

May 25, 2000

MEMORANDUM TO: Steven K. West, Chief
Generic Issues and Regulatory Improvements Section
Generic Issues, Environmental, Financial &
Rulemaking Branch
Division of Reactor Program Management, NRR

FROM: Joseph L. Birmingham, Project Manager
Generic Issues, Environmental, Financial &
Rulemaking Branch
Division of Reactor Program Management, NRR

SUBJECT: TELECONFERENCE WITH A REPRESENTATIVE OF THE NUCLEAR
ENERGY INSTITUTE (NEI) TO DISCUSS PRELIMINARY STAFF
COMMENTS ON NEI 00-01, REV. A, (DRAFT) APRIL 2000

On May 25, 2000, Leon Whitney (SPLB) and Joseph Birmingham (RGEB) held a teleconference with Fred Emerson of NEI on preliminary staff comments for NEI 00-01, Rev. A, (draft) April 2000, "Guidance for Post-Fire Safe Shutdown Analysis." The purpose of the teleconference was to allow the staff to clarify its comments on NEI 00-01 and no response to the comments was expected from NEI. NEI indicated that they understood the comments and agreed to consider them during subsequent reviews of NEI 00-01. The staff expects to have formal comments for the document after it has been developed further. A copy of the comments is attached.

Project No. 689
Attachment: As stated

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OFFICE	RGEB	RGEB
NAME	JBirmingham	SWest
DATE	05/25/00	05/25/00

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SPLB Staff Comments on NEI 00-01 Rev A (Draft), April 2000

Prepared by: Leon Whitney, SPLB/DSSA/NRR

- **Page 1, bullet “Appendix G ...”:** Multiple spurious “signals” and “operations” are addressed in this paragraph. The term “signal” requires definition to distinguish it from the terms “circuit fault” and “circuit failure mode.” It is important that the term “signal” be reserved for plant state/system control (parameter indication, logic circuit, and automatic function initiation) signals, and that the terms “fault” and “failure mode” be used to indicate the electrical effects of hot shorts, open circuits and shorts to ground. Through such definition discipline, the concept of single or multiple sets of circuit faults, which may cause one or more spurious signals and/or spurious operations or actuations, may be discussed without confusion. With respect to NEI 00-01, this would require a detailed re-consideration and rewrite of the document. [See the staff Response to Question 5.3.1 of GL 86-10.]
- **Page 1, bullet “Appendix G ...”:** The issue addressed in Appendix G, “Combined Equipment Impacts,” is not a matter of current contention between the staff and industry, and did not precipitate the staff’s Circuit Analysis Resolution Plan (CARP). Since the early 1980s the staff has limited its inspection reviews to “**any (spurious operations or signals) at all, one at a time**” with certain exceptions (such as for high/low pressure interface series valves). [A logical exception is when a single (or a set of) circuit faults causes more than one spurious signal, actuation or operation, as was the case with the River Bend SRV Trip Units. In such a case all resultant signals, actuations or operations should be addressed and mitigated.] What is a matter of current contention is whether, for a single fire, licensees must address the possibility of **multiple circuit faults** which, taken together, can cause spurious signals or spurious operations/actuations. Such sets of circuit faults may arise from within a single multi-conductor cable, or from conductors within separate cables in the fire area.
- **Page 3, second paragraph “Using this guidance document and the methodology contained within it to perform post-fire safe shutdown analysis will result in an analysis that meets the regulatory requirements, provides an acceptable level of fire risk and results in safe plant design.”:** This sweeping generality reduces the endorsability of NEI 00-01. Taken in the extreme, it argues that NRC inspection activity is not necessary if the NEI methodology is used by licensees.
- **Page 3, third paragraph “This document integrates the requirements and interpretations related to post-fire safe shutdown into a single location.”:** Such sweeping overselling of the document is unnecessary. The NRC staff’s (soon to be issued) Comprehensive Regulatory Guide specifically attempts to do this function. NEI 00-01 is not meant to, nor does it perform this function. All such examples of oversell in the text should be stricken.
- **Page 7, first paragraph “The spurious operations that present a potential concern ... accomplish the decay heat removal function.”:** Spurious operations, actuations and signals may, for example, affect plant parameter/process monitoring indications (and thereby confuse plant operators who are attempting to achieve safe shutdown), and may disable electrical or cooling support systems. None of these examples (taken from the list provided by NEI at the bottom of Page 16) are captured by the language in the cited sentence. It is not clear why NEI 00-01 Rev A at this point in the document bounds the consideration of spurious operations, actuations and signals.

