

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-397/88-16

Docket No. 50-397

License No. NPF-21

EA 86-070

Licensee: Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Facility Name: Washington Nuclear Project No. 2 (WNP-2)

Inspection at: WNP-2 Site, Benton County, Washington

Inspection Conducted: June 6-10, 1988

Inspectors:

Charles Ramsey
C. Ramsey, Reactor Inspector

7/21/88
Date Signed

A. V. Johnson
A. Johnson, Enforcement Officer

7/21/88
Date Signed

Kerry Rod
K. Rod, Reactor Inspector Trainee

7/21/88
Date Signed

Charles Ramsey for
J. Bradfute, NRR

7/21/88
Date Signed

Charles Ramsey for
S. Juergens, NRR

7/21/88
Date Signed

Charles Ramsey for
T. Chandrasekaran, NRR

7/21/88
Date Signed

Charles Ramsey for
I. Ahmed, NRR

7/21/88
Date Signed

Charles Ramsey for
M. Murphy, Reactor Inspector

7/21/88
Date Signed

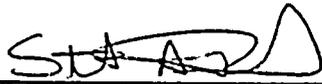
Charles Ramsey for
D. Ward, Reactor Inspector

7/21/88
Date Signed

Charles Ramsey for
K. Sullivan, Electrical Consultant
Brookhaven National Laboratory

7/21/88
Date Signed

Approved by:



S. Richards, Chief
Engineering Section

7/24/88
Date Signed

Summary:

Inspection on June 6-10, 1988 (Report No. 50-397/88-16)

Areas Inspected: Announced special safety inspection conducted to follow-up on fire protection program compliance and previously identified open items. Inspection Modules 30703, 64100, 93701 and TI 2515-61 were used.

Results: Of the areas examined, 3 violations (paragraphs 4.A(1), 4.A(2) and 5) were identified.



DETAILS

1. Persons Contacted

Washington Public Power Supply System

- * C.M. Powers, Plant Manager
- * G.D. Bouchey, Director, Licensing and Assurance
- * L.T. Harrold, Manager, Generation Engineering
- * D.S. Feldman, Plant QA/QC Manager
- * S.L. McKew, Assistant Operations Manager
- * A. Hosler, NSAG Manager
- * R. Barbee, Plant Technical Engineering Supervisor
- * J.T. Little, Planning and Scheduling Supervisor
- * C.D. Eggen, Principal Fire Protection Engineer
- * A.W. Clarkson Jr., Sr. Fire Protection Engineer
- * H.J. Fowler, Fire Marshal
- * S. Washington, Compliance
- * G. Bradstad, Technical Specialist
- * H.L. Aeschliman, Senior Licensing Engineer
- * D.R. Coody, Principal QA Engineer
- P. Powell, Licensing
- J.V. Hanson, Plant Technical Engineer

Bonneville Power Authority

- * D.L. Williams, Nuclear Engineer

NRC

- * G.W. Knighton, Project Directorate - NRR
- * R. Pate, Branch Chief, Region V

* Denotes those attending the exit meeting held on June 10, 1988.

2. Licensee Actions On NRC Staff Request For Additional Information

By letter dated November 11, 1987, the NRC staff requested the licensee to provide additional information clarifying twenty-eight NRC concerns. The licensee responded to the staff concerns by letters dated January 11, 1988 and April 15, 1988.

The results of the inspection team's follow-up on the licensee's response to the staff's concerns are as follows:

A. (Closed) 1 - "Combustible Inventory Fire Area TG-1"

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 to the FSAR, the licensee identified areas with additional combustible materials such as in the Turbine Generator Building Fire Area TG-1. Fire Area TG-1

includes the Turbine Generator Building, General Equipment Area, Transformer Rooms and Corridors. The team verified that the additional combustibles in these areas were due to the storage of protective clothing as previously identified by the licensee. The specified increase in combustible inventory in these areas has no effect on the ability to safely shutdown the reactor and the level of fire protection provided in Fire Area TG-1 remains acceptable. Therefore, this item is considered closed.

B. (Closed) 2- "Bus Duct Penetration Fire Barriers"

The team verified that there are no bus duct penetrations through technical specification fire walls as stated in the licensee's January 11, 1988, submittal to the NRC. The nine locations in the plant where bus ducts penetrate fire walls (transformer, turbine generator and switchgear) appeared to be sealed such that a fire rating equivalent to the rating of the wall is provided by the seal. Based on the team's observation and information provided by the licensee, it appears that the concern for bus duct failures to effect safe shutdown during a fire has been adequately addressed by the licensee. Therefore, this item is considered closed.

C. (Closed) 3 - "Closure Of Fire Dampers Under Air Flow".

The NRC staff requested that the licensee identify what testing and modifications have been implemented to assure that fire dampers close under air flow (when air is flowing through openings). The Ruskin fire dampers installed at WNP-2 are the subject of a November 6, 1984 Part 21 Report issued by the fire damper manufacturer which identified that the dampers may not close under air flow. The manufacturer recommended that the dampers be field modified and that periodic testing be performed to ensure that the dampers will close under actual air flow conditions.

