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October 1, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
AUXILIARY SYSTEMS BRANCH QUESTIONS
ON SAFE AND ALTERNATE SHUTDOWN

REF: (1) B. J. Youngblood to M. D. Spence letter of September 20, 1984, entitled, "Request for Additional Information Pertaining to Safe Shutdown and Alternate Safe Shutdown of Comanche Peak Steam Electric Station (Units 1 and 2)"

Dear Sir:

Reference (1) included two new questions from the Auxiliary Systems Branch, 010.24 and 010.25. The responses to these questions are attached. These responses are provided on the Comanche Peak dockets by letter to prevent administrative delays in the review process. These responses will also be included in a future amendment to the CPSES FSAR.

Respectfully,

DRWoodlan for

John W. Beck
Manager, Licensing

DRW:tls
Attachment

Original + 40 copies

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Q010.24 A recent plant inspection at another facility revealed that in order for some systems necessary for hot shutdown to be isolated from control room fire damage and maintain operability without fuse replacement, isolation must take place prior to fire damage. Although the present isolation switches at Comanche Peak do isolate the required equipment or components from the control room, it has not been demonstrated that it is unnecessary to replace fuses in order to place the equipment/component in the desired mode of operation or position. In order for the staff to conduct a review to determine if fuse replacement is necessary for the operation of safety systems after a control room fire, provide a description including schematic drawings of the different isolation switch designs used at Comanche Peak. If the Comanche Peak design necessitates the changing of fuses to achieve and maintain hot shutdown after a control room fire, modify your design to eliminate the need for fuse replacement and provide a description of the design modifications.

R010.24 The electrical circuits that allow operation of safe shutdown components from the Hot Shutdown Panel (HSP), are isolated from the Control Room (CR). This isolation provides electrical and physical independence between the electrical safe shutdown circuits in the HSP control configurations and respective circuits portions routed and/or installed within the Cable Spreading Room and Control Room. That design can be summarized as follows:

° Each pump or valve electrical control circuit having both remote (Control Room) and local

(HSP) control capability is equipped with separate fuse sets protecting:

1. The electrical cable conductors routed through the Cable Spreading Room (CSR) and/or Control Room; and

2. The cable conductors required for HSP circuit operation.

This double set of fuses is installed in the safe shutdown component circuitry such that fire induced electrical faults within the CSR or Control Room will be isolated without affecting the availability of the HSP safe shutdown circuit.

- The transfer/isolation switches which are provided for a CR fire are mounted in a separate panel (Shutdown Transfer Panel) and are physically independent from the HSP, CR and CSR locations. These switches can be operated in the event that the Control Room is not inhabitable.

  The operation of these switches transfer control to the HSP and will isolate the CR and CSR portions of the circuit. Necessary control power is thus provided to the HSP circuits through separately fused circuits, independent from the CR and CSR, thus eliminating the need for fuse replacement.

- Safe shutdown monitoring instrumentation available at the HSP consists of instrument

loops which are dedicated to the HSP control configuration. These instrument loops are independent from those monitoring instrument channels available at the CR. The required instrument loop power supplies and electrical feeds are such that no single fire will affect both CR and HSP instrumentation simultaneously.

The schematic drawings of the different isolation designs have been supplied by separate letter.

Q010.25 Provide 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 Position CMEB 9.5.1. In your response, provide the following information: (9.5.1)

a. Describe the methodology used to verify that proper separation is provided for the safe shutdown capability in accordance with the requirements of C.5.b of Branch Techical 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 provides 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.

c. Confirm that your proposed design will have the capability to achieve cold shutdown conditions within 72 hours and maintain cold shutdown thereafter, as defined in Section III.L of Appendix R to 10 CFR Part 50 and Section C.5.c of Branch Technical Position CMEB 9.5-1, assuming that offsite power is not available.

ATTACHMENT 1

ASSOCIATED CIRCUIT GUIDANCE

I. 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 asscoiated 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:

 1. Have 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 diagragm 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).