- **Page 10, second paragraph from the bottom beginning “Section 4.0 ...”:** Allusion is made to figures, but the figures and their locations are not specified.
- **Page 12, first complete paragraph “The term free of fire damage allows the operator to perform a manual action on safe shutdown equipment to accomplish its required safe shutdown function.”:** While the staff does not necessarily disagree with this statement, a discussion is needed on the logical argument to get here from the free of fire damage definition (“able to perform its intended function”) to the manual action conclusion on Page 12. (This statement is made in the first paragraph of Section 3.1, and in Section F.2.0 of Appendix F, without logical basis or derivation.)
- **Page 13, first paragraph “Therefore ... and maintain post-fire safe shutdown”:** Item (1) is not necessarily true. Item (2) as stated, would not allow circuit analysis to be conducted in lieu of deterministic barriers. The meaning of the last sentence of this paragraph is not clear.
- **Page 13, third paragraph “Depending on ... while not meeting certain specific requirements”:** This is a misinterpretation of Generic Letter 86-10 Section C on documentation requirements. GL 86-10 Section C on documentation required to demonstrate compliance addresses static structures such as fire area boundaries. It does not allow licensees to grant themselves de facto exemptions from the requirements of Appendix R. [Note: correction of this misinterpretation should lead to revision or clarification of Section 3.1.1.4, and Section 3.1.5 of Appendix D (top paragraph of page D-7) of the NEI text.]
- **Page 13, fourth paragraph “In addition capabilities, etc.):”:** The conduct of a probabilistic risk assessment does not substitute for compliance with the “prescriptive” separation requirements of Section III.G.2 of 10 CFR 50, Appendix R. Hypothetically, if such a principle were to be approved by the staff, what limits or thresholds should be met for a licensee to disregard Section III.G.2 of 10 CFR 50, Appendix R?
- **Page 14, Section 2.2.2:** The last paragraph of this section states that associated circuits need to be evaluated, but does not address the actions to be taken based on the results of the analysis.
- **Page 15, Section 2.3.2:** Recommend removing the word “both” and inserting the word “either.”
- **Page 16, Section 3.1, second paragraph “The goal of post-fire safe shutdown is to assure that a single fire in a single plant fire area will not result in any fuel cladding damage, rupture of the primary coolant boundary or the rupture of primary containment.”:** 10 CFR 50.48 (a) discusses assuring the “means to limit fire damage to structures, systems and components important to safety so that the capability to safely shut down the plant is ensured.” Sections III.G.1 and III.G.2 of Appendix R require the achievement of a hot shutdown condition, a concept which is not captured by the above quoted passage in NEI 00-01, Rev. A. The staff has long stated that the safe shutdown goal is to provide reasonable assurance that at least one means of achieving and maintaining safe shutdown conditions will remain available during and after any postulated fire in the plant. Given these requirements and policy statements, NEI should provide the logical arguments which lead from 50.48 and 10 CFR 50, Appendix R to NEI’s above goal statement.