The licensee responded to the NRC staff and stated that WNP-2 planned no additional modifications or testing of fire dampers. Instead, the response stated that the licensee intended to implement procedures to ensure that ventilation systems are shutdown for fire occurrences where fire damper closure is affected by air flow.

Based on the inspection team's review of the licensee's Procedure No. 4.12.4.1, Revision No. 4, the team concluded that the procedure adequately prescribes the actions to be taken in response to fire occurrences. Section 4.12.4.1.4. of the procedure specifies that air handling units supplying the area of a fire occurrence be shutdown at the discretion of the fire brigade leader. The team further verified that fire brigade leaders had received training on the need to shutdown ventilation systems during fire occurrences. This training was conducted in the Fire Brigade Third Quarter 1987 training session. Six fire brigade leaders attended the session. The team also reviewed the licensee's pre-fire plans and expressed concern that shutting down ventilation systems to a fire area involved in fire was not identified as a fire brigade leader action. In response to this concern, the licensee revised the pre-fire plans



during the inspection to include this action for fire brigade leaders on all fire occurrences in safety related areas of the plant. Based on the licensee's corrective actions, this item is considered closed.

D. (Open) 4 - "Protection Of Instrument Sensing Lines"

In Amendment No. 37 to the FSAR, 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 of less than one-half hour. The NRC has found this justification inadequate to date because it ignores locations within the area where concentrated combustibles may exist that could produce a fire of significant intensity to damage the instrument sensing lines. The licensee indicated that an additional calculation is in progress to verify the adequacy of instrument sensing line supports not mated directly with a concrete wall. If such supports reach temperatures above the specified design limit of 1200 degrees Fahrenheit during fire conditions, they will require protection to remain free from fire damage. The licensee requested an extension to forward their completed calculation on July 15, 1988 for NRC review. This item remains open, pending the licensee's submittal and NRR's review.

E. (Open) 5 - "Separation Of Redundant Trains In The Drywell Expansion Gap"

The NRC staff requested that the licensee provide information on separation and protection of redundant safe shutdown circuits located in the expansion gap between the primary containment vessel and the biological shield wall. The staff expressed this concern because the area is filled with polyurethane foam material which is highly combustible.

The licensee responded to the NRC staff and stated that a fire in this area was not credible based upon the configuration of the polyurethane foam material. However, the licensee had previously initiated Project Engineering Directive (PED) No. 5218-E-D144 dated May 29, 1984 and Design Change Package (DCP) No. 86-0405-0A, dated December 12, 1986, which required the installation of four inches of Kao-Wool to seal selected penetration openings through the biological shield wall. The PED indicates that the Kao-Wool material was installed in biological shield wall penetration openings where radiated heat energy could possibly raise the temperature of the polyurethane foam material to its ignition temperature. The DCP required the installation of four inches of Kao-Wool in biological shield wall penetration openings located between the floor and ten feet above the floor on each elevation of the Reactor Building to prevent sparks from welding activities conducted in the area of the penetrations from igniting the foam material.

The inspection team questioned the licensee's basis for using four inches of Kao-Wool as a thermal barrier for the polyurethane foam material. The team also questioned the licensee's rationale for

sealing only those biological shield wall penetration openings between the floor and ten feet above the floor on each elevation of the Reactor Building. The licensee indicated that this information was unavailable at the time of the inspection.

During the inspection, the team advised the licensee that their January 11, 1988 response to the NRC staff regarding this issue was unacceptable. The licensee considered this type of fire occurrence not to be credible. However, based on two recent fire occurrences at another nuclear plant where polyurethane foam material was installed in a similar annular space, the team took the position that the precautionary measures taken by the licensee to prevent this type of fire occurrence were not adequate. Therefore, the team requested that the licensee revise their January 11, 1988 response to the NRC staff and provide a detailed discussion of what methods are being utilized to prevent this type of fire occurrence, how early detection of fires occurring in the expansion gap will be accomplished, and how fires occurring in the expansion gap will be suppressed. This item remains open pending further licensee action and NRC review.

F. (Closed) 6 - "Inspection Of Water Control Valves"

The use of electric tamper switches and locks to supervise open fire protection water supply system control valves was previously accepted by the staff in the SER. In Amendment No. 37 to the FSAR, the licensee proposed to seal open certain control valves. In order to conform with the guidelines in the NFPA code, the sealed valves should be inspected on a weekly basis. The team confirmed that the valves in the sensing lines that control the auto start of the electric and diesel fire pumps are the sealed open control valves and that they are inspected weekly through the Scheduled Maintenance System. The weekly inspection documents for these sealed open valves, identified as PPM 2.8.7 "Fire Protection System", Attachments D and E, were reviewed by the team and found acceptable. In addition, those water control valves locked open are inspected by the licensee on a monthly basis under surveillance procedure No. 7.4.7.6.1.1.4., "Monthly Fire System Valve Alignment". Based on the team's review, this item is considered closed.

