RESPONSES TO NRC COMMENTS

ON NEI 00-01

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NEI Circuit Failure Issue Task Force

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Attachments

1. INTRODUCTION

This report documents the responses to the comments provided by NRC staff on NEI 00-01, "Guidance for Post-Fire Safe Shutdown Analysis," Draft Revision C and transmitted in the March 6, 2002 letter to NEI.

2. Comments/Responses From the Cover Letter

Comment L1: First, the NEI 00-01 proposed resolution of the circuit analysis issue is a risk screening tool that we may be able to use as guidance for focusing inspections, prioritizing corrective actions, or finding the proper significance determination process (SDP) color. We understand that NEI 00-01 can be used within the bounds of the current deterministic regulations to identify and potentially support exemptions or deviations. Also, it may be used to implement the proposed rule which endorses NFPA 805.

Response: Industry agrees that the NEI methodology may be used to focus inspections, prioritize corrective actions, or determine the safety significance of an inspection finding as part of the SDP use. We agree also that it may be used to implement a risk-informed circuit analysis technique within the NFPA 805 licensing basis.

With regard to its use for deterministic circuit analysis, NEI 00-01 was developed to resolve interpretive differences over regulatory guidance concerning certain circuit analysis assumptions. NEI 00-01 can be used to support exemptions or deviations in areas where the plant configuration unambiguously does not meet its own long-standing licensing basis. However, exemption or deviations should not be required where there has been a legitimate and long-standing difference in interpreting the regulations. In these cases, a safety significance determination is useful in determining the action to be followed by the licensee without having to directly address the interpretive differences.

Two examples will illustrate this position. In the first case, a licensee discovers an oversight in the implementation of its own licensing basis, and has failed to postulate a spurious actuation where one should have been postulated. In this case the licensee can determine the significance of the oversight using the methods of NEI 00-01. The licensee would place the problem in the corrective action program (CAP) if it is significant according to the NEI 00-01 criteria, or request an exemption or deviation, or change the fire protection plan, if it is not.

In the second case, the licensee has a longstanding licensing basis reflecting the postulation of any and all spurious actuations, one at a time. NRC inspectors several years previously informed that licensee that they should have considered a particular combination of two simultaneous spurious actuations in a particular fire area to maintain one train free of fire damage. As in the first example, the licensee would perform a risk significance analysis using the methods in NEI 00-01. If the licensee finds the combination to be risk significant, they should place the issue resolution in the CAP. If the licensee finds the combination to not be risk significant, however, no exemption request is required. The licensee would update its fire protection plan. The licensee remains in compliance with his own licensing basis and there is no significant safety benefit to be gain by fixing the “problem”; therefore, the health and safety of the public is preserved.

Comment L.2: Certain aspects of the NEI 00-01 methodology screen out from further analysis certain high consequence events. There are problems of statistical confidence with respect to judgements involving high consequence events where little data exist. Therefore, it may be appropriate to retain some deterministic acceptance criteria for high consequence events, i.e., not screen them out, unless an appropriate degree of rigor can be attached to the screening process. In any case, the treatment of uncertainty associated with a risk tool such as NEI 00-01 should be explicitly and carefully considered.

Response: NEI agrees that the uncertainty of the risk calculations should be considered. If it cannot be treated in a rigorous mathematical analysis, sensitivity studies should be performed to address this issue, as was done in the pilot evaluations of the NEI 00-01 method. However, the NEI 00-01 methodology follows the example of Regulatory Guide 1.174 by requiring consideration of safety margins (SM) and defense-in-depth (DID) before any circuit failure or combination thereof can be screened out on the basis of risk significance. Therefore, any screening out of high-consequence events would require the consideration of SM/DID. The combination of sensitivity studies and SM/DID analysis should be sufficient to address the concern in this comment.

2. General Comments

Comment G.1: The stated objective of Draft Revision C of NEI 00-01 in *"providing a consistent process for performing a fire safe shutdown analysis"* that *"will meet regulatory requirements,"* does not appear to have been achieved for reasons described in the following NRC staff comments.

Response: Please review the responses to the subsequent comments.

Comment G.2: As stated in Section I of the NEI document, the numerous variations in plant designs have resulted in wide variation in plant-specific approaches to post-fire safe shutdown analysis. Since Appendix R was promulgated after many plants were either already operating or well past their initial design phase, it was expected that implementation of its fire protection design features may not be practical or feasible at all plants. Through a plant-specific evaluation process, the staff has approved, on a case-by case-basis, alternative approaches that were deemed to provide an equivalent level of fire safety. Staff approvals documented in safety evaluations were specifically applicable to the plant under consideration and do not represent staff endorsement of a particular approach for industry-wide application. Further, plant-specific exemptions granted in accordance with 10CFR 50.48 and 50.12 do not constitute a new regulatory position generically applicable to all licensees.

Response: Refer to Attachment E (Role of NEI 00-01 in Licensing Basis). NEI 00-01 is intended to provide a method for licensees to determine the significance of circuit analysis issues on a <u>plant-specific</u> basis. While the method is generic, the specific risk factors applied are plant specific. Staff endorsement of the generic approach allows licensees to apply the method with some confidence that if the method is followed properly, the results will be accepted by the staff – for plant-specific issues.

In this comment, the staff is apparently concerned that deterministic methods approved by staff for specific plants are being generalized inappropriately for industry guidance. The deterministic methods, developed by the Boiling Water Reactor Owners Group, were later reviewed by PWR representatives and determined to be applicable to their plants as well. NRC should consider three essential points.

- First, these methods were provided as a set of criteria or guidelines to assist plants that choose to revise their deterministic circuit analyses, but not with the view that plants should redo their safe shutdown analysis to address these criteria. These plant analyses were performed over the years to address regulatory criteria, and have been reviewed by staff on more that one occasion. Therefore, the industry is not imposing a new set of criteria on the plants. The real criteria are embodied in the plant-specific licensing bases, not in this document

- Second, these deterministic methods and assumptions were based on a broad cross section of long-standing industry practices, which were in turn based on a largely consistent interpretation of the regulations. They were not based on a few plant SERs. They were developed, not to the lowest common denominator of plant practice, but with full consideration that some plants would have some work to do to fully address these criteria. Therefore, the staff should not view the deterministic methods as outside the range of acceptable practices.

- Third, the deterministic and risk significance methods should not be viewed in isolation from each other. The real purpose of this document was to allow the resolution of plant-specific circuit analysis issues from a risk significance standpoint, not to impose another layer of deterministic analysis requirements on the industry. If a licensee chose to revise a portion of his safe shutdown analysis using the deterministic criteria in this document, the level of safety in his plant would not be reduced and would in some cases be enhanced over where it is now. Industry and NRC can continue to argue over deterministic circuit analysis assumptions, but this would lose sight of the purpose of this method – to rise above these arguments.

While it is true that plant-specific safety evaluations were not intended for application to the industry at large, the restatement of similar staff positions in multiple SERs and inspection reports is indicative of a trend, or mode, in staff positions. Staff cannot discount such trends merely by stating that they were intended only for the plants in question.

Comment G.3: In general, the NEI document quotes interpretations and criteria for industry-wide application that have been derived from alternative approaches described in plant-specific safety evaluation reports (SER) issued by the staff. For example, in Section 1.3.2 the document cites the Browns Ferry SER as a basis for its position on spurious actuations of concern to post-fire safe shutdown. Justification of industry positions and interpretations should provide a technical justification for these approaches rather than to refer to plant-specific SERs, which were not intended to be applied generically.

Response: Refer to Attachment E (Role of NEI 00-01 in Licensing Basis). As noted in the response to Comment G.2, the approaches and criteria used in this document are a compendium of plant practices based on long-standing interpretation of the regulations incorporated into licensing bases. These practices and criteria were justified in numerous plant submittals to the staff and staff acceptances of these methods over the last twenty years, and require no additional justification here. Given their wide usage and acceptance without comment on so many dockets, NEI does not consider them to be "alternative approaches" ".

Comment G.4: The title for this document should be revised as the document discusses primarily circuit failure analysis, and is not a comprehensive guide to post-fire safe-shutdown analysis. For example, emergency lighting is not discussed. Therefore, the title should be changed to accurately reflect the subject matter; i.e., "circuit analysis."

Response: NEI will consider a title change that appropriately reflects the content of the document.

Comment G.5: On page 5, the NEI guidance states that; "This approach is in concert with the principle that risk-significant failures, or combinations thereof, should be addressed and non-significant ones need not be. The origin or basis of this principle is not provided by NEI and it appears to conflict with the existing NRC fire protection regulations, guidance and Commission policy.

Response: The statement in question reflects the purpose of risk-informing regulations in general as well as the specific purpose of this document to focus on the risk significance of potential fire-induced circuit failures rather than interpretive differences concerning the regulations. This method adds an objective resolution pathway to subjective differences of interpretation. As noted in the response to Comment L.1, if a potential circuit failure is an unambiguous noncompliance with regulations and the licensing basis, it must be corrected or exempted. If it is a matter of interpretation, it makes no sense to waste regulatory and licensee resources on non-significant issues.

This principle is in concert with this excerpt from the NRC's 1995 Policy Statement, "PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the art, to reduce unnecessary conservatism associated with current regulatory requirements, regulatory guides, license commitments, and staff practices."

The process in NEI-00-01 is provided to reduce the unnecessary conservatism, by screening from consideration low risk combinations, and focusing on potentially higher risk combinations.

Comment G.6: Also on page 5, the NEI guidance states that; "The methods in this document are not intended to require systematic re-evaluation of a plant's post-fire safe shutdown analysis, nor do they take precedence over specific requirements accepted by the NRC in a plant's post-fire safe shutdown analysis." This appears to allow a selective implementation of this methodology by licensees when issues related to post-fire safe shutdown are identified and to discourage intentions to use the approach to identify "risk-significant" vulnerabilities in a plant's safe shutdown analysis.

Response: Refer to Attachment E (Role of NEI 00-01 in Licensing Basis). In response to Generic Letter 88-20, plants performed extensive risk analysis to determine potential vulnerabilities to fire as part of the IPEEE program, and took action to resolve potential vulnerabilities identified in these analyses. NRC later concluded that the IPEEE program was successful in meeting the intent of Supplement 4 to GL 88-20.

Because of the admitted success of the IPEEE program, there is no need for another systematic search for vulnerabilities. Plant safe shutdown programs have been in place for almost twenty years and have been inspected repeatedly. Plants have made significant changes to address fire protection issues. If no clear-cut need has been demonstrated for another vulnerability search, it is inappropriate for NRC to expect that NEI 00-01 should be so used.

With regard to the "selective implementation" of this methodology, it has always been intended for plant-specific use to address plant-specific issues. Therefore, by its very nature, it must be "selectively" applied.

Comment G.7: NEI-00-01 relies on risk-based methodology to attempt to demonstrate adequate levels of safety, but the levels of uncertainty are not addressed. There could be a large enough degree of uncertainty in the analysis that could significantly change the results.

Response: The pilot projects addressed uncertainty and sensitivity. NEI-00-01 is being revised to include a requirement for consideration of uncertainty and sensitivity in the analysis. This analysis should include consideration of all major factors that could change the results and conclusions. Analysis of conservatism in the screening is less important since it would not result in a screened scenario becoming unscreened.

3. Specific Comments by Section

3.1 Section 1 Comments

Comment 1.1: Section 1.1.1 states that implementation of the deterministic methodology "will meet regulatory requirements" while Section 3 states that the methodology "meets the intent of requirements of Appendix R." During prior discussions with the staff, NEI representatives stated that the document would provide a consistent process for performing a post-fire safe-shutdown analysis in a manner that fully complies with established regulatory requirements. The difference in terminology should be reconciled.

Response: The intent of the document is to provide a consistent process for performing a post-fire shutdown analysis in a manner that complies with established regulatory requirements. However, in cases where a lack of clarity or vagueness exists in aspects of the regulatory requirements that have led to misinterpretations, widely accepted methods used within industry have been adopted to meet the intent of certain requirements. In order to avoid further confusion, Section 3 will be revised to indicate that the methodology complies with established regulatory requirements.

Comment 1.2: Section 1.3.1.2 states that the licensing basis includes the FSAR, docketed commitments, SERs and inspection finding resolutions. There is a discrepancy between this statement and the licensing basis definition provided in 10 CFR 54.3(a).

Response: NEI will consider the definitions in 10CFR54.3, but notes that these definitions **are**

specifically applicable to License Renewal. Please also refer to Attachment E (Role of NEI 00-01 in Licensing Basis). The items considered for licensing basis have been established based on long-standing industry practice, found acceptable on many occasions by NRC staff.

Comment 1.3: Section 1.3.2 states that the only spurious operations that present a potential concern are those that can cause, (1) a loss of inventory in excess of the makeup capability, (2) flow diversion or flow blockage in the safe shutdown systems being used to accomplish the inventory control function; (3) flow diversion or flow blockage in the safe shutdown systems being used to accomplish the decay heat removal function. This makes no provisions for a safety margin. Under NEI's approach, any loss of inventory smaller than the design makeup capability would be acceptable without any further analysis. Under that approach, an un-isolated loss of coolant (i.e. high/low pressure interface) would be acceptable provided it were less than the design makeup capability. In addition, only a single spurious operation is considered, therefore two or more spurious operations that result in a loss of inventory would not be considered. This listing should also consider the spurious operations that can impact reactor coolant system (RCS) pressure control. In Generic Letter 81-12, the staff identified RCS pressure control as a required function for hot standby/shutdown.

Response: Section 3.1 will be revised to eliminate the perception that spurious operations of concern are limited only to a loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability or a flow loss or blockage in the inventory make-up or decay heat removal systems being used for the required safe shutdown path. These are typical examples only and will be described as such. The issue of spurious operation or maloperation of non-safe shutdown equipment is responded to in Attachment C (Position on Spurious Actuation of Non-Safe Shutdown Equipment).

Comment 1.4: The second paragraph of Section 1.3.2 says that spurious operations concerns are limited in number to 3 potential concerns. What is the basis for this limitation? Why is it exhaustive? [Note, for example, that pumps that are stopped are neither flow diversions nor flow blockages, yet can affect the inventory control function of the second listed cause.]

Response: Section 1.3.2 will be revised to indicate that the 3 spurious operations identified are typical examples only.

Comment 1.5: Section 1.3.5 states that power cables associated with each bus in the electrical distribution system (EDS) are identified and related to the same safe shutdown path as the EDS equipment. Does this approach include identification of instrumentation and control cables related to the shutdown path?

Response: Paths are typically associated with safe shutdown components. The cables identified as being required for the operability or that result in the maloperation of each safe shutdown component then inherit the path(s) assigned to the component. This approach is applicable to all safe shutdown components including instrumentation required for achieving safe shutdown in each fire area.

Comment 1.6: Section 1.3.6 states that each conductor in each cable is reviewed for the effects of a hot short, a short to ground, or an open circuit. Does this approach include the potential for multiple hot shorts, shorts to ground, or open circuits, in the safe-shutdown circuit analysis?

Response: Refer to Attachment D (Position on Multiple Spurious Actuations). This approach requires the deterministic review of these circuit failure modes on a one-at-a-time basis, based on a consistent industry interpretation of regulatory guidance for many years.

Comment 1.7: Section 1.3.7 introduces a new approach that suggests that mitigating the impacts to the required safe shutdown paths is an acceptable alternative to providing the protection required in Section III.G.2 of Appendix R to 10 CFR Part 50 to maintain the equipment free of fire damage. What is the basis for this interpretation?

Response: Refer to Attachment E (Role of NEI 00-01 in Licensing Basis). The mitigation aspect of the process briefly summarized in Section 1.3.7 is not new, and reflects plant practices in use for many years. There is no reference in this section to Section III.G.2 of Appendix R, and the commenter should refer to the more detailed discussion later in Section 3.

3.2 Section 2 Comments

Comment 2.1[a]: Figure 2-1: The term "Remote Control" is not defined (in section E.5.0) and "manual operation" using the definition in section E.5.0 does not agree with the definition used in the regulations. According to the regulations, in order to meet III.G.1 of Appendix R, actions must be performed in the control room or emergency control station(s).

Response: Refer to Attachment B (Position on Manual Actions). Sections 5.0 definitions, as well as section E.5.0, have been revised or new definitions added to include the following: Remote Control, Manual Operation, Emergency Control Station and Free of Fire Damage. The industry definitions may be different than those of the NRC, however, the rationale for these differences was discussed during a recent meeting (June 25, 2002) between NEI, industry representatives, and the NRC staff.

Comment 2.1[b]: With regard to the definition of "Free of fire damage," Appendix R constrains it to mean that no spurious actuations occur and the safe-shutdown function may be performed automatically or manually from the control room or emergency control station(s).

Response: Refer to Attachment A (Position on Free of Fire Damage).

Comment 2.2: Figure 2-1 indicates that "free of fire damage" is achieved when the structure, system or component is capable of performing its intended function during and after the postulated fire, as needed. It may perform this function automatically by remote control, or by manual operation. The staff's definition of "free of fire damage" states that the structure, system or component under consideration is capable of performing its intended function during and after the postulated fire, as needed, without repair. The NEI definition represents a relaxation from the current NRC regulations and guidance. The flowchart in Figure 2-1 does not address cables and equipment located inside non-inerted primary containments (i.e. III.G.2.d, e, and f of Appendix R) nor does it address the requirement in Section III.L.5 of Appendix R to be able to repair equipment and achieve cold shutdown within 72 hours when relying on alternative or dedicated shutdown capability. The last diamond in the lower right hand corner needs clarification.

Response: Refer to Attachment A (Position on Free of Fire Damage). The first sentence in the NEI definition of "free of fire damage" in the first note for Figure 2-1, and the definition in Section 5, is the same as the staff's definition in GL 86-10 [Enclosure 1, "Interpretations of Appendix R," Section 3]: "the structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed." Note that the phrase "without repair" included in the comment does not appear in GL 86-10. The second sentence in the definition is the statement that adds clarity to the definition, and is consistent with the long-standing practice in the nuclear industry, reviewed on many occasions by NRC staff as being in conformance with NRC requirements.

Comment 2.3[a]: Section 2-1 states that the phrase "free of fire damage" allows the operator to perform a manual actions/operations of safe shutdown equipment to accomplish its required safe shutdown functions in the event the remote/automatic functions of the equipment is impacted. This position is not consistent with the existing NRC regulations or guidance. It is correct that the automatic functional capability of redundant systems is not required to be protected from a fire unless the circuits related to the automatic function of a safe shutdown system can prevent operation or cause maloperation of that system. In this instance such circuits would be considered associated circuits and would require protection in accordance with III.G.2 of Appendix R. Operator initiation of systems required to achieve and maintain safe shutdown from the control room is allowed.

Response: Refer to Attachment A (Position on Free of Fire Damage).

Comment 2.3[b]: For redundant systems located outside containment in the same fire area, Appendix R only provides three options for ensuring that one train is free of fire damage. Manual operator actions outside the control room to recover hot shutdown/standby systems that have been impacted by the fire is not recognized as an acceptable alternative under III.G.2 of Appendix R.

This section also implies that licensees have the option of complying with either III.G.1 or III.G.2 of Appendix R. However, compliance with III.G.1 of Appendix R is required in all plant areas important to safe shutdown. Section III.G.1 of Appendix R requires that fire protection features must be provided to ensure that one train of systems required for hot shutdown is maintained free of fire damage. If redundant safe shutdown trains are located in the same fire area the separation criteria specified in III.G.2 of Appendix R must be met, or the licensee must meet the requirements specified in III.G.3 and III.L of Appendix R for providing alternative/dedicated shutdown capability. The only alternative available to licensees is to request exemptions from the technical requirements of Appendix R through the process specified in 10 CFR 50.12, or request a deviation for the plants licensed post-Appendix R.

Response: Refer to Attachment B (Position on Manual Actions). This position has been discussed in more detail in NEI's letter to NRC of January 11, 2002 and in a subsequent meeting with NRC staff on June 20, 2002. The statement that "compliance with III.G.1 of Appendix R is required in all plant areas important to safe shutdown" seems not consistent with NRC comment 3.7 below, which states, "For example, if spurious operations must be mitigated by racking out breakers and closing manual valves, and these actions are not in the control room or at emergency control stations, III.G.1 of Appendix R does not apply, and such manual actions are not allowed. Therefore III.G.2 or III.G.3 of Appendix R must be followed to achieve compliance. III.G.1 of Appendix R applies to completely independent systems located in separate fire areas."

3.3 Section 3 Comments

Comment 3.1: As stated in other sections of the guidance document, this section restates that the use of manual operator actions to complete safe shutdown functions complies with the requirement to maintain a system free of fire damage. As previously noted, this is not consistent with existing NRC regulations and guidance.

Response: Refer to Attachment B (Position on Manual Actions) and to previous responses related to the use of manual actions.

Comment 3.2: This section states that the effects of spurious operations of concern are limited to: (1) a loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability; and (2) a flow loss or blockage in the inventory makeup or decay heat removal systems being used for the required safe shutdown path. These criteria are not listed in Generic Letter 81-12 as implied by the document.

As noted in the comment on Section 1.3.2, these criteria exclude other spurious actuation concerns identified in Generic Letter 81-12 and are therefore not consistent with existing staff guidance.

Response: Section 3.1 will be revised to eliminate the perception that spurious operations of concern are limited only to a loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability or a flow loss or blockage in the inventory make-up or decay heat removal systems being used for the required safe shutdown path. These are typical examples only and will be described as such. Refer also to the response to Comment 1.3. In addition, Section 3.1 does not imply that Generic Letter 81-12 provides a list of spurious operations. Section 3.1 states only that GL 81-12 provides direction to consider the effects of "associated circuits". Section 3.1 has been revised to reflect the above.

Comment 3.3: This section should include a discussion of high/low pressure boundaries consistent with the information provided in Generic Letter 86-10.

Response: A separate discussion on high/low pressure boundaries is included in Attachment C since consideration of these components and their circuits deviates from the methodology used for non-high/low pressure interface components.

