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

February 20, 1981

TO ALL POWER REACTOR LICENSEES WITH PLANTS  
LICENSED PRIOR TO JANUARY 1, 1979

SUBJECT: FIRE PROTECTION RULE (45 FR 76602, NOVEMBER 19, 1980) -  
Generic Letter 81-12

Paragraph 50.48(b) of 10 CFR Part 50, which became effective on February 17, 1981, requires all nuclear plants licensed to operate prior to January 1, 1979 to meet the requirements of Sections III.G, III.J and III.O of Appendix R to 10 CFR Part 50 regardless of any previous approvals by the Nuclear Regulatory Commission (NRC) for alternative design features for those items. This would require each licensee to reassess all those areas of the plant "... where cables or equipment, including associated non-safety circuits, that could prevent operation or cause maloperation due to hot shorts, open circuits or shorts to ground or (sic) redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment ..."\* to determine whether the requirements of Section III.G.2 of Appendix R are satisfied. If not, the licensee must provide alternative shutdown capability in conformance with Section III.G.3 or request an exemption if there is some justifiable basis.

Paragraph 50.48(c)(5) requires that any modifications that the licensee plans in order to meet the requirements of Section III.G.3 of Appendix R must be reviewed and approved by the NRC. This paragraph also requires that the plans, schedules and design descriptions of such modifications must be submitted by March 19, 1981. To expedite our review process and reduce the number of requests for additional information with regard to this review, we are enclosing two documents which specify the information that we will require to complete our reviews of alternative safe shutdown capability. Enclosure 1 is "Staff Position Safe Shutdown Capability". This document was originally sent to you in late 1979. Section 8 specifies the information required for staff review. If you have already submitted any of the information required, you need only reference that previous submittal. Enclosure 2 indicates the additional information needed to ensure that associated circuits for alternative safe shutdown equipment is included in your reassessment and in our review. If you made no modifications that were required to provide alternative safe shutdown capability and if your reassessment concludes that alternative safe shutdown capability in accordance with the provisions of Section III.G.3 is not necessary, you do not have to provide the information requested by these Enclosures.

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\*Quoted from Section III.G.2 of Appendix R to 10 CFR Part 50. Note that the "or" preceding "redundant trains" is a typographical error and should read "of redundant trains".

Finally, we request that as part of your submittal of plans and schedules for meeting the provisions of Paragraphs (c)(2), (c)(3) and (c)(4) of 10 CFR 50.48 as required by Paragraph 50.48(c)(5), you include the results of your reassessment of the design features at your plant for meeting the requirements of Sections III.G, III.J and III.O of Appendix R to 10 CFR Part 50.

This detailed information need not accompany the design description that must be submitted by March 19, 1981. However, we request that it be submitted as soon as possible, but no later than May 19, 1981.

This request for information was approved by GAO under a blanket clearance number R0071 which expires September 30, 1981. Comments on burden and duplication may be directed to the U. S. General Accounting Office, Regulatory Reports Review, Room 5106, 441 G Street, N. W., Washington, D. C. 20548.

Sincerely,



Darrell G. Eisenhut, Director  
Division of Licensing  
Office of Nuclear Reactor Regulation

Enclosures:

1. Staff Position
2. Request for Additional Information

cc w/enclosures:

See next page

STAFF POSITION  
SAFE SHUTDOWN CAPABILITY

Staff Concern

During the staff's evaluation of fire protection programs at operating plants, one or more specific plant areas may be identified in which the staff does not have adequate assurance that a postulated fire will not damage both redundant divisions of shutdown systems. This lack of assurance in safe shutdown capability has resulted from one or both of the following situations:

- \* Case A: The licensee has not adequately identified the systems and components required for safe shutdown and their location in specific fire areas.
- \* Case B: The licensee has not demonstrated that the fire protection for specific plant areas will prevent damage to both redundant divisions of safe shutdown components identified in these areas.