G. (Closed) 7 - "Halon Cylinder Storage Procedures"

The NRC staff requested the licensee to explain the change in the halon system storage cylinder verification procedure. The licensee responded to the NRC and stated that only editorial changes were made to the procedures and that the procedures satisfy the requirements of plant technical specifications.

The inspection team reviewed two licensee procedures for verifying halon system storage cylinder quantity and weight. Procedure Nos. 7.4.7.6.3.6., "Control Room Halon System Agent Quantity Fill/Weight Verification," and 7.4.7.6.3.2.3., "Control Room Halon System Agent Quantity Fill Verification 30 Pound Cylinder Bottles," were reviewed and compared with the manufacturer's instructions. The team



determined that the procedures conformed with the manufacturer's instructions and appeared to contain adequate instructions for verifying halon cylinder stored contents. Based on the team's review, this item is considered closed.

H. (Closed) 8 - "Conformance With Regulatory Guide 1.75"

Amendment 37 to the FSAR deleted conformance of the WNP-2 design to the provisions of Regulatory Guide 1.75. The deletion was from page F.3-112 of Appendix F to the FSAR. The NRC staff requested the licensee to explain why this commitment was removed. The licensee responded to the NRC staff and stated that the electrical separation criteria for WNP-2 was consistent with the intent of Regulatory Guide 1.75 but deviated in some areas as identified in Chapter 8 of the FSAR, Section 8.3.1.4. This criteria for separation of electrical equipment and cables was submitted by the licensee in amendment 23 to the FSAR and was evaluated and accepted by the staff in Supplement 2 of NUREG 0892, Section 8.4.1.1. The basis for the evaluation was that the requirement of Regulatory Guide 1.75 were not applicable to the WNP-2 design (construction permit date preceded the regulatory guide issue date). However, the staff evaluation used the principles implied in this regulatory guide as a guideline for accepting the proposed design.

Since Chapter 8 of the FSAR describes the Electrical System design in the plant, all other chapters of the FSAR should be consistent with the Chapter 8 information for the electrical systems. The team verified that the subject change on page F.3-112 of Appendix F to the FSAR is consistent with the information provided in Chapter 8 of the FSAR. Based on the team's review, this item is considered closed.

I. (Closed) 9- "Emergency Lighting"

The NRC staff requested that the licensee confirm that all the plant areas that have to be manned for safe shutdown and all ingress and egress routes thereto have adequate lighting in conformance with Appendix R, Section III.J. (As specified in Appendix F to the FSAR).

By letter dated January 11, 1988, the licensee responded to the staff concern and stated that FSAR Section F3, Position D5(a) will be revised in Amendment No. 39 to specifically state that all the subject areas mentioned and the associated ingress and egress routes have been provided with adequate lighting to facilitate performance of the required operator actions. The licensee further stated that all the emergency lighting modifications identified as necessary by the NRC during inspections performed in 1986 and 1987 have been completed.

During this inspection, the team verified that the licensee had provided adequate emergency lighting in all the subject areas and the associated ingress and egress routes. This is further discussed in paragraph 3.K of this inspection report. Based on the licensee's



corrective actions and the team's verification, this item is considered closed.

J. (Closed) 10 - "Number of ADS Valves Needed for Safe Shutdown"

The NRC staff expressed concern to the licensee that a fire in select fire areas outside the control room may reduce the number of ADS valves available in the control room to less than the required seven and thereby invalidate the information provided in the FSAR up to and including Amendment No. 37.

By letter dated January 11, 1988, the licensee responded to the NRC staff and stated that their analysis of the ADS valves and their associated controls indicated that at least one Division of seven ADS valves will be always available for a fire in any fire area other than the control room. The licensee further stated that each ADS valve has two solenoids, one for each Division and that one of the two solenoids is available (or protected/relocated) for each fire event outside the control room.

During the inspection, the control cable routing for 7 ADS valves for each Division was inspected and found satisfactory. Based on the inspection team's verification, this item is considered closed.

K. (Closed) 11 - "Conformance With Appendix R and BTP 9.5-1"

The NRC staff requested that the licensee confirm that all modifications are complete and are in conformance with the guidelines provided in Appendix R and Branch Technical Position CMEB 9.5-1. By letter dated June 8, 1988 (G. C. Sorensen - WPPSS to J. B. Martin - NRC) the licensee provided a schedule for completing fire protection modifications and fire protection program improvements. All fire protection modifications were scheduled to be completed by June 1988.

The team verified that the licensee had completed the planned fire protection modifications except as identified in paragraphs 2, 3, 4 and 5 of this report. Based on the open items and team findings identified in the report, this item is considered closed.

