UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAR 22 1982

MEMORANDUM FOR: Darrell G. Eisenhut, Director, Division of Licensing, NRR

FROM: Roger J. Mattson, Director, Division of Systems Integration, NRR

SUBJECT: FIRE PROTECTION RULE - APPENDIX R Clarification of

On February 20, 1981 generic letter 81-12 was forwarded to all reactor licensees with plants licensed prior to January 1, 1979. Additional information was requested concerning plant design modifications needed in order to comply with Section III.G.3 of Appendix R. Approximately half of the licensees have not submitted responses to this letter. Additionally, some of the responses received have been inadequate. It is our understanding that T. Wambach is preparing letters to these licensees requesting complete submittals. We request that the Enclosure to this memorandum be included in the letters being sent to the licensees. The Enclosure provides (1) clarifications of our request for information concerning the alternative or dedicated shutdown system, (2) clarification of the definition of associated circuits, and (3) clarification of our request for information concerning associated circuits. While the requests for information in the Enclosure differs somewhat from the February 20, 1981 letter, responding to the clarified questions should ease the utilities workload and provide more acceptable responses. Thus, we recommend that the licensee be given the opportunity to respond to the enclosed request for information rather than the request contained in the February 20, 1981 letter.

If we can be of any further assistance on this matter, please contact me.

Roger J. Mattson

Roger J. Mattson, Director
Division of Systems Integration
Office of Nuclear Reactor Regulation

Enclosure:
As Stated

cc w/enclosure:

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P. S.
Darrell, Dick
Vollmer has agreed to this approach.
Roger.

ATTACHMENT 1
CLARIFICATION OF GENERIC LETTER

On February 20, 1981, generic letter 81-12 was forwarded to all reactor licensees with plants licensed prior to January 1, 1979. The letter restated the requirement of Section 50.48 to 10 CFR Part 50 that each licensee would be required to reassess areas of the plant where cables or equipment including associated non-safety circuits of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located to determine whether the requirements of Section III.G.2 of Appendix R to 10 CFR 50 were satisfied. Additionally, Enclosure 1 and Enclosure 2 of the generic letter requested additional information concerning those areas of the plant requiring alternative shutdown capability. Section 8 of Enclosure 1 requested information for the systems, equipment and procedures of alternative shutdown capability and Enclosure 2 defined associated circuits and requested information concerning associated circuits for those areas requiring alternative shutdown.

In our review of licensee submittals and meetings with licensees, it has become apparent that the request for information should be clarified since a lack of clarity could result in the submission of either insufficient or excessive information. Thus, the staff has rewritten Section 8 of Enclosure 1 and Enclosure 2 of the February 20, 1981 generic letter. Additionally, further clarification of the definition of associated circuits has been provided to aid in the reassessments to determine compliance with the requirements of Sections III.G.2 and III.G.3 of Appendix R. In developing this rewrite we have considered the comment of the Nuclear Utility Fire Protection Group. The enclosed rewrite of the Enclosures contains no new requirements but merely attempts to clarify the request for additional information.

Licensees who have not responded to the February 20, 1981 generic letter, may choose to respond to the enclosed request for information. Since the enclosed request for information is not new, but merely clarification of our previous letter, responding to it should not delay any submittals in progress that are based upon February 20, 1981 letter. Licensees whose response to the February 20, 1981 letter, has been found incomplete resulting in staff identifications of a major unresolved item (i.e., associated circuits), may choose to respond to pertinent sections of the enclosed request for information in order to close open items (i.e., open item for associated circuits, use rewrite of Enclosure 2).

If additional clarification is needed, please contact the staff Project Manager for your plant.

ENCLOSURE 1

REWRITE OF SECTION 8 REQUEST FOR ADDITIONAL INFORMATION

The following is a rewrite of the staff's request for additional information concerning design modification to meet the requirements of Section III.G.3 of Appendix R. The following contains no new requests but is merely a rewording of Section 8 of Enclosure 1 of the February 20, 1981 generic letter.

1. Identify those areas of the plant that will not meet the requirements of Section III.G.2 of Appendix R and, thus alternative shutdown will be provided or an exemption from the requirements of Section III.G.2 of Appendix R will be provided. Additionally provide a statement that all other areas of the plant are or will be in compliance with Section III.G.2 of Appendix R.

