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

Enclosure

Safety Evaluation Report

Fire Protection Safety Evaluation Report - FSAR Amendment No. 37

Washington Nuclear Project Number 2 (WNP-2)

Docket No. 50-397

1.0 INTRODUCTION

In support of obtaining an operating license, the licensee (Washington Public Power Supply System) submitted Appendix F to the WNP-2 FSAR which provided an analysis of the protection of the plant in the event of a fire. The licensee's commitment to meeting the guidelines of Appendix A to BTP APCSB 9.5-1 and the requirements of 10 CFR Part 50, Appendix R, was contained in FSAR Appendix F. This appendix was reviewed by the staff and the results were documented in the Safety Evaluation Report (SER) dated March 1983 (NUREG-0892). The review identified that the Reactor Core Isolation Cooling (RCIC) system was to be used to achieve hot shutdown conditions in the event of a fire in the control room. Subsequent to the issuance of the SER, the licensee amended the FSAR (Amendment 19) and modified their approach to post-fire safe shutdown. The modifications called for using the Automatic Depressurization System (ADS) rather than the RCIC system to achieve hot shutdown conditions in the event a fire requiring the abandonment of the control room.

In supplement No. 4 to the SER the staff completed its review of the WNP-2 fire protection program as defined thru Amendment 19, in accordance with the guidelines of BTP CMEB 9.5-1, and the requirements of Appendix R.

In August 1986, the licensee submitted Amendment 37 to the FSAR which was intended to bring the FSAR into conformance with the as-built-condition of the plant and to correct previously identified errors in the FSAR. This SER addresses the acceptability of Amendment 37, and amends the staff's previous evaluation of the WNP-2 Fire Protection Program as contained in the original SER and supplements. This SER does not address the aspects of the February 10, 1987 submittal relating to the licensee's request for a modifications to the WNP-2 License Condition 2.C.(14), plant Technical Specifications, or the provisions of Generic Letter 86-10. These issues will be evaluated in a subsequent safety evaluation.

2.0 EVALUATION

2.1 Fire Hazards Analysis

The staff previously evaluated the licensee's fire hazards analyses for individual fire areas and accepted the level of fire protection provided. However, in Amendment No. 37, the licensee identified significant quantities of additional combustible materials in the Turbine Generator Building fire area TG-1 and General Equipment Area R-1. The licensee should describe how the hazards associated with these materials have been considered in the fire protection program.

2.2 Building Design

In the SER and supplements, the staff evaluated the licensee's use of fire-related wraps to protect safe shutdown related cables. In Amendment No. 37, the licensee indicated that in areas protected by an automatic sprinkler system, the supports for racesways will not be protected by wraps. The staff was originally concerned that a fire could cause these supports to fail, resulting in damage to the protected raceways. However, the sprinkler system would operate in a fire and limit room temperature rise and protect the steel such that failure of the raceway supports should not occur. The staff concludes, therefore, that unprotected supports for raceways which have been wrapped in areas protected by an automatic fire suppression system are an acceptable deviation from Sections C.5.a. and C.5.b of BTP CMEB 9.5-1.

In Amendment No. 37, the licensee revised the description of the fire protection for penetrations of fire barriers. However, the licensee has not described how bus duct penetrations of fire barriers are protected. This issue is considered open pending receipt of this information.

In November, 1984, the staff received a 10 CFR Part 21 notification from Ruskin, manufacturer and distributor of fire damper, which indicated that under certain airflow conditions, fire dampers would not close completely. The licensee should provide a response which indicates how they have responded to this issue any additional testing and appropriate modifications which were required.

2.3 Protection of Safe Shutdown System

In the SER and supplements, the staff evaluated the methods used to protect safe shutdown systems from fire damage. In Amendment 37, the licensee stated that protection for stainless steel instrument and sensing lines is not necessary because the areas through which these lines pass have an average fire loading less than one-half hour. This justification is inadequate because it ignores locations within the area where concentrated combustibles may exist which could produce a fire of significant intensity so as to damage the lines. The licensee should either more fully justify the existing level of protection for these lines or provide additional fire protection in accordance with Section C.5.b. of BTP CMEB 9.5-1. This issue remains open.

In Amendment 37, the licensee described the gap between the primary containment vessel and biological shield wall. However, this description did not include a discussion of the separation and protection of safe shutdown systems that pass through the gap. The licensee should identify any safe shutdown systems within the gap and justify the level of fire protection provided.

The licensee identified previously unprotected Division 2 safe shutdown instrument racks within the general equipment fire area R-1. The licensee has enclosed these racks in a 1-hour fire-rated barrier. Fire mitigation features include a fire detection system and manual fire fighting equipment. The fire loading has been calculated to be about 26,000 BTUs/sq. ft., which equates to a fire severity

of about 20 minutes on the ASTM E-119 time temperature curve. On the basis of this fire loading and the existing manual fire mitigation the staff considers the protection for the instrument racks to be acceptable.

2.4 Fire Protection Water Supply

In the SER and supplements, the staff accepted the use of electric tamper switches and locks to supervise open water supply system control valves. In Amendment No. 37, the licensee proposed to seal open certain control valves. In order to conform with the guidelines in NFPA Standards Numbered 13, 14 and 20, the sealed valves should be inspected on a weekly basis. The licensee should provide a description of the proposed inspection program for sealed valves to verify conformance with the NFPA code.