L. (Closed) 12 - "Protection of Both Divisions for Safe Shutdown"

The NRC staff requested that the licensee clarify how the Division I battery supply including Cabinets E-B1-1, E-DP-S1/1, E-DP-S1/1F, E-IN-3, E-PP-7A and E-PP-7AF, 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 I fire areas. Additionally, the staff noted that the licensee indicated that for certain fire areas, some Division I components, cabling and batteries are required for safe shutdown using Division I or Division II shutdown systems. Based on the staff's interpretation of this statement by the licensee, it was not clear to the staff that a fire in one of these areas would not prevent safe shutdown of the facility.



By letter dated January 11, 1988, the licensee responded to the staff concerns and stated that for a fire in any Division 1 fire area, only Division II batteries, equipment, components and cabling will be utilized. The Division I battery supply, including cabinets and cabling, do not require protection from the effects of fires in all Division I fire areas. The licensee further stated that WNP-2 safe shutdown methodology for any fire area other than the control room requires only a single Division of safe shutdown equipment and cabling which is ensured to be available. For the control room fire, however, Division I controls for 3 ADS valves at the alternate remote shutdown panel and Division II controls for 3 SRVs at the remote shutdown panel must be available. Therefore, the Division I battery supply including cabinets and cabling in addition to Division II equipment, battery supply and cabling are required, and these are ensured to be available for the control room fire. The licensee also stated that no spurious signals due to the control room fire can inadvertently trip the battery supplies since the DC battery bus distribution relies only on fuses.

The inspection team reviewed the Divisional safe shutdown capability for a fire in any fire area other than the control room and determined that at least one Division will be available. For a control room fire, both Divisional controls for the required relief valves (SRVs/ADS) are available. Table No. F.4.1 of Amendment No. 37 to the FSAR reflects this capability.

Based on the team's review this item is considered closed. However, the battery supplies for both the Divisions may be lost following a control room fire due to high impedance faults. Additionally, lack of adequate protection for power cables for valve RHR-V-9 in the reactor building may compromise safe shutdown capability. This is further discussed in paragraphs 4 and 5 of this report.

M. (Closed) 13 - "Equipment Needed for Safe Shutdown"

The NRC staff raised the question that the licensee's list of safe shutdown equipment needed for a control room fire did not include the Division 1 equipment, cables and components required in addition to the Division 2 items.

By letter dated January 11, 1988, the licensee responded and stated that the Division 1 equipment, cables and components required in addition to the Division 2 items are listed under the "Remote Shutdown" column in Amendment No. 37 Tables: F.4.1, F.4.2.a, F.4.2.b, F.4.2.c, F.4.2.d, and F.4.3. The licensee has also identified a minor correction to Table F.4.2.c.

A review of Amendment No. 37, Table F.4.1, by the inspection team disclosed that the safe shutdown equipment for the two Divisions are in separate fire areas except for the primary containment, which is inerted; the control room for which alternate shutdown capability is provided; and the Reactor Building General Equipment Area where the redundant Division equipment are individually protected. A review of the tables listed above by the inspectors showed that the

Division 1 equipment, cables and components required for a control room fire were listed. Based on the team's review, this item is considered closed.

N. (Closed) 14 - "Control Room Evacuation Procedure Conformance To Staff Guidelines"

The NRC staff requested the licensee to revise the control room evacuation procedure to conform with the staff's guidelines as related to the one operator action in the control room prior to evacuation following a control room fire.

During this inspection, the inspectors verified that the licensee had issued a procedure deviation to the Control Room Fire/Evacuation Procedure (No. 4.12.1.1), which identifies the manual scram as the preferred single manual action in the control room prior to evacuation following a control room fire. Based on the licensee's corrective action, this item is considered closed.

O. (Closed) 15 - "Protection for Division II SRVs"

The NRC staff requested the licensee to identify the method of separation of cables associated with the Division II Safety Relief Valve (SRV's) controls provided on the remote shutdown panel. The staff was concerned because cables for these three valves pass through the control room and could be lost during a control room fire. The licensee responded to the NRC staff and stated that the cables had been removed from the control room and were relocated to the cable spreading room which is separated from the control room by a 3-hour fire barrier.

The inspection team reviewed Maintenance Work Request (MWR) No. AU-9008 which required the removal of the cables from the control room. The MWR specified that the cables were to be pulled into the cable spreading room through a floor penetration seal. The cables were spliced inside the seal and the seal was resealed with 9 inches of Silicone Foam to form a 3-hour fire barrier. The team verified that Quality Control witnessed the cable splicing and resealing of the penetration seal. However, the team questioned the licensee's evaluation of the cable splices inside the seal. The licensee provided satisfactory responses to the team's concerns by demonstrating compatibility of the cable insulation and the penetration seal material. Also, the licensee verified there was no negative impact on the fire rating of the penetration seal. Based on the licensee's corrective actions, this item is considered closed.

P. (Closed) 16 - "Testing of Safe Shutdown Components"

The NRC staff requested the licensee to 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.



