

NRC PDR



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NUCLEAR REGULATORY COMMISSION
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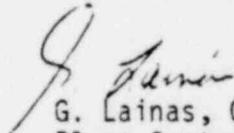
AUG 28 1979

MEMORANDUM FOR: R. Reid, Chief, Operating Reactors Branch #4, DOR
FROM: G. Lainas, Chief, Plant Systems Branch, DOR
SUBJECT: FIRE PROTECTION REVIEW - FORT CALHOUN

Facility: Fort Calhoun Nuclear Power
Station, Unit 1
Docket No.: 50-285
Licensee: Omaha Public Power District
Responsible Branch: ORB#4
Project Manager: P. Erickson
Reviewing Branch: Plant Systems Branch
Status of Review: SER Issued; Evaluation
of Incomplete Items is Ongoing

Our evaluation of the licensee's submittals listed in Enclosure 1 is complete. The results of our evaluation are attached (Enclosure 2). The licensee should be requested to provide additional information as identified in Enclosure 2 and 3 so that evaluation of Item 3.1.21 can be completed.

Current status of the SER supplement items is summarized in Enclosure 1.


G. Lainas, Chief
Plant Systems Branch
Division of Operating Reactors

Enclosures:
As stated

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cc w/enclosures:
See next page

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ENCLOSURE 1

Ft. Calhoun Fire Protection - SER Supplement

List of Submittals and Associated Issues

<u>SER Section</u>	<u>Subject Issue</u>	<u>Date of Submittal</u>
3.1.4	F.O. Tank for Diesel Fire Pump	2/23/79, 5/23/79
3.1.12	Fire Detectors	12/5/78
3.1.20	Cable Penetration Seals	10/18/79, 7/11/79
3.1.21	Alternate Shutdown Capability	9/10/78, 6/29/79
3.2.1	Rupture of Fire Water Piping	6/29/79
3.2.2	Testing/Study of Fire Detectors	10/18/78, 1/8/79
3.2.3	RC Pump Lube Oil Collection System	6/6/79
3.2.4&3.1.15	Cable Separation	9/29/79

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FT. CALHOUN FIRE PROTECTION
 REVIEW OF DESIGN INFORMATION
 STATUS

<u>ITEM</u>	<u>STATUS</u>
3.1.4 Fuel Tank for Diesel Fire Pump	Accepted
3.1.12 Fire Detectors	Accepted
3.1.15 Cable Separation	Incomplete
3.1.16 Fire Water Supply	I (11/79)
3.1.20 Cable Penetration Seals	Accepted
3.1.21 Alternate Shutdown Capability	I (9/79)
3.1.28 Enclosure of Stairway; Protection of Open Hatch	I (10/79)

RESOLUTION OF INCOMPLETE ITEMS

STATUS

3.2.1 Rupture of Fire Water Piping	I (11/79)
3.2.2 Testing/Study of Fire Detectors	Incomplete
3.2.3 Reactor Coolant Pump Lube Oil Collection System	Accepted
3.2.4 Cable Separation	Incomplete

KEY:

<u>TERM</u>	<u>MEANING</u>
Accepted	We have accepted the licensee's response.
Incomplete	We have not completed our evaluation of the licensee's response.
I - Date	We have completed our evaluation of the licensee's response and require additional information or licensee has not yet submitted information.
P - Date	We have completed our evaluation of the licensee's response and require additional modifications.

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ENCLOSURE 2FT. CALHOUN FIRE PROTECTION-SER SUPPLEMENTEVALUATION OF SUPPLEMENT ITEMS3.1.4 Fuel Tank for Diesel Driven Fire Pump

Our SER Section 3.1.4 indicated that a modification will be made to prevent structural steel framing in the vicinity of the fuel storage tank, supplying the diesel engine - driven fire water pump, from being damaged by a fire at the tank.

By letter dated August 23, 1978, the licensee proposed to provide a reinforced concrete block enclosure around the diesel fuel tank, and fill the space between the tank and the enclosure walls with sand and/or limestone.

The proposed modification effectively, buries the tank and eliminated it as a possible fire hazard. However, the proposed arrangement of liquid level indicator and drain line does not sufficiently eliminate the possibility of a diesel fuel leak which could present a fire hazard to the intake structure and the staff recommended the following modifications or equivalent alternatives be incorporated:

- (1) The drain line should be terminated above the enclosure without penetrating the enclosure wall.
- (2) The existing "glass sight" level indicator on top of the tank should be used instead of the proposed level indicator.

Subsequently, in the letter dated May 23, 1979, the licensee provided a revised plan which includes concrete wing walls to protect the drain line and the sight glass.

We accept the revised plan of modification.

3.1.12 Fire Detectors

Our SER section 3.1.12 indicated that the license will install fire detectors in the two safety injection and containment spray pump rooms on elevation 971' of the auxiliary building.