Comment 3.4: In Paragraph 2, under "Methodology," the last sentence states that this document does not address safe shutdown requirements such as fire detection, fire suppression, and barriers. Since fire impact mitigation is only casually discussed in this document and is not part of the purpose of this document, the title and scope should be clarified.

Response: To provide clarity, paragraph 2 will be revised to clearly state that the post-fire safe shutdown analysis does not consider the effects of fire on the fire detection, fire suppression, communication and lighting systems, and fire barriers.

Comment 3.5: Section 3, states that the circuit analysis and fire impact mitigation techniques described in the document are not applicable to communications systems and 8-hour emergency lighting equipment. This statement may be interpreted to mean that emergency communication and lighting systems need not be evaluated for the effects of fire damage. The document should clearly state that where these systems are deemed necessary to facilitate the accomplishment of safe shutdown functions, the potential effects of fire damage on their operability must be fully considered.

Response: The document will be revised to indicate that these systems are deemed necessary to facilitate the accomplishment of safe shutdown functions and the potential effects of fire damage on their operability must be fully considered. (Refer to the response to Comment 3.4)

Comment 3.6: Section 3.1, paragraph 1, sentence 4: this sentence should include the requirement that manual actions must be performed from the control room or emergency control stations. If NEI wishes to have manual actions performed at locations other than the control room or designated emergency control stations, which is generally understood as remote shutdown panel or alternate shutdown facilities, this guidance should include all locations that qualify as an "emergency control stations."

Response: Refer to Attachment B (Position on Manual Actions).

Comment 3.7: Section 3.1, paragraph 1, sentence 6: although operators are permitted to shut down the plant from the control room or emergency control stations which are free of fire damage, this does not allow the mitigation of spurious actions. If spurious operation could occur then the systems are not free of fire damage. For example, if spurious operations must be mitigated by racking out breakers and closing manual valves, and these actions are not in the control room or at emergency control stations, III.G.1 of Appendix R does not apply, and such manual actions are not allowed. Therefore III.G.2 or III.G.3 of Appendix R must be followed to achieve compliance. III.G.1 of Appendix R applies to completely independent systems located in separate fire areas. Note, as the rule is written, III.G.2 requires preventing the maloperation rather than mitigation of spurious operations.

Response: Refer to Attachment A (Position on Free of Fire Damage) and Attachment B (Position on Manual Actions).

Comment 3.8: Section 3.1, paragraph 2, sentence 1: The goal of post-fire safe shutdown is to assure that a single fire in any single plant fire area will not result in any fuel cladding damage, rupture of the primary coolant boundary or rupture of the primary containment. Protection at nuclear plants is not to prevent fuel damage, etc., the goal is to achieve safe shutdown, and prevent radiological releases. The goal is much higher, i.e., safe shutdown must be assured. Assuring safe shutdown means that at least one train of shutdown structures, systems, and components (SSC) must be available in the event of any fire. The NRC recommends that discussion of the goal of preventing fuel damage should be replaced with discussion of one train of shutdown SSCs being available. Obviously fuel damage should be prevented, but the goal of the NRC's fire protection rule is to assure safe shutdown, not simply to only prevent fuel damage.

Response: The phrase "fuel cladding" was obtained from the requirements defined in Appendix R Section II.G.3. Per the NRC recommendation, the discussion of the goal of preventing fuel damage will be replaced with a discussion of one train of shutdown SSCs being available.

Comment 3.9: Section 3.1, paragraph 2, sentence 4: Because the list of functions is not exhaustive, Paragraph 2 should be rewritten to state: "The functions important to post-fire safe shutdown generally include, but are not limited to the following. "

Response: Paragraph 2 will be revised as suggested.

Comment 3.10: Section 3.1 states: *"Appendix R Section III.G.1.a requires that the capability to achieve and maintain hot shutdown be free of fire damage. Free of fire damage allows for the use of manual operator actions to complete the required safe shutdown functions."*

This statement does not appear to be consistent with established regulatory criteria. Specifically, Section III.G.1 of Appendix R states: *"Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that: a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage;"* Fire protection design features necessary to ensure this capability for redundant systems located in the same fire area outside of containment are delineated in Section III.G.2.a, b, and c of Appendix R. Clearly, manual operator recovery actions would not be necessary if the affected systems, components, or cables were provided with suitable fire protection features. Additionally, as noted in NFPA 805, where manual operator actions are relied on to provide the primary means of recovery in lieu of providing fire protection features, risk may be increased.

Depending on the nature and extent of fire damage, the desired shutdown function of an affected component or system may frequently be restored through the use of manual operator recovery actions and, on a case-by-case basis, recovery actions have been found to provide a suitable means of satisfying regulatory objectives. It should be noted, however, that because the acceptability of their use must be substantiated by additional engineering evaluations, shutdown methodologies that rely on the use of manual operator actions do not provide prima-facie evidence of compliance with established regulatory requirements. Specific factors that must be considered include: time-critical consequences of the fire-initiated event/maloperation being mitigated; availability and capability of diagnostic instrumentation necessary to detect the event; time available for operators to perform required actions; number of actions that may be required; feasibility; accessibility; lighting; potential effects of the products of combustion (smoke, heat, toxic gasses) on operator performance; staffing needs; need for procedural guidance; communications; training; human performance factors under high stress conditions; and special tools. Additionally, one should consider that the implementation of manual recovery actions may increase risk, and the risk presented by their use should be carefully considered and compared to the risk associated with maintaining the system or component free of fire damage per Section III.G.2 of the regulation.

Response: Refer to Attachment B (Position on Manual Actions). The NEI 00-01 guidance is consistent with industry practice as noted above. The NEI letter of January 11, as well as the current guidance in NEI 00-01 Appendix E, recognizes that the plant should be able to demonstrate that manual actions are feasible given time availability resources, and favorable environmental conditions as noted in the comment. If these criteria are met, the increase in risk from the use of manual actions should be minimal.

Comment 3.11: As currently worded, Section 3.1 appears to arbitrarily limit "spurious operations of concern" to only those that can cause: (1) a loss of reactor pressure vessel inventory in excess of makeup capability, and (2) a flow loss or blockage in coolant makeup or decay heat removal systems. This statement requires a more substantial technical basis. Inspection experience has shown that spurious equipment operations or maloperations in other (non-safe shutdown) systems may have a significant effect on the credited method of achieving shutdown conditions. Specific examples include: Ventilation (HVAC), Component Cooling Water, Service Water, plant protection system logic circuitry, false start of non-essential electrical equipment (e.g. pressurizer heaters and large pumps), false instrument indications and equipment that could initiate a plant transient such as an uncontrolled injection into the reactor coolant system. The definition of "spurious actuations of concern" should be expanded to include all equipment whose fire-induced operation or maloperation could adversely affect the successful accomplishment of the specified performance goals of each shutdown function.

Response: Refer to Attachment C, “Spurious Actuation of Non-Safe Shutdown Equipment”. Section 3.1 will be revised to eliminate the perception that spurious operations of concern are limited only to a loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability or a flow loss or blockage in the inventory make-up or decay heat removal systems being used for the required safe shutdown path. These are typical examples only and will be described as such.

Comment 3.12: Section 3.1.1 criteria/assumptions should be grouped into three major groups, 1) NRC regulation, 2) NRC guidance, and 3) long standing industry guidance. Any regulatory approvals for long standing industry guidance (e.g., NRC Safety Evaluation Reports) should reference the approvals and technical justification on why it is applicable to this application. References should be provided for all criteria/assumptions.

Response: The criteria/assumptions listed are long-standing industry guidance primarily based on a combination of NRC regulations and NRC guidance. This section attempts to consolidate applicable criteria/assumptions that may be considered when performing the respective part of the analysis. However, the specific source of a criterion or assumption may not always be traceable to a specific document. Further, it is not the purpose of this document to re-justify long-standing positions. See the response to Comment G.2 for further information.

Comment 3.13: In section 3.1.1.1, it is not clear why this General Electric (GE) report is “considered to be acceptable.” How does this document address plant-specific designs, equipment location, cable routing etc.

Response: The purpose for the GE report is to provide a basis for establishing acceptable redundant safe shutdown methods including the use of SRVs and Low Pressure systems.

Comment 3.14: Section 3.1.1.3 states that any systems capable of achieving natural circulation are acceptable for achieving redundant safe shutdown in Pressurized Water Reactors (PWRs). This guidance would allow the use of feed and bleed (i.e. using a charging pump and a pressurizer power operated relief valve PORV) as the only fire protected safe shutdown path. Feed and bleed has not been accepted by the staff as an acceptable post-fire shutdown method. This position would also allow the use of safety injection pumps as redundant to charging pumps. This is inconsistent with the staff position. For example, in a memorandum from Marsh to Hebdon, dated October 2, 1997, the staff most recently restated this position concerning the use of safety injection pumps for compliance with III.G.2 of Appendix R at Turkey Point.

Response: Refer to Attachment H (Position on PWR Issues). The referenced memorandum (Marsh to Hebdon, dated October 2, 1997) describes an NRC concern with compliance with III.L criteria. NRC now understands (based on BWROG & NEI discussions) that III.L criteria do not apply to III.G.1 and III.G.2 shutdown capability. III.L provides specific criteria that must be met for any new shutdown capability that a licensee installed under III.G.3, in cases where the existing shutdown capability did not meet III.G.1 and/or III.G.2. In its December 12, 2000 letter from Stuart A. Richards to James Kenney, the NRC stated: "The staff concluded that Section III.L performance criteria are applicable only to alternative or dedicated shutdown capability, and need not be met for redundant post-fire safe shutdown capability." In general, redundant PWR shutdown strategies are a function of NSSS design, and have been extensively reviewed under various transient and accident analyses. The guidance provided in NEI 00-01 Section 3.1.1.3 assures that adequate core cooling will be maintained, since it prevents the formation of a steam bubble in the RPV.

Comment 3.15: Section 3.1.1.4 allows the use of manual actions and repairs for compliance with III.G.1 and III.G.2 of Appendix R. Repairs can only be used for cold shutdown capability unless previously reviewed and approved by the NRC. The NEI guidance should make a distinction between hot and cold shutdown in this regard.

Response: Section 3.1.1.4 will be revised to include, in parentheses, the words “cold shutdown only” after the word “repair”.

Comment 3.16: Section 3.1.1.5, last sentence, states that the unit(s) are assumed to be at full power. For a two-unit plant, it may be appropriate to assume that the fire-affected unit is at full power. But other units relied upon for alternate shutdown, should be analyzed as if they are in the most limiting condition, which may be shutdown or low power. For example, in a PWR with cross connects, the opposite unit in shutdown with the charging/safety injection pumps out of service would be of no help to the fire affected unit. This should be considered in an analysis.

Response: As with single unit plants, Technical Specifications govern the availability of equipment relied upon for accident mitigation. NRC has addressed Technical Specifications for Appendix R on a plant by plant basis. The SECY 97-168 SRM indicates that the staff has yet to issue the proposed rule related to shutdown and fuel storage pool operation. Plants have considered the availability of their safe shutdown equipment as part of their IPEEE process.

Comment 3.17: Section 3.1.1.7. Should be revised to read: For the case of redundant shutdown, offsite power may be credited if demonstrated to be free of fire damage. Offsite power should be assumed to remain available for those cases where its availability may adversely impact safety (i.e., reliance cannot be placed on fire causing a loss of offsite power if the consequences of offsite power availability are more severe than its presumed loss). No credit should be taken for a fire causing a loss of offsite power. For areas provided with an Alternative Shutdown capability, shutdown must be demonstrated both where offsite power is available and where offsite power is not available for 72 hours.

Response: Section 3.1.1.7 will be revised as suggested.

Comment 3.18: Section 3.1.1.8 states that safe shutdown systems can be either safety related or nonsafety related. The exception for the use of nonsafety related systems is applicable only to alternate/dedicated safe shutdown capability defined in III.G.3 and III.L of Appendix R. Redundant systems used for compliance with III.G.1 and III.G.2 of Appendix R are normally one train of systems necessary to achieve and maintain hot shutdown conditions. Hot shutdown conditions are defined in the plant's Technical Specifications. In the Technical Specifications, the equipment necessary to support hot shutdown conditions are normally safety related or important-to-safety equipment. The guidance should make a distinction between redundant systems and alternative/dedicated shutdown capability in this regard.

Response: Current regulations do not require that safe shutdown systems be safety-related.

Comment 3.19: Section 3.1.1.10 should be clarified to state that for certain situations, e.g., III.G.1 compliance, manual initiation is only allowed from the control room or emergency control stations.

Response: Refer to Attachment B (Position on Manual Actions).

Comment 3.20: Section 3.1.2.3 allows level to fluctuate beyond the pressurizer level indication range. According to Appendix R, Section III.L.2.b, the reactor coolant makeup function shall be within the level indication in the pressurizer for PWRs. The statement "Temporary fluctuations outside this range are permissible..." should be deleted or justified by an analysis acceptable to staff.

Response: Refer to Attachment H (Position on PWR Issues).

Comment 3.21: In section 3.1.2.6.1 the following sentence should be added: Offsite power should be assumed to remain available for those cases where its availability may adversely impact safety (i.e., reliance cannot be placed on fire causing a loss of offsite power if the consequences of offsite power availability are more severe than its presumed loss). No credit should be taken for a fire causing a loss of offsite power.

Response: Section 3.1.2.6.1 will be revised as suggested.

Comment 3.22: Section 3.1.2.6.2. The phrase "operating temperature range" (of equipment) should be clearly defined (e.g., operating temperature range specified in manufacturer literature or demonstrated by suitable test methods) and the phrase "room temperatures acceptable for performing operator actions" should be quantified.

Response: The phrase "operating temperature range" will be more clearly defined as suggested.

Comment 3.23: Section 3.1.2.6.2 discusses HVAC systems for post-fire safe shutdown. This section should be expanded to address habitability and smoke control/removal concerns (i.e., ventilation systems and equipment necessary to assure protection for plant operations staff from the effects of fire (smoke, heat, toxic gases) and gaseous fire suppression agents). Specific areas of concern are the control room, areas where post-fire shutdown activities are performed and access and egress pathways.

Response: *The section will be expanded appropriately.*

Comment 3.24: Section 1.1.1 states that the methodology "will meet regulatory requirements." However, the safe shutdown system performance criteria described in Section 3 do not incorporate the regulatory requirement (i.e. Appendix R, section III.L.1.) that during post-fire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal A.C. power. Depending on the plant-specific shutdown methodology, the deletion of this criterion may result in a significant reduction in safety margin from that which would be achieved through full compliance with the regulation.

Response: The requirements for Alternative/Dedicated Shutdown are contained in Attachment D to NEI 00-01. The requirements for Alternative/Dedicated Shutdown were placed in an appendix in order to eliminate confusion in the main body of the document between the requirements associated with III.G.1 & 2 shutdown and III.G.3 & L shutdown. The requirements of III.L.1 are contained in the appendix referenced above. Section III.L acceptance criteria deals strictly with those systems classified as “alternative” and is not intended for “redundant” systems. Therefore, full compliance with the regulation may be achieved based on the current criterion provided in the document.

Comment 3.25: Section 3.1.2.5 appropriately identifies diagnostic instrumentation for safe shutdown systems as a required process monitoring function. However, the document does not provide any further guidance in this area. The purpose and function of diagnostic instrumentation should be defined in the document. Additionally, the document should state that, where reliance on diagnostic instrumentation is required, the instrumentation must be demonstrated to remain unaffected by the fire. (For example, the analyst should not credit control room annunciators as a means of detecting system perturbations unless it can be shown that their operation will not be affected by the fire).

Response: Further guidance will be provided to indicate the purpose and function of the diagnostic instrumentation.

Comment 3.26: In section 3.2, the need to consider the potential for a single fire to cause various combinations of equipment to maloperate should be more clearly stated. The following sentence should be added to Section 3.2.2.2: *"The potential for multiple spurious operations or maloperations must be considered during the equipment identification process."*

Response: Refer to Attachment D (Position on Multiple Spurious Actuations).

Comment 3.27: Section 3.2 should clarify the definition of ‘exposure fire’ to include the possibility that the safe shutdown SSC fire is the initiating event.

Response: The definition of "exposure fire" in NEI 00-01 Section 5, which is the same as that in 10 CFR 50 Appendix R, already addresses this comment.

Comment 3.28: According to section 3.2.1.2, it appears that manual operation of a valve in the fire- affected area is acceptable for achieving and maintaining hot shutdown/standby conditions. This is not consistent with NRC interpretations. In order to meet the requirements of III.G.1 of Appendix R, one train of systems must be operable during and following a fire. A manual operation of a valve in the fire affected area is not possible during the fire. Actions in the fire affected area are allowed only for repair and operation of equipment necessary for achieving and maintaining cold shutdown.

Response: Refer to Attachment B (Position on Manual Actions). Section III.G.1 of Appendix R does not require that one train of systems must be operable "during" a fire. It states that one train of systems must be "free of fire damage". Section 3.2.1.2 simply states that fire exposure to manual valves and piping would not impact their safe shutdown function including the ability to manually operate the valve. This does not imply that manual operation of valves for achieving and maintaining hot shutdown/standby conditions is necessarily acceptable if operation of these valves is required "during" the fire duration period for the area where these valves are located. This is not to say that justification for actuation during a fire could not be provided for certain low combustible fire zones.

Comment 3.29: Section 3.2.1.5 states that instruments should be assumed to fail as a result of fire damage. This statement should be revised to state that, in the absence of further evaluation, the specific failure mode of instruments (full up-scale, full down-scale or midrange) can not be determined, and the worst case should be assumed.

Response: Section 3.2.1.5 will be revised as follows: "Instruments (e.g., resistance temperature detectors, thermocouples, pressure transmitters, and flow transmitters) are assumed to fail up-scale, mid-scale or down-scale as a result of fire damage, which ever is worse. An instrument performing a control function is assumed to provide an undesired signal to the control circuit…".

Comment 3.30: Section 3.2.1.5 states that instrument fluid boundaries and sight glasses remain undamaged by a fire. There is no technical basis provided for this assumption.

Response: This statement will be removed.

Comment 3.31: Section 3.2.1 should include the assumption that instrument air is considered unavailable unless there is a separate redundant system located outside the fire exposed area, or the instrument air system is otherwise protected from fire. Also, Section 3.2.1.2 should clarify that heat sensitive piping materials, e.g., soldered/brazed piping or copper tubing, and any valves or piping that have pressure boundary components which are heat sensitive are not included in this assumption.

Response: Section 3.2.1.7 provides guidance to consider the impact of a fire on the instrument tubing within a fire area. Section 3.2.1.1 will be revised to clarify that heat sensitive piping materials are not included in the assumption.

Comment 3.32: In section 3.3-Safe Shutdown Cable Selection and Location, the statement, *"This section provides industry guidance on the recommended methodology and criteria for selecting safe shutdown cables and determining their potential impact...,"* should be further defined.

Response: It is not clear what needs further definition in this statement. Section 3.3 basically describes criteria/assumptions and a methodology for identifying and locating cables that may impact safe shutdown equipment.

Comment 3.33: Section 3.3.1.3 should state that this only applies if the switch controls do not also enter the fire- affected area.

Response: The intent of Section 3.3.1.3 is to give consideration to isolation devices that prevent the propagation of a fault to other circuits during the process of identifying cables that may impact a safe shutdown component. The location of components and sub—components (e.g. switches, relays, associated cables, etc.) is considered during the fire area evaluation phase of the methodology.

Comment 3.34: Section 3.3.1.4 should note that although these components may be screened in this step, they may lead to high impedance faults or breaker coordination problems, and therefore will be considered later.

Response: The focus of Section 3.3.1.4 is to provide guidance when selecting cables that may impact safe shutdown components. Non-safe shutdown loads and their cables that are screened out during this phase may or may not require further analysis depending on whether they are fed from a common power source or if breaker coordination concerns exist.

Comment 3.35: Section 3.3.2 states that the consideration of spurious actuations need only be considered for cables whose failure could cause the spurious actuation/operation of safe shutdown equipment. This needs to be clarified to include that spurious actuations need to be considered if those spurious actuations could impact safe shutdown capability regardless of whether or not the spurious actuation is of required safe shutdown equipment.

Response: Refer to Appendix C (Position on Spurious Actuations of Non-Safe Shutdown Equipment). The licensed industry approach to performing Appendix R safe shutdown analyses is based upon interpretation of the guidance provided by the NRC in Clarification to GL 81-12. GL 81-12 specifically describes appropriate analysis techniques to be used when performing a post-fire safe shutdown analysis. The “systems approach” described in the GL 81-12 clarification involves first identifying safe shutdown systems and components, then identifying the cables that are required to operate the selected components or that may cause maloperation of these components (associated circuits). Finally, these components are located by fire area and an evaluation performed to identify the potential for fire damage and the resulting effects. The GL 81-12 “systems approach” methodology requirements does not include postulating the spurious operation of every circuit in the fire area (the number of circuits contained in a typical fire area is very large) and the resulting safe shutdown effects scenario for each. This methodology has been reviewed and approved by the NRC during numerous site inspections. Requests by the NRC staff or results from a plant self-assessment requiring consideration of specific combinations of potential failures outside the safe shutdown system flow path can be evaluated for risk significance using Section 4 methodology. Therefore, the industry position is that only those spurious operations resulting from fire-induced damage to safe shutdown components and associated circuits whose failure can cause a direct effect on safe shutdown equipment operation require evaluation during the deterministic analysis.

Comment 3.36: Sections 3.3, 3.4, 3.5 - General Comment on the Scope of the Evaluation of Cable Damage. Section 3.3 states, *"The Appendix R safe shutdown cable selection criteria is developed to ensure that all cables that could affect the proper operation or that could cause the maloperation of safe shutdown equipment are identified and that these cables are properly related to the safe shutdown equipment(s) whose functionality they could effect."* Section 3.3.1.6 states, *"If not protected from the effects of fire, the fire-induced failure of automatic initiation logic circuits must not adversely affect any post-fire safe shutdown system function."* Section 3.4 states: *"By determining the location of each component and cable by fire area and using the cable to equipment relationships described above, the affected safe shutdown equipment in each fire area can be determined... The specific impacts to the selected safe shutdown path can be evaluated using the Circuit Analysis and Evaluation criteria contained in Section 3.5 of this document;* and Section 3.5 states*, "This section on circuit analysis provides information on the potential impact of fire on circuits used to control and power safe shutdown equipment"* (emphasis added).