2.5 Sprinkler and Standpipe Systems

Previously, the staff evaluated and approved the proposed automatic and manual sprinkler systems in the plant. In Amendment No. 37, the licensee identified additional locations which have been protected by sprinkler systems. These systems have been installed to satisfy staff guidelines and are, therefore, acceptable.

In the SER and supplements, the staff evaluated the design of the standpipe system and manual hose stations. In Amendment No. 37, the licensee indicated that hose stations have been modified to provide standpipe outlets with hose connections equipped with a maximum of 100 feet of 1.5 inch fire hose in

safety-related areas. This conforms with Section C.6.c. of BTP CMEB 9.5-1 and is, therefore, acceptable.

2.6 Halon Suppression System

Previously, the staff evaluated the design, installation, maintenance, and testing of the halon fire suppression system. In Amendment No. 37, the licensee changed the description of the method used to assure an adequate quantity of halon stored on site. The licensee should provide a complete description of the methods used to verify the quantity of halon stored to assure that the previous staff approval remains valid.

2.7 Cable Separation Criteria

In previous amendments to the FSAR, the licensee committed to separate safety-related cables in accordance with the criteria delineated in Regulatory Guide 1.75. In Amendment No. 37, the licensee removed this commitment. The licensee should justify this change.

2.8 Emergency Lighting

The licensee committed to meet the requirements of Appendix R prior to receiving a plant operating license. Amendment 37 to the FSAR states that the design of the facility is in compliance with the guidelines for emergency lighting. The specific guidelines are found in Branch Technical Position CMEB 9.5-1, paragraph C.5.g, which specifies the need for individual 8-hour minimum battery powered lights for all areas required for safe shutdown and for ingress and egress to those areas. As identified to the licensee during

the August

1986 and the January 1987 plant inspections, the design of the facility does not comply with the above criteria. The licensee acknowledged their lack of compliance and has adequately addressed the concern for emergency lighting in the specific areas identified by the staff. The staff will confirm in an inspection that manned areas and ingress and egress routes have adequate lighting in accordance with safety guidelines.

2.9 Terminology

In Amendment 37 to the FSAR, the licensee has provided a list of definitions and acronyms. The definitions and acronyms used are, with the one exception discussed below, consistent with the standard fire protection terminology and are compatible with the staff acceptance criteria. The only exception is the designations of the remote and alternate remote shutdown panels. The remote shutdown panels are installed to be used in the event of a control room fire, i.e., to comply with the criteria of Appendix R to 10 CFR Part 50. The alternate remote shutdown panels are installed in order to comply with the requirements of General Design Criterion 19 of Appendix A to 10 CFR Part 50. Although this terminology is the reverse of that found at other plants, it is acceptable. It should be noted, however, that with the exception of the need for the use of the three SRVs at the remote shutdown panel and the three ADS valves at the alternate remote shutdown panel, the plant can be safely shut down at either panel in the event of a control room evacuation provided no circuits are damaged by the fire.

3.0 POST-FIRE SHUTDOWN CAPABILITY

3.1 Systems Required For Safe Shutdown

In the event of a fire, shutdown (scram) of the reactor is initiated either automatically by the reactor protection system in the event of a loss of off-site power, or manually from the control room. No high pressure systems (HPCS, RCIC) are relied on to provide makeup water to the reactor vessel for post-fire safe shutdown. In the event of a fire, other than in the control room, seven Automatic Depressurization System (ADS) valves are opened to reduce the reactor pressure. Once the reactor pressure is sufficiently reduced, one train of the Residual Heat Removal (RHR) system is initiated in the Low Pressure Coolant Injection (LPCI) mode of operation to inject water from the suppression pool into the reactor vessel in order to maintain an adequate reactor coolant inventory. The licensee has performed an analysis which demonstrates that with the use of six or more ADS valves and timely initiation of LPCI, an adequate inventory of reactor coolant would be maintained such that no fuel degradation would be expected. Decay heat removal would be accomplished by using the RHR system in conjunction with the ADS and the Standby Service Water (SSW) system. Both the diesel generator, which is used for achieving safe shutdown in the event of a loss of offsite power concurrent with a fire event in the plant, and the supporting HVAC systems are cooled by the SSW system.

The licensee considered the plant to be divided into two fire divisions, depending on which diesel generator was providing the power for the equipment or routing of the cabling. Fire areas which contained equipment or cables

which were related to the Division 2 power supply (the Division 2 diesel generator) were identified as Division 2 fire areas. Similarly, those fire areas which were related to the Division 1 power supply were identified as Division 1 fire areas. Any Division 2 cable or equipment in a Division 1 fire area was either protected, relocated, or evaluated to provide assurance that the failure of the equipment or cable would not prevent the plant from safely shutting down. Thus, for a fire in any fire area (except the control room), the fire would affect only one division and the redundant division's components would be available and controlled from the control room. However, the licensee has not provided any details as to how the seven ADS valves are protected from the effects of fires in all fire areas, excluding the main control room. Since there are only seven ADS valves, a fire in one or more individual fire areas could potentially reduce the number of ADS valves available in the control room to less than seven and thereby invalidate the information provided in the FSAR. Lacking such information and pending an acceptable review, this remains as an open item in the staff's evaluation.