- **Page 17, Section 3.1, “The effects of spurious operations of concern are the following: ... post-fire safe shutdown goal.”:** No basis is provided for excluding all but two possible examples of spurious actuations. No justification is provided for stating that only direct effects on post-fire safe shutdown need be considered.
- **Page 18, Section 3.1.1.4:** Appendix R states that alternative shutdown capability is provided when protection “does not satisfy” the requirements of Section III.G.2, not necessarily only when there is an inability to satisfy the requirements. The “inability” wording is unnecessarily restrictive.
- **Page 18, Section 3.1.1.5:** Is there any limit to the operability assumptions of this section? Why, for example, should a unit which provides shared safe shutdown equipment be assumed to be operating at all times and have its shared equipment on line and ready for use by the other unit? Are these assumptions risk-informed?
- **Page 18, Section 3.1.1.9:** Are the “fire-induced impacts” alluded to in this section impacts to hot shutdown equipment only? Cold shutdown fire-induced impacts may prevent the cold shutdown process to be commenced upon completion of repairs at the 72 hour point (III.G.1.b).
- **Page 19, Section 3.1.2.2 [PWR]:** What analysis excludes the possibility of cooling transients which could empty the pressurizer, and, through the loss of high temperature water in the pressurizer volume, cause a depressurization event? Section 3.1.2.3 says that non-heater pressure control capability is only “typical,” not assured.
- **Page 20, Section 3.1.2.3 [PWR]:** Use of the word “typically” reduces the endorsability of NEI 00-01. All design variation groups should individually be addressed and determined to be adequate.
- **Page 20, Section 3.1.2.4 [PWR]:** Use of the word “typically” reduces the endorsability of NEI 00-01. All design variation groups should individually be addressed and determined to be adequate.
- **Page 20, Section 3.1.2.5:** Use of the words “in general” reduces the endorsability of NEI 00-01. The verb “navigate” seems unnecessarily stylistic. We recommend the word “use.”
- **Page 21, Section 3.1.2.6.1 [DC] last paragraph of the page:** Recommend that the phrase “at all times during power operation” be added after the phrase “sufficient battery power exists.”
- **Page 24, Section 3.2.1.5:** Is the “instruments fail up-scale/down-scale” assumption true for all reactor vendor equipment? For example, don’t B&W designed reactors have instruments and controllers which fail to their mid-positions? The staff has experience to indicate that mid-range indication failures occur to some degree at all licensed reactor plants.
- **Page 28, Section 3.3.2 Cables Whose Failure May Cause Spurious Actuations:** Why is the potential cause of spurious actuations limited to damage to one cable. Why not the combined effects of damage to two or more cables?

- **Page 29, Section 3.3.2 Common Enclosure Cables:** Why is it assumed that the fire propagates into another fire area? Why not just to another cable tray with cables for redundant equipment?
- **Page 30, Section 3.3.3.3. second paragraph:** Recommend replacing “The list of cables” with the phrase “Sets of cables affected by multiple electrical faults” unless an adequate justification is provided for not doing so.
- **Page 32, Section 3.4.1.4:** In the 20 foot separation case it is stated that fire detectors and an automatic fire suppression systems must provide “full area coverage,” which goes beyond the explicit requirements of Appendix R.
- **Page 32, Section 3.4.1.4:** In the last paragraph of the section the phrase “to achieve the following mentioned above” is not understood.
- **Page 33, Section 3.4.2.2, second paragraph:** The phrase “realizing that a subset of a safe shutdown path can accomplish a specific goal that is not achievable by utilizing a single shutdown path” is not understood.
- **Page 33, Section 3.4.2.2, second paragraph:** Recommend replacing “a fire-induced cable failure” with the phrase “fire-induced cable failures” unless an adequate justification is provided for not doing so.
- **Page 34, Section 3.4.2.4:** Replace “Perform a repair” with “Perform a cold shutdown repair.”
- **Page 36, Section 3.5.1.1:** Why is the effect of each type of circuit failure evaluated one at a time? What is the engineering basis for this limit?
- **Page 36, Section 3.5.1.3:** Is there no malfunctioning indication circuit which can negatively affect post-fire safe shutdown? This is what the text says in this section.
- **Page 36, Section 3.5.1.3:** What is an isolated auxiliary circuit, and what is the import of considering only “isolated” circuits?
- **Pages 36 and 37, Section 3.5.2:** Appendix R does not provide circuit design requirements. It is hard to imagine how circuits could be designed “for the fire-induced effects of a hot short, short-to-ground, and open circuit.” Whatever the point is in this section, it needs to be more clearly stated.
- **Page B-2, Section B.4.0, third paragraph:** The assertion that control room cables and components are separated from their redundant counterparts is incorrect. For example, at some reactor plants, under cabinet cable chases exist which provide a propagation path for flames and hot gases. Cabinet walls themselves are not fire rated barriers.
- **Page B-3, a):** It is not clear why it is necessary to assert that mechanistic damage need not be postulated when the probabilistic analysis of Section B.4.0 assumes that it does occur.
- **Page B-3/B-4, Sections B.4.0.a.1 through B.4.0.a.4:** No probabilities or risk values are ascribed to the technical arguments, making the exercise a plausibility argument, not an analysis. Therefore, the “highly improbable” and “low credibility” conclusions at the end of Section B.4.0 are reduced to mere assertions.