The above statements presuppose that the scope of the evaluation need only focus on an assessment of the effects of fire damage to the relatively limited set of equipment that comprises the selected shutdown paths. Under this approach, consideration of the effects of fire damage to cables/circuits of equipment whose operation is not specifically required to accomplish a specified shutdown function does not appear to be warranted. More specifically, it appears that while the approach recognizes that failures in other "non-essential" equipment will occur, as long as those failures do not have a direct effect on the operation of the selected equipment the effect of these failures on the shutdown capability does not need to be considered further. This premise appears to run counter to inspection experience which has shown that the failure to evaluate the effects of fire damage to certain non-essential equipment had the potential to initiate transients that were beyond the recovery capability of the credited (i.e., protected) shutdown path. For example, at one Boiling Water Reactor (BWR) it was noted that the loss of a non-essential source of electrical power (due to fire damage or loss of offsite power, LOOP) would result in the failure of equipment necessary to prevent unacceptable levels of water hammer in the piping of essential reactor coolant makeup systems. Additionally, the inspection of one PWR revealed that fire damage to a motor-operated valve (MOV) located within a flow path that was not deemed by the licensee to be required for safe shutdown, had the potential to cause a collapse of the steam bubble in the pressurizer and rapid depressurization of the RCS. Other examples include the start of makeup pumps that could lead to a reactor overfill condition and the energization of large electrical loads (e.g. pressurizer heater banks) that could overload the credited source of emergency electrical power. With the current wording of Section 3.3, it is not clear how to identify cables and circuits of equipment that are not part of the selected shutdown path but whose damage due to fire could adversely affect the ability of credited shutdown systems to achieve and maintain hot shutdown conditions.

Response: Refer to Attachment C (Position on Spurious Actuations of Non-Safe Shutdown Equipment) and the response to Comment 3.35. The identification of a scenario at one plant does not warrant changing the approved safe shutdown analysis at every plant. Specific scenarios of concern can be reviewed for risk significance.

Comment 3.37: Section 3.3.3.5 should include the verification of cable routing data obtained from a review of plant drawings (e.g., field walk-downs).

Response: Plants will use appropriate methods to verify locations of the cables selected. It is not always necessary to perform field walkdowns to verify cable locations.

Comment 3.38: In section 3.4.1.2, the statement, *"This does not imply that the fire instantaneously spreads throughout the fire area..."* does not include a technical basis and if a technical basis is not available, it should be deleted. Specifically, this statement could be interpreted to mean that it is not necessary to postulate concurrent failures (i.e., there is some finite, but undefined, time interval between failures).

Basis: Section I of Appendix R states that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control station(s) must be maintained free of fire damage by a single fire, including an exposure fire. Acceptable methods for assuring components remain free of fire damage are delineated in Section III.G of the regulation.

Response: The second sentence will be revised to read, "This assumes that neither the fire size nor the fire intensity is known." The revised second sentence provides additional explanation for the assumption in the first sentence. Because this is the most conservative possible assumption, no technical basis is required.

Comment 3.39: Section 3.4.1.3 suggests that mitigation of potential fire impacts is an acceptable alternative to providing the required fire protection features for structures, systems and components important to safe shutdown. This is not in accordance with the requirements specified in Section III.G.1 and III.G.2 of Appendix R or the existing NRC staff fire protection guidance.

Response: Refer to Attachment A (Position on Free of Fire Damage) and Attachment B (Position on Manual Actions).

Comment 3.40: Section 3.4.1.4 states that the use of manual actions is an acceptable alternative to providing the fire protection features required by Section III.G.1 and III.G.2 of Appendix R. This does not meet current regulations.

Response: Refer to Attachment A (Position on Free of Fire Damage) and Attachment B (Position on Manual Actions).

Comment 3.41: Section 3.4.1.6: Editorial comment: Insert "no safety" between "associated" and "circuits" in all three subparagraphs. Basis: consistency with wording of regulation (See Section III.G.2 a, b, and c of Appendix R)

Response: Section 3.4.1.6 will be revised to ensure consistency of wording with regulation.

Comment 3.42: Section 3.4.1.6 uses the phrase "demonstrate equivalency." To assure consistency, the document should provide additional guidance and criteria for performing equivalency evaluations used to demonstrate compliance with specific fire protection design requirements specified in the regulation.

Response: Refer to Attachment E (Role of NEI 00-01 in Licensing Basis). Due to the variety of SER's, exemption requests, deviation requests, inspection findings and other NRC correspondence relating to equivalency evaluations, it would be impractical to standardize these. The equivalency evaluations typically involve plant specific attributes that may or may not be applicable to other plant designs.

Comment 3.43: Section 3.4.1.7: States, *"...each equipment impact, including spurious operations, is to be addressed on a one-at-a-time basis. The focus is to be on addressing each equipment impact or each potential spurious operation and mitigating the effects of each individually"* This criterion does not appear to satisfy regulatory requirements for assuring one train is free of fire damage and is not supported by a technical basis. For example, under this criterion, if the start circuit of a required makeup pump and control cabling associated with the pump's suction valve are both subject to damage as a result of a single fire, it appears that the potential for fire to cause a spurious closure of the pump suction valve and an automatic start of the pump (resulting in pump damage) would need not to be considered.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations). As stated previously, the practice embodied in Section 3.4.1.7 reflects existing industry practices that are not to be made more conservative in this document. Technical bases have been provided in many individual plant submittals and need not be repeated here. Please also see the responses to Comment L.1 and other comments related to multiple spurious actuations for additional information.

Comment 3.44: Section 3.4.1.8: This criterion nonconservatively limits the evaluation of the effects of fire damage to instrument sensing lines to those instrument readings or signals *"associated with the protected safe shutdown path."* Depending on plant-specific conditions, fire damage to instruments not associated with the credited shutdown path may adversely affect the shutdown capability. This statement should be modified or deleted from the criterion. A more appropriate version of this criterion is contained in Section 3.4.1.8 of the BWR Owners Group guidance document (GE-NE-T43-00002-00-02).

Response: Section 3.4.1.8 will be revised to correspond to the wording in the BWROG document (actually Section 3.4.1.7). Refer to Attachment C (Position on Spurious Actuations of Non-Safe Shutdown Equipment).

Comment 3.45: Section 3.4.2.3 states, *"Using the Circuit Analysis and Evaluation criteria contained in Section 3.5 of this document, determine the equipment on the required safe shutdown path that can potentially be impacted by a fire in the fire area, and what those possible impacts are."* In Section 3.5 it states: *"Appendix R Section III.G.2 identifies the fire-induced circuit failure types that are to be evaluated for impact from exposure fires on safe shutdown equipment. Section III.G.2 of Appendix R requires consideration of hot shorts, shorts to ground and open circuits."* Additionally, paragraph B.2.0 of Appendix B states: *"Appendix R requires that equipment and circuits required for safe shutdown be free of fire damage and that these circuits be evaluated for fire induced effects of hot shorts, open circuits and shorts to* *ground."*

Application of the criteria described above could result in a failure to provide fire protection features necessary to ensure that essential hot shutdown equipment remains free of fire damage.

The fire protection requirements specified in 10 CFR 50.48 require that the fire protection program have a means to limit fire damage to SSC important to safety so that the plant's safe shutdown capability is ensured. Additionally, Section III.G of Appendix R to 10 CFR 50 requires, in part, that associated non-safety circuits and cables that could prevent operation or cause maloperation of systems and components important to safe shutdown, be provided with a level of fire protection necessary to ensure such circuits will remain free of fire damage. As stated in the staff's clarification of Generic Letter 81-12, the requirements of Appendix R address hot shutdown equipment which must be free of fire damage. Acceptable options for providing this level of fire protection are delineated in Section III.G.2 of the regulation. Because these features are expected to preclude fire damage, alternative approaches that rely on an analysis of the types of circuit faults that may occur as a result of fire damage may significantly reduce the safety margin that would be achieved through compliance with regulatory requirements.

Recent inspections of licensee implementation of analytical approaches similar to those described in NEI 00-01 have resulted in some fairly significant inspection findings. For example, at one PWR control cables of redundant Auxiliary Feedwater System valves were not provided with fire protection features sufficient to meet III.G.2 of Appendix R on the basis that the inadvertent closure of both valves would require multiple circuit failures (i.e., one fault in the control circuit of each valve). Inspections of other facilities identified similar concerns including one licensee's decision not to include normally open, automatically actuated valves located in required shutdown flow paths in its list of required equipment, and another licensee's general lack of fire protection features for control cables of hot shutdown components on the unsupported position that multiple operator recovery actions could effectively mitigate any equipment failures and/or maloperations that may be initiated by fire.

Because the consequence of failure may be high, NEI 00-01 should be revised to assure that the use of analytical methods for determining the potential effects of fire damage be limited to circuits of equipment whose failure or inadvertent actuation would not have a direct and immediate impact on the ability of selected hot shutdown systems to perform their intended function. In the absence of a plant-specific exemption or deviation, required flow path components such as pumps and automatically actuated valves should be provided with fire protection features sufficient to meet Section III.G.2 of Appendix R. It is believed that such an approach would be more consistent with the Commissions' statements of consideration regarding the Final Rule on Fire Protection (Ref: Enclosure A to SECY-80-438A) which states: *"When considering the consequences of fire in a given area, it must be concluded that one train of equipment that can be used immediately to bring the reactor to hot shutdown conditions remains unaffected by a fire."*

Response: Refer to Attachment A (Position on Free of Fire Damage), Attachment D (Position on Multiple Spurious Actuations), and the response to Comment L.2.

Comment 3.46: Section 3.4.2.4 restates options, beyond those permitted by the regulations, for resolving circuit failures that can have an adverse impact on safe shutdown capability. Comments on these non-compliant alternatives have been previously identified.

Response: Refer to Attachment A (Position on Free of Fire Damage) and Attachment B (Position on Manual Actions).

Comment 3.47: Section 3.5.1.1: The first bullet should be revised to read "...resulting in an undesired impressed voltage *or signal* on a specific conductor," for clarification purposes. A hot short between conductors of certain instrument circuits may result in an undesired signal other than voltage.

Response: Section 3.5.1.1 will be revised to include the term "or signal".

Comment 3.48: Section 3.5.1.1 suggests that circuit failures need only be considered for safe shutdown cables. This is inconsistent with current regulations since any cable that could prevent operation or cause maloperation of redundant trains of safe shutdown systems must be protected. This section also limits the consideration of open circuits to power and control cables. Instrumentation circuits are not included. If an open circuit in an instrumentation circuit can prevent operation or cause maloperation, it must be protected.

Response: Refer to Attachment C (Position on Spurious Actuations of Non-Safe Shutdown Equipment) and the responses to Comments 3.11, 3.36, and 3.44. Further, Section 3.5.1.1 does not limit consideration of open circuits to power and control cables. It states, "An open circuit may prevent the ability to control or power the affected equipment." Since the ability to "control or power the affected equipment" may be impacted by an open circuit in instrument cable, the licensee applying this method is expected to consider open circuits in instrument cable as well.

Comment 3.49: Section 3.5.1.1, last paragraph, states that circuit failures should be assumed to occur individually on each conductor of each safe shutdown cable, and the effects of each circuit failure are to be evaluated one at a time. Based on this criterion, the evaluation of the potential effects of fire damage to multiconductor cables need only consider the occurrence of a single fault on a single conductor of a multiconductor cable. This criterion is not consistent with regulatory requirements and its application may result in a failure to consider potentially high consequence fire events. For example, at one BWR it was determined that two short circuits between twisted pairs of conductors located within a single multi-conductor cable were sufficient to cause all 16 safety relief valves to spuriously open.

Basis: Section III.G of Appendix R, Generic Letter 86-10 Response to Question 5.3.1, Memorandum From G. Holahan (NRR/DSSA) to D. Crutchfield (NRR/DRP) dated December 4, 1990. Additionally, the assumption that only a single fault will occur in multiconductor cables does not appear to be consistent with the results of recent fire tests performed by NEI.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations), Attachment E (Role of NEI 00-01 in Licensing Basis), and the response to Comment G.2. If the plant or NRC has identified potential circuit failure issues of concern that are outside the assumptions embedded in the plant licensing basis, multiple simultaneous failures may be reviewed using the screening methods in Section 4. NEI agrees that the circuit failure testing indicates a high likelihood of multiple failures within a single multiconductor cable, given cable damage, but in most cases only one component's cables are routed through a single multiconductor cable. NEI 00-01 will indicate that any new circuit analysis should consider this insight.

This guidance reflects the results of the circuit failure testing noted in the comment, but does not inappropriately expand the licensing basis to include consideration of multiple simultaneous spurious actuations.

Comment 3.50: Section 3.5.2 states that fire damage to circuits that provide control and power to equipment on the required safe shutdown path must be evaluated. This excludes instrumentation circuits and associated circuits. Circuits that provide for process monitoring necessary for hot shutdown such as pressurizer pressure and level, reactor coolant cold leg temperature, and core exit thermocouples or hot leg temperature, steam generator pressure and wide range level, source range flux, diagnostic instrumentation, and tank level indication for PWRs, or reactor water level and pressure, suppression pool level and temperature, isolation condenser level, diagnostic instrumentation and tank level indication for BWRs must be protected. Instrumentation circuits whose failure could result in erroneous indications to plant operators who, as a result, would take improper actions or fail to take appropriate and prompt action in response to the indications, must also be protected. In addition associated circuits that could prevent the operation or cause the maloperation of systems needed for safe shutdown must also be protected.

Response: The response to this comment is similar to that for Comment 3.48. The reference in this section to "circuits that provide control and power" does not exclude instrument circuits. Also, refer to response to comment 3.36.

Comment 3.51: Section 3.5.2.2. Two or more shorts to ground on ungrounded D.C. systems may result in an undesired actuation of equipment. This failure mode should be thoroughly described in the document.

Response: This failure mode is discussed under section 3.5.2.2 under Short-to-Ground on Ungrounded Circuits.

Comment 3.52: Section 3.5.2.4. The third bullet's statement, *"demonstrate proper coordination by comparing the time current characteristic (TCC) curve for the largest size load breaker to the TCC curve for the incoming source breaker supplying the bus,"* may not be accurate. This "rule of thumb" is only valid if all protective devices under consideration are of the same type and manufacturer and are operating in similar environmental conditions.

Response: The statement has been revised to state "For each power source, demonstrate proper circuit coordination using acceptable industry methods."

Comment 3.53: Section 3.5.2.4 the third bullet's statement, *"Fuses of the same type are assumed to coordinate when an upstream to down stream fuse size ratio of at least two to one is applied,"* is not presented with a technical basis. This "rule of thumb" is generally only applicable to low voltage fuses of the same type and manufacturer that are installed in the same operating environment (i.e., operating temperature). For all other cases, it must be ensured that the total clearing energy of the load side fuse is less than the melting energy of the line side fuse. This is typically demonstrated by a comparison of time/current characteristic curves developed by the manufacturer for the specific fuse type in question.

Response: The bullet statement has been removed.

Comment 3.54: In section 3.5.2.4, third bulleted paragraph, the assumption that fuses will trip prior to an upstream molded case circuit breaker in response to a short-circuit current should be supported by reference to a valid technical basis such as a national consensus standard.

Response: The bullet statement has been removed.

Comment 3.55: In section 3.5.2.4, the discussion of circuit coordination should provide additional guidance with regard to circuit breaker and relay maintenance and administrative controls for fuse replacement.

Response: The bullet statement has been removed.

Comment 3.56: Section 3.5.2.5, second paragraph, states, *"Adequate electrical circuit protection and cable sizing is included as part of the original plant electrical design and this may be demonstrated by reviewing the plant's electrical design criteria for compliance with the National Electrical Code."* The objective is to ensure non-essential cables, that are routed in a common enclosure with cables of required shutdown equipment, are provided with adequate electrical protection. The document should clearly state that protection should be provided to ensure that the ampacity rating of the cable is not exceeded. Additionally, inspection findings have identified instances where uncontrolled plant modifications (such as fuse replacements) have resulted in cases where the as-found electrical configuration did not match the plant's design criteria. Therefore, it is not apparent, from the above statement, how a review of the plant design criteria will effectively confirm actual plant configurations.

Response: The statement has been revised to indicate that the plant design is maintained as part of the design change process. Procedures should be in place to verify that changes to the plant including fuse replacements adhere to the electrical design criteria. Industry agrees that cables should be protected. The design change process is generally adequate to assure newly added cables and protective devices by reviewing as-built drawings as well as design criteria. Section 3.5.2.5 will be revised to include a review of as-built drawings and design change documentation.

4. Section 4 - Risk Significance Analysis

Comment 4.1: From a risk analyst view point, the document is complex and difficult to follow. The role of Chapter 4 is defined in the last paragraph of section 1.1, "Purpose", where it is stated, "This document provides criteria for assessing the risk significance of *those issues* that are not included in current safe shutdown analyses, but which..." From then on, the terminology changes, so that, instead of issues, the analyst first identifies *potential failures and combinations*, and determines whether these failures/combinations should be addressed, (section 1.3.1.2, first paragraph). Presumably there is a connection between an issue and potential failures and combinations, in the sense that an issue (maybe some problem with fire protection), leads to the potential for a component or several components to be unprotected, and therefore susceptible to failure during a fire. A few examples of issues and their consequences would help increase the clarity of the document. It would also help to clarify what the combinations are (i.e., combinations of failures or fire caused failures combined with other failures?).

Response: We will review and revise for clarification. The McGuire pilot provides some examples of issues and component combinations. An issue was identified regarding charging pump suctions spurious operation. This resulted in several component combinations that were analyzed in 3 to 4 rooms each (typically treated as 1 scenario per room/fire area). One component combination was charging pump failure and RCP seal cooling failure. Another component combination was PORV spurious opening and loss of charging. Examples will be added to the report.

Comment 4.2: The risk-based approach presented in this section of the document should give consideration to the potential consequences of fire-induced circuit failures. Due to the high level of uncertainty in the ability to accurately predict the nature of fire initiation, fire spread, and damage that may occur (either as a direct result of fire damage or from subsequent fire suppression activities), it is suggested that a qualitative evaluation of the potential consequence of fire damage be performed. If this evaluation determines that the consequence of failure may be significant, then compliance with the separation/protection and evaluation criteria specified in the regulation and/or established NRC guidance documents must be assured. Specific examples of fire-induced failures that should be specifically excluded from further consideration under the risk-based screening process described in this section are those that could have a direct and immediate impact on the ability of the selected hot shutdown systems to perform their required function such as valves and pumps located in the required flow path (as credited/defined in the plant's safe shutdown analysis for the fire-affected area), components whose operation is "time critical" (i.e., required to be operable within the first two-hours of the fire event), such as emergency diesel generators, and components whose fire induced failure or maloperation could initiate a potentially unrecoverable condition, such as reactor coolant system boundary isolation valves.

Response: First, because this section requires consideration of such non-risk related factors as defense-in-depth and safety margins, it is a risk-informed approach rather than a risk-based approach. Second, removing high-consequence events from the use of risk screening tools defeats the whole purpose of the methods in Section 4, and is inconsistent with efforts to use risk information in general. Following this logic, core damage could be considered a high consequence event; any scenario possibly leading to core damage would be removed from the use of risk insights; and only deterministic regulations could be used. High consequence events should be used as an entry point for the use of risk methods, not to prevent use of these methods. Adequate consideration of event consequences is provided by both the risk screening process and the application of Safety Margins/Defense-In-Depth Analysis. See also the response to Comment L.2.

Comment 4.3: The fire protection program must provide reasonable assurance, through a defense-in-depth approach, that the probability of fire is minimized, and that the effects of fires that start in spite of the fire prevention program and burn for a considerable time in spite of fire protection activities will not prevent essential plant safety functions from being performed. The multiple levels of protection that are embodied in the defense-in-depth philosophy assure fire safety throughout the life of the plant by minimizing both the probability and consequence of fires. While strengthening any one element of defense-in-depth (e.g., fire prevention or suppression) can compensate in some measure for known or unknown weaknesses in the others, all elements must be provided and meet minimum requirements (e.g., BTP 9-5.1). NEI 00-01 concurrence with this philosophy is articulated in Section 1.1.1, which states: *"Because of the uncertainties associated with the actual behavior of fires in a nuclear power plant, each of the echelons of the defense-in-depth fire protection program is important in assuring that the plant is safe from the adverse effects of fire."*

However, Section 4 suggests that it is only necessary to achieve a "balance" in defense-in-depth elements and appears to introduce a new interpretation of the defense-in-depth concept by concluding that it is not necessary to consider the effects of fire damage provided a suitable means of fire detection and extinguishment are provided. Specifically, Section 4.1.3 states, *"the components can be screened out as risk insignificant if at least two other reducing factors (such as automatic detection and suppression and manual suppression) can be credited qualitatively as effective."* From this screening criterion, it appears that the effects of fire damage to unprotected circuits or cables located in areas typically provided with automatic detection and suppression, such as the cable spreading room at most plants, need not be considered. Given the high degree of uncertainty in determining potential causes for fire initiation, growth and type of damage that may occur to exposed equipment and cables, this approach may result in a significant reduction in safety margin from that which would have been achieved through application of all elements of the well established concept of defense-in-depth.

Response: Please see Attachment F (Defense-In Depth Considerations).