The reactor containment (Fire Area R-II) is normally inerted during power operation and therefore no fires are considered inside containment.

3.2 Areas Where Alternate Safe Shutdown is Required

The licensee examined the need for alternate safe shutdown of the facility for a fire in any of the 61 fire areas. Based on the examination, the licensee has concluded that a fire in any fire area will not require an alternate safe shutdown capability, except for the main control room (Fire Area RC-X).

3.3 Alternative Safe Shutdown System

3.3.1 Minimum Safe Shutdown System

The alternative safe shutdown capability utilizes existing systems and equipment as identified in Section 3.1 of this SER with some plant modifications which have not been completed at this time. When the modifications are completed, the licensee will have adequate equipment, instrumentation, and controls to ensure the availability of the minimum safe shutdown system (SSDS) capability for a fire (fire concurrent with a loss of offsite power) in any plant fire area for achieving cold shutdown within 72 hours. For all fire areas except Fire Area RC-X (Control Room), safe shutdown will be achieved by operator actions within the control room. Additionally, for a fire in the cable spreading room (Fire Area RC-II, redundant trains in the cable spreading room will be utilized for operating the redundant division for performing the safe shutdown.

The minimum SSDS includes the reactor protection and control rod drive (CRD) systems for performing the scram function, the ADS for providing the reduction in the reactor system pressure, the RHR system in the LPCI mode of operation for reactor water inventory control, the SSW system to provide cooling for the RHR heat exchanger and for cooling the diesel generator, and a diesel generator for motive power for the pumps.

Main Steam System

The licensee stated in Amendment 37 to the FSAR that seven ADS valves provide the basis for the shutdown scheme used to meet the criteria of 10 CFR Part 50, Appendix R, Section III.G for all fire areas, except the main control room. In the case of a fire in the main control room, six Safety Relief Valves (SRVs) are required, three SRVs on the remote shutdown panel (Division 2) and three ADS valves on the alternate remote shutdown panel (Division 1).

RHR System

One RHR pump in the LPCI mode of operation is required to maintain the reactor coolant water inventory after the ADS/SRVs have reduced reactor pressure below the RHR system design pressure. The RHR pump in conjunction with its related heat exchanger will be used for decay heat removal once the reactor water level and pressure has been stabilized. There is one RHR pump and heat exchanger available on the remote shutdown panel (Division 2) and one set on the alternate remote shutdown panel (Division 1). From the control room, the RHR system which will be used will be based on where the fire is located.

Standby Service Water System

One standby service water system (SSWS) pump, spray pond, and related piping, valves, and instrumentation is required for cooling the diesel generator, the RHR heat exchanger, and the HVAC systems. There are two divisions of SSWS and the specific loop of SSWS that will be used is based on where the fire is. The Division 2 SSWS is controlled from the remote shutdown panel and the Division 1

SSWS is controlled from the alternate remote shutdown panel. Both divisions can be controlled from the control room.

3.3.2 Auxiliary Systems For Minimum SSDS

The auxiliary supporting systems for the minimum SSDS include the 1) HVAC systems for the control areas and the SSDS equipment areas, 2) the Division 1 and Division 2 DC power systems, 3) diesel generator support systems, 4) Main Steam Isolation Valves, and 5) instrumentation and controls. These systems provide the following support functions:

1. Supply onsite AC power when needed to the RHR system, the SSWS, HVAC systems, and the DC battery chargers.

2. Supply DC power for the instrumentation and controls and the ADS/SRVs.

3. Supply cooling water to the diesel generator.

4. Ensure long term operation of the diesel generator.

5. Ensure long term operation of the RHR system and cooling to the reactor.

The staff concludes that the above systems are adequate. However, the licensee should clarify how the Division 1 Battery Supply, including cabinets E-B1-1, E-DP-S1/1, E-DP-S1/1F, E-IN-3, E-PP-7A, and E-PP-7A-F, and cables 1D11-11, 1D11-1, 1D11-4, 1D11-7, 1P7A-7 and 1P7A-4 are protected from the effects of

fires in all Division 1 fire areas. Lacking this information and pending an acceptable review, this remains as an open item in the staff's evaluation.

3.3.3 Manual Operations

For a fire in any fire area other than in the control room (Fire Area RC-X), the licensee will require no manual actions outside of the control room. All manual actions to be taken inside of the control room are expected to be capable of being performed by the operators in sufficient time to prevent any core degradation. Page F.4-10 of Amendment 37 to the FSAR states that "In the event of a Main Control Room evacuation the Operator is required by procedure to perform the following actions:

a. Scram the Reactor
b. Close Main Steam Isolation Valves
c. Trip the Main Generator
d. Trip RCC pumps to LFMG
e. Operate transfer switches (H22-P-100, C61A-P001, E-CP-ARS, FRTS, SM-8 and DG-2 Control Panel)

(Actions b, c, d are desirable but not necessary to affect control room evacuation and subsequent safe shutdown.)"

