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

OCT 12 1984

MEMORANDUM FOR: George W. Knighton, Chief, Licensing Branch No. 3, Division of Licensing

FROM: Olan D. Parr, Chief, Auxiliary Systems Branch, Division of Systems Integration

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING POST-FIRE SAFE SHUTDOWN CAPABILITY - BEAVER VALLEY UNIT 2, AUXILIARY SYSTEMS BRANCH

The Auxiliary Systems Branch has reviewed Beaver Valley, Unit 2 FSAR Section 9.5.1, "Fire Protection System," the Fire Protection Evaluation Report, and the responses to previous staff questions concerning the ability of the plant to achieve and maintain a safe shutdown condition following a fire. As a result of this review, the enclosed request for additional information has been prepared. A response to these questions is needed in order for us to complete our review. Attachment 1 to the enclosed request provides our guidance with respect to the fire protection associated circuit review. Attachment 2 provides additional guidance regarding allowable repairs to achieve cold shutdown.

Jerry H. Wilson for
Olan D. Parr, Chief
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AUXILIARY SYSTEMS BRANCH
REQUEST FOR ADDITIONAL INFORMATION
BEAVER VALLEY POWER STATION, UNIT 2

1. Section 2.5.3 of the Beaver Valley, Unit 2 Fire Protection Evaluation Report indicates that the postulated control room fire is limited to the ignition of one train of safety-related panel wiring. Section 7.4.1.3 of the FSAR indicates that a control room fire is not postulated to generate spurious or unwanted control signals which would prevent establishing hot standby from the emergency shutdown panel (ESP). In addition tc above, Figure A5-15 - Alternate Shutdown Panel, contains a note that states "To date, an exposure fire is not postulated in the control room, only loss of habitability."

   Standard Review Plan, Section 9.5.1, which incorporates the criteria of Appendix R to 10 CFR 50 requires that the fire hazards analysis include exposure fires which could damage both trains of safe shutdown systems if they are located in a single fire area and not sufficiently separated. Further, the assumption that spurious or unwanted control signals will not result from fire damage is not consistent with the SRP criteria. Based on the above criteria for the control room:

   a. Revise your submittal "Fire Protection Evaluation Report" and identify any necessary modifications to assure that fires will affect the safe shutdown capability as indicated by the above criteria, or

   b. Provide justification for your position and identify any resulting deviation from the above criteria.

2. Describe the details of your proposed design to demonstrate that you satisfy the criteria of Section C.5.b and C.5.c of Branch Technical Positions CMEB 9.5.1 by providing the following information:

   a. Describe the methodology used to verify that proper separation is provided for the safe shutdown capability in accordance with the guidelines of C.5.b of Branch Technical Position CMEB 9.5.1. Provide the area arrangement drawings showing the safe shutdown system including the cable routing.

   b. Address the means you will provide for assuring the proper functioning of your safe shutdown capability, assuming fire induced failures in the associated circuits. Attachment 1 identifies our concerns with associated circuits. This attachment also provides guidance for reviewing the associated circuits of concern and the additional information we need. Your response should specifically address Part II.C of this attachment.

   In evaluating your response to Part II.C of this attachment regarding spurious actuation of equipment, the staff intends to utilize the following guidelines:

a. The safe shutdown capability should not be adversely affected by any one spurious actuation or signal resulting from a fire in any plant area; and

b. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in the loss of all automatic function (signals, logic) from the circuits located in the area in conjunction with one worst case spurious actuation or signal resulting from the fire; and

c. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in simultaneous spurious actuation of all valves in high-low pressure interface lines.

3. Aside from the fact that the emergency shutdown panel (ESP) is capable of controlling two safety-related trains while the alternate shutdown panel (ASP) is only capable of controlling one shutdown train, the applicant should identify and describe all functional differences and limitations of the two shutdown panels in attaining and maintaining either a hot or cold shutdown conditions. Also, identify the conditions for which these panels will be utilized.