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

B. The following guidelines are for protecting the shutdown capability from fire induced failures of circuits (cables) is 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 or 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 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 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 breakers 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

1. 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 must 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 shorts to ground) of the cables will not cause maloperation and result in a LOCA.

R010.25 a. 1) Methodology

Plant safe shutdown logics are developed to identify components required to achieve shutdown. This includes both equipment and instrumentation. After this is completed, cables used to power and control the components identified are listed and input into a program to tabulate path related components. Other information included in the input information are system identifiers, cable revision code, fire zone, and raceway node points. This input is crossed with the plant cable and raceway list to generate a list of cables with descriptions and routes for the cable by fire zone. This product is used in conjuction with the safe shutdown logics to

identify components that would provide a safe shutdown path.

After identification of fire-safe-shutdown related components (i.e., equipment, trays, conduits, and cables) by fire area, a review is done to identify interactions of path related components. This review is done in a preliminary form on drawings. The actual interaction study is done by field walkdowns. The drawings are then used to aid in identifying and locating components.

EQUIPMENT INTERACTIONS

For all interactions of path related equipment identified in the field, it is determined if the 20 foot separation criteria of Appendix R Section III.G.2.b is satisfied. If not, an interaction analysis is performed to identify a redundant shutdown path. Where these redundant paths are required, they are documented.

TRAYS AND CONDUITS

Based on the preliminary drawing review, an entire shutdown path is protected for each fire area. Where only one path is in an area, the protection is provided in accordance with the criteria of Appendix R Section III.G.2a. Where two paths enter one fire area, protection is provided in

accordance with the criteria of Appendix R Section III.G.2.b or c.

A design verification program is in progress to confirm the fire safe shutdown analysis methodology as described above. This program is intended to ensure that all plant design changes are incorporated into the analysis. The program is also intended to conform that all aspects of the analysis are properly documented. The program will be completed prior to exceeding 5% power.

2) Drawings

As indicated above, area arrangement drawings are not the basis of protection determinations. This function is achieved by performing plant walkdowns.

b. The methodology used to provide adequate safe shutdown capability as described in "a" above included a consideration of associated circuits. This consideration included common power sources, common enclosures and the spurious operation of certain equipment. Hot shorts, open circuits and shorts to ground were evaluated. This effort included fire safe shutdown paths and high-to-low pressure interfaces with the high pressure primary coolant system.

In light of the position attached to this question and to update our previous efforts to

incorporate the current plant design, the evaluation of associated circuits as they relate to fire safe shutdown, alternate shutdown and high-to-low pressure interfaces is being confirmed and documented as part of the review efforts described in part "a" above. This confirmation will be completed prior to exceeding 5% power and is being performed as described below:

<u>Associated Circuit by Common Power Supply</u>

Circuits and cables associated by common power supply are those whose fire-induced failure may cause the loss of a power source (bus, distribution panel, MCC) that is necessary to support safe shutdown. The issue of Associated Circuits of Concern by common power supply is resolved by ensuring adequate electrical coordination between the safe shutdown power source supply breaker or fuse and the feeder breakers or fuses at the various safe shutdown power supplies.

Electrical circuit fault protection at CPSES is designed to provide protection for plant electric circuits via protective relaying, circuit breakers, and fuses. The design of the protective equipment is to ensure adequate protection of electrical distribution equipment from electric fault and overload conditions in the circuits. Such coordination ensures that the protective device nearest to the fault operates prior to the operation of any upstream

devices, and provides interruption of electrical service to a minimum amount of equipment.

The electrical distribution system of CPSES is being reviewed to ensure that acceptable coordination and selective tripping is provided for the safe shutdown circuits on the ac and dc power systems.

