Docket Nos. 50-338
and 50-339

Mr. R. H. Leasburg
Vice President - Nuclear Operations
Virginia Electric and Power Company
Post Office Box 26666
Richmond, Virginia 23261

Dear Mr. Leasburg:

SUBJECT: FIRE PROTECTION RULE - 10 CFR 50.48(c)(5) - ALTERNATIVE SAFE SHUTDOWN - SECTION III.G.3 OF APPENDIX R TO 10 CFR 50; NORTH ANNA POWER STATION, UNITS NO. 1 AND NO. 2 (NA-1&2)

The Fire Protection Rule (10 CFR 50.48 and Appendix R to 10 CFR 50) became effective on February 17, 1981. Paragraph 50.48(c)(5) requires submittal of design descriptions of modifications needed to satisfy Section III.G.3 of Appendix R to 10 CFR 50 by March 19, 1981.

By letter dated May 19, 1981, you submitted the design description of modifications required to meet Section III.G.3 of Appendix R to 10 CFR 50 for NA-1&2. We have reviewed your submittal and find that additional information is required to complete our review. The information required was orginally requested from you by letter dated February 20, 1981 and was presented to you in draft form at a meeting in Bethesda, Maryland on March 1, 1982 and is also provided in Enclosure No. 1 to this letter. Provide a complete response of items indicated in the enclosure within 60 days of receipt of this letter. If your response is not complete at that time, you will be found in violation of 10 CFR 50.48(c)(5). Such violation will be a continuing one and a civil penalty may be imposed for each day the violation continues.

Enclosure 2 provides a rewording of the request for information included with Generic Letter 81-12. This rewording is the result of meetings with representative licensees who felt that clarification of the request would help expedite responses. It does not include any new requests and, therefore, will not adversely affect licensees' ability to respond to Generic Letter 81-12.

Enclosure 3 provides information regarding our criteria for evaluating exemption requests from the requirements of Section III.G.2 of Appendix R.

Sincerely,
Original signed by

Robert A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

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Enclosures:
1. Request for Additional Information
2. Safe Shutdown Capability
3. Criteria for Evaluating Exemptions

cc: See next page

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NORTH ANNA
POST FIRE SAFE SHUTDOWN REVIEW

Request for Additional Information

Based on a review of May 19, 1981 submittal, and the SER for North Anna, the following questions (following outline of NRC letter of February 20, 1981) remain unanswered.

1. Give a description of the systems or portions thereof used to provide post fire safe shutdown capability based on a single postulated fire in any area of the plant. (Only information on charging pumps has been given).

2. Are the pressurizer heaters required for hot shutdown? If so, how are they controlled outside of the control room?

3. What systems or equipment is used for decay heat removal for both hot and cold shutdown? Where are the controls for these systems out of the control room? How are they isolated from the control room?

4. What support systems are required (cooling water, AC and DC power sources, lubrication, etc.) for post fire safe shutdown?

5. Drawings submitted indicate that a new instrumentation panel outside of control room will display pressurizer pressure and level, and primary loop temperature. Other instrumentation that might be required for safe shutdown includes steam generator pressure and temperature, steam generator level, pump flows (auxiliary feed pumps, etc.). These should be available outside of the control room although they need not all be in one location. In addition, for PWR's we will require a source range flux monitor, and both hot and cold leg primary temperatures. Give a complete list of all instrumentation available outside of the control room.

6. How do you plan to demonstrate that procedures developed for post fire safe shutdown (including procedure AP 48) are adequate for the purpose intended?

7. Are the available spare fuses located conveniently to the equipment in which they are required?

8. ANL will require 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.

9. 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).

10. 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.

11. 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.

12. 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.

13. For each alternative shutdown equipment listed in 12 above, provide a table that lists the essential cables (instrumentation, control and power) that are located in the fire area.

14. 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.

15. Show that fire-induced failures of the cables listed in 13 and 14 above will not prevent operation or cause maloperation of the alternative or dedicated shutdown method.