   For each of those fire areas of the plant requiring an alternative shutdown system(s) provide a complete set of responses to the following requests for each fire area:

   a. List the system(s) or portions thereof used to provide the shutdown capability with the loss of offsite power.

   b. For those systems identified in "1a" for which alternative or dedicated shutdown capability must be provided, list the equipment and components of the normal shutdown system in the fire area and identify the functions of the circuits of the normal shutdown system in the fire area (power to what equipment, control of what components and instrumentation). Describe the system(s) or portions thereof used to provide the alternative shutdown capability for the fire area and provide a table that lists the equipment and components of the alternative shutdown system for the fire area.

For each alternative system identify the function of the new circuits being provided. Identify the location (fire zone) of the alternative shutdown equipment and/or circuits that bypass the fire area and verify that the alternative shutdown equipment and/or circuits are separated from the fire area in accordance with Section III.G.2.

c. Provide drawings of the alternative shutdown system(s) which highlight any connections to the normal shutdown systems (P&IDs for piping and components, elementary wiring diagrams of electrical cabling). Show the electrical location of all breakers for power cables, and isolation devices for control and instrumentation circuits for the alternative shutdown systems for that fire area.

d. Verify that changes to safety systems will not degrade safety systems; (e.g., new isolation switches and control switches should meet design criteria and standards in the FSAR for electrical equipment in the system that the switch is to be installed; cabinets that the switches are to be mounted in should also meet the same criteria (FSAR) as other safety related cabinets and panels; to avoid inadvertent isolation from the control room, the isolation switches should be keylocked or alarmed in the control room if in the "local" or "isolated" position; periodic checks should be made to verify that the switch is in the proper position for normal operation; and a single transfer switch or other new device should not be a source of a failure which causes loss of redundant safety systems).

e. Verify that licensee procedures have been or will be developed which describe tasks to be performed to effect the shutdown method. Provide a summary of these procedures outlining operator actions.

f. Verify that the manpower required to perform the shutdown functions using the procedures of e; as well as to provide fire brigade members to fight the fire is available as required by the fire brigade technical specifications.

g. Provide a commitment to perform adequate acceptance tests of the alternative shutdown capability. These tests should verify that: equipment operates from the local control station when the transfer or isolation switch is placed in the "local" position and that the equipment cannot be operated from the control room; and that equipment operates from the control room but cannot be operated at the local control station when the transfer isolation switch is in the "remote" position.

h. Provide Technical Specifications of the surveillance requirements and limiting conditions for operation for that equipment not already covered by existing Technical Specifications. For example, if new isolation and control switches are added to a shutdown system, the existing Technical Specification surveillance requirements should be supplemented to verify system/equipment functions from the alternate shutdown station at testing intervals consistent with the guidelines of Regulatory Guide 1.22 and IEEE 338. Credit may be taken for other existing tests using group overlap test concepts.

i. For new equipment comprising the alternative shutdown capability, verify that the systems available are adequate to perform the necessary shutdown function. The functions required should be based on previous analyses, if possible (e.g., in the FSAR), such as a loss of normal ac power or shutdown on Group 1 isolation (BWR). The equipment required for the alternative capability should be the same or equivalent to that relied on in the above analysis.

j. Verify that repair procedures for cold shutdown systems are developed and material for repairs is maintained on site. Provide a summary of these procedures and a list of the material needed for repairs.

SAFE SHUTDOWN CAPABILITY

The following discusses the requirements for protecting redundant and/or alternative equipment needed for safe shutdown in the event of a fire. The requirements of Appendix R address hot shutdown equipment which must be free of fire damage. The following requirements also apply to cold shutdown equipment if the licensee elects to demonstrate that the equipment is to be free of fire damage. Appendix R does allow repairable damage to cold shutdown equipment.