By letter dated January 11, 1988 and April 15, 1988, the licensee responded and stated that testing of the Remote Shutdown Panel (RSP) was completed during the Power Ascension Testing Program (PATP) and that the test simulated control room evacuation. The licensee stated that the test further demonstrated the ability to place the RHR system into the shutdown cooling mode of operation from the RSP while in a hot standby condition. Additionally, the licensee further stated that the test demonstrated their ability to control, maneuver and transit into cold shutdown from a hot standby condition at the RSP. Regarding the Alternate Remote Shutdown Panel (ARSP), which was installed subsequent to completion of the PATP, the licensee stated that component level testing for all the components (e.g., cycling motor-operated valves, energizing solenoid valves, etc.) had been completed.

The NRC staff found the licensee's component level testing for the ARSP acceptable. However, the staff required procedural verification of independence of the necessary process variable indications from the control room for a control room fire. During this inspection, the inspection team performed a review of the revised surveillance procedures for demonstrating this independence for Reactor Water Level and Pressure indications at the RSP. Procedure No. 7.4.3.7.5.1, "Accident Monitoring Level Indication Division II", and Procedure No. 7.4.3.7.5.2, "Accident Monitoring Instrumentation Reactor Vessel Pressure" were reviewed and determined to be satisfactory. Based on the team review, this item is considered closed.

Q. (Closed) 17 - "Testing of Installed Transfer Switches"

The NRC staff requested the licensee to confirm that the required transfer switches in the SM-8 switchgear cabinets have been installed, tested and determined to be operational.

By letter dated January 11, 1988, the licensee responded and stated that the required transfer switches in the SM-8 switchgear cabinets (five - one per cabinet) were installed, tested and declared operational during the 1987 outage.

Maintenance Work Request documentation (AT 2201, 02, 03, 04, and 05) for post-installation testing of shorting switches to replace the shorting terminal screws was reviewed during this inspection. The documentation shows that the shorting switches were installed and tested successfully. This is further discussed in paragraph 2.U of this report. Based on the team's review, this item is considered closed.

R. (Closed) 18 - "Identification of Six SRV's/ADS Valves for a Control Room Fire"

The NRC staff requested the licensee to identify by tag numbers which six ADS/SRVs will be used for a control room fire.

By letter dated January 11, 1988, the licensee responded and stated that the required six Division 1 and Division 2 ADS/SRVs have been identified by tag numbers in Amendment No. 37, Table F.4.1.

During this inspection, the team verified that three SRV's (MSRV-4A, 4B and 4C) have their control and transfer switches at the RSP and three ADS valves (MSRV-2A, 2C and 3B) have their control and transfer switches at the ARSP. These valves are also identified by the above tag numbers in the Control Room Fire/Evacuation Procedure No.4.12.1.1 and RPV Remote Cooldown Procedure No.4.12.1.2. Based on the team's review, this item is considered closed.

S. (Closed) 19 - "Process Instrumentation"

The NRC staff requested the licensee to provide diagnostic instrumentation outside the control room for the Standby Service Water System (SSWS) pump flow rate indication and indications for other support systems. This instrumentation is required as part of the alternative shutdown capability for a control room fire.

By letters dated January 11, 1988 and April 15, 1988, the licensee responded and stated that the SSWS pump discharge pressure indication, along with valve position indication, have been provided at the RSP. Remote shutdown support system (e.g., HVAC, Electrical distribution) monitoring is provided by local indications. Equipment rooms are provided with instrumentation for temperature indications and the temperatures are monitored periodically during a remote shutdown event as required by procedures. Electrical distribution is monitored at switchgear locations by indicating lamps and display of amp/volts for diesel generators and related buses.

During this inspection, the inspection team verified that the SSWS pump discharge pressure indication and the valve lineup indication are available at the RSP. The inspectors noted that the Control Room Fire/Evacuation Procedure No. 4.12.1.1 calls for monitoring safe shutdown equipment room temperatures periodically on an hourly basis and initiating room cooling for the applicable room before its temperature exceeds the limit specified for the room in the procedure. The inspectors concluded that the applicable fan flow performance is therefore available indirectly through temperature monitoring. Based on the team's review, this item is considered closed.

T. (Closed) 20 - "Required Repairs for Safe Shutdown"

This item is closed based on the discussions provided in paragraphs 2.U and 3.E of this report and the licensee's clarification provided in the January 11, 1988 response to the NRC staff. The licensee clarified that safe shutdown is achieved by using the minimum equipment identified in Section F.4 of Amendment No. 37 to the FSAR.



U. (Closed) 21 - "SM-8 Cabinet Transfer Switches"

Section 2.D.3. of NRC Inspection Report No. 397/87-02, dated April 17, 1987, indicates that in lieu of making repairs (installing shorting screws in switchgear terminal blocks), the licensee indicated that transfer switches would be installed in the SM-8 switchgear cabinets. By letter dated November 11, 1987, the NRC staff requested that the licensee provide the status of the installation of the transfer switches. The licensee responded to the NRC staff and stated that the transfer switches were installed during the spring 1987 outage.