Associated Circuits of Concern by Common Enclosure

Circuits can be associated by common enclosure in two ways. First, fire-induced damage to nonsafe shutdown cables can create circuit faults in electrically unprotected cables. Such faults could be of sufficient magnitude to create secondary fires in the cables due to the fault currents. If such secondary fires were to occur in enclosures (raceways, panels, etc.), these fires could impact safe shutdown cables or equipment contained within this common enclosure. CPSES will ensure that such electrically induced secondary fires will not occur by reviewing a sufficient number of cables that share a common enclosure with safe shutdown equipment to confirm that the CPSES design provides adequate electrical protection via circuit breakers, fuses, or current-limiting devices.

For associated circuits that could allow fire propagation to a common enclosure, the design of the fire protection features at CPSES in

conjuction with field checks of intervening combustibles ensures that no such circuits exist. This second type of associated circuit by common enclosure is concerned with the issue of cable jacket fire propagation. This aspect of associated circuits can also be viewed as an intervening combustible question. The concern here is that fires will spread due to cable burning beyond the immediate area of concern and will ultimately affect safe shutdown cables that share raceways with the ignited cables. This concern is limited given the inherent fire retardant properties of the cable types used at CPSES, the protection of raceways by one-hour-rated fire protection materials and the extent of the fire suppression systems. Since fire area boundaries at CPSES do contain appropriate cable penetration seals, the issue of fire propagation via cable jacket ignition exists only where the 20-ft separation criteria is credited in achieving separation requirements. A field verification is conducted whenever a 20 foot separation is used in the cable separation analysis. This field check ensures that there are no intervening combustibles that could allow fire propagation from one safe shutdown train to the other. Associated circuits by common enclosure of this type should not appear, as intervening combustibles are not a concern at CPSES because of:

1) Field checks of intervening combustibles confirming the absence of fire propagation paths or resolution by suitable fire protection measures

2) Electrical penetrations for safe shutdown cables being sealed at their fire area boundary wall penetrations with fire stops equivalent to those required for the wall

3) Physical separation of normal and alternative shutdown power cable routings and enclosures, and electrical design practices

4) Inherent propagating characteristics of the cables at CPSES, and

5) Use of one-hour-rated fire barriers around raceways and the presence of fire suppression systems

<u>Associated Circuits Causing Spurious Operation</u>

Circuits associated by spurious operation are those that can cause safe shutdown equipment or nonsafe shutdown equipment to maloperate, by fire-induced failures, in a way that defeats the function of safe shutdown systems or equipment. Examples include the uncontrolled opening or closing of valves due to fire-induced damage to control circuit cables, or fire-induced damage to instrument or control circuits that may affect the safeguard circuit interlocks associated with these components (e.g., containment isolation logic).

There are two types of components whose spurious operation could affect safe shutdown. These components can be defined as:

1) Components whose spurious operation (fire-induced) may cause a breach in the reactor coolant system boundary at high/low pressure interfaces (i.e., result in a loss of reactor coolant inventory) or cause an uncontrolled and undesirable depressurization of the steam generators

2) Components whose spurious operation (fire-induced) may have a detrimental impact on safe shutdown capability by negating the operation of a safe shutdown system

The identification of potential spurious operation of the first type is based on an evaluation of CPSES flow diagrams and I&C logic diagrams for the applicable plant systems. This evaluation consists of the identification of high/low pressure interfaces and potential paths for reactor coolant or steam generator inventory loss. The flow paths identified are those that are isolated by electro-mechanical or electro-pneumatic components. Potential flow paths that are isolated by local hand-operated valves, check valves, or relief valves are not considered for spurious operations.

Spurious operations of the second category are addressed by the methodology followed in the identification of safe shutdown cables.

Should spurious actions affecting designated safe shutdown equipment occur, such actions will

be terminated and/or corrected by one of the following operator actions:

1) Use of equipment assigned to a redundant safety train to perform the required function

2) Use of a redundant component that is assigned to a different safety train to isolate or bypass the affected component

3) Removal of control power from equipment control circuits

4) Removal of motive power from the component and manual operation

5) Any combination of the above methods.

c. The present alternate shutdown design is capable of achieving cold shutdown conditions within 72 hours, and maintaining cold shutdown thereafter. Loss of offsite power is assumed.