Based on the above, we conclude that the first and only action REQUIRED to be performed by the operator inside of and before leaving the control room is to manually scram the reactor. The control room evacuation procedure (Procedure Number 4.12.1.1, Revision 8, dated October 27, 1986, page 1 of 35) states that

states that the first and only operator action to be taken inside of and before leaving the control room is to close all MSIVs. While the information provided in the FSAR is in conformance with the NRC requirements and guidelines, the control room evacuation procedure is not (i.e., close MSIVs not reactor scram). The licensee should submit a revised control room evacuation procedure which conforms to the staff's guidelines. Lacking this revised evacuation procedure and pending an acceptable review, this remains as an open item in the staff's evaluation.

Given that the manual action inside of the control room is to scram the reactor, the operator evacuates the control room and must take the following actions outside of the control room:

1. Transfer control away from the control room and to the remote shutdown panels at the remote shutdown panels - immediately.

2. Open all six ADS/SRVs (three at the remote shutdown panel and three at the alternate remote shutdown panel) - less than 10 minutes.

3. Start SSWS pump to provide cooling to the diesel generator - less than 5 minutes if the diesel generator started concurrently with the reactor scram.

4. Initiate the RHR system in LPCI mode for injection of suppression pool water into the reactor vessel - as soon as reactor pressure is reduced below the RHR system design operating pressure.

The controls and instrumentation for the RCIC system are also located on the remote shutdown panel even though the RCIC system has not been protected from the effects of a fire. If this system is available, the operators may use this system to assist in maintaining reactor vessel water inventory. The use of this system will reduce the water level drop within the reactor vessel but no credit has been given for this potential benefit by the licensee in their analysis nor by the staff in the evaluation of the licensee's fire protection program. This capability is mentioned only for completeness.

3.3.4 Modifications

Since the original licensing of WNP-2, the licensee has made many modifications to the facility with respect to fire protection. These modifications have included such items as the re-routing of cables, installation of fire-rated cable wraps, the installation of the alternate remote shutdown panel, and the relocation of the remotely controlled ADS valves from the remote shutdown panel to the alternate remote shutdown panel. Based on the site inspections in August 1986 and January 1987, additional modifications were discussed. These include upgrading the emergency lighting, providing transfer switches for the SM-8 cabinets (the Division 2 diesel generator switchgear cabinets), potential installation or relocation of fire detectors, and prevention of LOCAs at high/low pressure interfaces. The licensee indicated during the January 1987 site inspection that these modifications would be completed prior to startup following the first refueling outage, except for those needed to prevent LOCAs. (The prevention of LOCAs is discussed in Section 3.4.14.3 of this SER.) These modifications will enhance the operation of the SSDS and will provide assurance that a fire can be

detected in time to ensure a safe shutdown of the facility. Furthermore, these modifications will bring the facility into compliance with the commitments made at the time the plant was originally licensed.

Amendment 37 to the FSAR states that the "transfer switches have been provided in the Remote Shutdown Room and in the switchgear rooms (which are adjacent rooms) for Appendix R Safe Shutdown equipment to override effects of a Main Control Room fire." On the basis that the installation of the SM-8 transfer switches during power operation would jeopardize the safe operation of tne plant, we conclude that the quoted FSAR statement is before the fact. Thus the licensee should submit a letter specifying on what date these transfer switches were installed, tested and declared operational. Lacking this information, this remains as an open item in the staff's evaluation.

When the licensee relocated control of the ADS valves from the remote shutdown panel to the alternate remote shutdown panel, the licensee installed three SRVs on the remote shutdown panel. The cables for these three valves are located in the control room such that a fire in the control room could prevent the operation of the three SRVs from outside of the control room. During the January 1987 plant inspection, the inspection team observed the protection that the licensee had afforded these cables. The licensee admitted that the protection, as of the inspection, was inadequate and did not meet the requirements of Title 10 CFR Part 50, Appendix R, Section III.6, and that further evaluation was being performed. The licensee should provide the final fire protection details for these SRV cables which demonstrate compliance with the regulations. Without this

information and pending an acceptable review, this remains as an open item in the staff's evaluation.

Contrary to License Condition 2.C.(14) and the guidelines of Generic Letter 86-10, the licensee has performed a Title 10 CFR Part 50.59 safety evaluation for all of the fire protection modifications performed by the licensee and concluded that the licensee did not need staff approval and that the modifications do not introduce any unreviewed safety issues.

It is not clear what, if any, testing will be undertaken to ensure that systems and components required for shutdown for fires will function properly. Furthermore, if modifications are made to remote shutdown facilities provided for purposes other than fires, it is not clear what testing will be undertaken.

Based on the staff's review of the above modifications, with the exception of 1) the documentation relating to the SM-8 transfer switches, 2) fire protection details for the SRVs, and 3) the testing concern, the staff concludes that the modifications are acceptable.

3.3.5 Reactivity Control

Reactivity control will be accomplished from an automatic reactor protection system logic scram, or by manually scramming the reactor from the control room. The physical components are the control rods which will be driven into the core by the control rod drive system by the reactor system pressure and the use of the accumulators.