The licensee's December 15, 1978 Fire Detector Analysis shows the approximate locations of the three ionization type smoke detectors which will be installed in each of these rooms. Based on a review of the information submitted, the proposed modifications appear to be satisfactory with one exception. The detectors to be installed in safety injection and containment spray pump area #2 (Fire Area 2) are shown on drawing #13007-SK-3 to be upstream of a cable tray in the room. Because of the air flow in this room, a fire in these cables might not be readily detected by these detectors. Unless there are additional considerations which are not included in the licensee's analysis, a better location for the two detectors between column line 6e and 8a would be west of the cable tray shown on the drawing.

Subsequently, in the submittal dated July 9, 1979, the licensee indicated that the cable tray of concern contains two (2) non-safety control cables as compared to the one on the east side of the room that contains twenty-eight

control cables (of which twenty-four are safety-related) and six power cables (of which four are safety-related). The selected locations of detectors are above the safety injection pumps where the exposure fire hazard is greatest. Therefore, it is concluded that the selected detector locations are optimum for the fire hazards in the room.

We agree with the licensee's contention and accept the proposed modification.

3.1.20 Cable Penetration Seals

Our SER Section 3.1.20 indicated that the licensee will upgrade the electrical cable penetration seals to a design demonstrated by test to have a 3-hour fire resistance rating.

The licensee's letter dated October 18, 1978 described modifications to achieve the 3-hour fire rating and indicated that the penetration seals being installed have passed tests conducted generally in agreement with the methods and criteria described in the NRC August 30, 1977 letter to the Omaha Public Power District, except there is no indication that a pressure differential was applied across the seals during the test.

Subsequently, the licensee indicated in his letter, dated July 11, 1979, that Chemtrol Corporation, to whose installation procedures Fort Calhoun cable penetration seals have been installed, acknowledged that a test was successfully conducted with a positive pressure of 9.0 inches of water maintained on a 5,885 square inch penetration over a duration of the three-hour fire test.

Because the largest penetration in the plant is 1,924 square inches and because the maximum differential pressure expected is approximately 0.5 inches of water, we find the proposed modification for cable penetration seals acceptable.

3.1.21 Alternate Shutdown Capability

Our SER Section 3.1.21 and Table 3.1 indicated that the licensee will complete the design for the alternate shutdown system independent of cabling in the cable spreading room or the control room and submit the design details for the staff's review.

The licensee's submittal dated June 29, 1979 provided the conceptual design of such system. Equipment to be used to shutdown the plant under the postulated fire emergency were discussed and the anticipated sequence of events was outlined.

We have reviewed the information contained in this submittal. The design does not meet all requirements of the staff position and the information provided lacks the design information which are deemed essential to completing our evaluation. The licensee is requested to meet all requirements of the staff position and provide additional information to supplementing these already submitted, so that all the information identified in Section 8 of Enclosure 3 is available to the staff.

3.2.1 Rupture of Fire Water Piping

Our SER Section 3.2.1 indicated that the effect on safety related equipment of rupture of the fire water piping, to be installed, will be analyzed and the results submitted for our review.

By his letter, dated June 29, 1979, the licensee provided a submittal describing the method and assumptions to be used for such analysis and indicated that the results of such analysis will be submitted in November 1979.

We have reviewed the submittal and found the proposed method in compliance with the guidelines provided in Branch Technical Position APCS 3-1. The proposed method is, therefore, acceptable. We will evaluate the results of the analysis when they become available.

3.2.2 Testing/Study of Fire Detectors

Our SER Section 3.2.2 indicated that the licensee will provide the basis and criteria for the location and testing of fire detectors in the plant.

The licensee's January 8, 1979 submittal included a Fire Detector Analysis which outlined the basis for location, spacing, and number of fire detectors in plant Fire Areas 1 - 43. In addition, the Fire Detector Analysis provided descriptions and drawings of all affected plant areas.

The ceilings of 19 designated fire areas which contain safety related equipment are not smooth; that is, they are supported by beams of various depths and spacings. The presence of beams under the ceiling between a detector and the vertical axis of a fire can have a profound effect on the movement of heat and smoke to the detector. NFPA 72E recognizes this by requiring reduced cross-beam spacing of detectors when beam depths are greater than 8 inches, and the beams are more than 8 feet on centers, each bay is to be treated as a separate area requiring at least one detector. The criteria used in the licensee's Fire Detector Analysis are generally more liberal than those in NFPA 72E and will probably result in delayed detection of fires relative to that achievable by compliance with NFPA 72E.

In addition, a recently published report of a study on the effects of beam depth and spacing on fire detectors - Phase II: "Effect of Ceiling Configuration", National Bureau of Standards, Washington, D.C.) concludes that the cross-beam spacing of detectors should be considerably reduced from the smooth ceiling spacing (even more than recommended in the NFPA 72E). The effect is less pronounced at higher than normal ceiling heights, but still significant. Because of the test configuration, the results pertain mainly to large, unobstructed beamed ceilings and may be overly conservative for many situations. On the other hand, the results are based on detection when the fire has grown to a heat output of 1,000 Btu per second. A fire this size produces flames 10 to 15 feet high. Detection before the fire is this large may be desirable, in which case reducing the desired fire size at detection and detecting the fire in an other-than-large area may be somewhat compensating factors.