Using the requirements of Sections III.G and III.L of Appendix R, the capability to achieve hot shutdown must exist given a fire in any area of the plant in conjunction with a loss of offsite power for 72 hours. Section III.G of Appendix R provides four methods for ensuring that the hot shutdown capability is protected from fires. The first three options as defined in Section III.G.2 provides methods for protection from fires of equipment needed for hot shutdown:

1. Redundant systems including cables, equipment, and associated circuits may be separated by a three-hour fire rated barrier; or,

2. Redundant systems including cables, equipment and associated circuits may be separated by a horizontal distance of more than 20 feet with no intervening combustibles. In addition, fire detection and an automatic fire suppression system are required; or,

3. Redundant systems including cables, equipment and associated circuits may be enclosed by a one-hour fire rated barrier. In addition, fire detectors and an automatic fire suppression system are required.

The last option as defined by Section III.G.3 provides an alternative shutdown capability to the redundant trains damaged by a fire.

4. Alternative shutdown equipment must be independent of the cables, equipment and associated circuits of the redundant systems damaged by the fire.

Associated Circuits of Concern

The following discussion provides A) a definition of associated circuits for Appendix R consideration, B) the guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits and C) the information required by the staff to review associated circuits. The definition of associated circuits has not changed from the February 20, 1981 generic letter; but is merely clarified. It is important to note that our interest is only with those circuit (cables) whose fire-induced failure could affect shutdown. The guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits are not requirements. These guidelines should be used only as guidance when needed. These guidelines do not limit the alternatives available to the licensee for protecting the shutdown capability. All proposed methods for protection of the shutdown capability from fire-induced failures will be evaluated by the staff for acceptability.

A. Our concern is that circuits within the fire area will receive fire damage which can affect shutdown capability and thereby prevent post-fire safe shutdown. Associated Circuits* of Concern are defined as those cables (safety related, non-safety related, Class 1E, and non-Class 1E) that:

*The definition for associated circuits is not exactly the same as the definition presented in IEEE-384-1977.

1. Have a physical separation less than that required by Section III.G.2 of Appendix R, and;

2. Have one of the following:

   a. a common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices (see diagram 2a), or

   b. a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, PORVs, steam generator atmospheric dump valves, instrumentation, steam bypass, etc.) (see diagram 2b), or

   c. a common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,

      (1) are not electrically protected by circuit breakers, fuses or similar devices, or

      (2) will allow propagation of the fire into the common enclosure, (see diagram 2c).

EXAMPLES OF ASSOCIATED CIRCUITS OF CONCERN

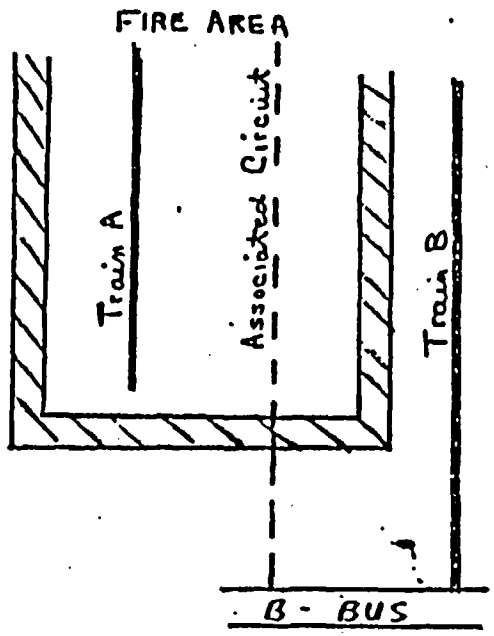
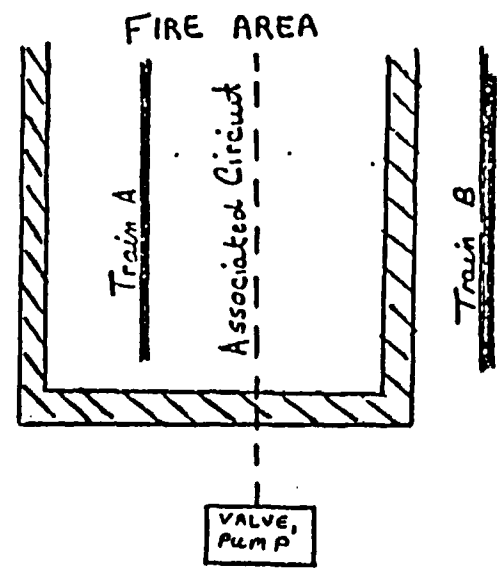
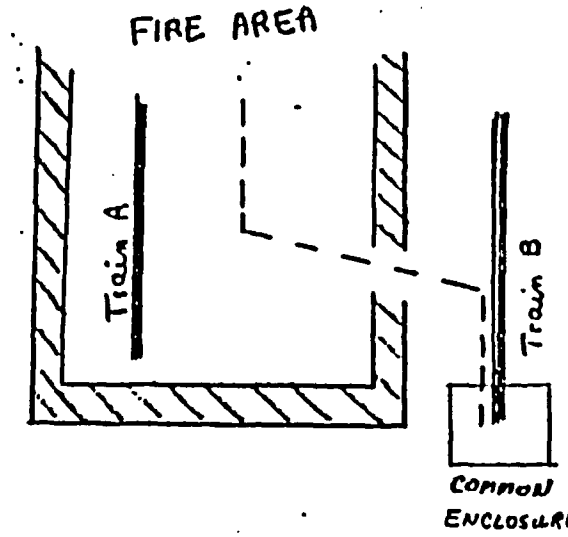