4. The applicant's submittal does not indicate whether repairs are required to achieve cold shutdown. The applicant shall identify any required repairs. It is our position that systems and components used to achieve and maintain hot standby conditions must be free of fire damage and capable of maintaining such conditions without repairs. Systems and components used to achieve and maintain cold shutdown 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 achieved within 72 hours. Attachment 2 (Memorandum from R. Mattson to R. Vollmer dated July 2, 1982) provides additional guidance regarding allowable repairs to achieve cold shutdown.

5. The applicant should provide a commitment to develop and implement alternate shutdown procedures prior to fuel load. These procedures should address manpower requirements and manual actions to accomplish shutdown. A summary of the operator actions needed for safe shutdown should be provided for our review.

ATTACHMENT 1

ASSOCIATED CIRCUIT GUIDANCE

1. 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 applicant/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 circuits (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

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

cables (safety related, non-safety related Class 1E, and non-Class 1E) that:

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

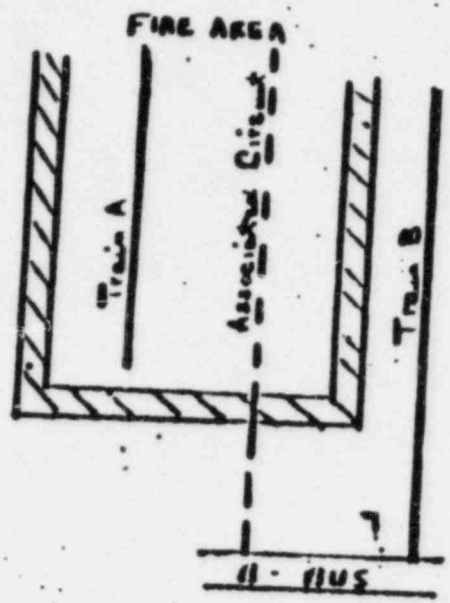
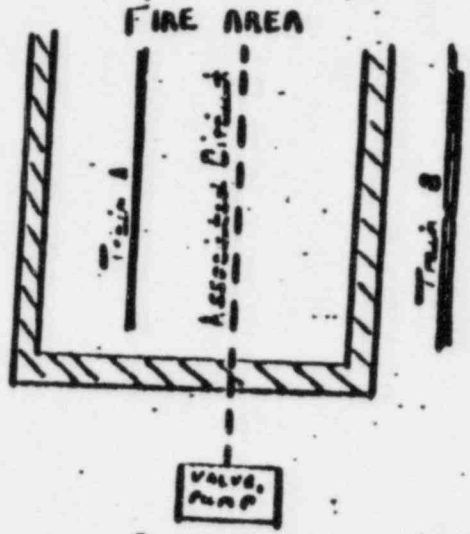
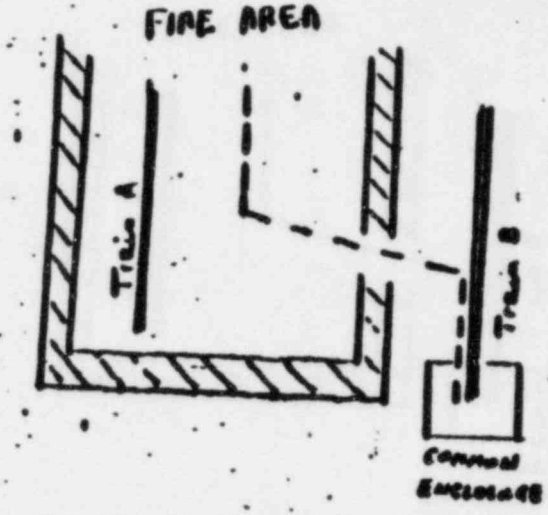


Diagram 2A



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

(1) The associated circuits of concern interrupting devices (breakers of fuses) time-overcurrent trip characteristic for all circuit 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 interruption without loss of function of the shutdown loads.

The acceptability of a particular interrupting device is considered demonstrated if the following cirteria 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 accidently 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 berakers to stop 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 circuits 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.

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.