3.3.6 Reactor Coolant Inventory

For a fire in any fire area, including the control room, an RHR pump will be used in the LPCI mode of operation to maintain reactor water inventory after the reactor has been depressurized by use of the seven ADS valves in the control room (or three ADS and three SRVs from outside of the control room). The above method has the potential for uncovering the upper portion of the core for a short period of time during the depressurization and, thus, does not meet the provisions of Title 10 CFR Part 50, Appendix R, Section III.L. These provisions require that the alternate shutdown capability be able to maintain 1) the reactor water level above the top of the core (III.L.2.b), and 2) the reactor process variables within those predicted for a loss of normal AC power (III.L.1). The staff has previously evaluated the licensee's proposed use of six ADS/SRVs as the alternate shutdown method, and has concluded that this method is acceptable provided that the uncovering time is short enough to preclude a threat to the fuel cladding integrity thus meeting the intent and the purpose of the Section III.L provisions mentioned here.

The licensee's analysis assumed manual depressurization with three ADS valves (on the alternate remote shutdown panel) and three SRVs (on the remote shutdown panel) within 10 minutes after the manual scram. After the reactor has been depressurized below the RHR shutoff head, the RHR pump will be able to restore the water level to normal. The minimum water level inside the shroud has been estimated by General Electric to occur 15 minutes into the event and to be approximately 4.1 feet below the top of the active fuel (i.e., one third of the core will be uncovered). The estimated total uncovery time is approximately 5.4 minutes with the fuel node having the highest calculated Peak Cladding

Temperature (PCT) estimated to be uncovered for 4.5 minutes. The PCT is calculated to be 762 degrees F and to occur approximately 19 minutes after initiation of the event. No fuel cladding damage is expected to occur at this low temperature. Based on General Electric's clad swelling and rupture model (R. H. Buchholz (GE) letter to D. D. Eisenhut (NRC), MEN 278-79, dated November 16, 1979; NUREG-0630, dated April 1980; H. Bernard (NRC) letter to G. G. Sherwood (GE), dated May 11, 1982) no fuel rod perforations are expected to occur below 1700 degrees F. Cladding expansion begins at a temperature which is approximately 200 degrees F lower than the perforation temperature (NEDO-20556, dated January 1976).

Based on the staff's review of the above, the staff concludes that the licensee's proposed method to maintain reactor coolant inventory and the exemptions from the applicable III.L provisions are acceptable.

Regarding the potential loss of coolant inventory via the main steam lines, the licensee states that this will be prevented immediately by closure of the MSIVs either due to operator action, normal isolation signal on low water level, loss of offsite power, or by closure of the turbine stop and control valves as the result of the tripping of the turbine generator on overspeed as the result of the loss of generator load.

3.3.7 Reactor Pressure Control

The reactor pressure control is provided by the seven ADS valves controlled from the control room or the three ADS valves and the three SRVs controlled from outside of the control room. Overpressure protection prior to depressurization is provided by the self actuating pressure mode of the SRVs. The staff finds this acceptable.

The licensee has identified that there will be six safety relief valves (SRVs) available in the event of a fire in the control room. However, the licensee has not clearly stated which SRVs will be used. The licensee should clearly specify the use of six ADS/SRVs as the minimum acceptable number of valves to be used and to specify which six ADS/SRVs by tag number.

3.3.8 Decay Heat Removal

The licensee does not intend to maintain hot shutdown conditions for a fire in any fire area but to proceed from power operation directly to cold shutdown conditions. For a fire in any fire area, the licensee intends to only use the minimum SSDS. Thus, the initial method of removing decay heat is via the release of steam through the SRVs, followed by release through the ADS/SRVs. Once the pressure is reduced below the RHR system shutoff head, the heat removal method will be by removing steam through the ADS/SRVs with make up by the RHR system until the steaming stops. After steaming has terminated, the RHR system will continue to fill the reactor vessel and eventually the water will flow through the steam lines and out of the ADS/SRVs to return to the suppression pool. The staff finds the proposed method of decay heat removal acceptable.

3.3.9 Process Monitoring

For the event of a control room fire, the licensee has provided instrumentation for direct indication of the following process variables:

1) RHR pump flow indication.

2) SSWS pump discharge pressure indication.

3) Suppression Pool water level indication.

4) Suppression Pool water temperature indication.

5) Reactor pressure indication.

6) Reactor water level indication.

The staff finds the licensee's process and diagnostic monitoring capability acceptable subject to the resolution of the following concern. The licensee should provide the ability through local instrumentation to obtain information on the SSWS pump flow rates and for applicable support systems, such as the HVAC systems. The staff has concluded that such diagnostic monitoring is essential to assure the availability of the minimum SSDS associated with the alternate shutdown capability. Without this instrumentation and pending an acceptable review, this remains as an open item in the staff's evaluation.

3.3.10 Support Functions

The auxiliary systems described in Section 3.3.2 and 3.3.9 of this SER provide the necessary support functions to the remote shutdown system. The staff finds them acceptable subject to the resolution of the concerns relating to the Division 1 power supply and the local instrumentation identified in the above sections.

3.3.11 72-Hour Shutdown Requirement

The licensee has indicated their intention to proceed immediately to cold shutdown conditions in the event of a fire in any plant area. The staff finds this approach is acceptable.