16. For each cable listed in 12 above, provide detailed electrical schematic drawings that show how each cable is isolated from the fire area.

17. Can this plant sustain a fire in the shutdown logic panel?

18. If a fire occurs in the shutdown logic panel, how will the plant be shutdown?

19. Which electrical support systems will be used for post fire alternative shutdown?

20. Could a fire at the new reactor coolant shutdown panel endanger safe shutdown by giving incorrect instrument readings at both the new panel and at the control room? What kind of isolation is provided for instruments? for control?

21. Was the change shown on 11715-ESK 5AM, 5AN, 5AP, and 12050-ESK 5AM, 5AN, 5AP only added interlock and indicate lights for new reactor coolant monitoring panel?

22. What is the function of relay 3AJ-2C15A06 referred to on [illegible]
Same with other note 4 relays.

23. Will you send ESK 11AK, 11AN, 11AL series of prints that [illegible] in ESK-5AN and elsewhere?

24. Print 13075-FE-3DP-3. Are the 120 volt AC feeds to the RCMP [illegible] emergency diesel generators? What control function, if any, [illegible] from this panel? Will you forward print 12050 FE-3AN [illegible] have notes for this print.

25. Print 12050 FE-BAX-7. What changes were made? No written [illegible] given; E and DCR referred to.

26. Print 12050 FE-27A-11. Three auxiliary relay panels referred to. How does this tie into changes in new RCMP?

SAFE SHUTDOWN CAPABILITY

The following discusses the requirements for protecting redundant and 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 by enclosed by a one-hour fire rated barrier. In addition, fire detection 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 effect 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

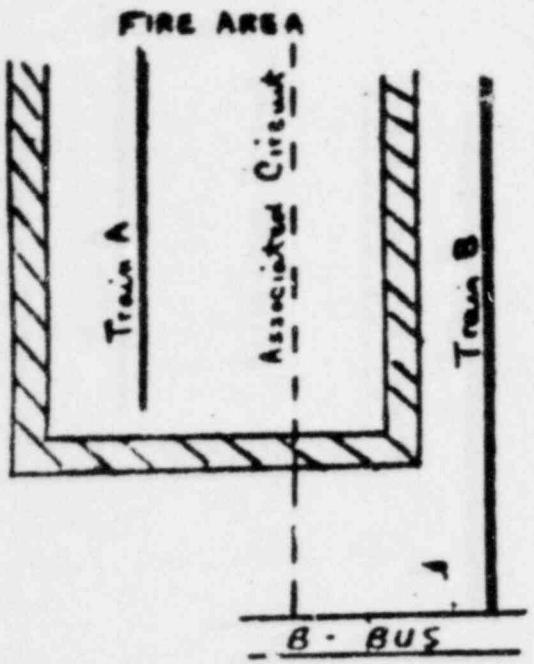
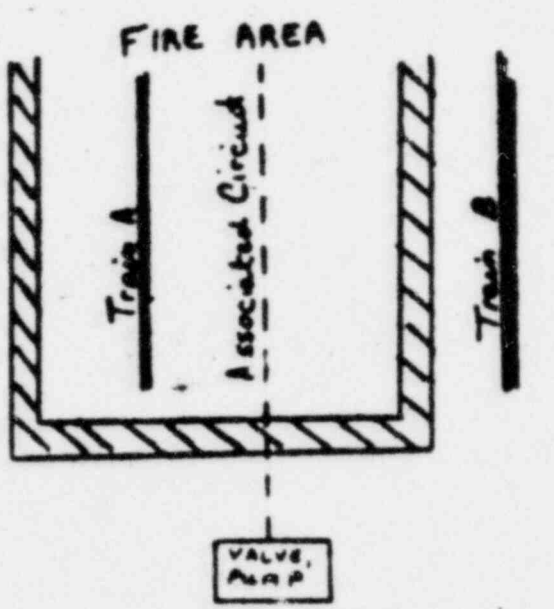
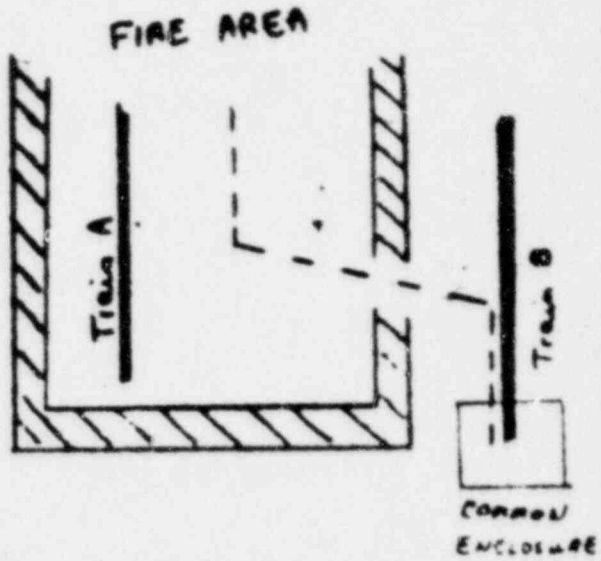