Comment 4.4: Section 4.1.2 states that only those issues that could affect the safe shutdown system flow path are considered when evaluating the "risk significance" of identified circuit failure issues. This excludes instrumentation and associated circuits that can have an adverse impact on safe shutdown capability as previously noted. This section also limits consideration to those circuit issues whose maloperation could result in a loss of a key safety function, or in immediate, direct and unrecoverable consequences comparable to high/low pressure interface failures. While these terms are not defined in NEI 00-01, this approach is not consistent with current NRC requirements that specify that, during the post-fire shutdown, the reactor coolant process variables be maintained within those predicted for a loss of offsite power. The NEI approach should provide for margin of safety to account for uncertainty in the risk analysis. If adequate margins of safety are not included, it is a substantial reduction in the defense-in-depth concept required by the current regulations.

Response: First, since the methods in Section 4 are to be applied to identified issues as noted in the Section 4.1.2 bullets, the sentence beginning "Only those issues…" will be deleted.

Second, this approach is entirely consistent with NRC guidance. The reason for the regulations' explicitly requiring consideration of simultaneous circuit failures for high-low pressure interface components was undoubtedly that these interface failures can have immediate direct, and unrecoverable consequences. Therefore, it makes sense to apply risk significance tools to other high-consequence scenarios.

Third, safety margins are addressed and applied as part of the Section 4 methods. The safety margins determination is based on similar guidance in Regulatory Guide 1.174.

Comment 4.5[a]: Comments on Section 4.1.4 Defense-In-Depth. An issue will not screen out unless defense-in-depth (DID) elements are met. Therefore, as a result, efforts to clearly define the meaning of DID should be made in NEI 00-01. For example, the first item indicates that fire protection DID preserves a reasonable balance among prevention of fires, early detection, suppression of fire, and fire confinement. The term "reasonable" should be clarified. For example, it appears that in the bottom, far right block of Table 4-1, low frequency of fires satisfies fire protection defense-in-depth, i.e., credits the lack of significant ignition sources as a fire protection defense-in-depth attribute.

Also, NEI 00-01 indicates that over-reliance upon programmatic activities due to spurious actuations, in addition to added time or risk from programmatic activities must exist for defense-in-depth not to be met. Yet, Reg. Guide 1.174 identifies only over-reliance upon programmatic activities as a means of not meeting defense-in-depth. Please clarify the difference.

Response: Refer to Attachment F (Defense in Depth Considerations).

Comment 4.5[b]: Concerning Large Early Release Frequency (LERF), Reg. Guide 1.174 identifies LERF as a metric for licensee applications. However, the contribution of spurious actuations to LERF is not discussed in NEI 00-01, and therefore no limit is placed upon the contribution of spurious actuations to LERF. It is suggested that the impact of LERF be considered, and a limit be placed upon LERF contributions from spurious actuations.

Response: NEI will add guidance for performing a containment failure review as part of the SM/DID analysis. Thus, LERF will not be routinely reviewed as a part of every significance determination, but it will be considered before screening out any failure(s).

Comment 4.6: Section 4.1.4.2 has expanded on the guidance specified in Regulatory Guide 1.174 concerning safety margins by asserting that screening out fire induced circuit failures, based solely on fire frequency and the probability of spurious actuation, provides sufficient margin to account for analysis and data uncertainty. Safety margin, as described in Regulatory Guide 1.174, refers to compliance with NRC endorsed codes and standards and safety analysis acceptance criteria in the licensing basis. The approach in NEI 00-01 appears to conflict with both of these criteria. Please provide additional information to resolve this discrepancy.

Response: This comment is based on a misunderstanding of the language in NEI 00-01, so a clarification will be provided. NEI did not intend that screening out circuit failure(s) automatically provides sufficient margin. The NEI 00-01 phrase "or screening out the fire induced circuit failure provides sufficient margin to account for analysis and data uncertainty" is intended to be the equivalent of the phrase in Regulatory Guide 1.174 "or proposed revisions provide sufficient margin to account for analysis and data uncertainty." This change to the language was made because the NEI 00-01 process of interest is a screening analysis rather than a proposed revision. Otherwise, the intent is the same.

Comment 4.7[a]: Section 4.2.2, consistent with the philosophy throughout the NEI guidance, states that even if the resultant increase in fire risk is greater than 1E-06/year, corrective actions should be considered. Therefore, NEI 00-01 should specify when corrective actions are required (or even recommended).

Response: An industry guidance document cannot require a course of action unless an 80% majority of the utility Chief Nuclear Officers agree. The phrase "should be considered" is, in fact, a recommendation. If a licensee has reached the limit of further analysis, the numeric criterion of 1E-6 is in fact a specification as to when corrective action should be performed. NEI will revise NEI 00-01 to recommend that plant-specific criteria for placing the issue into the Corrective Action Program be followed if the risk threshold remains above 1E-6.

Comment 4.7[b]: The variables in the NEI guidance used to calculate the delta Core Damage Frequency (CDF) due to fire appear to be treated as independent variables. This would exclude the dependencies that exist between some of the factors used in the formula. The NEI formula appears to be also susceptible to the double counting phenomenon that was observed in the IPEEE program by the use of a severity or "fire size." parameter that allowed double credit for manual and automatic suppression probabilities.

Response: NEI-00-01 includes some discussion on potential dependencies between the factors. The guidance is that the factors used for the screening process should be independent. The pilot report discusses this further. A specific area of dependence is the dependence between severity factors and manual suppression in the control room. For the analysis, the severity factors are not credited in the control room analysis upon credit for manual suppression. For automatic suppression, if the EPRI method is used, the definition of severity factors precludes the dependency between automatic suppression and severe fires. See EPRI document SU-105928 for further discussion on this issue. Additional guidance will be added to NEI-00-01 to ensure factors remain independent.

Comment 4.7[c]: The NEI fire frequency parameter states that it is representative of the total number of fires of any size in a fire area. This may not be correct. The data used to develop this parameter is based solely on reported fire events. Most fires that occur at licensees' facilities are below the threshold for reporting, therefore, the stated values are not representative of all fires.

Response: The wording in section 4.2.2, item 1 is that the fire frequency F_f is representative of fires of any size anywhere in the fire area. The data is representative in the sense that it is based on the best available data sources. It is understood that all fires are not reported and thus the frequency of all fires would be greater than that used for F_f. It is understood that in the initial screening phase that the fire frequency should be as broad and encompassing as possible so as not to exclude any combination that has risk significance and should be further analyzed.

Comment 4.7[d]: The values used for automatic suppression capability are categorized as representative of the likelihood that the fires are controlled prior to damage occurring to safe shutdown equipment. It appears that NEI 00-01 has non- conservatively interpreted data on the reliability of fire suppression systems (i.e. failure to actuate on demand) as equivalent to data on how effective a suppression system is in preventing damage. This may not be correct because, in some cases, damage to equipment can occur prior to system activation or even subsequent to system activation.

Response: Section 4.2.2.2, step 5 provides guidance on evaluation of automatic suppression. The three elements for automatic suppression, availability, reliability and effectiveness are addressed in step 5b. This step provides restrictive guidance on effectiveness, and refers to additional guidance in Table 4-3. The pilot demonstrated application of this guidance. Typically, automatic suppression was credited only when we could demonstrate that a cable was protected from a specific fire/ignition source (per design). Some additional guidance will be added to 4.2.2.2 to incorporate experience from the pilot application.

Comment 4.7[e]: The parameter to account for the effectiveness of manual suppression in preventing damage is also not well defined. The reliance on fire brigade response times, as needed in the NEI document, as a surrogate for fire brigade effectiveness may not be appropriate. The fire brigade response time is only one factor in assessing the effectiveness of the brigade. For example, fire brigade effectiveness is dependent upon several factors such as: (1) the fragility of the component, (2) the severity of the fire, (3) the location of the fire, (4) the location of the equipment, (5) the compartment geometry, (6) interior finish, (7) fire detection time, (8) confirmation time, (9) brigade notification time, (10) brigade response time, (11) the time required for the brigade to don protective clothing and breathing apparatus, (12) the time to initiate fire attack and (13) the time to control the fire. The amount of uncertainty in the basis and use for the values could result in non-conservative estimates of fire induced CDF and will therefore screen out potential circuit failure scenarios that are potentially risk significant that should have been identified and corrected.

Response: Section 4.2.2.3 will be enhanced to provide additional guidance. The pilots demonstrated that manual suppression failure probabilities developed in the plant IPEEE or Fire PRA can be used, if they are shown to be applicable. Additionally, without fire modeling and time to damage estimates, determining manual suppression probabilities can be difficult. Use of standard methodology for manual suppression credit should be assured. The standard methodology, such as in the EPRI methodology, accounts for the types of issues raised here.

Comment 4.8: Concerning the basis for Table 4-1, "Preliminary Screening" i.e., Appendix G, sequences with core damage frequency of less than 1E-6/yr are screened from consideration. However, because a spurious actuation could impact multiple areas, many of these sequences may apply for a single spurious actuation. As a result, a smaller cutoff for each sequence in Appendix G is suggested to screen potentially insignificant sequences.

Response: Refer to Attachment G (Position on Pre-Screening Criteria).

Comment 4.9[a]: Table 4-2, "Fire Frequency." Component frequencies developed in the Fire induced Vulnerability Evaluation (FIVE) methodology were based on an average. In this approach, frequencies for a cable spreading room with electrical cabinets are above 1E-3, regardless of the number of cabinets in the cable spreading room. If NEI 00-01 chooses to identify the frequency of a cable spreading room by the number of cabinets (and as a result, postulate frequencies lower than average), then the method must also realize that some cable spreading room configurations will have frequencies larger than average, as well. Deviations from the average frequencies in FIVE for components, rooms, or fire areas in general should be supported by technical justification.

Response: It is agreed that values of fire frequencies that are higher or lower than is typical should have a documented justification. This will be added to section 4.1.3.

Comment 4.9[b]: Severity factors should not be used at this stage because their application should be highlighted in the method under 4.2.2.

Response: Severity factors are not specifically used in the qualitative screening, only the judgment that a fire has the potential to damage critical equipment if left alone. The mention of EPRI fire PRA severity factors in the tables is to assist in this judgment. The text will be clarified as to this point.

Comment 4.10: Table 4-2, "Probability of spurious actuation of components." Failure probabilities for momentary and sustained hot shorts are given without providing a technical basis. A technical basis needs to be provided as well as a means for determining when sustained or momentary hot shorts occur.

Response: EPRI issued the its report 1006961 titled "Spurious Actuation of Electrical Circuits Due to Cable Fires: Results of an Expert Elicitation" in May 2002. This report provides a technical basis for Table 4-2, as well as selection of spurious operation probabilities for the detailed analysis. Table 4-2 is being revised in NEI-00-01, based on the recommendations from this report. The expert panel report did not address the difference between sustained and momentary hot shorts. Additional discussion on this is being added to NEI-00-01.

The preliminary screening will be revised based on the results of the EPRI report, Table 7-2). This requires revision of the quantitative basis for P_{SA} in Table 4-2 (see footnote to the table), the quantitative basis for the preliminary screening criteria documented in Appendix F and the application of the preliminary screening in section 4.1.3.

The P_{SA} from Table 7-2 may be grouped in the following grades for the purpose of qualitative screen:

P_{SA} (HIGH): If circuits of the selected component/combination have a P_{SA} (best estimate from Expert Elicitation Report) between 0.1 and 1, including (for example) T-set/plastic intra-cable, M/C or 1/C inter-cable, and conduit without CPT. Best estimate value of 1.0 is used for screening.

P_{SA} (MED): If circuits of the selected component/combination have a P_{SA} (best estimate from Expert Elicitation Report) between 0.01 and 0.1, including (for example) conduit with CPT and no-fused armored cable. Additionally, one can include combinations such as two T-set intra-cable failures with CPT where the product of the failures is between 0.01 and 0.1. Lastly, the Medium category will include combinations where the initial probability is greater than 0.1, but is required to be sustained for greater than 5 minutes (see below). The best estimate value of 0.1 is used for screening.

P_{SA} (LOW): If circuits of the selected component/combination have a P_{SA} (best estimate from Expert Elicitation Report) less than 0.01, including (for example) fused armored cable. Additionally, one can include combinations such as two cables in conduit (with CPTs) where the product of the failures is between 0.01 and 0.1. Lastly, the Low category will include combinations where the initial probability is between 0.1 and 0.01, but is required to be sustained for greater than 5 minutes (See below). The best estimate value of 0.01 is used for screening.

The test data used for the EPRI report shows that a majority of the circuit failures resulting in spurious operation had a duration of less than 1 minute. Less than 10% of all failures lasted more than 5 minutes, with the longest duration recorded for the tests equal to 10 minutes. If NEI-00-01 Table 4-2 is changed to indicate a sustained failure is anything greater than 5 minutes, then the category reduction for any sustained versus momentary is consistent with the test data. That is, a sustained short is approximately 10 times less likely than a momentary short.

Comment 4.11: Table 4-2, "Safe shutdown capability." It is not clear that all safe shutdown schemes can be credited as much as 0.1 (for the failure probability). The full set of influences identified in Appendix E should be used to determine if credit for manual actions can be used a 0.1. Number of actions, time, and availability of procedure should be supplemented by these remaining influences in Appendix E as they may pose additional constraints/impediments to manual actions. As indicated on the bottom of Table 4-2 for safe shutdown capability, this credit must be examined and justified on a case-by-case basis. As a result, the screening may be non-conservative when assuming 0.1 for safe shutdown capability.

Response: Table 4-3 provides specific guidance to account for conditions where significant manual actions may be required, and the resulting safe shutdown capability failure could be above 0.1. Some additional clarification will be added to Table 4-3 to ensure non-conservative screening does not occur.

Comment 4.12: Section 4.2.2.1, .General Description of Method. The definition for a component combination should be clarified. An evaluation of a component combination should not only take into account the spurious actuation, but also multiple spurious actuations, if appropriate, per fire area. It is suggested that examples for component combinations be provided to clarify the definition.

Also, in the last few sentences of the next to last paragraph on page 73, it is stated that, "Unless all screening steps are complete, screening against these two criteria would provide an overly conservative result. All three criteria must be satisfied for an issue to screen out." It would appear that satisfying fewer criteria would provide non conservative results. Please clarify this sentence.

With respect to the equation on page 76 for core damage frequency, the credit for detection, suppression should be predicated on the fire determined by fire size parameter. With respect to credit for the fire brigade, time available for control and extinguishment of a fire should be offset by the time required for an operator to verify a fire exists. The development of the probability for failure of the fire brigade should incorporate this delay. (Note that Table 4-2, under detection and manual suppression, did not mention this delay.)

Response: 4.12a: Some clarification will be added to 4.2.2.1 and/or 4.1.2 to discuss what a component/combination is and how it leads to the analysis of a fire-induced accident scenario.

4.12b: NEI will reword 4.2.2.1. The CDF estimates for the sum over all areas, and the sum in a single area could be conservative if many of the individual combinations are screened without detailed analysis. For example, if a fire area has 50 scenarios, all of which screen in step 4 at 9E-08/year, the total for the fire area can be 4.5E-06/year – and does not screen for the area. This means more detailed analysis is required to screen based on all criteria. This is discussed in the individual screening steps.

4.12c: NEI agrees with comment. See the response to Comment 4.7. Detection and suppression is needed for severe fires, and credit should be based on the assumption that the fire is severe.

4.12d: See the response to Comment 4.7. NEI will revise the discussion on manual suppression credit.

Comment 4.13: Section 4.2.2.2, "Screening Analysis". Nuclear Safety Analysis Center, (NSAC) and Electric Power Research Institute (EPRI) documents are referenced as sources of data in the various screening steps. The use of these data may be subject to review on a case-by-case basis unless the respective results in these documents have been reviewed and approved by NRC.

Response: Staff should identify specific concerns over the use of data from these sources so that the concerns can be resolved generically rather than on a case-by-case basis.

Comment 4.14: Section 4.1.2, "Identification." The purpose is to, "provide guidance for identifying potential plant-specific spurious actuation issues for further review." However, there is no guidance on a systematic way to identify issues. The two bullets only state that if NRC inspectors or the self assessment process at the plant have found issues, they should be included.

Response: Appendix F provides additional methods for identifying additional issues. The discussion on use of Appendix F in Section 4.1.2, last paragraph, will be revised based on the pilot evaluation. See also the response to Comment G.6.

Comment 4.15: Tables 4-2, and 4-3: The information required for comparison with the criteria appears to be similar to that required for the more detailed screening analysis discussed in Section 4.2. Please explain how this first screening stage is of value.

Response: Refer to Attachment G (Position on Pre-Screening Criteria). Additionally, there are several benefits to the performance of pre-screening. First, prescreening can be performed on component combinations without a knowledge of cable location in the fire area. Second, the prescreening can be performed easily without significant work. For example, for a scenario in a pump room, we can easily determine approximate fire frequency, what DID elements we can credit, and what the approximate spurious operation probability would be. If detailed analysis were required, then we need to performed detailed calculations on fire frequency, fire severity, spurious operation probability, manual/automatic suppression, and CDP. Based on the pilot evaluation, prescreening can be performed at a rate of several per hour, while detailed analysis can take several hours or even days per scenario (depending on the state of the plant's Fire PRA).

Comment 4.16: It should be further explained how the general equation addresses the following issues: 1) the deterministic method assumes multiple simultaneous fires not to occur, however this should not be assumed for a risk-informed method, 2) multiple fires originating from same source (e.g. Palo Verde fire), and 3) frequency that redundant equipment is out of service. (Note that if plants use alternate shutdown techniques, this could be significant.) Additional information should be provided on how these factors are included in the Chapter 4 methodology. None of the assumptions in Chapter 3 (section 3.4.1, et al) of the document should be automatically applied to the risk-informed methodology and should be factored into the risk calculation.

Response: First issue: Since industry does not have data for multiple simultaneous fires, staff should recommend an appropriate initiating event frequency. The case of the Palo Verde fire was not a typical event due to a design flaw from misapplication of electrical design criteria. Second issue: Staff should recommend an initiating event frequency for multiple fires originating from the same source. Third issue: The probability that redundant equipment is out of service is accounted for in the P_{CCD} calculation. Fourth issue: The assumptions of Section 3 are not automatically factored into the Section 4 methods.

Comment 4.17: In "Screening and Analysis," the fire frequency numbers for the screening and the analysis are different. This could be a cause for error. Fire frequencies should not be different for the same area.

Response: The fire frequency for a given fire area may be the same or may be different, depending on the information available. If the fire frequency for an area is unknown, then the characteristics for a fire area may be used in the preliminary screening to categorize the frequency as high, medium or low. If detailed analysis is needed, then a new fire frequency can be derived to determine the best guess estimate for the area. This may agree or disagree with the preliminary screening, but would be a more exact estimate for the frequency. For example, with the McGuire pilot, since the McGuire Fire PRA used old fire data, the fire frequencies were treated as not developed. Scenario 1 in the McGuire Pilot initially ranked all the fire areas as either High or Medium, and the initial estimate agreed well with the detailed screening estimates (prior to the application of severity factors of cable routing data). Fire area 4, for example, was assigned a high fire frequency in the preliminary screening, and a 6E-03/year initial fire frequency in the detailed screening. This frequency was later estimated as 4E-03/year once severity factors were applied, and 4E-04 once detailed cable routing was considered. Therefore, it is expected that if previously available fire frequencies were available, the preliminary and detailed fire frequencies should agree. Otherwise, the fire frequencies would not agree.

Comment 4.18: Table 4-1: The meaning of the terms "detection" and "suppression" should be provided. Would a sprinkler system which provides an alarm meet the requirements of detection and suppression? For example, detection and suppression from a wetpipe sprinkler system should not be counted together because there is no redundancy. One valve closed for maintenance would defeat the entire system.

Response: See Table 4-3 for further clarification of crediting detection and suppression. Some revision to Table 4-3 has resulted from the pilot evaluation and other comments. One valve closed for maintenance is a low probability, and is included in the base unavailability estimate for automatic suppression failure.

Comment 4.19: Table 4-1: Manual suppression should not be credited in this table. In fact, if there is a Safe Shutdown or Safety Related area for which manual suppression is not available, this would be considered a significant deficiency in the current program.

Response: Manual suppression is credited only when it meets the criteria of Table 4-3 (which is being revised). Manual suppression is one level of defense-in-depth, and should be credited when it contributes significantly to lowering the overall risk for a component combination scenario.

Comment 4.20: Table 4-1: Provide additional information on what is meant by, "safe shutdown capability can be credited." If safe shutdown, (i.e., completely redundant trains such as III.G.1), capability is provided then there would not be a need to use this method.

Response: See Table 4-3 for a further clarification of crediting safe shutdown capability.

Comment 4.21: Table 4-2: "Fire Frequency." It is unclear why a fire frequency classification should be impacted by "potential to damage critical equipment if left alone." Fire frequency should only be based on frequency and not the potential to damage critical equipment. This bundling of elements could lead to double counting.

Response: The fire frequency is the frequency of "fires that have the potential to damage critical equipment if left alone". This frequency is a subset of all possible fires in the fire area. This frequency is used for the qualitative screening only. The quantitative screening begins with a broader fire frequency and then applies a fire size parameter.

Comment 4.22: Table 4-2: High, medium, Low: Fire frequency should be the total of fire frequency, and not the frequency of a "damaging fire." Bundling of fire frequency and potential of damaging fire leads to double counting. Small, non-damaging fires are precursors of damaging fires and should be counted in fire frequency calculations.

Response: See response to comment 4.21.

Comment 4.23: Table 4-2, last sentence: Turbine buildings may contain safety-related and safe shutdown equipment and tend to have high fire frequency. How could they be ruled out from this category?

Response: Table 4-2 is being revised to change the wording for Turbine Building. The wording was meant to indicate that large areas, no matter how categorized (e.g., pump room, switchgear room, etc.) should be considered as having a high frequency fire ignition frequency. This includes areas adjacent to large areas, where spread of fire is not ruled out. Thus a corridor containing little or no equipment connected to a large area like the turbine building, where fire spread is possible from the large area to the corridor, should be categorized as High Frequency.

Comment 4.24: Table 4-2, High Category: It appears that dry-type transformers are excluded from this category. It may be true that they generally do not have a large quantity of combustibles but they do have the potential for causing fires.