Diagram 2A



Equipment whose spurious operation could affect shutdown

Diagram 2B



The area barriers shown above meet the appropriate sub-paragraphs (a-f) of section III.G-2 of Appendix R.

Diagram 2C

B. The following guidelines are for protecting the shutdown capability from fire-induced failures of circuits (cables) in the fire area. The guidance provided below for interrupting devices applies only to new devices installed to provide electrical isolation of associated circuits of concern, or as part of the alternative or dedicated shutdown system. Previous coordination analyses need not be reanalyzed; however, breakers that were not included in previous reviews, will require a coordination analysis. The shutdown capability may be protected from the adverse effect of damage to associated circuits of concern by the following methods:

1. Provide protection between the associated circuits of concern and the shutdown circuits as per Section III.G.2 of Appendix R, or

2. a. For a common power source case of associated circuit:

   Provide load fuse/breaker (interrupting devices) to feeder fuse/breaker coordination to prevent loss of the redundant or alternative shutdown power source. To ensure that the following coordination criteria are met the following should apply:

   (1) The associated circuit of concern interrupting devices (breakers or fuses) time-overcurrent trip characteristic for all circuits faults should cause the interrupting device to interrupt the fault current prior to initiation of a trip of any upstream interrupting device which will cause a loss of the common power source,

   (2) The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of the shutdown loads.

The acceptability of a particular interrupting device is considered demonstrated if the following criteria are met:

(i) The interrupting device design shall be factory tested to verify overcurrent protection as designed in accordance with the applicable UL, ANSI, or NEMA standards.

(ii) For low and medium voltage switchgear (480 V and above) circuit breaker/protective relay periodic testing shall demonstrate that the overall coordination scheme remains within the limits specified in the design criteria. This testing may be performed as a series of overlapping tests.

(iii) Molded case circuit breakers shall periodically be manually exercised and inspected to insure ease of operation. On a rotating refueling outage basis a sample of these breakers shall be tested to determine that breaker drift is within that allowed by the design criteria. Breakers should be tested in accordance with an accepted QC testing methodology such as MIL STD 10 5 D.

(iv) Fuses when used as interrupting devices do not require periodic testing. Administrative controls must insure that replacement fuses with ratings other than those selected for proper coordination are not accidentally used.

b. For circuits of equipment and/or components whose spurious operation would affect the capability to safely shutdown:

(1) provide a means to isolate the equipment and/or components from the fire area prior to the fire (i.e., remove power cables, open circuit breakers); or

(2) provide electrical isolation that prevents spurious operation. Potential isolation devices include breakers, fuses, amplifiers, control switches, current XFRS, fiber optic couplers, relays and transducers; or

(3) provide a means to detect spurious operations and then procedures to defeat the maloperation of equipment (i.e., closure of the block valve if PORV spuriously operates, opening of the breakers to remove spurious operation of safety injection);

c. For common enclosure cases of associated circuits:

(1) provide appropriate measures to prevent propagation of the fire; and

(2) provide electrical protection (i.e., breakers, fuses or similar devices)

C. We recognize that there are different approaches which may be used to reach the same objective of determining the interaction of associated circuits with shutdown systems. One approach is to start with the fire area, identify what is in the fire area, and determine the interaction between what is in the fire area and the shutdown systems which are outside the fire area. We have entitled this approach, "The Fire Area Approach." A second approach which we have named "The Systems Approach" would be to define the shutdown systems around a fire area and then determine

those circuits that are located in the fire area that are associated with the shutdown system. We have prepared two sets of requests for information, one for each approach. The licensee may choose to respond to either set of requests depending on the approach selected by the licensee.

FIRE AREA APPROACH

1. For each fire area where an alternative or dedicated shutdown method, in accordance with Section III.G.3 of Appendix R is provided, the following information is required to demonstrate that associated circuits will not prevent operation or cause maloperation of the alternative or dedicated shutdown method:

   a. Provide a table that lists all the power cables in the fire area that connect to the same power supply of the alternative or dedicated shutdown method and the function of each power cable listed (i.e., power for RHR pump).

   b. Provide a table that lists all the cables in the fire area that were considered for possible spurious operation which would adversely affect shutdown and the function of each cable listed.

   c. Provide a table that lists all the cables in the fire area that share a common enclosure with circuits of the alternative or dedicated shutdown systems and the function of each cable listed.

   d. Show that fire-induced failures (hot shorts, open circuits or shorts to ground) of each of the cables listed in a, b, and c will not prevent operation or cause maloperation of the alternative or dedicated shutdown method.

e. For each cable listed in a, b and c where new electrical isolation has been provided or modification to existing electrical isolation has been made, provide detailed electrical schematic drawings that show how each cable is isolated from the fire area.

SYSTEMS APPROACH

1. For each area where an alternative or dedicated shutdown method, in accordance with Section III.G.3 of Appendix R is provided, the following information is required to demonstrate that associated circuits will not prevent operation or cause maloperation of the alternative or dedicated shutdown method:

   a. Describe the methodology used to assess the potential of associated circuit adversly affecting the alternative or dedicated shutdown capability. The description of the methodology should include the methods used to identify the circuits which share a common power supply or a common enclosure with the alternative or dedicated shutdown system and the circuits whose spurious operation would affect shutdown. Additionally, the description should include the methods used to identify if these circuits are associated circuits of concern due to their location in the fire area.

   b. Provide a table that lists all associated circuits of concern located in the fire area.

   c. Show that fire-induced failures (hot shorts, open circuits or shorts to ground) of each of the cables listed in b, will not prevent operation or cause maloperation of the alternative or dedicated shutdown method.

d. For each cable listed in b. where new electrical isolation has been provided, provide detailed electrical schematic drawings that show how each cable is isolated from the fire area.

e. Provide a location at the site or other offices where all the tables and drawings generated by this methodology approach for the associated circuits review may be audited to verify the information provided above.

HIGH-LOW PRESSURE INTERFACE

For either approach chosen the following concern dealing with high-low pressure interface should be addressed.

2. The residual heat removal system is generally a low pressure system that interfaces with the high pressure primary coolant system. To preclude a LOCA through this interface, we require compliance with the recommendations of Branch Technical Position RSB 5-1. Thus, the interface most likely consists of two redundant and independent motor operated valves. These two motor operated valves and their associated cables may be subject to a single fire hazard. It is our concern that this single fire could cause the two valves to open resulting in a fire initiated LOCA through the high-low pressure system interface. To assure that this interface and other high-low pressure interfaces are adequately protected from the effects of a single fire, we require the following information:

   a. Identify each high-low pressure interface that uses redundant electrically controlled devices (such as two series motor operated valves) to isolate or preclude rupture of any primary coolant boundary.

b. For each set of redundant valves identified in a., verify the redundant cabling (power and control) have adequate physical separation as required by Section III.G.2 of Appendix R.

c. For each case where adequate separation is not provided, show that fire induced failures (hot short, open circuits or short to ground) of the cables will not cause maloperation and result in a LOCA.