Diagram 2A



Equipment where 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. 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 consicered 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 peridically 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, due to their stability, lack of drift, and high reliability. Administrative controls must insure that replacement fuses with ratings other than those selected for proper coordinating 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 in the fire area prior to the fire (i.e., remove power cable fuses or 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 deter-

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. 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.

CRITERIA FOR EVALUATING

EXEMPTIONS TO SECTION III G OF APPENDIX R

OF 10 CFR PART 50

Paragraph 50.48 Fire Protection of 10 CFR Part 50 requires that all nuclear power plants licensed prior to January 1, 1979 satisfy the requirements of Section III.G of Appendix R to 10 CFR Part 50. It also requires that alternative fire protection configurations previously approved by an SER be reexamined for compliance with the requirements of Section III.G. Section III.G is related to fire protection features for ensuring that systems and associated circuits used to achieve and maintain safe shutdown are free of fire damage. Fire protection configurations must either meet the specific requirements of Section III.G or an alternative fire protection configuration must be justified by a fire hazard analysis.

The general criteria for accepting an alternative fire protection configurations are the following:

- The alternative assures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage.

- The alternative assures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited such that it can be repaired within a reasonable time (minor repairs with components stored on-site).

- Fire retardant coatings are not used as fire barriers.

- Modifications required to meet Section III.G would not enhance fire protection safety above that provided by either existing or proposed alternatives.

- Modifications required to meet Section III.G would be detrimental to overall facility safety.

Because of the broad spectrum of potential configurations for which exemptions may be requested, specific criteria that account for all of the parameters that are important to fire protection and consistent with safety requirements of all plant-unique configurations have not been developed. However, our evaluations of deviations from these requirements in our previous reviews and in the requests for III.G exemptions received to date have identified some recurring configurations for which specific criteria have been developed.

Section III.G.2 accepts three methods of fire protection. A passive 3-hour fire barrier should be used where possible. Where a fixed barrier cannot be installed, an automatic suppression system in combination with a fire barrier or a separation distance free of combustibles is used if the configurations of systems to be protected and in-situ combustibles are such that there is reasonable assurance that the protected systems will survive. If this latter condition is not met, alternative shutdown capability is required and a fixed suppression system installed in the fire area of concern, if it contains a large concentration of cables. It is essential to remember that these alternative requirements are not deemed to be equivalent. However, they provide adequate protection for those configurations in which they are accepted.