Response: The wording in Table 4-2 was not intended to exclude dry-type transformers or any other equipment not listed on the table. The intent was to indicate that rooms with a few small electrical cabinets or small dry-type transformers (e.g. lighting or low voltage) could be categorized as medium frequency. For example, some cable spread rooms would have emergency lighting with a small transformer for the lighting battery. This type of room, if it still contains only a few electrical cabinets, should still be categorized as medium fire frequency. For the McGuire Pilot, an individual transformer was estimated to have approximately a 1E-04/year ignition frequency. Generally, any area with a large transformer is categorized as high frequency. Table 4-2 is being revised to clarify the above issue.

Comment 4.25: Table 4-2, Medium, Basis, last sentence: It does not appear that discussion of severity factor is related to fire frequency. It is recommended that fire frequency should be its own factor and not bundled with other factors

Response: The mention of the EPRI fire PRA severity factors is provided as an aid to making the fire frequency judgment not as a quantitative factor to be applied at this phase in the process. The text will be clarified.

Comment 4.26: Table 4-2, Low Category: All locations of plants that contain safety-related or safe shutdown equipment are required to have programs for controlling transient combustibles. Administrative controls for ignition sources are also required for all areas and should not be credited. This may be credible if the criteria requires a fire watch to be in effect for any transient fire load in the area but to rely on "provisions" is not sufficient protection.

Response: Transient fire loads affect the Fire Ignition Frequency only when additional work is being performed that can ignite the load. A fire watch is needed only when work is being performed. For example, location of a trash can in a cable room would not require a fire watch (for a low category in Table 4-2), since this does not increase the fire ignition frequency. This section will be reworded to provide additional clarification. The basis for low category frequency is basically that we know based on data and experience what types of rooms will result in a low fire frequency. A fire area with no or little fixed combustibles, and typical plant controls for transient combustibles, would be analyzed with a detailed Fire PRA and result in less than 1E-04 year frequency.

Comment 4.27: Table 4-2, Possibility of Spurious Actuation Portion: This portion of the table should not be included until the expert panel has completed its review. Following the expert panel conclusions, this table should be issued for comment.

Response: Note 1 to Table 4-2 indicates that Table 4-2 will be updated when the expert panel results are available. Refer to Attachment G (Position on Pre-Screening Criteria).

Comment 4.28: Table 4-3, Automatic Suppression: This discussion of automatic suppression should state that code compliant systems are credited and non-code compliant systems should be evaluated using NRC guidelines or otherwise accepted by Authority Having Jurisdiction (AHJ i.e., the NRC in an SER).

Response: The table already states, "If the automatic suppression system in the area deviates from applicable NFPA codes, an equivalency examination may be warranted to demonstrate that the installed system is equivalent in protecting the intended circuits."

Comment 4.29: Table 4-3, Detection and Manual Suppression: Current regulations require that a plant maintain a fire brigade that meets NFPA requirements. It is unclear how uncertainties in the long term performance of a fire brigade can be permanently credited in these screening criteria or in any long lived probabilistic risk assessment. Please provide justification.

Response: Meeting NFPA guidelines is a reasonable criterion at this preliminary screening stage. With the conservatism applied to this preliminary screening process, it is unlikely that actual fire brigade performance will be the difference between screening out spurious actuations and not screening them out. Note that the pilot report recommends revising Table 4-3 to reflect the evaluation of drill response times in crediting manual suppression.

Comment 4.30: Figure 4-3: How does this methodology correct an unacceptable result when one is reached? If the result is unacceptable after the screen, is it acceptable to rework the analysis and screen again? If the screens are unsuccessful, then there should be steps such as, 1) perform plant modification, 2) request exemption/ deviation.

Response: Figure 4-3, at the end of the screening process has the results documented and then goes to a box entitled "develop resolution strategies". This would include the steps listed in the comment and others such as evaluation of the addition of other equipment to the safe shutdown method. This is described in section 4.2.2.3.

Comment 4.31: Figure 4-3 and delta CDF formula: A number of SSCs which were assumed to be available for the deterministic approach should be factored into this figure or this formula. For example, there is always a chance, however small, of a LOOP at any time. A LOOP would significantly degrade the chance to recover from a fire, yet this is not factored into the formula.

Response: The P_{CCD} calculation accounts for these factors.

Comment 4.32: Section 4.2.2 Screening Criteria: It appears that each component combination is assessed independently of all others. For example, for the third criterion, the sum over delta CDF for each component combination in one location is taken one at a time. This might be nonconservative. The EPRI tests showed several cases where more than one spurious actuation occurred. In areas where more than one component/combination is susceptible to fire damage and spurious actuation, then other technical justification is needed.

Response: From the expert panel results, failures should be considered dependent if they occur in a multi-conductor cable, but independent if they occur in separate cables. Additionally, non-conservatism can result if the combinations are considered together and not separate. In this case, if fire modeling shows time to damage all cables in the scenario is long, then additional suppression may be credited above what can be credited for the separate scenarios. NEI 00-01 will include revised guidance on this area.

Comment 4.33a: In Section 4.2.2.1, page 76: In the equation for .CDF, the terms PAS and PDM should be defined as "probability that ... will control the fire *before damage to the cable is such that spurious actuation could occur"*. Considering the sequence of events, moving PSA after PDM, would provide a logical progression, even though the screening is currently done in a different order.

Response: 4.33a**:** NEI will reword 4.2.2.1 to include the recommended language.

Comment 4.33b: Psa is included early in the screening because it is easily defined and estimated, without detailed fire modeling. Since it can be estimated independently of the other factors, we included it early in order to screen more scenarios earlier in the process. For example, in the McGuire pilot, many of the scenarios with 2, 3 or 4 spurious operations would screen at this point, without an evaluation of detection and suppression.

Comment 4.34: Screen One (page 78), item 3: The current draft of the expert panel report does not present estimates of P_{SA} as it is defined in this report. It is suggested that estimates for P_{SACD}, the probability of spurious actuation given cable damage, be withheld until completion of the panel review.

Response: The panel review has been completed, and is being incorporated into NEI-00-01. Item three of screen one is being rewritten to reference these results.

Comment 4.35: Screen Four, item 9: An IPEEE would probably have to be restructured to include the impact of any spurious actuations, as they are unlikely to be already included in the model. There may be some practical difficulties here. If the model is modified to include the impact of all possible spurious actuations, then in order to deal with just one, the others will have to be turned off in the model. An alternative is to treat the spurious actuations off-line by interpreting their effect in terms of failure of a train or system associated with a critical safety function and requantifying the model appropriately.

Response: NEI agrees with this comment. In Screen 4, we mention that the conditional core damage probability (CCDP) can be determined from a modified internal events PSA or fire IPEEE analysis. The pilot plant analysis demonstrated that the CCDP may be as simple as a single point estimate value, or may be more complicated to determine. If a single point estimate value is used, this can come directly from the PSA or IPEEE analysis. However, if the CCDP requires model changes, it is likely the PSA or IPEEE would require restructuring to determine the impact of the fire scenario. Screen four wording will be adjusted to point out some of the issues associated with CCDP quantification.

Comment 4.36: The EPRI experiments have shown that, multiple spurious actuations cannot be factored out. The increase in ?P_{CCD} caused by the impact of two or more spurious actuations over that considering only one spurious actuation may be greater than the reduction in probability considering the joint probability of two actuations compared to a single spurious actuation. While there is little data on correlation between failures, there is one strong coupling factor and that is the occurrence of the fire which has the capability of damaging two or more cables simultaneously. Whether two or more cables are susceptible to the same fire is a function of their proximity to each other and to the region of influence of the fire. Provide additional guidance or technical justification on how NEI 00-01 addresses this.

Response: As indicated, in many cases the probability of spurious actuation can easily be greater than the independent system failures. This of course depends on the type of cable and cable failure mode required for spurious operation. The expert panel results indicate that in general, circuit failure probabilities for circuits in separate cables can be considered independent. However, with some circuit failures being as high as 0.3 to 0.6, even independent circuit failures would have a higher failure probability than a typical component or system failure. Another similar issue would be to credit systems for the CCDP calculation that have cables in the Fire Area, where an open circuit would fail the system. In this case, fire damage to the cable would result in a failure probability of 1.0.

The NEI-00-01 method addresses this issue in two areas. First, in the circuit selection, the scenarios identified should consider what systems are available for a fire in a given area. If a system or component credited for a given function has cabling in a given fire area, then it is included in the scenario, and not included in the CCDP calculation. The McGuire pilot looked at this in a different way. We looked for “pinch points” for a safe shutdown function, and then looked for fire areas containing cabling for most or all of the components identified in the pinch point. For example, the three charging pumps have two common suction lines containing 2 valves each. A set of scenarios was identified with combinations of the four suction line valves, and cable tracing was performed to determine the fire areas containing valves from both lines. A third injection method is available, and cable tracing was performed to ensure it was free from fire damage in all areas.

The second way NEI-00-01 addresses this concern is by ensuring the CCDP credits components or systems free from fire damage. The calculation for CCDP in either IPEEE or Fire PRA calculations has always required validation that the credited equipment is free from fire damage. The reference to the EPRI Fire PRA guide in screen four refers to guidance in this area. However, since new circuits may be included in the NEI-00-01 pilot that were not previously looked at, some additional guidance in NEI-00-01 would be helpful to ensure the analysts looks at both primary cables for a function, and cables that may fail a component or system due to spurious operation. The Screen Four wording is being modified to include this additional discussion.

5. Section 5 - Definitions

The definitions for the following terms should be changed because they differ from current established NRC definitions: design basis fire, fire protection design change evaluation, free of fire damage, manual operation, raceway, remote shutdown, redundant, alternative, and redundant.

Comment 5.1: *Hot Short*: The definition should be revised to read: "...undesired impressed voltage *or signal* on a specific conductor."

Response: The definition of a Hot Short will be revised as follows: “A fire-induced insulation breakdown between conductors of the same cable, a different cable or from some other external source resulting in a compatible but undesired impressed voltage or signal on a specific conductor."

Comment 5.2: *Free of Fire Damage*: For reasons previously discussed in the comments, the sentence *"It may perform this function automatically, by remote control, or by manual operations"* should be corrected. NEI 00-01 should cite the definition provided in Generic Letter 86-10, Enclosure 1, Item 3. Because the intent of the phrase "free of fire damage" may not appear obvious to those who are unfamiliar with the evolution of staff positions regarding fire protection, it may be helpful to provide a brief background discussion of the circumstances that led to the need for further clarification of this phrase.

Response: Refer to Attachment A (Position on Free of Fire Damage).

Comment 5.3: The document should define "*safe shutdown.*"

Response: The ANSI definition of Safe shutdown will be included as follows: "Safe Shutdown: A shutdown with (1) the reactivity of the reactor kept to a margin below criticality consistent with technical specifications, (2) the core decay heat being removed at a controlled rate sufficient to prevent core or reactor coolant system thermal design limits from being exceeded, (3) components and systems necessary to maintain these conditions operating within their design limits, and (4) components and systems necessary to keep doses within prescribed limits operating properly.

Comment 5.4: *Safe Shutdown Capability - Redundant*: The definition should be revised to clearly state that the systems and equipment must be capable of accomplishing the shutdown functions defined in Section III.L of Appendix R and that with the exception of a temporary, short-duration, core uncovery that may occur as a result of using low-pressure injection systems at BWRs, the equipment and systems selected to perform these functions must be capable of satisfying acceptance criteria that are is also defined in Section III.L.

Response: The NRC SER on the BWROG document GE-NE-T43-00002-00-03 has resolved this issue. Appendix R III.L criteria are not applicable to III.G.1 and III.G.2 shutdown strategies.

Comment 5.5: Required Safe Shutdown Equipment/Component: The definition suggests that the evaluation need only focus on an assessment of the effects of fire damage to the relatively limited set of equipment that comprises the selected shutdown paths.

Response: Refer to Attachment C (Position on Spurious Actuations of Non-Safe Shutdown Equipment).

Comment 5.6: Safe Shutdown Capability - Alternative: The statement, "The shutdown systems used are classified as alternative" is inconsistent with Appendix D which states, "Use of the term Alternative...is applied to the specific plant areas and not to the equipment or methodology employed." It is suggested that a consistent definition be used throughout the document.

Response: The definition of Alternative Safe Shutdown Capability will be revised as follows: "For a given fire area/zone where none of the hot shutdown trains of the redundant safe shutdown capability are "free of fire damage" and dedicated equipment is not provided, the shutdown strategy systems used are classified as alternative."

6. Section 6 - References

Comment 6.1: This section should be reviewed for completeness. The list of references should include Reg Guide 1.189 and documents that have been withdrawn (e.g., Reg Guide 1.120) should be removed.

Response: The references will be revised as suggested. RG 1.120 should not be removed just because it has been withdrawn. The NRC has issued a small number of SERs pursuant to RG 1.120 that are still valid. Withdrawing or revising a historical standard does not invalidate the approval that was granted against it.

7. Appendix A Comments

Safe Shutdown Analysis

Comment 7.1: Section A.2: The established definition for "defense-in-depth," as it appears in the regulation, should be used.

Response: Section A-2 will be revised to include to definition of “defense-in-depth” as it appears in the regulation.

Comment 7.2: Section A.2: Item 5 under defense-in-depth states that the ability to safely shutdown must be demonstrated. The regulation states that the means to safely shutdown must be protected. In theory, you could use fire frequency arguments to ‘demonstrate’ that the ability to safely shutdown would not be affected. This would not meet the regulatory definition of DID which is to protect the means to safely shutdown.

Response: Item 5 was referring to methods discussed in the document used to demonstrate safe shutdown based on Appendix R requirements. Protecting the ability to achieve safe shutdown may be accomplished in various ways within the regulation thereby demonstrating safe shutdown capability.

Comment 7.3: Section A.3.2, first paragraph, the Browns Ferry fire was severe due to its effects on the plant. The fire only affected two areas and an isolated area of a building. It should be specified that this fire was not a severe fire, but a moderate fire that had severe consequences on the plant.

Response: Section A.3.2 will be revised with the following statement: “The Browns Ferry fire was a moderate severity fire that had significant consequences on the operator’s ability to control and monitor plant conditions. Considerable damage was done to plant cabling and associated equipment affecting vital plant shutdown functions. The fire burned, uncontrolled, while fire fighting efforts, using CO2 and dry chemical extinguishers, continued for approximately 7 hours with little success until water was used to complete the final extinguishing process.”

Comment 7.4: Section A.3.2, last paragraph, change "ensure that events similar in magnitude to the Browns Ferry Fire do not occur again." to "help to ensure" or "reduce the chances of." An absolute statement is not appropriate.

Response: Section A.3.2 will be revised as follows: “The combination of these upgrades has resulted in a significant increase in plant safety and reliability, and, along with preventative measures, they help to ensure that events similar in magnitude to the Browns Ferry fire will not occur again.”

Comment 7.5: Section A.3.3, bullet 6: The separation requirements prior to Appendix R were for electrical separation and provided little protection against fire spread. This bullet should state that separation criteria was inadequate to protect against fire.

Response: The bullet will be revised to indicate that the electrical separation was inadequate to prevent the spread of the fire.

Comment 7.6: Section A.3.3, bullet 6, sub-bullet 1: Provide more information about separation distances, the distances which were in place were 5 feet. Even without intervening combustibles fire could propagate across such a short distance.

Response: Separation distances were 3 feet horizontal and 5 feet vertical without intervening combustibles. These distances were consistent with the distances used in IEEE 384 and RG 1.75.

Comment 7.7: Section A.3.4, paragraph 1: This paragraph could be misread to conclude that all of these improvements were performed at plants. This is simply a list of recommended improvements. The last sentence of this paragraph should state, ”The improvements listed in NRC guidance are as follows.”

Response: Section A.3.4 will be revised as suggested.

Comment 7.8: Section A.4.0, paragraph 1, the words "necessary assurance" could imply that a fire can not cause a situation where safe shutdown can not be achieved. It would be more accurate to state that, if the modifications were performed in accordance with NRC guidance, then there is reasonable assurance that plants are safe from fire.

Response: Section A.4.0 will be revised as follows: “The changes made to the plant fire protection programs in response to the Brown’s Ferry fire as described above provide reasonable assurance that the plant design and operation will be safe from the effects of fire.”
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8. Appendix B Comments

<u>Deterministic Circuit Failure Characterization</u>

Comment 8.1: Appendix B should be revised in light of the comments made earlier. The circuit failure criteria and interpretations are not consistent with previously established requirements and staff guidance. Many of the comments previously discussed are also applicable to this section.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations) and the responses to other comments related to multiple spurious actuations.

Comment 8.2: Lack of a technical or regulatory basis for limiting the number of circuit faults that are expected to occur to one single fault (ref: Section B.2.0, *"determine the effects of each type of circuit failure on each conductor one at a time."*

Response: Refer to Attachment D (Position on Multiple Spurious Actuations) and the responses to other comments related to multiple spurious actuations.

Comment 8.3: Section B.4.0, *"In recent years growing concern has been expressed regarding the combination of spurious actuations... There is no consistent way to address the multitude of scenarios that may occur when postulating combinations of circuit failure types and/or combinations of component spurious actuations. To consider the effects of multiple concurrent circuit failure types and affected components ...becomes a daunting and overwhelming task."* The resolution for this "concern" is presented in Section D.4.0 (Page D6) of the document which states: "Section III.G.2 provides certain protection requirements. Where such requirements are met, analysis is not necessary."

Response: Refer to Attachment D (Position on Multiple Spurious Actuations). First, the quotation at the end of the comment is not accurate. The actual quotation is "Section III.G.2 provides certain separation, suppression, and detection requirements within fire areas; where such requirements are met, analysis is not necessary." Second, Section III.G.2 cannot be used to provide protection without first doing the analysis to determine what protection is required. The staff's proposed resolution in this comment therefore does not affect the potentially unbounded analysis required to address an essentially unlimited quantity of potential multiple spurious actuations. If consideration of multiple simultaneous spurious actuations is necessary to address potential safety issues, then such evaluations must be focused on those with the greatest safety significance.

9. Appendix B.1 Comments

<u>Justification for the Elimination of Multi-conductor Hot Shorts Involving Power Cables</u>

Comment 9.1: This section presents a risk-based justification for eliminating consideration of three-phase faults on power cables of high/low pressure interface boundary isolation valves. This argument has been presented many times by various licensees in the past. Historically, the staff has agreed that the probability of this failure mode is very low. However, because the consequence of a fire-induced LOCA event is unacceptable and because there exists a high degree of uncertainty in the ability to accurately predict the manner in which fire-damaged cables may fail, the staff has consistently concluded that suitable fire protection features or administrative controls must be provided to preclude such an occurrence.

Response: As pointed out in Appendix B.1, such a failure mode would require a breakdown in the insulation of each of the three phases of both the aggressor cable's conductors and the target cables conductors, at the same time that the insulation on all other potential target cables in the vicinity is robust enough to prevent a short to ground or a short to another cable. The recent EPRI circuit tests suggest that it is very unlikely that there can be significant differences in cable insulation damage in the same location. The "uncertainty" associated with this phenomenon is not so great as to allow a realistic chance for this failure mode to occur.

NEI does not take issue with protecting high-low pressure interfaces from multiple spurious actuations as is specified in GL 86-10, but protecting them against three-phase faults seems unnecessary in the light of the staff's acknowledgment of their low probability.

Comment 9.2: Section B.1-1 is not in agreement with the long held NRC staff position that multiconductor three phase AC hot shorts and multiconductor ungrounded DC need to be addressed for high/low pressure interfaces. The NEI position that such circuit failures are highly unlikely and need not be postulated is based solely on the probability of the initiating event (based on uncertain data) and does not consider the consequences if such faults occur. This is clearly within the current licensing basis for all operating plants.

Response: The NEI position does consider the consequences of the accident. See the response to Comment 9.1. In addition, the response to Comment 4.2 addresses the consideration of risk when the consequences are high.

10. Appendix B.2 Comments

Justification for the Elimination of Multiple High Impedance Faults

Comment 10.1: Many of the assumptions presented in this section, such as the low probability of multiple faults that may be caused by fire, time for high-impedance faults to propagate to a bolted-fault, the self extinguishing characteristics of arcing faults, and likelihood of high-impedance fault occurrence at various voltage levels, should be supported by reference to an acceptable technical basis such as industry consensus standards, NRC guidance documents, and/or industry documents and fire test results that have been reviewed and endorsed by the staff. The documents referenced in this section do not appear to have been reviewed and endorsed by the NRC.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations). References B.2-5.1, .2, .4 and .5 identified on page B.2-4 of the NEI 00-01 are provided as industry documents supporting the elimination of high impedance fault considerations. In addition to these references, the elimination of high impedance fault analysis is supported by the results of the recent NEI cable fire tests which showed that high impedance faults may occur during a fire, but are slow to occur, are of short duration, are limited to certain voltage levels and are few in number. The support afforded for this position by the test results will be reflected in the next revision to Appendix B.2.

Comment 10.2: Section B.2.0 states that combinations of failures (e.g., multiple hot shorts) are generally considered by the industry to be outside plant licensing basis. We note that several licensees have reported combinations of failures that have been identified during a re-assessment of the plants safe shutdown analysis and have voluntarily taken corrective action to address the deficiencies. Some examples are provided in Information Notice 92-18. The NRC has informed NEI of its position that this is within the scope of the existing fire protection regulations in a letter from S. Collins to R. Beedle dated March 11, 1997.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations). The fact that some licensees have protected against combinations of failures does not change in any way the fact that most licensees consider this outside their licensing basis. The identification of a combination of failures at one plant does not warrant changing the approved safe shutdown analysis at every plant. The industry responded at length to the letter noted in the comment (NEI letter to NRC of May 30, 1997).

However, the purpose of NEI 00-01 is to rise above previous arguments over interpreting the regulations. This issue is further addressed in the responses to many previous comments.