For Case A, the staff has required that an adequate safe shutdown analysis be performed. This evaluation includes the identification of the systems required for safe shutdown and the location of the system components in the plant. Where it is determined by this evaluation that safe shutdown components of both redundant divisions are located in the same fire area, the licensee is required to demonstrate that a postulated fire will not damage both divisions or provide alternate shutdown capability as in Case B.

For Case B, the staff may have required that an alternate shutdown capability be provided which is independent of the area of concern or the licensee may have proposed such a capability in lieu of certain additional fire protection modifications in the area. The specific modifications associated with the area of concern along with other systems and equipment already independent of the area form the alternate shutdown capability. For each plant, the modifications needed and the combinations of systems which provide the shutdown functions may be unique for each critical area; however, the shutdown functions provided should maintain plant parameters within the bounds of the limiting safety consequences deemed acceptable for the design basis event.

Staff Position

Safe shutdown capability should be demonstrated (Case A) or alternate shutdown capability provided (Case B) in accordance with the guidelines provided below:

1. Design Basis Event

The design basis event for considering the need for alternate shutdown is a postulated fire in a specific fire area containing redundant safe shutdown cables/equipment in close proximity where it has been determined that fire protection means cannot assure that safe shutdown capability will be preserved. Two cases should be considered: (1) offsite power is available; and (2) offsite power is not available.

## 2. Limiting Safety Consequences and Required Shutdown Functions

- 2.1 No fission product boundary integrity shall be affected:
  - a. No fuel clad damage;
  - b. No rupture of any primary coolant boundary;
  - c. No rupture of the containment boundary.
- 2.2 The reactor coolant system process variables shall be within those predicted for a loss of normal ac power.
- 2.3 The alternate shutdown capability shall be able to achieve and maintain subcritical conditions in the reactor, maintain reactor coolant inventory, achieve and maintain hot standby\* conditions (hot shutdown\* for a BWR) for an extended period of time, achieve cold shutdown\* conditions within 72 hours and maintain cold shutdown conditions thereafter.

\* As defined in the Standard Technical Specifications.

## 3. Performance Goals

- 3.1 The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.
- 3.2 The reactor coolant makeup function shall be capable of maintaining the reactor coolant level above the top of the core for BWR's and in the pressurizer for PWR's.
- 3.3 The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.
- 3.4 The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.
- 3.5 The supporting function shall be capable of providing the process cooling, lubrication, etc. necessary to permit the operation of the equipment used for safe shutdown by the systems identified in 3.1 - 3.4.
- 3.6 The equipment and systems used to achieve and maintain hot standby conditions (hot shutdown for a BWR) should be (1) free of fire damage; (2) capable of maintaining such conditions for an extended time period longer than 72 hours if the equipment required to achieve and maintain cold shutdown is not available due to fire damage; and (3) capable of being powered by an onsite emergency power system.
- 3.7 The equipment and systems used to achieve and maintain cold shutdown conditions should be either free of fire damage or the fire damage to such systems should be limited such that repairs can be made and cold shutdown conditions achieved within 72 hours. Equipment and systems used prior to 72 hours after the fire should be capable of being powered by an onsite emergency power system; those used after 72 hours may be powered by

REQUEST FOR ADDITIONAL INFORMATION

1. Section III.G of Appendix R to 10 CFR Part 50 requires cabling for or associated with redundant safe shutdown systems necessary to achieve and maintain hot shutdown conditions be separated by fire barriers having a three-hour fire rating or equivalent protection ( see Section III.G.2 of Appendix R). Therefore, if option III.G.3 is chosen for the protection of shutdown capability cabling required for or associated with the alternative method of hot shutdown for each fire area, must be physically separated by the equivalent of a three-hour rated fire barrier from the fire area.

In evaluating alternative shutdown methods, associated circuits are circuits that could prevent operation or cause maloperation of the alternative train which is used to achieve and maintain hot shutdown condition due to fire induced hot shorts, open circuits or shorts to ground.