3.3.12 Repairs

At the time of the January 1987 plant inspection, the only repairs that were required by the control room evacuation procedure in order to achieve safe shutdown in the event of a fire in the control room were in the SM-8 cabinets. The licensee stated that transfer switches for the SM-8 cabinets will be installed prior to restart following the first refueling outage. Without verification of the completion of the installation of these transfer switches, this remains as an open item in the staff's evaluation.

3.3.13 Technical Specifications

The licensee has proposed no new Technical Specifications relating to fire protection.

3.3.14 Associated Circuits and Isolation

The licensee has examined the associated circuit concerns, such as common power source including high impedance faults, common enclosure, fire induced spurious operations (including high/low pressure interfaces), and electrical isolation deficiencies. The licensee has discussed all of these concerns in their Amendment 37 to the FSAR as summarized below.

3.3.14.1 Common Power Source and Common Enclosure

The plant is divided into two separate fire area designations, Division 1 or Division 2, based on the majority of the cables and equipment in the area. The components from the other division were considered to be the "intruding division." All intruding division equipment and circuits were evaluated to determine whether or not their failure would adversely affect the facilities ability to achieve a safe shutdown. If a safe shutdown could not be assured, the intruding components were either relocated or provided fire protection. This approach in conjunction with the licensee's ongoing breaker coordination program provides assurance that fire related effects on safe shutdown components will not adversely affect the facility's safe shutdown capability.

At the time of the January 1987 plant inspection, the licensee was in the process of performing a high impedance fault analysis of all of the plant loads to assure that no high impedance fault would result in the opening of a breaker which supplies power to safe shutdown equipment. The approach being taken by the licensee was reviewed at that time and found to be reasonable. The responsibility for verifying adequate completion of the licensee's high impedance fault analysis is the responsibility of Region V.

The cable spreading room (Fire Area RC-II) is the only fire area where Division 1 and Division 2 circuits are in the same fire area. One division has its related circuits in cable trays or conduits along a wall with the redundant

divisional circuits along the opposite wall. The two divisions are separated by a space of twenty feet. Additionally, there are circuits in trays and conduits along the two remaining walls, some of which are safe shutdown circuits. The licensee has applied a fire-rated cable wrap (thermolag) to these trays and conduits for the twenty feet between the Division 1 and the Division 2 circuits, so as to eliminate the "intervening combustibles." On the basis of the January 1987 plant inspection, we concluded that the use of the thermolag, while not providing a fire barrier, does eliminate the intervening combustibles. The licensee has installed sprinklers above the trays in both divisions in accordance with the NFPA guidelines. On the basis of the 20 foot separation, the elimination of the intervening combustibles and the installation of sprinklers, we find the cable spreading room common enclosure acceptable.

The staff finds the licensee's approach for handling common power source and common enclosure concerns acceptable.

3.3.14.2 Electrical Isolation

Regarding the electrical isolation deficiency (i.e., the repairs required in the SM-8 cabinets), the licensee stated that transfer switches will be provided and installed prior to startup following the first refueling outage. For the existing transfer switches, redundant fuses have been provided for the remote shutdown panel circuits which will consequently ensure power supply for local control of the needed equipment.

In Amendment No. 37, the licensee has assumed that circuit protective devices will be capable of isolating faults even if the protective device is in the

fire area (Reference page F, 4-7). While the staff would concur with this assumption for "downstream" faults, the licensee has not addressed the compensating measures taken against faults occurring "upstream" from the protective device. This issue remains open.

3.3.14.3 Spurious Operations

A fire in an area could, without proper design, impair the safe shutdown capability due to fire-induced spurious operation of safe shutdown equipment or components. Therefore, separation requirements (Appendix R item III.G.2) have been developed for redundant safe shutdown equipment, components, and associated cabling as far as practicable (e.g., not provided in the control room) to ensure the availability of the minimum SSDS. When proper separation is not possible, spurious operations are to be mitigated in a timely manner by corrective manual operations at local stations. This is made possible by providing manual control capability at the remote shutdown panels for minimum SSDS equipment and components. Following transfer of control from the control room to the remote shutdown panels, the minimum SSDS will be isolated from the fire affected area. The controls at the remote shutdown panels are maintained in their desired position for transfer and they are routinely verified to be in their correct position. Thus when transfer is effected, the equipment will automatically return to their appropriate state for effecting a safe shutdown. These spurious operations involve the RHR suppression pool suction valves, the RHR outboard injection valves, the RHR heat exchanger outlet valves, the SSWS discharge valves, the RHR pump, the SSWS pump, and the diesel generator and related support systems. The licensee has performed an analysis which demonstrates that, except as discussed below, for each potential spurious signal one of the following conditions will occur: 1) the signal will

result in adding water to the reactor vessel - this is a benefit which is relied upon; 2) the signal will cause water to drain from the reactor vessel and a) will be terminated from outside of the control room and b) will not prevent reflooding of the reactor vessel such as to degrade the fuel; and 3) the signal will do neither of the above and thus has no effect on the plant's safe shutdown capability.