Comment 10.3: Section B.2: In regard to the treatment of high impedance faults resulting from a fire, NEI has concluded that, at various voltage levels, multiple high impedance faults will not occur, at voltage levels where they are possible the fault current is too low to be of a concern and the probability of such faults is sufficiently low to eliminate the need to evaluate the impact. NEI appears to have used a risk argument that does not consider the consequences, even though the concern is clearly within the licensing basis for all operating plants. NEI should provide sufficient technical basis to support its conclusions.

Response: Supporting technical bases are found in the references for this Appendix. In addition to these references, results from fire tests may be used to develop further technical bases to support these conclusions in the next revision to NEI 00-01. The MHIF concern is not within the licensing basis for all operating plants because GL 86-10 staff positions were not promulgated in a way that required plants to comply with their new staff position on multiple high impedance faults.

Comment 10.4: Appendix B, Section 5, should list the test objectives that were in the test plan.

Response: Section 5 will be revised to list the objectives that were in the test plan.

Comment 10.5: Appendix B, Section 5: During the fire tests the cables were not exposed to direct flame, yet they ignited. NEI 00-01 should contain a discussion on the insights derived from the fire tests. The Institute of Electrical and Electronics Engineers (IEEE) standard 383 qualified and unqualified cables used in the testing should also be discussed.

Response: A discussion on the insights derived from the fire tests will be included when the EPRI report on the fire tests is completed.

Comment 10.6: Appendix B Section 5.0: The insights from the cable fires should be more specific including a discussion on which factors contributed to cable damage and which factors did not.

Response: A discussion on the insights derived from the fire tests will be included when the EPRI report on the fire tests is completed.

Comment 10.7: Appendices B.1 and B.2 rely on risk-informed methods to eliminate deterministic requirements. The conservative deterministic requirements are in balance with the non- conservative assumptions that are also used in the deterministic analysis. If these requirements were to be eliminated, the deterministic analysis could then be non-conservative.

Response: The deterministic requirements for these types of failure combinations are over-simplified and overly conservative because they extend into multiple fault combinations without a specified limit and without consideration for what cable failures are credible as a result of fire damage. These Appendices serve to explain the improbable nature of these of failures as a result of cable fire damage.

11. Appendix C Comments

High/Low Pressure Interfaces

Comment 11.1: The criteria, definitions, and interpretations presented in this appendix need additional information to fully address established concerns regarding high/low pressure interfaces. As described in Generic Letter 81-12, and Information Notice 87-50, the fundamental concern for high/low pressure interfaces is the potential for a single fire to initiate an unrecoverable loss of reactor coolant system inventory that is in excess of the available makeup capability (i.e., LOCA). The language in other sections of the NEI 00-01 appear to be consistent with this interpretation. For example, in describing the potential effects of fire-induced spurious operations, Section 3.1 states that one of the concerns is, "*a loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability*..." Additionally, Appendix B, paragraph B.3.0, states that selected high/low pressure interface equipment are evaluated to more stringent requirements, *"to ensure that a fire induced LOCA does not occur."* Contrary to the above, Appendix C defines high/low pressure interfaces of concern as only those valves whose fire-induced spurious operation would cause "*a breach of the RCS boundary by failure of the downstream piping due to a pipe rupture."* Using this criterion, certain valves whose spurious operation could initiate a loss of reactor coolant inventory in excess of makeup capability, such as the Pressurizer PORVs in a PWR or SRVs in a BWR, that credits the use of a high-pressure/low volume pump to accomplish the RCS makeup function, may not be evaluated against the more stringent requirements established, *"to ensure that a fire induced LOCA does not occur."*

Response: The NEI 00-01 text is consistent with GL 81-12 (and clarification) and IN 87-50, which are concerned with rupture and a resulting un-isolable loss of reactor coolant. RCS leakage paths that do not result in rupture must also be evaluated, to verify that they do not create a loss of coolant greater than the makeup capability, however they need not be evaluated to the more conservative HI/LOW criteria. Their acceptability or failure is handled the same as any other safe shutdown function.

Comment 11.2: This appendix states that valves that open directly to the atmosphere are not high/low pressure interfaces and, therefore, would not be considered to be subject to increased protection (such as protection from 3-phase faults). A valve opening to atmosphere would be a much more severe event than a high/low pressure interface accident as discussed in this chapter. How would high pressure to atmospheric pressure interfaces be treated?

Response: Non-high/low pressure interface components are evaluated by postulating the various circuit failure modes (hot short, open circuit, short to ground) on each conductor one at a time rather than in multiple combinations as with high-low pressure interfaces. A spurious operation that results in high pressure to atmospheric pressure interface is evaluated for its effect on safe shutdown system equipment operation similarly to any other circuit failure. Any adverse effects identified will be evaluated and a resolution provided.

Comment 11.3: Consistent with its position in Section B.1-1, NEI 00-01 does not consider multiple circuit faults that result in a high/low pressure interface. An acceptable technical basis needs to be provided to support the relaxation of current NRC positions. The NEI positions and definitions concerning high/low pressure interfaces are inconsistent with established NRC positions and would be unacceptable without an adequate technical basis.

Response: This comment is incorrect. Section 1.3.4 and Appendix B Section 3.0 clearly indicate that multiple spurious actuations for high/low pressure interfaces are to be considered (except for 3-phase hot shorts).

12. Appendix D Comments

<u>Alternative / Dedicated Shutdown Requirements</u>

Comment 12.1: Paragraph D.2.0: The document should fully describe "physical and electrical independence" and provide specific examples of components, cables, and circuits that must be provided with this capability.

Response: The document will be revised to include the following discussion: “Appendix R, section III.G.3, requires that the equipment, cabling and associated circuits required for Alternative Shutdown must be independent of the fire area being evaluated. Therefore, in the case of a Control Room fire, the safe shutdown systems and components may be similar to those used in other areas for redundant shutdown, however, they must be physically located outside of the fire area and if required, the control of the components must be electrically isolated by transferring control to a remote shutdown control station(s). Examples of components and cables that must be physically and electrically independent of the control room for alternative or dedicated shutdown use includes the components that can be controlled from a remote shutdown panel and the cables that provide control from that panel once they are isolated from the control room circuit. GL 81-12 required that each Appendix R plant submit their modification plans for their Alternative Shutdown capability for prior staff review and approval. These submittals typically included details of the proposed isolation/transfer design.”

Comment 12.2: Paragraph D.2.0: The sentence, *"Use of the term "Alternative" or "Dedicated" shutdown is applied to the specific plant areas and not to the equipment or methodology (capability) employed to achieve safe shutdown."* requires further clarification as to its intent. Sections III.G and III.L of Appendix R specifically refer to "Alternative Shutdown Capability."

Response: The intent of this statement was to indicate that the same equipment and systems used to achieve safe shutdown in typical III.G.2 fire areas with redundant shutdown methods are typically also used to achieve safe shutdown in Alternative Shutdown areas. Alternative shutdown capability may consist of similar components and systems to that used for redundant shutdown methods but with different mitigating actions. Therefore, it is not necessarily the shutdown system or equipment that defines whether it is considered Alternative but rather the mitigating actions taken within a specific fire area.

Comment 12.3: Paragraph D.4.0 states, *"When utilizing Alternative or Dedicated shutdown capability, transients that cause...a short duration of RCS level below that of the level indication in the pressurizer for PWRs ...have been deemed to be acceptable deviations from the performance goals.* Provide a technical justification (reference to NRC guidance document, safety evaluation, or memorandum) that has found this to be an acceptable deviation from PWR performance goals.

Response: Refer to Attachment H (Position on PWR Issues).

Comment 12.4: Paragraph D.4.0: A technical justification and regulatory basis for the statement, *"As is the case in all other fire areas, potential spurious operations are assumed to occur one-at-a-time,"* should be provided.

Response: Refer to Attachment D (Position on Multiple Spurious Actuations).

Comment 12.5: Paragraph D.4.0 states, *"...the availability of redundant fusing should be considered when relying on transfer switches"* needs further clarification. What level of "consideration" is necessary? What factors must be considered? Section D.5.0 states that either isolation transfer switches with redundant fusing or electrical and physical isolation and manual manipulation of equipment must be provided. If the alternative shutdown capability is not provided with transfer switches, would fuse replacement be an acceptable means?

Response: According to IN 85-09, a redundant set of fuses should be installed for those components that have to remain operable after transfer to a remote panel since circuit fire damage may occur before the switchover, fuses might blow at the motor control centers or local panels and require replacements to make the affected systems/components operable. This situation could exist if the transfer scheme depends on the existing set of fuses in the affected circuit and did not include switching-in redundant fuses in all of the alternate shutdown system circuits. If transfer switches or other similar mechanisms are not provided, any mitigating action by means of manual manipulation of equipment must be evaluated for feasibility with respect to timing, manpower, lighting and accessibility to ensure that an unrecoverable condition does not occur.

Comment 12.6: Paragraph D.4.0 states: *"As clarified in the body of this document the term free of fire damage allows for the use of operator actions to complete required shutdown functions."* For reasons described in previous comments above, this "statement" is inconsistent with regulatory requirements.

Response: Refer to Attachment A (Position on Free of Fire Damage) and Attachment B (Position on Manual Actions).

Comment 12.7: Paragraph D.5.0 states that actuation of an isolation transfer switch is an acceptable technique for mitigating the effects of spurious operation. This statement may not be valid for all cases and should be further defined. In general, the purpose of an isolation transfer switch is to preclude the maloperation of equipment by providing a means to isolate circuits that may be affected by fire. The ability of isolation transfer switch actuation to mitigate the effects of fire damage that may have occurred prior to transfer is a function of circuit design. For example, an isolation/transfer scheme that switches in a new source of electric power upon transfer of control to the Alternate Shutdown Panel would certainly mitigate the effects of fire damage to the "normal" source of electric power. The ability of similar schemes to mitigate (i.e. alleviate) the effects of fire damage that caused an MOV to spuriously change position prior to actuation of the transfer switch has not been technically justified.

Response: The statement in Section D.5.0 will be revised as follows: "For the case of the Alternative/Dedicated shutdown area fire, as is the case in all other fire areas, potential spurious operations are assumed to occur one-at-a-time. If the circuit can be isolated by the actuation of an isolation/transfer switch, the actuation of the transfer switch is considered to be an adequate mitigating action. For those circuits in the affected fire area, which are not provided with transfer switches, each identified potential and credible spurious operation must be identified to determine if mitigating actions are required. Similarly, for those circuits in the affected fire area prior to isolation/transfer, that are provided with transfer switches, each identified potential and credible spurious operation must be identified, to assure that the isolation/transfer capability has provided the means to restore the component to its desired shutdown position."

Comment 12.8: Section D.2.0, paragraph 1, states that Alternative/Dedicated shutdown is generally provided for the control room. Are there any known exceptions to this? If not, the word "generally" should be deleted.

Response: The word "generally" does not detract from the sense of the sentence, and removing it will not clarify matters.

Comment 12.9: Section D.3.0, overview: Many control panels (bench boards/backboards) use nonrated cables, and are not sealed from adjoining panels. A technical justification should be provided as to why it is assumed that a fire would not be expected to affect multiple panels. Also, the smoke generated from a fire in one panel could cause problems in other panels. There are also implications that there is a lack of ignition sources. However, experience has shown that where there is electricity there are always potential ignition sources. This section also implies that all main control rooms have automatic fire suppression, which is not the case.

Response: As described in section D.3.0, due to a continuously manned control room, ignition sources and transient combustibles being strictly controlled, and fire protection features available to quickly identify and extinguish such an event, multiple panel cabling and equipment being involved and damaged, either by fire or smoke, is unlikely.

Comment 12.10: With regard to the NEI positions concerning "short duration" partial core uncovery or loss of pressurizer level indication, there should be some supporting analysis acceptable to the NRC staff. This analysis should establish limits on the duration and the acceptability of these transients. That analysis may be cited in NEI 00-01 or in plant specific analyses.

Response: The BWROG has provided such analysis to address the issue of partial core uncovery. Please see Attachment H for a discussion of pressurizer level indication.

Comment 12.11: This section should address the method to be used to identify that spurious actuations have occurred such that credit can be taken for operator actions. This differs from established staff positions that a means to detect spurious operation must be protected. This section also allows the crediting of numerous operator actions prior to control room abandonment. The established staff position in Generic Letter 86-10, question 3.8.4, is that only a reactor trip should be credited prior to the abandonment of the control room. This section assumes that alternative/dedicated shutdown only applies to scenarios that require the evacuation of the control room. Alternative/dedicated shutdown must be provided for any fire area that contains redundant trains of safe shutdown equipment that have not been separated in accordance with the requirements specified in Section III.G.2 of Appendix R. Some plants have several alternative/dedicated shutdown areas that do not necessitate control room abandonment.

Response: This section will be revised to include a discussion of the design of remote control stations and how spurious actuations can be identified and how the effects of spurious actuations that may have occurred prior to transfer have been previously considered. For example, remote stations include equipment and system status monitors that help to identify spurious actuations that have occurred. Transfer switch and local control switch designs typically provide an override scheme for spurious operations even if they occur prior to transfer. The additional operator actions described in this section, are those recommended to be performed immediately prior to evacuation of control room evacuation. Unless specifically licensed for a plant these actions are not credited within the post fire sate shutdown analysis, but are prudent since they are beneficial in minimizing the potential for flooding of the main steam lines outside of primary containment (BWRs) and minimizing the potential of an overcooling event (PWRs) and in conserving RCS inventory. Sections D.2.0, D.3.0, D.4.0, D.5.0 and D.6.0 have been revised to reflect the above.

13. Appendix E Comments

Manual Actions and Repairs

Comment 13.1: Paragraph E.2.0 states, *"Manual actions on equipment... is allowed under the definition of free of fire damage."* As previously discussed, this statement is not consistent with current established regulatory criteria.

Response: Refer to Attachment A (Position on Free of Fire Damage).

Comment 13.2: Paragraph E.3.0: The statement that the use of manual operator recovery actions will provide an *"equivalent mitigation capability to automatic operation"* if they can be *"performed in a time frame sufficient to restore level prior to the onset of core damage"* truncates the minimum capabilities and performance goals of shutdown systems specified in Section III.L of Appendix R. This appears to contradict staff guidance established in Generic Letter 91-18, "Information to Licensees Regarding Two Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and Operability," dated November 7,

1991. Specifically, in Section 6.7, the Generic Letter states, *"Although it is possible, it is not expected that many determinations of operability will be successful for manual action in place of automatic action. Credit for manual initiation to mitigate the consequences of design basis accidents should have been established as part of the licensing review of the plant."* Additionally, the statement appears to be predicated on the assumption that operators will always accomplish desired activities in a satisfactory manner under high-stress conditions.

Response: Refer to Attachment B (Position on Manual Actions). If the commenter is objecting to the viability of manual actions as a replacement for automatic actions, this is inconsistent with long-standing staff acceptance of the use of manual actions for alternate shutdown. As stated in the NEI letter of January 11, 2002, licensees should be able to demonstrate that credited manual actions can be performed within the time and environmental constraints imposed by the fire. Therefore, industry does not assume that operators will 'always' accomplish desired activities.

Comment 13.3: Paragraph E.4.0: The statement, *"From an operational perspective, there is no meaningful distinction whether an action is defined as a manual action or repair since the same considerations apply."* requires further clarification / explanation. In general, repairs are more complex than manual actions, typically involving the use of tools (fuse puller, screwdriver, wrench etc.) and/or may expose personnel to additional hazards. Additionally, because the NEI document acknowledges that hot shutdown conditions must be achieved without repairs (but allows manual actions), this statement further reinforces the position that reliance on manual actions does not provide an equivalent level of safety to that which would be provided by fire protection features specified in the regulation.

Response: Refer to Attachment B (Position on Manual Actions). NEI 00-01 acknowledges that hot shutdown conditions must be achieved without repairs only because that is the acceptable methodology specified in Appendix R, Section III.L and others. However, manual actions can provide an equivalent level of safety to that provided by fire protection features assuming that mitigating action(s) by means of manual control of equipment are evaluated for feasibility with respect to timing, manpower, lighting and accessibility to ensure that an unrecoverable condition does not occur.

Comment 13.4: Paragraph E.6.0, Criterion 1: The phrase *"such that an unrecoverable condition does not occur"* should be replaced with "such that performance criteria of Appendix R Section III.L.1 and III.L.2 are met." The basis for this is in Information Notice 84-09, Section V, which states, "The systems and equipment needed for post-fire safe shutdown are those systems necessary to perform the shutdown functions defined in Section III.L of Appendix R ... The acceptance criteria for systems performing these functions is also defined in Section III.L ... These guidelines apply to the systems needed to satisfy both Section III.G and III.L of Appendix R."

Response: The phrase "such that an unrecoverable condition does not occur" appears in the July 12, 1982 Mattson Vollmer memorandum. NEI 00-01 is using this term consistently with the NRC memorandum.

Comment 13.5: Paragraph E.6.0, Criterion 3: In general, no credit may be taken for operator recovery actions in the fire affected area or for actions that require an operator to traverse a fire affected area. However, these types of actions have been approved on a case-by-case basis where it has been clearly demonstrated that the actions are not "time critical" to post-fire safe shutdown (will not be required to be performed for some time after the initiation of fire) and the actions are tenable from a human performance/environmental perspective. The document should define the set of minimum performance standards/criteria for demonstrating the acceptability of performing manual operator actions in the fire affected area or in traversing fire affected areas.

Response: NEI will consider the development of such criteria.

Comment 13.6: Paragraph E.6.0, Criterion 4: Provide a technical and regulatory basis for stating that the path to and from remote buildings need not be provided with outdoor battery-backed emergency lighting. The need for this type of lighting may vary widely between plants and should be evaluated. Depending on the plant-specific features and post-fire shutdown strategy employed, such an evaluation may identify specific locations such as outdoor stairwells or other locations where battery-backed emergency lighting units may be needed to prevent personal injury.

Response: NRC has accepted that portable lighting complies with Appendix R and is suitable for outdoor use. The last sentence of this paragraph will be revised as follows: "The path to and from actions required at remote buildings (such as pump house structures) does not require outdoor battery backed lights, if other lighting provisions are available (portable lights, security lighting, etc.)."

Comment 13.7: Paragraph E.6.0, Criterion 5: Provide a technical basis for relying on a system change as a means of confirming that a manual operator action has achieved its objective. A "system" change may be caused by any one of a number of variables. For example, would reliance on pressurizer level indication alone be sufficient to diagnose the specific reason that pressurizer level is dropping?

Response: This paragraph provides examples of system parameters that "may" be used to confirm that a manual operator action has been achieved. This paragraph does not imply that any one parameter alone is all that is needed to verify the success of manual operator actions. Depending upon the parameter used, the protection provided for that parameter during fire conditions, etc., input from additional parameters may also be required to ensure accurate conclusions are reached. One indication may not be sufficient to diagnose the specific reason but would give an indication that the level is dropping and action needs to be taken to refill. After the indication is received that water is getting into the RCS then one can look for the reason that the level dropped.

Comment 13.8: Paragraph E.6.0, Criterion 6: The phrase "available and accessible" should be defined.

Response: The phrase will be defined as suggested.

Comment 13.9: Paragraph E.6.0, Criterion 7: The phrase "provisions for communications" should be defined.

Response: The phrase will be defined as suggested.

Comment 13.10: Paragraph E.6.0, Criterion 8: Provide additional specific guidance for determining when procedures are required.

Response: The following statement will be added: "Procedures would be required for activities not addressed in existing procedures (normal, abnormal, EOPs) for operator actions and repairs as a result of fire induced failures that cannot be readily diagnosed using information available to the operator."

Comment 13.11: Paragraph E.6.0 - Other Types of Actions: states that the need for emergency lights, communications, and timing considerations need not be addressed for manual actions specified as backup or confirmatory actions. This statement should be substantiated. For example, when an operator needs to confirm proper system alignment by monitoring indication of a local flow instrument, there is a need for emergency lighting and communications at the flow instrument. As another example, consider the case where the post-fire shutdown strategy relies on operator actions to remove motive power from certain motor-operated valves (i.e., trip the MOV breaker at the MCC) as a means of preventing their spurious actuation as a result of fire damage to unprotected control cables. Because the MOV control circuits have not been provided with suitable fire protection features necessary to prevent spurious actuations there is a potential that the valve(s) may have changed position prior to the removal of motive power. Due to this lack of assured protection, operators are procedurally directed to "confirm" or "verify" the position of potentially affected motor-operated valves. Under the criterion provided in NEI 00-01, it is not clear if such "confirmatory" actions would require the need for emergency lighting and communications to be considered.

Response: Backup or confirmatory actions are those not required and credited in the Appendix R analysis, but, as stated, could have a positive benefit. If the action(s) is not credited in the Appendix R analysis, the requirement for emergency lighting or communication relating to that backup activity is also not required. The examples that were provided in the Question would typically be required and credited and not backup activities. This paragraph will be revised to clearly define backup and confirmatory. Section E.6.0 has been revised to reflect the above.

Comment 13.12: Section E.5: Clarify the following definitions "manual" means not automatic. "Local" typically means that the function is performed at the location of the device, i.e., valve or breaker. What is listed as "Local Control" would more commonly be known as "Remote Manual". The "Manual Control" would more commonly be known as "Manual." "Manual Operation" would be known as "Local." The terms "control" and "operation" are typically used interchangeably. If they mean different things they should be defined separately.

Response: Definitions will be clarified as suggested.

Comment 13.13: Section E.5, Definitions: It should be stated that repair activities are intended to restore functions and not equipment, especially since equipment may be destroyed in a fire event. In the same paragraph, last sentence: This sentence should state that exterior security lighting may be relied upon if independent 8 hour power supply is available.

Response: The sentence will be revised as suggested except to say that "exterior security lighting or portable lighting may be relied upon if independent 8 hour battery backed lighting is unavailable."

Comment 13.14: Section E.6, Criteria, bullet 4: Provide the technical basis for the statement that access/egress/emergency lighting is not required for actions not required for 8 hours.