Safety related and non-safety related cables that are associated with the equipment and cables of the alternative, or dedicated method of shutdown are those that have a separation from the fire area less than that required by Section III.G.2 of Appendix R to 10 CFR 50 and have either (1) a common power source with the alternate shutdown equipment and the power source is not electrically protected from the post-fire shutdown circuit of concern by coordinated circuit breakers, fuses or similar devices, (2) a connection to circuits of equipment whose spurious operation will adversely affect the shutdown capability, e.g., RHR/RCS Isolation Valves, or (3) a common enclosure, e.g., raceway, panel, junction box, with alternative shutdown cables and are not electrically protected from the post-fire shutdown circuits of concern by circuit breakers, fuses or similar devices.

For each fire area where an alternative or dedicated shutdown method, in accordance with Section III.G.3 of Appendix R to 10 CFR Part 50, is provided by proposed modifications, 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 equipment including instrumentation and support system equipment that are required by the alternative or dedicated method of achieving and maintaining hot shutdown.
- B. For each alternative shutdown equipment listed in 1.A above, provide a table that lists the essential cables (instrumentation, control and power) that are located in the fire area.
- C. Provide a table that lists safety related and non-safety related cables associated with the equipment and cables constituting the alternative or dedicated method of shutdown that are located in the fire area.
- D. Show that fire-induced failures of the cables listed in B and C above will not prevent operation or cause maloperation of the alternative or dedicated shutdown method.
- E. For each cable listed in 1.B above, provide detailed electrical schematic drawings that show how each cable is isolated from the fire area.

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, this interface most likely consists of two redundant and independent motor operated valves. These two motor operated valves and their associated cable 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 subject 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. Identify the device's essential cabling (power and control) and describe the cable routing (by fire area) from source to termination.
- C. Identify each location where the identified cables are separated by less than a wall having a three-hour fire rating from cables for the redundant device.
- D. For the areas identified in item 2.C above (if any), provide the bases and justification as to the acceptability of the existing design or any proposed modifications.

offsite power.

- 3.8 These systems need not be designed to (1) seismic category I criteria; (2) single failure criteria; or (3) cope with other plant accidents such as pipe breaks or stuck valves (Appendix A BTP 9.5-1), except those portions of these systems which interface with or impact existing safety systems.

#### 4. PWR Equipment Generally Necessary For Hot Standby

(1) Reactivity Control

Reactor trip capability (scram). Boration capability e.g., charging pump, makeup pump or high pressure injection pump taking suction from concentrated borated water supplies, and letdown system if required.

(2) 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 reduce pressure to allow use of the high pressure injection pumps.

(3) Reactor Coolant System Pressure Control

Reactor pressure control capability, e.g., charging pumps or pressurizer heaters and use of the letdown systems if required.

(4) Decay Heat Removal

Decay heat removal capability, e.g., power operated relief valves (steam generator) or safety relief valves for heat removal with a water supply and emergency or auxiliary feedwater pumps for makeup to the steam generator. Service water or other pumps may be required to provide water for auxiliary feed pump suction if the condensate storage tank capacity is not adequate for 72 hours.

(5) Process Monitoring Instrumentation

Process monitoring capability e.g., pressurizer pressure and level, steam generator level.

(6) Support.

The equipment required to support operation of the above described shutdown equipment e.g., component cooling water service water, etc. and onsite power sources (AC, DC) with their associated electrical distribution system.

5. PWR Equipment Generally Necessary For Cold Shutdown\*

(1) Reactor Coolant System Pressure Reduction to Residual Heat Removal System (RHR) Capability

Reactor coolant system pressure reduction by cooldown using steam generator power operated relief valves or atmospheric dump valves.

(2) Decay Heat Removal

Decay heat removal capability e.g., residual heat removal system, component cooling water system and service water system to removal heat and maintain cold shutdown.