One special category of spurious operations involves high/low pressure interfaces. The licensee has listed all such interfaces. The concern with the high/low pressure interfaces is that the components on the low pressure side of the valves are not designed for operation at the normal operating pressure of the reactor. Thus, if the valves were to open when the reactor is at pressure, the low pressure piping would rupture, the isolation valves may not be able to close, and the result would be an unisolatable LOCA outside of containment. Appendix R Section III.L.1 specifically states that "during the postfire shutdown, ...there shall be no fuel cladding damage, rupture of any primary coolant boundary, or rupture of the containment boundary." The high/low pressure interface valves of concern are associated with the RHR system, as follows:

1. RHR-V-8, RHR-V-9
2. RHR-V-52A, RHR-V-87A
3. RHR-V-52B, RHR-V-87B
4. RHR-V-53A, RHR-V-123A
5. RHR-V-53B, RHR-V-123B

The licensee stated in Amendment 37 to the FSAR that valves RHR-V-87A and 87B will be locked closed and that "during normal plant operation, power is removed

from valves RHR-V-8, V-123A and V-123B to assure that inadvertent opening will not occur." The position taken by the licensee, as stated in Amendment 37, is acceptable for all five pairs of valves. However, it is not clear that the licensee intends to meet the commitment as stated in the Amendment 37 for the RHR suction line isolation valves (RHR-V-8 and RHR-V-9). The licensee stated in a submittal dated July 16, 1986 (and re-affirmed in a submittal dated December 1, 1986) that they had no intention of removing power from RHR-V-8 or RHR-V-9 during normal plant operation nor to make any modifications to prohibit the creation of a LOCA through this line in the event of a fire in the control room. The licensee's apparent position in the two submittals is unacceptable. A fire in the control room with a spurious opening of these valves would create an unisolatable LOCA outside of containment, thus violating two of the three aforementioned Appendix R requirements. The consequences of this accident would be significant and could adversely affect the health and safety of the public. Furthermore, we are not aware of any plant that has not removed power from one of the RHR suction line isolation valves or has not located a pressure interlock outside of the control room. To our knowledge, preventing a LOCA through the RHR suction line by one of these options has not resulted in undue hardship upon any facility. The licensee should either commit to meet their commitment in the FSAR, as specified in Amendment 37, or provide an acceptable means of meeting the regulations as they relate to the prevention of LOCAs at the high/low pressure interface by the installation of a modification that would prevent the above LOCA.

Amendment 37 to the FSAR states on page F.4-11 that the inboard RHR suction line isolation valve (RHR-V-9) is a Division 1 powered valve. Page F.4-43 states that the RHR suction line isolation valve RHR-V-8 is a Division 1 powered valve.

in order to provide redundancy of the power to assure isolation, one of these valves should be powered from the Division 2 power supply. The licensee should clarify which valve is Division 2 powered or should specify what, if any, plant modifications are required to provide this redundancy of power.

Based on the above, the staff finds the licensee's proposed handling of the spurious operation concerns and the high/low pressure interface concerns numbered 2 through 5 above, acceptable. Without verification of the licensee's commitment to comply with their commitments as stated in Amendment 37 to the FSAR or the installation of an acceptable modification to prevent a LOCA outside of containment and the clarification as to the power supply for the RHR suction line isolation valves, this remains as an open item in the staff's evaluation. This issue should be resolved and all modifications completed prior to restart following the first refueling outage.

In Amendment No. 37, the licensee has assumed that three phase power feeders will not fail in such a manner as to reconnect to an adjacent three phase power feeder and cause an electrically isolated motor to operate. The staff concurs with this assumption except as it applies to high/low pressure interfaces. The licensee should confirm that this assumption has not been applied.

3.3.15 Safe Shutdown Procedures and Manpower

The licensee has informally provided the control room evacuation procedure (Number 4.12.1.1) for our review. The procedure directs the operator to proceed immediately to Attachment D of the procedure in the event the evacuation of the control room was due to a fire.

The licensee has stated in Amendment 37 to the FSAR that the fire protection program complies with the regulations with respect to the fire brigade. However, the licensee does not specifically state the minimum number of operators required to shut the facility down safely, whether these operators are part of the fire brigade, and the minimum number of personnel in the fire brigade.

The licensee states that the fire brigade is trained by conducting drills at least quarterly in order to familiarize personnel with their specific duties, plant layout, equipment location and operation, and to work as a team. Members of each shift crew are trained in fire protection. The training of the fire brigade is coordinated with the local fire department.

The licensee stated that the guidelines of "Regulatory Guide 1.39 will be used as a guide in procedure preparation." This implies that the licensee has not yet prepared appropriate administrative procedures to control the storage of combustible materials. The licensee should provide clarification as to when these procedures will be created and implemented in the plant.

Branch Technical Position CMEB 9.5-1, Position B1, states that guidance is provided in NFPA codes numbered 4, 4A, 6, 7, 8, and 27 relating to administrative procedures, controls and the fire brigade. The licensee stated in Amendment 37 to the FSAR that "administrative procedures for maintaining performance of fire protection systems and personnel are provided in accordance with applicable NFPA codes and standards." The licensee should provide a clear statement as to which NFPA codes and standards were used as guidance.

Without this information and pending an acceptable review, this remains as an open item in the staff's evaluation.