The inspection team performed a field verification of the SM-8 switchgear cabinets and observed that transfer switches had been installed in the SM-8 cabinets. Based on the team's observations, this item is considered closed.

V. (Closed) 22 - "Coordinated Circuit Protection"

By letter dated November 11, 1987, the NRC staff requested the licensee to provide clarifying information regarding compensatory measures taken against possible faults occurring "upstream" of a protective device when the protective device is in the fire area. The licensee responded to the NRC staff by letter dated January 11, 1988 and stated that all faults are "downstream" of a protective device.

The inspection team verified that the licensee's protective devices protect circuits downstream of the device. Based on the team's review, it appears that if the licensee's circuits are properly coordinated, faults occurring upstream of the protective device will appear downstream to at least one protective device located upstream of the fault. The team also reviewed the licensee's safe shutdown circuit coordination study and coordination practices and found them to be acceptable. Based on the team's review, this item is considered closed.

W. (Closed) 23 - "Removal of Power to RHR Valve V-8"

The NRC staff requested the licensee to either to meet their commitment in Amendment No. 37 to remove power from the High/Low pressure interface motor-operated isolation valve RHR-V-8 on the RHR suction line during normal plant operation, or provide an acceptable means to prevent the interface breach. The NRC staff has identified the potential significance of a control room fire to spuriously open both redundant RHR isolation valves in series. The two valves constitute a High/Low pressure interface at reactor pressures greater than 220 psig. Therefore, these valves are normally kept closed during power operation and are remote manually opened at other times if needed (e.g., normal shutdown cooling). The interface is further protected by pressure interlocks for the valves which at reactor pressures above the shutdown range permissive (135 psig) ensures the line isolation (i.e., prevents opening of the valves or closing the valves if they are open).



By letters dated January 5, 1988; February 12, 1988; and March 15, 1988, the licensee elected to provide an acceptable means to prevent the interface breach due to a control room fire in lieu of power removal from valve RHR-V-8 during normal plant operation. The licensee committed to maintain control of valve RHR-V-8 at the ARSP during plant Operational Conditions 1, 2, and 3 (power operation, startup and hot shutdown respectively) with the option to restore the valve control to the control room and operate it from there during startup and hot shutdown (if needed), provided the reactor pressure is less than 135 psig. The associated valve interlocks and automatic isolation signals will be bypassed when its control remains at the ARSP. These will be restored when the valve control is transferred back to the control room.

The licensee had installed control and transfer switches for the valve at the ARSP and in the submittals discussed above committed to install a key-lock switch at the panel and keep it locked with the valve in the closed position to prevent its inadvertent opening. The key will be administratively controlled. The licensee stated that during normal operation with the valve control switch kept in the "CLOSE" position at the ARSP; the transfer switch in the "EMERGENCY" position; and the key-lock switch in the "DISABLE" position with the valve closed, a control room fire cannot spuriously open the valve and there will be no breach of the subject high/low pressure interface. In the submittals, the licensee proposed Technical Specification (TS) changes to WNP-2 to reflect this approach.

The NRC Staff approved the licensee's approach and the proposed TS changes for preventing the spurious opening of valve RHR-V-8 due to a control room fire. During this inspection, the team verified that the control, transfer and key-lock switches for valve RHR-V-8 had been installed at the ARSP. Based on the team's review, this item is considered closed.

However, the team identified an additional concern for spurious actuation of RHR valves V-8 and V-9 outside of the control room, and inadequacies in the licensee's approach to high-low pressure interface concerns plantwide. This is further discussed in paragraph 4.A(1) of the report.

X. (Closed) 24 - "Divisional Power to RHR Valves V-8 and V-9"

The NRC staff requested the licensee to provide clarifying information regarding the Divisional power supplies to RHR valves V-8 and V-9. The licensee responded to the NRC staff and stated that RHR valve V-9 are powered by Divisions I and II respectively.

The inspection team performed a drawing review and field verification and observed that RHR valve No. V-8 is powered from Division I and RHR valve No. V-9 is powered from Division II. Based on the inspection team finding, this item is considered closed.

Y. (Closed) 25 - "3 Phase Faults at Hi-Lo Pressure Interfaces"

This item is closed based on the discussion provided in paragraph 4.A(1) of this report.

Z. (Closed) 26 - "Minimum Staffing Needed for Safe Shutdown"

The NRC staff requested that the licensee identify the minimum number of operators (exclusive of the fire brigade) required to shutdown the facility safely given a fire in any fire area.

By letters dated January 11, 1988 and April 15, 1988, the licensee responded and stated that the safe shutdown team consists of five members: Shift Supervisor, Shift Technical Advisor and three other members of the shift complement (one Senior Reactor Operator and two Reactor Operators). The licensee stated that the fire brigade consists of five different members: Shift Support Supervisor (Brigade Leader), three Equipment Operators and one Health Physics/Chemistry Technician. The licensee further stated that the minimum crew of five members for the safe shutdown team is sufficient for achieving safe shutdown following a fire in any fire area and that Technical Specification 6.2.2.e explicitly prohibits any of these five from being a member of the fire brigade.