(3) Support

Support capability e.g., onsite power sources (AC & DC) or offsite after 72 hours and the associated electrical distribution system to supply the above equipment.

\* Equipment necessary in addition to that already provided to maintain hot standby.

6. BWR Equipment Generally Necessary For Hot Shutdown

(1) Reactivity Control

Reactor trip capability (scram).

(2) Reactor Coolant Makeup

Reactor coolant inventory makeup capability e.g., reactor core isolation cooling system (RCIC) or the high pressure coolant injection system (HPCI).

(3) Reactor Pressure Control and Decay Heat Removal

Depressurization system valves or safety relief valves for dump to the suppression pool. The residual heat removal system in steam condensing mode, and service water system may also be used for heat removal to the ultimate heat sink.

(4) Suppression Pool Cooling

Residual heat removal system (in suppression pool cooling mode) service water system to maintain hot shutdown.

(5) Process Monitoring

Process monitoring capability e.g., reactor vessel level and pressure and suppression pool temperature.

(6) Support

Support capability e.g., onsite power source (AC & DC) and their associated distribution systems to provide for the shutdown equipment.

7. BWR Equipment Generally Necessary For Cold Shutdown\*

At this point the equipment necessary for hot shutdown has reduced the primary system pressure and temperature to where the RHR system may be placed in service in RHR cooling mode.

(1) Decay Heat Removal

Residual heat removal system in the RHR cooling mode, service water system.

(2) Support

Onsite sources (AC & DC) or offsite after 72 hours and their associated distribution systems to provide for shutdown equipment.

\* Equipment provided in addition to that for achieving hot shutdown.

8. Information Required For Staff Review

- (a) Description of the systems or portions thereof used to provide the shutdown capability and modifications required to achieve the alternate shutdown capability if required.
- (b) System design by drawings which show normal and alternate shutdown control and power circuits, location of components, and that wiring which is in the area and the wiring which is out of the area that required the alternate system.
- (c) Demonstrate 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 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 switch is in the proper position for normal operation; and a single transfer switch or other new device should not be a source for a single failure to cause loss of redundant safety systems).
- (d) Demonstrate that wiring, including power sources for the control circuit and equipment operation for the alternate shutdown method, is independent of equipment wiring in the area to be avoided.

- (e) Demonstrate that alternate shutdown power sources, including all breakers, have isolation devices on control circuits that are routed through the area to be avoided, even if the breaker is to be operated manually.
- (f) Demonstrate that licensee procedure(s) have been developed which describe the tasks to be performed to effect the shutdown method. A summary of these procedures should be submitted.
- (g) Demonstrate that spare fuses are available for control circuits where these fuses may be required in supplying power to control circuits used for the shutdown method and may be blown by the effects of a cable spreading room fire. The spare fuses should be located convenient to the existing fuses. The shutdown procedure should inform the operator to check these fuses.
- (h) Demonstrate that the manpower required to perform the shutdown functions using the procedures of (f) as well as to provide fire brigade members to fight the fire is available as required by the fire brigade technical specifications.
- (i) Demonstrate that adequate acceptance tests are performed. These 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 or isolation switch is in the "remote" position.
- (j) Technical Specifications of the surveillance requirements and limiting conditions for operation for that equipment not already covered by existing Tech. Specs. For example, if new isolation and control switches are added to a service water system, the existing Tech. Spec. surveillance requirements on the service water system should add a statement similar to the following:  
  
"Every third pump test should also verify that the pump starts from the alternate shutdown station after moving all service water system isolation switches to the local control position."
- (k) Demonstrate that the systems available are adequate to perform the necessary shutdown functions. The functions required should be based on previous analyses, if possible (e.g., in the FSAR), such as a loss of normal a.c. power or shutdown on a Group I isolation (BWR). The equipment required for the alternate capability should be the same or equivalent to that relied on in the above analysis.

- (1) Demonstrate that repair procedures for cold shutdown systems are developed and material for repairs is maintained on site.