For areas in which only one division of safety related equipment is located, a small delay in fire detection is probably tolerable, although not desirable. However, detection in areas containing redundant divisions of safety related equipment or cables should be prompt relative to the rate of fire spread. Upon completion of the modifications described in the SER, such areas will include:

- . Fire Areas 6 and 20, personnel corridor areas
- . Fire Area 10, charging pump area
- . Fire Area 32, compressor area
- . Fire Area 30, containment
- . Fire Area 31, intake structure
- . Fire Area 41, cable spreading room
- . Fire Area 42, control room complex

The licensee will provide alternate safe shut-down capability independent of Fire Areas 41 and 42. Fire Areas 10 and 31 have essentially smooth ceilings, and the detector location and spacing are satisfactory, except that the detectors proposed for the operating level of the intake structure do not appear to be located well with respect to fire locations and air flows. These should be reviewed by the licensee and revised as necessary.

The Fire Detector Analysis calculations for Fire Area 30, containment building, are in error for at least one floor elevation. On floor elevation 1045', the floor area is given as 2,430 square feet, and this figure is used to determine the required number of detectors and their spacing. The required area is actually that of the ceiling. The type, number, and

location of detectors above the operating level of the containment should be determined on the basis of ceiling area and height, and possible stratification effects close to the ceiling, in addition to factors previously considered in the analysis.

Also, heat and smoke will tend not to collect under open metal grating floors, but pass right through. Unless a heat or smoke detector was directly in the fire plume, it would probably not detect a fire under these circumstances. This should be considered in a reevaluation of the other areas in the containment.

Fire Area 32, the compressor area, contains redundant auxiliary feedwater pumps. The licensee will install a barrier between these pumps, and additional detectors in the area of the pumps. This combination should be effective in preserving at least one pump in event of fire.

Fire Areas 6 and 20, personnel corridor areas joined by an open stairway, contained divisions of cable redundant to each other. The proposed detector installation appears satisfactory for the intended purpose.

Our evaluation of the licensee's January 8, 1979 submittal as discussed above were telecopied earlier to the licensee. The licensee has addressed these concerns subsequently in his submittal dated July 9, 1979. We are currently evaluating this additional information.

3.2.3 RC Pump Oil Collection System

Our SER Section 3.2.3 indicated that the licensee will provide one of the following:

- (1) A lube oil collection system to contain lube oil leakage and to drain leaked oil to a safe place.
- (2) A fire suppression system to control a lube oil fire and to protect the reactor components from that fire.
- (3) The results of a study demonstrating that safe shutdown will not be impaired in the event of an unmitigated reactor coolant pump lube oil fire.

In his letter of June 6, 1979, the licensee proposed to install lube oil collection systems and provided the design description and drawings for the proposed systems.

We have reviewed the submitted information and find it acceptable.

3.1 15 and

3.2.4 Cable Separation

Our SER Sections 3.1.15 and 3.2.4 indicated that the licensee agreed to:

- (1) Apply flame retardant coatings in areas where redundant trains of safety related cables do not meet separation requirements or where non-safety related cables are interposed between redundant safety related divisions of cables.

- (2) Describe the minimum separation between redundant cables and proposed modifications to preserve the safe shut-down capability of the plant, including the presence of interposing combustibles.

The licensee's September 29, 1978 submittal provides a discussion of the results of a cable separation analysis and proposed various modifications for areas where the licensee believes cable separation is not adequate.

It is assumed that cable separation in an individual fire area is adequate:

- (1) If only one division of safety related cables is present, or
- (2) If there are alternate methods, (including manual operation of valves) of performing the same safe shut-down operations for which the affected cables exist.

These assumptions are acceptable and subject to the verification that valves which have to be manually operated are in areas unaffected by the postulated fire.

There are eight fire areas which do not fall into one of the above situations. The licensee will provide an alternate shut-down capability independent of two of these (Fire Areas 41 and 42, cable spreading room and control room complex), and install a three hour rated fire barrier between redundant equipment in Fire Area 36 (switch gear area). In five other fire areas, the licensee proposes to reroute or protect the cables against fire. The information which we have is not sufficient to conclude that the proposed

modifications are necessarily adequate for the intended purpose, although the concept is. Additional information is needed to complete the evaluation.

In response to the staff's comments discussed above, the licensee submitted on July 9, 1979 a revision to his cable separation analysis which includes several drawings. The staff is currently evaluating these additional information.

ENCLOSURE 3FT. CALHOUN FIRE PROTECTION - SER SUPPLEMENTSTAFF POSITIONSAFE SHUTDOWN CAPABILITYStaff 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.

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- 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) 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 powered by an onsite emergency power system; those used after 72 hours may be powered by 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 Systems 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 Standby(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) Verification 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 signal transfer switch or other new device should not be a source for a single failure to cause loss of redundant safety systems.)
- (d) Verification 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) Verification 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) Verification 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 reviewed by the staff.

- (g) Verification 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) Verification 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) Verification 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 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) Verification 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.

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