability of these actions. At best, it would result in a small improvement in the frequency of a damaging fire.

This requirement would result in the expenditure of millions of dollars for new suppression systems at most plants with little or no safety gain. The obvious alternative would be exemption requests for the existing configurations, which would result in a high administrative burden on the staff and industry with no improvement in safety. This would also negate the purpose of the rulemaking itself, which was to allow the use of appropriate operator manual actions without the need for exemptions from III.G.2.

4. The NRC should remove the requirement for a 100% time margin factor and instead treat manual actions consistently with other operator actions used in plant operations and event response. The proposed requirement is intended to allow for uncertainties in the ability of the operating crews to carry out the manual actions; instead, it negates the demonstrated performance of the operating crews.

   Operator actions to carry out EOPs and Severe Accident Management Guidelines, in place at plants for many years, are not penalized with these arbitrary time margin factors to assure reliability. Since the results of these actions are at least as consequential as those for fire safe shutdown, there is no apparent reason for this new requirement.

   We propose instead a performance-based approach that would:

   - Provide more credit for demonstrated performance
   - Allow alternate methods for demonstrating reliability
   - Avoid duplicate or burdensome conservatism
   - Reduce or eliminate the need for high-cost changes to existing T-H analysis

   We further recommend that performance goals, and acceptable methods for satisfying them, be developed at public interactions or workshops to develop performance goals and explore methods for satisfying them. This type of public input was not sought when NRC developed the time margin factor.

   As with the requirement for automatic suppression, there is a strong likelihood for exemption requests if this provision is maintained, thus defeating the purpose of the rulemaking.

5. Another criterion requires that the licensee conduct walkdowns at intervals not to exceed 12 months, using an established crew of operators, to demonstrate that each operator manual action required to achieve and maintain the plant in a hot shutdown condition can be accomplished consistent with the analysis. Demonstrating the ability to perform manual actions every 12 months is inconsistent with other requirements for operator training. As an example, operator training on topics such as emergency operating procedures typically occurs every two years.

6. The rule should not be applicable to manual actions previously approved by NRC.