- **Page B-4, Section B.4.0.c.1:** Focusing on the probable survival of a redundant train capability during and after a control room fire ignores the potential existence of fire-induced effect scenarios, such as flow diversions, which can exist even though redundant train capability may exist. Also, general divisional separation of control room cabinets does not represent fire separation. The cabinets are not fire rated, and there can exist under-cabinet cable chases through which flames and hot gases may propagate.
- **Page C-4, third paragraph of the response:** Recommend replacing “the” with “other” as the first word of the fourth line (“other safe shutdown components.”). [High/low pressure interface valves should be considered to be safe shutdown components.]
- **Page C-7, Case (b):** Putting forth a position that, for high/low pressure interface valves, “a post-fire action may be taken that mitigates the effects of the condition prior to reaching an unrecoverable condition relative to safe shutdown, if this can be shown to be feasible” does not appear to be a conservative approach. It implies lack of concern for preservation of reactor coolant inventory. Please provide any conditions, limitations or restrictions on application of this approach.
- **Page D-9, top of page “The requirement for addressing a worst-case spurious signal is met by identifying any spurious actuation that has the potential to adversely affect the safe shutdown capability and to evaluate the effects on the safe shutdown capability on a one-at-a-time basis”:** This would eliminate any consideration of spurious signals which may cause multiple actuations (e.g. River Bend FPF1 finding that a single multi-conductor cable could cause a signal which opened multiple safety valves).
- **Page D-9, bullet at the bottom of the page:** Alternative/dedicated shutdowns must be shown to be achievable with and without offsite power, not just without.
- **Page F-2, Section F.4.0:** The staff does not agree that “the fundamental difference between manual actions and repairs is definitional. While there are some similar characteristics, the two terms represent distinct concepts.
- **Page F-2, Section F.4.0:** In the fourth sentence of the first paragraph, recommend replacing the words “provides the opportunity” with “indicates the requirement for the capability.”
- **Page F-3, Section F.4.0:** The last sentence of the fourth bullet is incorrect. It is required to have “outdoor battery backed (emergency) lighting” for paths to and from remote buildings. However, the NRC staff has granted exemptions based on other available and reliable lighting (such as security lighting).
- **Page G-2, Section G.3.0:** The fourth sentence of the first paragraph is correct, as far as it goes. It leaves open the question of potential multiple faults which may cause spurious actuations, operations and/or signals (see first comment above).
- **Page G-2, Section G.3.0:** The arguments put forward in the first three paragraphs of the section are over generalizations (e.g., not all locations in all reactor plants containing post-fire safe shutdown equipment are as robust against a fire event as is described).

- **Page G-2, Section G.3.0:** Item (3) of the fourth paragraph is true, but the underlying issue is that all fire-induced effects need to be identified, including those from multiple faults (see first comment above for a more detailed discussion of this issue).
- **Pages G-3 to G-6, Section G.4.0:** This sections topic of “combined equipment impacts” seems to support the staff’s longstanding inspection position that “any (spurious operations, actuations or signals) at all, will be considered one at a time.” This is not under contention today. What is under contention is **whether multiple faults, internal to a single multi-conductor cable, or contained within separate cables, need to be considered as having the potential to cause spurious operations, actuations or signals** (see second comment above for a more detailed discussion of this issue).
- **Page G-3, Section G.4.0:** The correlation between the terms “relative safety significance” and “probability” is not clear, if safety significance is in any way a measure of consequence. A definition is needed of the term “safety significance” as it is used in the NEI text in connection with the term “probability.” The term “safety significance” is used again in the second paragraph of Page G-5, seeming to indicate that safety significance is not related to consequence. Is this the intent of the text?
- **Page G-5, Section G.4.0:** The conclusion regarding “combined equipment impacts,” that only a certain subset of conceivable combinations of effects from multiple faults (three bullets, middle of the page) need be considered, appears arbitrary and has no apparent logical basis. The conclusion appears to solely be based on an NEI perception that these three combinations have the “greatest potential” to impact post-fire safe shutdown. For the same reasons that a small break LOCA can not be ignored or “bounded” out of reactor safety consideration, NEI needs to show that all events excluded from the three item subset are of negligible consequence or safety significance.
- **Page G-5, Section G.4.0:** Regarding the third bullet on the page, it is not clear why a threshold of “more severe consequences” that the fire-induced spurious signals identified for the SRV Trip Units at River Bend was chosen. What event could be worse than a large number of SRVs opening and remaining open for up to 10 minutes?