During this inspection, the team reviewed the licensee's Administrative Procedures No. 1.3.2 - "Shift Compliment and Functions" and No. 1.3.36 - "Fire Protection Program," and Technical Specification 6.2.2.e, and found the information on minimum staffing needed for fire control and achieving safe shutdown to be consistent with that which was stated by the licensee. Based on the team's review this item is considered closed.

AA. (Closed) 27 - "Regulatory Guide 1.39 Procedure Conformance"

As requested by the NRC staff, the licensee provided clarification as to when procedures for which Regulatory Guide 1.39 will be used as a guide have been implemented. The team reviewed the following procedures which are implemented in the plant:

- (1) PPM 1.3.10 - Fire Protection Program,
- (2) PPM 1.3.19 - Housekeeping, and
- (3) PPM 1.3.35 - Fire Protection Program Controls.

These procedures establish the programs providing the controls needed to assure the implementation of the Fire Protection Program in accordance with Reg. Guide 1.39 - "Housekeeping Requirements for Water-Cooled Nuclear Power Plants," such as the storage of combustible materials. Based on the team's review, this item is considered closed.

BB. (Closed) 28 - "NFPA Administrative Procedure Conformance"

The NRC staff requested that the licensee identify the specific NFPA codes and standards used in developing procedures for maintaining



performance of fire protection systems and personnel. The licensee responded to the NRC staff by letter dated January 11, 1988 and stated that all licensee commitments to NFPA codes had been verified and documented in Manual WMC-064. In addition, the licensee provided a summary of deviations from NFPA codes to the NRC by letter dated April 13, 1987. Included in the April 13, 1987 letter are justifications for deviations from the codes and planned modifications to eliminate code deviations. The licensee plans to incorporate Manual WMC-064 and the NFPA code deviations in the April 13, 1987 letter, into Amendment No. 39 to the FSAR. During the inspection, the licensee was advised that their April 13, 1987 submittal containing NFPA code deviations was still under review by the NRC staff and formal acceptance of the deviations will be based on the staff's completed review which will be discussed in a supplemental SER.

The team verified that the licensee's procedures for design change control, No. EI 2.8, "Generating Facility Design Change Process", revision No. 6, and No. 39, "Fire Protection Program", revision No. 3, include requirements for all design changes to be reviewed against the approved fire protection program. The procedures require that all design changes be reviewed by a fire protection engineer to assure conformance with applicable regulatory requirements and commitments. Based on the licensee's corrective actions, this item is considered closed.

3. Licensee Actions On Previous Inspection Findings

A. (Closed) Unresolved Item 397/86-05-04 "Common Enclosure Analysis"

This item identified an NRC concern that fire induced circuit damage could result in the imposition of excessively high voltages on low-voltage circuits routed within a common enclosure or raceway with high voltage cables.

This concern was resolved by the inspection team's reference to a NRC staff position dated December 4, 1986, which concluded that due to the improbability of the postulated circuit damage and the licensee's provisions for interrupting devices upstream of the circuits of concern, the licensee's analysis of the postulated event was acceptable. Based on the stated NRC staff position, this item is considered closed.

B. (Closed) Unresolved Item 397/86-05-06 "Worst Case Fire Analysis for Control Room and Cable Spreading Room"

The licensee stated in Amendment No. 37 to the FSAR that they had not analyzed the worst case fire for the Control Room (CR) and the Cable Spreading Room (CSR). Since both Appendix R and the applicable Standard Review Plan require such analysis to determine the consequences of a fire in any plant area, this item identified the NRC's concern that the worst case fire in these areas could result in an unreviewed safety question.



By letter dated September 22, 1986, the licensee provided Amendment No. 37 to the FSAR and further clarified the concern. The licensee provided the fire analyses both for the CR and the CSR using Appendix R assumptions for the fire event and its consequences. The licensee determined that a fire event in either area with the proposed safe shutdown system will not result in reactor parameters exceeding the values predicted in FSAR Chapter 15 transient analysis, though they may exceed the limits for a loss of off-site power transient event.

The NRC staff has reviewed the licensee's analysis for a CR fire which uses an alternative shutdown capability for achieving hot shutdown. Specifically, the method assumes Low Pressure Coolant Injection (LPCI) within ten minutes after a Reactor scram when the Residual Heat Removal (RHR) system entry condition is satisfied. This condition is accomplished by Reactor Coolant System (RCS) manual depressurization using three automatic depressurization (ADS) valve controls located on the Alternative Remote Shutdown Panel (ARSP) and three Safety Relief Valve (SRV) controls located on the Remote Shutdown Panel (RSP). Although this method will result in RCS process variables not being maintained within those predicted for a loss of normal AC power, as required by Appendix R, Section III.L, the NRC staff found the analysis acceptable.