Response: The technical basis for this statement is that temporary lighting can be established with 8 hours.

Comment 13.15: Section E.6, Criteria 5 and 8: Replace should with shall.

Response: (for Criterion 8): The purpose of this document is to provide guidance, not requirements, for performing manual actions.

Comment 13.16: Section E.6, Additional Criteria Specific to Repairs, bullet 2: This bullet should be clarified. For example, if hot shutdown can be maintained indefinitely, would there still be a requirement to be equipped to go to cold shutdown? If cold shutdown repairs are expected to be able to be completed in 10 hours and hot shutdown can only be maintained for a little more than 10 hours would this be acceptable?

Response: The requirements for achieving hot and cold shutdown are provided elsewhere.

Comment 13.17: This section combines criteria for hot shutdown/standby with cold shutdown which could confuse users as the requirements are different. NEI 00-01 states that the same considerations apply both to manual actions and repairs, which may not be true. This section also allows operator actions in, and travel through, the fire affected area to achieve hot shutdown/standby which is inconsistent with current NRC requirements.

Response: Refer to Attachment B (Position on Manual Actions). Any mitigating action by means of manual action/repair of equipment must be evaluated for feasibility with respect to timing, manpower, lighting and accessibility to ensure that an unrecoverable condition does not occur.

14. Appendix F Comments

Supplemental Selection Guidance for Pilot Evaluation

Comment 14.1: Bullets on the first page F-1. Are the two approaches complementary, or are they sequential? Identifying the potential for flow diversion and blockages, and identifying those SSCs that could lead to diversions and blockages is certainly a necessary step. It is a prerequisite to modifying the Probabilistic Safety Analysis (PSA) model. Is the intention here to modify the model to include the impact of spurious actuations? However, even if the model were modified, the quantification will be a function of what has been assumed for the probability of spurious actuation. Is the intention that a high probability be assumed so that possible spurious actuations are not prematurely screened?

Response: The methods are complementary. The NEI 00-01 pilot evaluation report will provide additional information for use of both methods. PSA model modification is not required for Appendix F analysis. This method uses the present PSA model to identify potential combinations, not to use the PSA to evaluate a known combination or new issue. A high probability for spurious actuations is assumed for identifying potential combinations.

Appendix F will be revised to reflect this information.

Comment 14.2: The three steps describing the use of a "plant logic model that includes all possible fire events" should provide more useful guidance. The first sentence in Step 1(a) appears to be open-ended and provides little guidance on how to identify missing sequences. The remainder of the paragraph needs more substance. Step 1(b) is a reiteration of the first bullet (Identify flow diversions etc.) on the previous page. Step 2 gives examples of what components are NOT susceptible to fire, but gives no indication on how to identify which components are susceptible to fire. It's not clear what is meant by the first sentence in Step 3. Should it be interpreted as "Run the new model, and exclude (i.e., screen out) components/combinations with a ….? Provide the metric for the screening criterion. With a screening value of 1E-02, it clearly should not be delta CDF.

Response: Appendix F will be revised appropriately.

Comment 14.3: Appendix F: Provide additional guidance on how "unacceptable consequences" can be evaluated using a PSA. There is no CDF where an "unacceptable consequence" becomes acceptable. The consequence is unacceptable regardless of the probability.

Response: The PSA is used in this appendix to identify combinations with unacceptable consequences. Those combinations are then addressed using Section 3 and Section 4 of NEI 00-01.

Comment 14.4: NEI 00-01 provides guidance on resolving potential circuit failures that represents an alternative to established NRC requirements and guidance. NEI 00-01 states that only those multiple spurious actuations that result in immediate and unrecoverable consequences comparable to high/low pressure interfaces (as redefined in the NEI document) need to be considered. This is inconsistent with NRC requirements. The NEI guidance excludes components that provide space/heating or cooling even if required for hot shutdown/standby from consideration based on the potential for recovery by plant personnel which would need to be technically justified.

Response: Refer to Attachment C (Position on Spurious Actuation of Non-Safe Shutdown Equipment).

Comment 14.4[b]: The NEI guidance also allows the elimination of components from consideration if the probability is less than 1E-2 without consideration of the consequences of the event and without appropriate treatment of the uncertainty in the determination of the probability.

Response: Appendix F will be revised appropriately.

Attachment A
Free of Fire Damage

A.1 Issue

Does the definition of "free of fire damage" reflect the use of manual operations?

A.2 Industry Position Statements

NEI 00-01 defines free of fire damage as: "The structure, system or component under consideration is capable of performing its intended function during and after the postulated fire, as needed. It may perform this function automatically, by remote control, or by manual operations."

The use of manual actions to achieve safe shutdown (both alternate and redundant) is acceptable, without prior NRC approval, as long as the reliance on manual actions does not adversely affect the ability of the plant to achieve and maintain safe shutdown. Licensees should be able to demonstrate that the actions can be carried out in the time frame and under the environmental conditions applicable to the actions.

A.3 Discussion

Appendix R Section III.G.1 states "Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that:

> *A. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or the* emergency control station(s) *is free of fire damage; and…*

Appendix R Section III.G states that fire damage must be limited such that one train of necessary equipment is "free of fire damage". However, the regulation does not provide a definition for free of fire damage.

NUREG 0800 Section C.5.b(1)(a) states "One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage".

The industry interpretation of the phrase "free of fire damage" is that the system or component is available to perform its intended safe shutdown function, as needed during the fire event evolution, but that it is not required to function automatically and may be manually controlled by the operators from either the control room or an emergency control station. An emergency control station includes the remote shutdown panel(s), local starters, electrical distribution panels, MOV handwheels and other equipment locations designed for operator use or monitoring.

When an operator action(s) is necessary to maintain equipment free of fire damage, the

Attachment A
Free of Fire Damage

following must be considered :

- Is ample time available for the operator to perform the necessary action(s) prior to the plant reaching an unrecoverable state;
- Is sufficient plant operating staff available to perform all required manual actions;
- Are access and egress routes and adequate necessary to perform the action available and unaffected by the postulated fire;
- Are required emergency lighting and communication equipment available and unaffected by the postulated fire .

Use of manual actions for maintaining a train "free of fire damage" is feasible when supported by appropriate analysis. Analysis must demonstrate that manual actions do not affect the ability of the plant to achieve and maintain safe shutdown.

Attachment B
Manual Actions

B.1 Issue

Whether the use of manual actions for redundant shutdown requires prior NRC approval.

B.2 Industry Position Statements

The use of manual actions to achieve safe shutdown (both alternate and redundant) is acceptable, without prior NRC approval, as long as the reliance on manual actions does not adversely affect the ability of the plant to achieve and maintain safe shutdown. Licensees should be able to demonstrate that the actions can be carried out in the time frame and under the environmental conditions applicable to the actions.

Longstanding staff acknowledgement of redundant shutdown manual actions for compliance with regulations is evident in:

- Regulatory guidance
- SERs
- Numerous inspections
- Plant-specific correspondence and meetings with staff

Use of manual actions for redundant shutdown is feasible when supported by appropriate analysis. Industry understands that NRC plans to provide a rule change reflecting acceptability of manual actions when shown to be feasible (long term) and inspection guidance to reflect this position (short term).

B.3 Discussion

The NEI letter of January 11, 2002 stated the industry position and rationale and recommended revision of November 2001 inspection training information.

The bases for the industry position include the following:

- Regulatory requirements and guidance
- Licensee/NRC interactions
- Industry survey/practices

Regulatory Requirements

10CFR 50 Appendix R, Section III.G
NUREG-0800

Appendix R, Section III.G.1
G Fire Protection of Safe Shutdown Capability
1. Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so

Attachment B
Manual Actions

that one train of systems necessary to achieve and maintain hot shutdown conditions from either the **control room or emergency control stations(s)** is free of fire damage; and systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

<u>NUREG-0800 Section C.5.b(1)(a)</u>
One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage

<u>Appendix R, Section III.G.2</u>
2. Except as provided for in paragraph G.3 of this section, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, or shorts to ground, of **redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area** outside of primary containment, one of the following means of ensuring that one of the trains is free of fire damage…

<u>Appendix R, Section III.J</u>
"Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto."

Free of Fire Damage

<u>GL 86-10 Enclosure 1, Interpretation. 3, Fire Damage:</u>
The structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed.

<u>RG 1.189 Section 5.3 Hot Standby (PWR) Hot Shutdown (BWR) Systems and Instrumentation</u>
One success path of equipment necessary to achieve hot standby (PWR) or hot shutdown (BWR) from either the control room or emergency control stations should be maintained free of fire damage by a single fire, including an exposure fire. Manual operation of valves, switches, and circuit breakers is allowed to operate equipment and isolate systems and is not considered a repair.

<u>Industry Interpretation</u>
The structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed. It may perform this function automatically, by remote control, or by manual operations.

Attachment B
Manual Actions

Emergency Control Station

RG 1.189 (Glossary):
Location outside the main control room where actions are taken by operations personnel to manipulate plant systems and controls to achieve safe shutdown of the reactor.

Industry interpretation:
Emergency control stations consists of: Remote shutdown panels, local control panels, local starters, electrical distribution panels, and local control stations, such as an MOV handwheel, and other plant components designed for local operator use or monitoring.

Regulatory Guidance

Regulatory guidance acknowledges the use of manual actions to achieve redundant safe shutdown, and does not identify the need for prior approval. Manual actions are also permitted for other types of accident response (such as EOPs) without specific regulatory language authorizing them.

Regulatory guidance addressing use of manual actions for other than alternate/dedicated shutdown:

- Regulatory Guide 1.189, Section 5.3 accepts manual actions for safe shutdown
- 1982 Mattson to Vollmer memorandum states that manual actions acceptable for achieving hot shutdown

GL 86-10
Question 5.3.8 response recommends manual actions to clear multiple high impedance faults for both III.G.2 and III.G.3 safe shutdown

1997 FPFI guidance (TI 2515)
Inspectors should evaluate redundant and alternative safe shutdown operator activities

Appendix R Statements of Consideration
Emergency Lighting Technical Basis.
"Emergency lighting is required in all nuclear power plants. Battery powered lights with capacities of 1-1/2 to 2 hours are usually sufficient for emergency egress. However, the post-fire emergency lighting requirements in a nuclear power plant are of a different kind. The need is for lighting that aids the access to equipment and components that must be manually operated by plant personnel to effect safe plant shutdown during plant emergencies. Because such activities may extend over a considerable period of time both during and after the fire, it is prudent to provide 8-hour battery emergency lighting capability to allow sufficient time for normal lighting to be restored with a margin for unanticipated events."

Clarification to GL 81-12

Attachment B
Manual Actions

Section on requirements for protecting redundant or alternative equipment
B: Can protect shutdown capability from damage to associated circuits by
B.1 Protection per III.G.2, or
B.2.b.3 For spurious operation, detect spurious operation and employ procedures to defeat maloperation

<u>SECY 83-269, Attachment C (NRC Positions on Post Fire Shutdown Capability)</u>

"Section III.G.1 of Appendix R states that one train systems needed for hot shutdown must be free of fire damage. Thus, one train of systems needed for safe shutdown has to be operable during and after a fire. Operability … must exist without repair. Manual operation of valves, switches and breakers is allowed to operate equipment and isolate systems and is not considered a repair."

Additional Guidance

- TI-2515-62 March 16, 1983 meeting with NUFPG
- 1984 NRC workshops
- Inspection Procedure 64100, Section 02-03.a.1 concerning location of emergency lights
- Technical Review of BWROG Post-fire SSD analysis
- Agreement 4 -- Free from fire damage
- Agreement 10 -- Manual Actions

Industry Practice

NEI surveyed most plants to determine their usage of manual actions. Most plants use manual actions for redundant shutdown - numerous plants use them extensively, and most plants use them to some degree

Rationale for Plant Use

Plant use of manual actions for redundant shutdown are based on:

- Longstanding plant interpretations of regulatory guidance
- No previous compliance issues noted during inspections
- Plant incorporation of manual actions into operating procedures via 10 CFR 50.59
- Ability to justify particular manual actions
- Time to perform
- Environment
- Availability of personnel

Most plants use manual actions for redundant shutdown without exemptions/deviations. Their implementation and feasibility has been reviewed by NRR on many occasions

Attachment B
Manual Actions

Their use for redundant shutdown was not questioned by NRC as a compliance issue until very recently.

Summary

- Clear pattern of NRC acceptance of manual actions for redundant shutdown without exemptions/ deviations
- Feasibility of manual actions is a prerequisite for use
- Issue intended for resolution via rulemaking and enforcement guidance.

Attachment C
Spurious Actuation of Non-Safe Shutdown Equipment

C.1 Issue

NRC Comment: Section 3.3.2 states that the consideration of spurious actuations need only be considered for cables whose failure could cause the spurious actuation/operation of safe shutdown equipment. This needs to be clarified to include that spurious actuations need to be considered if those spurious actuations could impact safe shutdown capability regardless of whether or not the spurious actuation is of required safe shutdown equipment.

C.2 Industry Position Statement

The industry position is that only those spurious operations resulting from fire induced damage to safe shutdown components and associated circuits whose failure can cause a direct effect on safe shutdown equipment operation require evaluation. This position is implicitly included in the licensing bases of most plants.

The NEI 00-01 guidance is intended for application to known circuit failure issues, identified either by NRC or the licensee. These "known issues" may reflect combinations of circuit failures, IN 92-18 issues, or other circuit failure issues. NEI 00-01 also has guidance for determining whether there are additional combinations or potential failures that may be risk significant. This guidance was intended for trial during the pilot evaluations, but not for application by any licensee unless there is a need. NRC recommended broad use of this "vulnerability search" guidance to determine whether additional circuit failure issues may exist.

An additional vulnerability search to determine potential circuit failures / combinations is not needed.

C.3 Discussion

The licensed industry approaches to performing Appendix R safe shutdown analyses are based upon interpretation of the guidance provided by the NRC in the clarification letter to GL 81-12, dated March 22, 1982. GL 81-12 specifically describes appropriate analysis techniques to be used when performing a post-fire safe shutdown analysis and involves first identifying safe shutdown systems and components, then identifying the cables that are required to operate the selected components or that may cause maloperation of these components (associated circuits). Finally, these components are located by fire area and an evaluation performed to identify the potential for fire damage and the resulting effects.

Based upon this guidance, the industry interpretation of the GL 81-12 requirements does not include postulating the spurious operation of every circuit in the fire area (the number of circuits contained in a typical fire area is very large) and the resulting safe shutdown effects scenario for each. The plant licensing basis incorporates what the regulations require and licensing bases have been reviewed and approved by the NRC during numerous site inspections.

Attachment C
Spurious Actuation of Non-Safe Shutdown Equipment

An analysis addressing the potential spurious failure(s) of every non-safe shutdown circuit in a fire area leads to an unbounded analysis that includes an unlimited amount of permutations and combinations of failures. Additionally, such an analysis would go far beyond what the "single failure criterion" requires for analysis of plant systems responses for accidents and transients. As such, it would require a completely new set of failure modes and effects analyses for all of the possible combinations and permutations (power available, power lost, spurious, no spurious, multiple spurious, etc.). Plants have used the guidance in GL 86-10 Paragraph 5.3.10 "Design Basis Plant Transients" and have concluded that this level of analysis is not required by Appendix R.

Specific requests by the NRC staff to consider spurious actuation of equipment other than safe shutdown equipment would necessitate a vulnerability search. The IPEEE analyses, performed by all plants and reviewed and accepted by NRC, constituted a thorough vulnerability search. In addition, plant safe shutdown analyses have been extensively reviewed and accepted for many years. With the exception of minor, and plant-specific, areas of noncompliance, plants have demonstrated compliance with their licensing bases.

Since plants are complying with their licensing bases, the only occasions when a risk significance analysis is needed is when the plant may have missed an element of compliance, or when a pressing potential safety issue may exist. In the absence of a pressing safety issue or a clear case of noncompliance, a vulnerability search is not warranted. The pilot plant evaluations of NEI 00-01 demonstrated clearly that the vast majority of such additional failures/combinations, identified through the methods in NEI 00-01 Appendix F, are not significant. The effort to identify such additional failures or combinations is mostly wasted, and overwhelms risk analysis resources with unnecessary work, reducing the ability of the plant to focus on risk-significant issues. Suitable methods for conducting a vulnerability search, if the plant deems it necessary to do so, will continue to be provided in NEI 00-01; however, this type of evaluation is not necessary unless the NRC determines that a safety issue exists in accordance with 10 CFR 50.109.

The fact that the NRC has accepted many plant licensing bases without such an evaluation suggests that no such safety issue has been identified to date. However, if necessary, results from a plant self-assessment requiring consideration of certain combination of failures within or outside the safe shutdown system flow path can be evaluated for risk significance using NEI 00-01 Section 4 methodology.

Attachment D
Multiple Spurious Actuations

D.1 Issue

Fire protection regulations require that one train of safe shutdown equipment be maintained free of fire damage. The NRC has interpreted this as follows: Any combination of spurious actuations that could affect the ability of a safe shutdown train to remain free of fire damage must be analyzed (and mitigated where necessary). The Industry, on the other hand, has followed the regulatory guidance in GL 86-10 (and prior staff guidance provided in workshops and individual plant inspection interactions) that indicates any and all potential spurious actuations that could impact maintaining a safe shutdown train free of fire damage should be analyzed one at a time and mitigated where necessary.

As a special case of this, the NRC believes that the licensee should consider more than one simultaneous hot short within a single multiconductor cable if damaged by fire. This could result in not maintaining one train free of fire damage if circuits for redundant components exist in the same cable.

D.2 Industry Position Statement

The industry position is that all potential spurious actuations that could impact maintaining a safe shutdown train free of fire damage should be analyzed one at a time and mitigated where necessary. However, licensees should, in cases where circuits for redundant components (whose simultaneous failure would cause immediate, direct, and unrecoverable consequences) are known to be routed in a single multiconductor cable, include an evaluation of these cables in any new deterministic circuit analysis. A systematic search for such combinations is not required for the reasons stated in Attachment C.

D.3 Discussion

NEI 00-01, Chapter 3, provides methodology to evaluate post fire safe shutdown issue relating to the Industry interpretation identified above. NEI 00-01, Chapter 4, provides a method for licensees to determine the significance of any identified circuit analysis issues on a plant-specific basis including those that may be identified from the NRC's interpretation of post fire safe shutdown criteria. These circuit analysis issues may include cases of multiple spurious actuations or the potential cases of IN 92-18 valve damage due to spurious actuations. These issues may arise from specific NRC inspection findings, or plant self-assessment results or other plant issues. Chapter 4 is provided primarily as a tool for a plant to evaluate the risk significance of circuit failure issues that are clearly outside the licensing basis of the plant. It can also be used to support exemption requests for circuit failure issues within the plant licensing basis.

Thus, NEI 00-01 addresses multiple spurious actuations, but does so in a risk context. While the deterministic portion of the method (Chapter 3) does not evaluate the plant for multiple spurious actuations, the risk portion (Chapter 4) can evaluate any combination of identified circuit failure(s) for safety significance.

Attachment D
Multiple Spurious Actuations

The deterministic and risk significance methods should not be viewed in isolation from each other. The purpose of NEI 00-01 was to allow the resolution of plant-specific circuit analysis issues from a deterministic as well as from a risk significance standpoint, not to impose another layer of deterministic analysis requirements on the industry. NEI 00-01 is being prepared to give the Industry and the NRC an agreed upon methodology that addressed both licensing basis deterministic issues as well as beyond licensing basis issues that could be evaluated using risk significance techniques.

The purpose of the deterministic portion of the method is to establish comprehensive guidelines that a plant may follow in performing new (or revised) post fire safe shutdown circuit analysis. The purpose of the document was not to systematically review previous circuit analysis. The deterministic guidance is consistent with the practices followed at most utilities, and accepted by NRC staff. These plant analyses were performed over many years to address regulatory criteria, and have been reviewed by staff on more than one occasion. The criteria for evaluating single versus multiple spurious actuations are embodied in the plant-specific licensing bases, not in NEI 00-01.

Attachment E
Role of NEI 00-01 in Licensing Basis

E.1 Issue

The issues are whether NEI 00-01 can be used to change a plant's licensing basis, and how it can be applied to determine the significance of failures inside or outside the licensing basis.

E.2 Industry Position Statement

NEI 00-01 will not redefine the plant licensing basis. For potential failures outside the licensing basis, NEI 00-01 will be used to determine whether action is needed to address the potential failures based on the safety significance. For potential failures within the licensing basis, NEI 00-01 can be used to determine whether action is required to address the failures, or support an exemption request if low significance.

E.3 Discussion

Prior to adopting the standard fire protection license condition recommended by GL 86-10 and GL 88-12, establishing and revising the fire protection and fire safe shutdown licensing basis was performed under the license amendment process. This is important to understand, since this process required that licensees submit several documents for staff review and approval, including:

- Their comparison to BTP ABCSB 9.5-1, BTP ABCSB 9.5-1 Appendix A, BTP ASB 9.5-1, RG 1.120, or NUREG-0800.
- Documentation describing each fire area's compliance with III.G.1, III.G.2, or III.G.3 of Appendix R,
- Their proposed changes to comply with Appendix R (i.e., information specifically requested by GL 81-12 RAI),
- Exemptions that would be required under Appendix R,
- Schedular information and specific modification status information.

The NRC reviewed this information at length, typically utilizing the assistance of their own consultants, and ultimately issuing a handful of SERs per plant. During this time period (1982-1986), the NRC was in frequent communication with licensees, including individual meetings, and workshops, and provided numerous interpretations and staff positions, both documented, and informally, which also are reflected in licensee's design and analysis practices. To the extent that these positions and interpretations are embedded in a licensee's analysis, they too form part of the licensing basis, and are not readily changeable. Following the issuance of an SER, licensees were required to continue to submit additional documentation for NRC review, describing any subsequent changes that were determined to be required during, or following implementation.