When the fire protection features of each fire area are evaluated, the whole system of such features must be kept in perspective. The defense-in-depth principle of fire protection programs is aimed at achieving an adequate balance between the different features. Strengthening any one can compensate in some measure for weaknesses, known or unknown in others. The adequacy of fire protection for any particular plant safety system or area is determined by analysis of the effects of postulated fire relative to maintaining the ability to safely shutdown the plant and minimize radioactive releases to the environment in the event of a fire. During these evaluations it is necessary to consider the two-edged nature of fire protection features recognized in General Design Criterion 3 namely, fire protection should be provided consistent with other safety considerations.

An evaluation must be made for each fire area for which an exemption is requested. During these evaluations, the staff considers the following parameters:

A. Area Description

- walls, floor, and ceiling construction
- ceiling height
- room volume
- ventilation
- congestion

B. Safe Shutdown Capability

- number of redundant systems in area
- whether or not system or equipment is required for hot shutdown
- type of equipment/cables involved
- repair time for cold shutdown equipment within this area
- separation between redundant components and in-situ concentration of combustibles
- alternative shutdown capability

C. Fire Hazard Analysis

- type and configuration of combustibles in area
- quantity of combustibles
- ease of ignition and propagation
- heat release rate potential
- transient and installed combustibles
- suppression damage to equipment
- whether the area is continuously manned
- traffic through the area
- accessibility of the area

D. Fire Protection Existing or Committed

- fire detection systems
- fire extinguishing systems
- hose station/extinguisher
- radiant heat shields

A specific description of the fire protection features of the configuration is required to justify the compensating features of the alternative. Low fire loading is not a sufficient basis for granting an exemption in areas where there are cables.

If necessary, a team of experts, including a fire protection engineer, will visit the site to determine the existing circumstances. This visual inspection is also considered in the review process.

The majority of the III.G exemption requests received to date are being denied because they lack specificity. Licensees have not identified the extent of the exemption requested, have not provided a technical basis For the request and/or have not provided a specific description of the alternative. We expect to receive requests for exemption of the following nature:

1. Fixed fire barriers less than 3-hour rating.

2. Fire barrier without an automatic fire suppression system.

3. Less than 20 feet separation of cables with fire propagation retardants (e.g., coatings, blankets, covered trays) and an automatic suppression system.

4. For large open areas with few components to be protected and few in-situ combustibles, no automatic suppression system with separation as in item 3 above.

5. No fixed suppression in the control room.

6. No fixed suppression in areas without a large concentration of cables for which alternative shutdown capability has been provided.

Our fire research test program is conducting tests to provide information that will be useful to determine the boundary of acceptable conditions for fire protection configurations which do not include a fire rated barrier.

Based on deviations recently approved, specific criteria for certain recurring configurations are as follows:

Fire Barrier Less than Three Hours

This barrier is a wall, floor, ceiling or an enclosure which separates one fire area from another.

Exemptions may be granted for a lower rating (e.g., one hour or two hours) where the fire loading is no more than 1/2 of the barrier rating. The fire rating of the barrier shall be no less than one hour.

Exemptions may be granted for a fixed barrier with a lower fix rating supplemented by a water curtain.

An Automatic Suppression System With Either One Hour Fire Barrier or 20-Foot Separation

This barrier is an enclosure which separates those portions of one division which are within 20 feet of the redundant division. The suppressant may be water or gas.

Exemptions may be granted for configurations of redundant systems which have compensating features. For example:

A. Separation distances less than 20 feet may be deemed acceptable where:

   1. Fire propagation retardants (i.e., cable coatings, covered trays, conduits, or mineral wool blankets) assure that fire propagation through in-situ combustibles will not occur or will be delayed sufficiently to ensure adequate time for detection and suppression.

   2. Distance above a floor level exposure fire and below ceiling assures that redundant systems will not be simultaneously subject to an unacceptable temperature or heat flux.

B. The ommission of an automatic suppression system may be deemed acceptable where:

   1. Distance above a floor level exposure fire and below ceiling assures that redundant systems will not be simultaneously subject to an unacceptable temperature or heat flux.

2. The fire area is required to be manned continuously by the provisions in the Technical Specifications.