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Docket Nos.: 50-400
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Mr. E. E. Utley
Executive Vice President
Power Supply and Engineering
and Construction
Carolina Power and Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Dear Mr. Utley:

Subject: Additional Guidance to Clarify Associated Circuits for Safe
Shutdown (Shearon Harris)

On September 26 and 27, 1983, the NRC staff met with representatives from Carolina Power and Light Company to discuss fire protection at the Shearon Harris Plant. During this meeting the staff agreed to forward to CP&L guidance on the subject of associated circuits for safe shutdown for a nuclear power plant after a fire. Enclosed is a detailed description of associated circuits which should be useful in preparing your safe shutdown analysis.

If you should require any additional assistance, please contact the Shearon Harris Project Manager, Mr. B. C. Buckley.

Sincerely,

Original signed by:
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George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

Enclosure:
As stated

cc: See next page

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JHolonich/yt
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Shearon Harris.

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ASSOCIATED CIRCUIT GUIDANCEI. INTRODUCTION

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.

II. 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. It is important to note that our interest is only with those circuit (cables) whose fire-induced failure could affect shutdown. Guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits are provided. 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

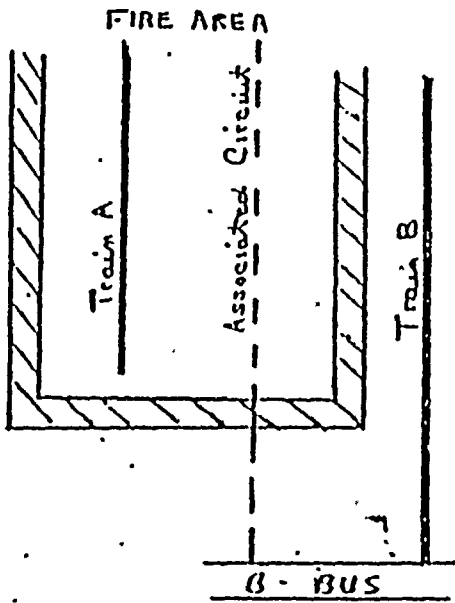
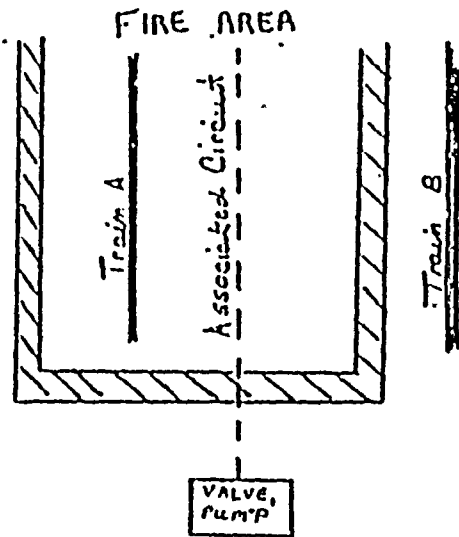
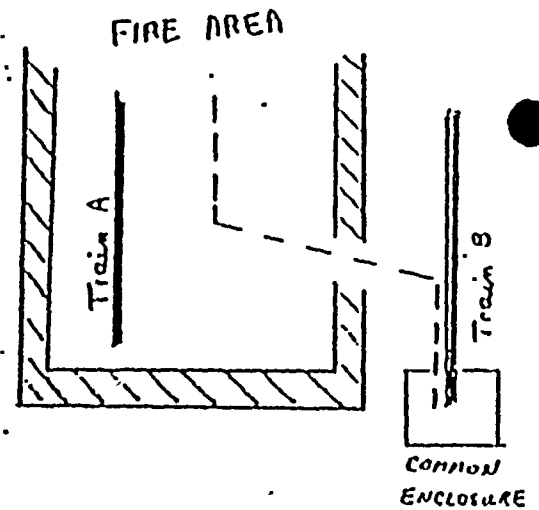


Diagram 2A



Equipment whose spurious operations 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

8. The following guidelines are for protecting the shutdown capability from fire-induced failures of circuits (cables) in the fire area. 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. INFORMATION REQUIRED

The following information is required to demonstrate that associated circuits will not prevent operation or cause maloperation of the shutdown method:

- a. Describe the methodology used to assess the potential of associated circuit adversely affecting the 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 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. Show that fire-induced failures (hot shorts, open circuits or shorts to ground) of each of the associated circuits of concern will not prevent operation or cause maloperation of the shutdown method.
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.



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- 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.6.2 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.



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