At various stages of implementation, the NRC performed special inspections to verify plant compliance with the regulations, and conformance with the submitted information (e.g. NRC Inspection Guidance Documents TI-2515-62, TI-2515-61, IP-64051, IP-64053, IP-64100, IP-

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Role of NEI 00-01 in Licensing Basis

64704). There were comprehensive inspections, made up of NRR, Regional Staff, and NRC consultants. These inspections confirmed each plant's compliance with the regulations and are referenced in the applicable SERs.

GL 86-10 and GL 88-12 recommended that Licensees document the salient portions of their NRC-approved fire protection program in the UFSAR, and adopt the standard FP license condition.

GL 88-12 recommended the following information be incorporated into the UFSAR:

> The NRC-Approved Fire Protection Program must be incorporated into the FSAR and submitted with the certification required by 10 CFR 50.71(e)(2). as requested by Generic Letter 86-10. The FSAR update includes the incorporation of the Fire Protection Program, including the fire hazards analysis and major commitments that form the basis for the NRC-approved Fire Protection Program. This may be accomplished by referencing the documents which define the licensee's Fire Protection Program as identified in the NRC's Safety Evaluation Reports.

GL 88-12 defines the approved fire protection program as follows:

> The NRC-approved Fire Protection Program includes the fire protection and post-fire safe shutdown systems necessary to satisfy NRC guidelines and requirements; administrative and technical controls; the fire brigade and fire protection related technical staff; and other related plant features which have been described by the licensee in the FSAR, fire hazards analysis, responses to staff requests for additional information, comparisons of plant designs to applicable NRC fire protection guidelines and requirements, and descriptions of the methodology for assuring safe plant shutdown following a fire.

Given this history, it is clear that the licensing basis for a facility has been methodically developed, and has had ample opportunity for prior staff review.

Role of NEI 00-01

Chapter 3 of NEI 00-01 serves to raise the general level of understanding of actual practices for performing safe shutdown analyses. The information presented in chapter 3 is based on a compendium of industry practices, which have been submitted to the NRC for review, reviewed by NRC and their consultants, approved under SERs, and reviewed yet again under multiple inspections, including inspections containing NRR staff and NRC consultants. The level of agreement in industry practice is consistent, even with the lack of specific written NRC guidance on many topics. This has been attributed to individual interactions with the NRC provided during workshops, inspections, and project status meetings.

NEI 00-01 was not developed to force licensees to change their analysis practices, but can be used by a licensee that has chosen to revise their analysis. NEI 00-01 is an industry guidance document that embodies plant safe shutdown analysis practices used and approved for many years, and should not be construed to suggest that these practices should be changed.

Attachment E
Role of NEI 00-01 in Licensing Basis

Since NEI 00-01 is based on the methods that have already been endorsed by the NRC for many licensees, it represents a compendium of previously approved methods that can be used to meet the regulation. Given that the NRC has accepted the methods in NEI 00-01 for numerous licensees as meeting the regulation, a licensee could use NEI 00-01 to support a licensing basis change, and be confident that the final result would meet NRC regulations. This approach is consistent with the recent clarifications to 10CFR50.59 under NEI 96-07, which provide further guidance for the use of methods that received previous NRC approval.

The definition of which types of circuit failures, or how many spurious operations are postulated for a particular licensee in their existing analysis cannot be absolutely defined in an industry guidance document. The burden remains on the licensee to understand their current licensing basis, and to comply with it. NEI 00-01 can be used as a source of clarifications, if a licensee finds that a particular analysis topic is not currently addressed in the licensing or design basis, and there is sufficient evidence that the licensee's practices were consistent with NEI 00-01.

The licensee is familiar with the types of potential circuit failures that lie inside and outside its licensing basis. For failures outside the licensing basis, identified by NRC or licensee self-assessments, the NEI 00-01 safety significance determination method can be used to indicate the type of changes needed within the Corrective Action program for failures not screened out. If failures are screened out, no further action is required other than documentation of the analysis.

If potential failures are clearly inside the licensing basis, as agreed to by both NRC and the licensee, screening out the potential failures using NEI 00-01 would demonstrate low safety significance and would support an exemption or deviation request for NRC acceptance of the plant configuration. If the potential failures do not screen out the plant would be expected to take appropriate action within the Corrective Action Program to address the potential failures.

Note that if the potential failure/combination is determined to be risk significant, the licensee is expected to address the issue within the Corrective Action Program with appropriate priority, whether or not the potential failure, or combination of failures, is within or outside the plant licensing basis.

Attachment F
Defense-In-Depth (DID) Considerations

F.1 Issue

Potential failures will not screen out unless defense-in-depth (DID) elements are met. Therefore, efforts to clearly define the meaning of DID should be made in NEI 00-01.

F.2 Industry Position Statement

NEI 00-01 takes the Reg. Guide 1.174 guidance on balancing DID and risk, and interprets this for circuit analysis issues. Some additional guidance on balancing DID and risk for multiple spurious operations will be provided in the DID discussion in Chapter 4 based on the discussion below and feedback from the pilot applications.

F.3 Discussion

Balance among DID elements is a cornerstone of risk-informed applications, and is described in Reg. Guide 1.174, Section 2.2.1.1. Reg. Guide 1.174 provides the following guidance:

- If a comprehensive risk analysis is done, it can be used to help determine the appropriate extent of defense in depth (e.g., balance among core damage prevention, containment failure, and consequence mitigation) to ensure protection of public health and safety.
- Further, the evaluation should consider the impact of the proposed LB change on barriers (both preventive and mitigative) to core damage, containment failure or bypass, and balance among defense in depth attributes.

For fire protection and fire PRA, both traditional fire protection DID and traditional reactor protection DID are represented. Clearly, fire protection DID has been treated in the past as a balance, with some fire areas having automatic suppression, some not, some areas allowing transient combustible storage, and some not, etc. NEI-00-01 attempts to balance is the level of tradition fire protection DID and the DID for protection of public health and safety.

One of the arguments against the "balance" of DID elements is the possibility of having a scenario where one of the traditional fire protection DID elements fails. For example, a scenario that results in a failure of all safe shutdown equipment, and a resulting core damage probability (CDP) of 1.0, is unacceptable. In achieving a balance, any time a beyond design basis accident has a DID barrier failed, the risk should be shown to be low, with certainty and the DID attributes should be evaluated. A scenario with all elements of DID, and a CDF of 9E-08/year would be treated differently than a scenario with a CDP of 1.0, and a CDF of 9E-08/year. In the end, the balance results in consideration of all aspects of the component combination, including the Risk, DID, Safety Margins, uncertainty, and other relevant issues.

Defense-in-Depth review for multiple spurious operations should consider whether the scenario affects more than one element of DID. The example above with a CDP at or near 1.0 may be considered unacceptable if detection/suppression is ineffective. For example, if we found a scenario from a fire inside a cabinet, where suppression prior to damage to all target cables was

Attachment F
Defense-In-Depth (DID) Considerations

unlikely, and the CDP was near 1, then DID would be inadequate. In most cases, this lack of DID would correspond to a high calculated risk, since the DID elements for fire protection are integrated into the risk calculation. However, if the risk calculation relies heavily on a low fire frequency to screen the scenario, the risk calculation could screen such a scenario. The DID review would however not show a balance between DID and risk, and the scenario would not screen.

Applying a DID review to a screening process needs to account for conservatism in the screening. It is common to use a screening assignment of 1.0 for CDP or manual suppression during screening in order to perform the analysis with minimal resources. The DID review needs to qualitatively assess these factors to assure DID is maintained if a quantitative assessment is not available. Additional analysis may be required to complete the DID assessment in this case, since the information available may not have been sufficient to perform a quantitative assessment.

NEI-00-01 takes the Reg. Guide 1.174 guidance on balancing DID and risk, and interprets this for circuit analysis issues. Some additional guidance on balancing DID and risk for multiple spurious operations will be provided in the DID discussion in Chapter 4 based on the discussion above and feedback from the pilot applications.

Attachment G
Preliminary Screening Criteria

G.1 Issue

NEI 00-01 Appendix G provides a basis for Table 4-1, "Preliminary Screening." In this table, sequences with core damage frequency of less than 1E-6/yr are screened from consideration. However, because a spurious actuation could impact multiple areas, many of these sequences may apply for a single spurious actuation. As a result, NRC recommends a smaller cutoff for each sequence in Appendix G for screening potentially insignificant sequences.

G.2 Industry Position Statement

A 1E-06/year pre-screening criteria is appropriate for this application. Performance of a DID/SM review along with conservatism in all factors in the screening provides assurance that scenarios that screen out using Table 4-1 would also screen out using the detailed quantitative screening analysis method.

G.3 Discussion

The screening value (1E-06/year) used for the preliminary screening is higher than the individual area screening (1E-07/year) in the detailed screening due to the conservatism in the factors applied in the preliminary screening. For example, the whole room fire frequency is applied, without consideration of either the percentage of fire events that can cause the scenario, or the application of severity factors. Severity factors are typically on the order of 0.1 for most components. Additional conservatism is applied for all factors in the table. For example, a spurious operation probability of 0.3 is applied as a high (1.0). Additionally, probability of cable damage (P_{CD}), as shown in Figure 1 of the Expert Elicitation Report, is assumed to be 1.0 for the screening. The McGuire pilot application showed examples of the conservatism of the preliminary screening. For example, two areas that were screened out at a 1E-06/year estimate in the preliminary screening would result in a 1E-12 and 1E-11/year core damage frequency using the detailed calculation methods.

The detailed screening criteria of 1E-07/year (per scenario per fire area) is actually conservative and could be raised to 1E-06/year CDF (similar to the preliminary screening) if the circuit combination was limited to a single fire area, and the scenario did not represent a high-to-low pressure interface or other LERF event. Scenarios from the pilot applications showed a scenario was typically limited to 3 to 4 fire areas, with 1 area providing a majority of the risk. Thus, application of the 1E-07/year detailed screening criteria is a conservative approach, and could be raised to 1E-06/year with some additional considerations based on Reg. Guide 1.174 guidance.

Scenarios screened in the preliminary screening are required to have a DID and Safety Margins review (see Attachment F). This review, along with conservatism in all factors in the screening, provides assurance that scenarios that screen in the pre-screen would not result in a high calculated risk using the detailed screening analysis.

Attachment H
PWR Issues

H.1 Issues

H.1.1 Feed and Bleed

The NRC has stated that the use of 'Feed and Bleed' has not been accepted by the staff as the sole post-fire safe shutdown method.

H.1.2 Utilization of High Pressure Safety Injection (HPSI) Pumps

The staff has stated that the use of safety injection pumps as redundant to charging pumps is inconsistent with the staff position and cites an October 2, 1997 memorandum related to this subject. The memorandum indicates the use of the safety injection pumps would be considered an "Alternate Shutdown' method.

H.1.3 Pressurizer Level

According to Appendix R, Section III.L.2.b, the reactor coolant makeup function shall be within the level indication in the pressurizer for PWRs. NRC indicates that the statement "Temporary fluctuations outside this range are permissible…" should be deleted or justified by an analysis acceptable to the staff.

H.2 Industry Position Statements

H.2.1 Feed and Bleed

There is no restriction in 10CFR50.48 nor 10CFR50 Appendix R to preclude the use of once-through cooling (OTC), also known as "feed and bleed." Conversely, utilization of OTC is routinely credited in PWR accident analyses. Technical Specifications typically define the operability requirements of the components necessary to accomplish OTC. Therefore, the use of OTC has been accepted by the staff.

H.2.2 Utilization of High Pressure Safety Injection (HPSI) Pumps

The utilization of the HPSI pumps to provide RCS inventory control and perform Decay Heat Removal, is within the design basis of the HPSI system. Since the components associated with HPSI are being utilized to perform their design function, crediting use of the HPSI pumps should not be considered an Alternate Shutdown method.

H.2.3 Pressurizer Level

If plant design indicates that certain fire related plant transients could lead to a pressurizer level that fluctuates outside the range of associated indicating instruments, then the licensee should generate an analysis to ensure that level can be restored prior

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PWR Issues

to the occurrence of unrecoverable conditions. With the restoration of level, safe shutdown conditions would occur. Fuel damage would not occur and the process variables would be restored once positive control of the equipment is restored.

H.3 Discussion

H.3.1 Feed and Bleed

<u>Once-through-cooling (feed and bleed)</u>

By plant design (PWRs), even with a loss of forced reactor coolant system (RCS) flow, hot shutdown conditions can be achieved by establishing natural circulation conditions within the RCS. One method for accomplishing natural circulation is to establish feedwater (emergency or auxiliary) injection into the steam generators and control steam release on the secondary side of the plant. To facilitate natural circulation, it is important to prevent voids from forming in the RCS (i.e. in the reactor vessel head). Thus, maintaining adequate RCS inventory is an integral part of ensuring safe shutdown conditions can be achieved.

As a measure of defense in depth, PWRs were designed with another method for accomplishing decay heat removal. For cases where the capability to establish primary to secondary decay heat removal cannot be maintained, PWRs are designed to utilize OTC. OTC entails the injection of borated water directly into the RCS and opening a vent path (typically, a relief valve on the pressurizer) to promote circulation through the core. The 'turnover' of RCS inventory adequately removes decay heat from the RCS and is an equivalent method for accomplishing hot shutdown conditions. When utilizing OTC, three critical functions are provided; 1) Reactor Coolant Makeup, 2) Reactor Coolant System Pressure Control and 3) Decay Heat Removal.

Due to the potential for spreading contamination within the Reactor Building and the resultant expensive decontamination efforts, licensees typically did not choose to rely upon OTC as method for achieving safe shutdown conditions. Nevertheless, there is no restriction in 10CFR50.48 nor 10CFR50 Appendix R to preclude the use of OTC. Conversely, utilization of OTC is routinely credited in PWR accident analyses. Technical Specifications typically define the operability requirements of the components necessary to accomplish OTC.

H.3.2 Utilization of High Pressure Safety Injection (HPSI) Pumps

Generic Letter 86-10, Enclosure 2, Section 3.8.3 (Redundant Trains/Alternate Shutdown) states :

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"QUESTION

Confusion exists as to what will be reclassified as an alternate shutdown system and thus what systems might be required to be protected by suppression and detection under Section III.G.3.b. For example, while we are relying upon the turbine-building condensate system for a reactor building fire and the RHR system for a turbine building fire, would one system be considered the alternate to the other. If so, would suppression and detection be required for either or both systems under III.G.3.b? An explanation of alternate shutdown needs to be advanced for all licensees.

RESPONSE

If the system is being used to provide its design function, it generally is considered redundant. If the system is being used in lieu of the preferred system because the redundant components of the preferred system do not meet the criteria of Section III.G.2, the system is considered an alternative shutdown capability…."

Generic Letter 81-12, Enclosure 1, Section 4, lists the equipment the staff considered necessary for "Hot Standby." Item 2 states:

"Reactor Coolant Makeup

Reactor coolant makeup capability, e.g., charging pumps or the high pressure injection pumps. Power operated relief valves may be required to allow use of the high pressure injection pumps."

For certain PWRs, the HPSI pumps are not designed to provide flow during normal operating pressure scenarios. Instead, in order to overcome the shutoff head of the HPSI pumps, the relief valve is opened to reduce pressure. The scenario is similar to the utilization of ADS in a BWR.

As noted above, PWRs are designed to utilize an electrically controlled relief valve (e.g. PORV) in conjunction with the HPSI pumps to provide OTC (i.e. perform decay heat removal) and maintain adequate RCS inventory control. The thought process for designing the OTC capability was to serve as a redundant system in the event the primary to secondary decay heat removal systems (i.e. auxiliary or emergency feedwater) were inoperable. In the same way, RCS inventory is maintained via the design function of the HPSI system (i.e. depressurize RCS to allow injection via the HPSI pumps).

From the above, it is clear that the utilization of the HPSI pumps to provide RCS inventory control and perform Decay Heat removal, is within the design basis of the HPSI system. Since the components associated with HPSI are being utilized to perform

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their design function, crediting use of the HPSI pumps should not be considered an alternate shutdown method.

H.3.3 Pressurizer Level

Comment 3.20 Section 3.1.2.3 allows level to fluctuate beyond the pressurizer level indication range. According to Appendix R, Section III.L.2.b, the reactor coolant makeup function shall be within the level indication in the pressurizer for PWRs. The statement "Temporary fluctuations outside this range are permissible…" should be deleted or justified by an analysis acceptable to the staff.

Response: For background, consider the statements provided in Section III.L.1 which include :

"During the postfire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal a.c. power, and the fission product boundary integrity shall not be affected; i.e., there shall be no fuel clad damage, rupture of any primary coolant boundary, of [sic] rupture of the containment boundary."

The performance goals listed in Section III.L.2 will ensure that the fission product boundary integrity will not be jeopardized. The intent of the regulation is to ensure that unrecoverable conditions do not occur that will lead to the failure of one or more of the above listed boundaries. Thus subcooling is maintained.

Due to the specifics of some PWR designs, a loss of normal a.c. power can result in a transient condition in which the pressurizer level fluctuates. However, the restoration of level (and the resultant protection of the fission product boundary) is readily accomplished when mitigating actions are performed. The pressurizer response to a transient is a function of the NSSS design, and not a function of the equipment protected for safe shutdown. True, the pressurizer is designed to respond to a transient, with level fluctuating accordingly. However, a fire could affect the operation of the makeup/charging pumps and/or the ability to isolate Letdown. The NSSS design assumes these components function as designed. For areas in which these components are impacted by a fire, certain mitigating actions will need to be performed (e.g. manually closing the Letdown isolation valve, manually starting a charging pump). These actions are required to ensure that pressurizer level is restored. Acceptance of temporary fluctuations is evident from the following documents :

- IE bulletin 79-05 discusses a feedwater transient that occurred as a result of a loss of off-site power. The resultant shrinkage of the primary coolant volume resulted in a loss of pressurizer level indication. Enclosure 2 to the bulletin contains the following:

  "The pressurizer, together with the reactor coolant makeup system, is designed to maintain the primary system pressure and water level within their operational limits only during normal operating conditions. Cooldown transients, such as loss of offsite

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power and loss of feedwater, sometimes results in primary pressure and volume changes that are beyond the ability of this system to control. The analyses of and experience with such transients show, however, that they can be sustained without compromising the safety of the reactor."

"… The loss of pressurizer water level indication could be considered to deviate from GDC 13, because this level indication provides the principal means of determining the primary coolant inventory. However, provision of a level indication that would cover all anticipated occurrences may not be practical. As discussed above, the loss of feedwater event can lead to a momentary condition wherein no meaningful level exists, because the entire primary system contains a steam water mixture."

- Generic Letter 81-12, Enclosure 1, provides the staff position on safe shutdown capability and provides guidelines toward ensuring that safe shutdown can be achieved. Section 3 lists the various performance goals. The intent of the requirements in Appendix R, Section III.L is amplified by these guidelines as indicated by the following :

  "The reactor coolant makeup function shall be capable of maintaining the reactor coolant level above the top of the core for BWR's and <u>in</u> [emphasis added] the pressurizer for PWR's."

- Generic Letter 86-10, Enclosure 2 provides guidance (in the form of industry questions and NRC answers) on a variety of issues. Section 5.3.5 addresses the affects of the loss of pressurizer heaters. The NRC response states that maintaining pressurizer level outside the indicated range (i.e. is an acceptable practice as indicated by :

  "PWR licensees have demonstrated the capability to achieve and maintain stable hot shutdown conditions without the use of pressurizer heaters by utilizing the charging pump and a water solid pressurizer for reactor coolant pressure control."

- On May 30, 1991, Davis-Besse was issued an SER pertaining to the Fire Protection Program. While the document was plant specific, the evaluation of the performance goals of Section III.L were of a generic nature as indicated by the following :

  "The staff initially had several concerns with the licensee's alternate shutdown approach. The first was the performance goals for the alternate shutdown function, as required by Section III.L of Appendix R, may not have been met. At Davis-Besse as with other pressurized water reactors, some plant transients of short duration may cause certain reactor coolant process variables and their indications, such as pressurizer level, to exceed those predicted for a loss of offsite power. These transients would occur for a short period and could result from a delay in reactor trip or from a delay in equipment manipulations such as the time to properly realign auxiliary feedwater valves following fire induced spurious signals. The staff has

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evaluated the consequences of these transients and concludes that they are not safety significant as long as no unrecoverable condition will occur. **An unrecoverable plant condition is defined as the loss of any shutdown function(s) for such a duration as to ultimately cause the reactor coolant level to fall below the top of the reactor core and lead to a subsequent breach of the fuel cladding.** This was a quote from the staff. The statement includes "… and lead to a subsequent breach of fuel cladding", which implies that short duration events are recoverable."

From these NRC documents, it is clear that the intent of the regulation is to ensure that the reactor coolant makeup function is capable of restoring/maintaining sufficient volume in the pressurizer such that unrecoverable conditions do not occur. Plant transients may result in a temporary fluctuation of pressurizer level that is beyond the range (either low or high) of the indicating instruments. However, if plant-specific analyses indicate that level can be restored and that safe shutdown conditions can be achieved, then the intent of the rule is met.

It should be noted that for BWRs, the same performance goal specifies maintaining level above the top of the core. However, the NRC has previously determined that the intent of the goal can be met even though a plant transient can temporarily cause the level to drop below that of the top of the core. This is evident by the SER issued on 12/12/2000 to the BWROG (Accession # ML0037768280) concerning the utilization of the ADS system to achieve safe shutdown conditions. This SER determined that the intent of the performance goal is met, even though utilization of the ADS will result in a momentary uncovering of the top of the core. Analysis has determined that the fuel cladding would not be damaged during the transient and that level can be promptly restored. Consequently, an unrecoverable condition does not occur.

If plant design indicates that certain fire related plant transients could lead to a pressurizer level that fluctuates outside the range of associated indicating instruments, then the licensee should generate an analysis to ensure that level can be restored prior to the occurrence of unrecoverable conditions. With the restoration of level, safe shutdown conditions would occur. Fuel damage would not occur and the process variables would be restored once positive control of the equipment is restored.