Attachment 2

UNITED STATES
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WASHINGTON, D. C. 20555

JUL 2 1982

MEMORANDUM FOR: Richard H. Vollmer, Director, Division of Engineering

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

SUBJECT: POSITION STATEMENT ON ALLOWABLE REPAIRS FOR ALTERNATIVE SHUTDOWN AND ON THE APPENDIX R REQUIREMENT FOR TIME REQUIRED TO ACHIEVE COLD SHUTDOWN

Some licensees have experienced difficulties in interpreting two areas of Sections III.G and III.L. The purpose of this memorandum is to inform you of these two areas and interpretations which we believe are needed. These interpretations pertain to the (1) allowable repairs to achieve safe shutdown and (2) allowable time to achieve safe shutdown. The interpretations which follow are not new. We request your concurrence in this matter.

Allowable Repairs to Achieve Safe Shutdown

Section III.G.1 of Appendix R states that one train of systems needed for hot shutdown must be free of fire damage. Thus, one train of systems needed for hot shutdown must be operable during and following a fire. Operability of the hot shutdown systems, including the ability to overcome a fire or fire suppressant induced maloperation of hot shutdown equipment and the plant's power distribution system, must exist without repairs. Manual operation of valves, switches and circuit breakers is allowed to operate equipment and isolate systems and is not considered a repair. However, the removal of fuses for isolation is not permitted. All manual operations must be achievable prior to the fire or fire suppressant induced maloperations reaching an unrecoverable plant condition.

Modifications, e.g., wiring changes, are allowed to systems and/or components not used for hot shutdown, but whose fire or fire suppressant induced maloperations may indirectly affect hot shutdown. These repairs must be achievable prior to the maloperations causing an unrecoverable plant condition.

Repairs for cold shutdown systems are allowed by Section III.L.5 of Appendix R. For cold shutdown capability repairs, the removal of fuses for isolation and the replacement of cabling is permitted. Also, selected equipment replacement, e.g., such as replacing a valve, pump, control room controls and instruments, will be reviewed on a case-by-case basis to verify its practicality within the appropriate time constraints. Procedures for repairing damaged equipment should be prepared in advance with replacement equipment (i.e., cables

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made-up with terminal lugs attached) stored onsite. All repairs should be of sufficient quality to assure safe operation until the plant is restored to an operating condition. Repairs not permitted include the use of clip leads in control panels (which means that hard wired terminal lugs must be used), and the use of jumper cables other than those fastened with terminal lugs.

When repairs are necessary in the fire area, the licensee will have to demonstrate that sufficient time is available to allow the area to be re-entered and that expected fire and fire suppressant damage will not prevent the repair from taking place and that repair procedure will not endanger operating systems. In addition, written procedures must exist for the orderly transfer of control from the control room and the remote shutdown stations and vice versa. The repairs to cold shutdown systems are considered to be an upper limit. The licensee may design the plant so that cold shutdown can be achieved without repair.

Allowable Time to Achieve Safe Shutdown

Section III.G of Appendix R states that fire damage to cold shutdown capability must be limited to damage that can be repaired within 72 hours. Section III.L.1 of Appendix R states that the alternative shutdown capability shall be able to achieve cold shutdown within 72 hours. Further, Section III.L.5 of Appendix R states that fire damage shall be limited so that the systems can be made operable and cold shutdown achieved within 72 hours. Sections III.L.1 and III.L.5 state that a plant must be capable of achieving cold shutdown using only onsite power prior to the elapse of 72 hours. Section III.L.5 also clearly states that offsite power is assumed restored after 72 hours in that equipment and systems not needed until 72 hours may be powered by offsite power only.

We have been using and propose to continue to use Sections III.L.1 and III.L.5 in our evaluations. Thus, a licensee should have the capability of repairing equipment and achieving cold shutdown within 72 hours using only onsite power. The 72 hours is considered an upper limit; a licensee may limit the repairs and achieve cold shutdown in a shorter time frame.

We have applied the interpretations of Sections III.L.1 and III.L.5 of Appendix R to approximately twenty plant fire protection reviews. We propose to continue to use the interpretations discussed above for future alternative shutdown reviews. If you agree, then please indicate your concurrence at the bottom of this page and return to me.

Roger J. Mattson

Roger J. Mattson, Director
Division of Systems Integration

Approved: _____

Richard H. Vollmer, Director
Division of Engineering

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