4.0 SUMMARY

Based on an evaluation of Amendment No. 37, the staff has identified the following open issues:

1. (SER Paragraph 2.1) The licensee should explain why the increase of combustible inventory, such as in Turbine Generator Building Fire Area TG-1, has not resulted in the need for additional fire protection in the locations where these combustibles are now present.

2. (2.2) The licensee should clarify how bus duct penetrations of fire barriers are sealed and protected to assure the integrity of the wall during a fire. (Reference page F.2-9)

3. (2.2) The licensee should provide a response to the 10 CFR Part 21 issue concerning closure of fire dampers under air flow conditions. Specifically, what testing and modifications have been implemented to assure that fire dampers will close under ambient air conditions.

4. (2.3) The licensee should justify the conclusion that instrument and sensing lines will remain free of fire damage in the absence of fire protection features stipulated in Section III.G of Appendix R to 10 CFR 50. (Reference page F.2-7)

5. (2.3) The licensee should provide information concerning the separation and protection of redundant shutdown systems in the gap between the primary containment vessel and the biological shield wall. (Reference page F.2-8.)

6. (2.4) The licensee should describe the frequency of inspection of sealed water supply control valves. It should be noted that in order to conform with the provisions of NFPA Standard No. 13, sealed valves have to be inspected on a weekly basis. (Reference page F.3-95)

7. (2.6) The licensee should explain and justify the change in the halon system storage cylinder verification procedures. (Reference page F.3-102)

8. (2.7) The licensee should explain why the commitment to conform with Regulatory Guide 1.75 was removed from Amendment No. 37. (Reference page F.3-112)

9. (2.8) Until the licensee verifies, and the staff can confirm, that all plant areas that have to be manned for safe shutdown and all ingress and egress routes have adequate lighting in conformance with the NRC's regulations, this remains as an open item in the staff's evaluation.

10. (3.1) Since there are only seven ADS valves it would seem that a fire in selected fire areas would potentially reduce the number of ADS valves available in the control room to less than seven and thereby invalidate the information provided in the FSAR up to and including Amendment 37.

11. (3.3.1) The licensee should confirm that all modifications are complete and are in conformance with the guidelines provided in Appendix R and the Branch Technical Position CMEB 9.5-1.

12. (3.3.2) The licensee has indicated that for certain fire areas some Division 1 components, cabling and batteries are required for safe shutdown using Division 1 OR Division 2 alternate shutdown methods. Thus, it is not clear that a fire in one of these areas would not prevent safe shutdown of the facility.

13. (3.3.2) The licensee lists the safe shutdown equipment needed in the event of a fire in the control room. The list does not include the Division 1 equipment, cables, and components required in addition to the Division 2 items.

14. (3.3.3) The licensee should submit a revised control room evaluation procedure which conforms to the staff's guidelines as related to the one operator action in the control room prior to evacuation.

15. (3.3.4) The licensee should provide the final fire protection details for the Division 2 SRV cables in the control room.

16. (3.3.4) The licensee should provide a discussion of what, if any, testing will be undertaken to ensure that systems and components required for post-fire shutdown will function properly.

17. (3.3.4) The licensee should confirm that required transfer switches have been installed, tested and are operational AFTER they have been installed.

18. (3.3.7) The licensee has identified that there will be six safety relief valves (SRVs) available in the event of a fire in the control room. The licensee should document this operational capability and clearly state which six SRVs will be used.

19. (3.3.9) The licensee should provide instrumentation to give the operator information at a location outside of the control room on flowrates for the SSWS pump and other support systems; for example, the HVAC system.

20. (3.3.12) The licensee has used an acceptance criterion of the ability to safety shutdown the facility to determine whether repairs are required. It is not clear as to whether or not achieving a safe shutdown relied only upon the identified protected minimum set of safe shutdown equipment.

21. (3.3.12) The licensee should provide the status of the transfer switches for the SM-B cabinets.

22. (3.3.14.2) The licensee should justify the assumption that a properly coordinated circuit protection device will isolate a fault "even if the protective device is in the fire area."

23. (3.3.14.3) The licensee should either meet their commitment in the FSAR, Amendment 37 to remove power from the RHR-V-8 during normal plant operation or provide an acceptable means of meeting the criteria as they relate to the prevention of LOCAs at the high/low pressure interface.

24. (3.3.14.3) The licensee has stated that both RHR-V-8 and RHR-V-9 valves are both Division 1 powered valves. This, if true, is unacceptable.

25. (3.3.14.3) The licensee's assumption that three phase power feeders will not fail in such a manner as to reconnect to an adjacent three phase power feeder and cause an electrically isolated motor to operate is acceptable except for high/low pressure interfaces. The licensee should describe the means used to protect against 3-phase faults at high/low pressure interfaces. (Reference page F.4-7)

26. (3.3.15) The licensee should identify the minimum number of operators required to safely shut down the facility for all fire areas.

27. (3.4.15) The licensee should provide clarification as to when procedures for which "Regulatory Guide 1.39 will be used as a guide" will be created and implemented in the plant.

28. (3.3.15) The licensee should indentify specific NFPA codes and standards governing administrative procedures for maintaining performance of fire protection systems and personnel.