The basis for this NRR acceptance of this analysis is that the analysis demonstrates that even with uncovering of the upper portion of the core for a short time period, the fuel cladding integrity will be maintained. Furthermore, the licensee has completed the corrective actions regarding NRC staff concerns identified with Safe Shutdown Methodology (Unresolved Item 397/86-25-05). Therefore, as discussed in Inspection Report No. 50-397/87-02 Item E, the team concluded that a control room or CSR fire would not result in the licensee's reactor parameters exceeding the values predicted in the FSAR Chapter 15 transient analysis. However, the team cautioned the licensee that a loss of DC power to the Division I ADS valve controls located on the ARSP within ten minutes, as indicated by the licensee's high impedance fault analysis, may result in the loss of function of these valves prior to manual depressurization of the RCS to the RHR entry condition. This would result in reducing the depressurization capability to the three Division II SRV controls located on the RSP. This concern is further discussed in paragraph 4.A(2) of this report.

The licensee's analysis for a CSR fire for which the unaffected redundant shutdown train (Division I or Division II depending upon fire location) will be used for achieving safe shutdown was accepted by the NRC. In the CSR, one Division has its related circuits in cable trays or conduits along one side of the fire area wall and the other Division has its related circuits along the opposite side of the fire area. This is further discussed in paragraphs 3.I and 5 of this report. Based on the team's review, this item is considered closed.

C. (Open) Unresolved Item 397/86-25-03 "Fire Mains Beneath Safety Related Structures"

Several fire protection inspections were conducted by Region V inspectors in 1986 and their findings were reported in Inspection Report Nos. 50-397/86-25 and 50-397/87-02. These inspections were prompted by several allegations received by Region V in 1986. (Allegation File No. RV-86-A-027) One of these allegations relates to the twelve inch fire protection water mains to the Reactor Building that allegedly were installed beneath the safe shutdown Emergency Diesel Generator Building in violation of NFPA codes. This issue was identified as 50-397/86-25-03 and, at that time, was considered an unresolved issue pending further NRC review.

NRR participated in several of the Region V fire protection inspections and visited the WNP-2 site on several additional occasions in 1986. As a result, a Request For Additional Information (RAI) on ten separate issues was sent by NRR to the licensee (Adensam, NRR to Sorensen, SS; dated 20 October 1986). The licensee's response to question 5 of this RAI, dated 1 December 1986, indicated that the licensee believed that "the routing of WNP-2 fire lines under safety related structures meets the intent of Reg. Guide 1.29". This review by the licensee focused NRC attention to two additional issues:

- (1) "Line 12" FP (13)-1 running under the Diesel Generator Building into the south west corner of the Reactor Building appears unable to take differential movements during SSE.
- (2) Line 12" FP (43)-1 running under the Diesel Generator Building from the east appears to lack adequate thrust restraint in one direction."

Regarding the first issue, the team reviewed the licensee's documentation which indicated that the licensee had cut the 12" FP (13)-1 line on either side of the Diesel Generator Building foundation and inserted two 8x12 inch reducers and a length of 8 inch pipe through the segment of 12 inch pipe that remained in place under the Diesel Generator Building foundation. In effect this arrangement protected the integrity of the fire main from the load generated by the close proximity of the building foundation and permitted differential building movement during SSE by enclosing the fire main in a sleeve. This arrangement appears acceptable. Therefore, this portion of item 397/86-25-03 is considered closed.

Regarding the second issue, the apparent inadequate thrust blocking of 12" FP (43) caused the licensee to perform an analysis of the load on and restraint of this buried fire main. This analysis (Calculation ME-02-87-28, Revision 0, "Thrust Restraint for Line 12"FP(43)-1", dated 14 January 1987) was formally transmitted to the NRC on 15 January 1987. The analysis concluded that ... "the Class 1 backfill against the elbow and vertical riser of the line 12" FP (43)-1 will restrain motion of the elbow to much less than the engagement of the mechanical joints in the pipe; therefore, no



additional restraint is required." This analysis is currently under review by NRR. The team noted that the underground portion of FP (43)-1 can be isolated by appropriate valves and the main resupplied by a six inch line from a separate tie-in, thus mitigating, to some extent, the effect of a possible rupture of the 12" underground main. Pending completion of the NRR review, this item will remain open.

D. (Closed) Unresolved Item 397/86-25-04 "Deficiencies Not Documented in LER 84-31"

This item identified the NRC's concern that acceptable compensatory measures were not in place during all periods of operation for deficiencies documented in LER 84-31 and that other Appendix R type deficiencies existed but were not documented in LER 84-31. This item is considered closed based on the discussion provided in paragraphs 4.A(1), 4.A(2) and 5 of the report.

E. (Closed) Unresolved Item 397/86-25-05 "Safe Shutdown Methodology"

During the July 14-18; July 28-31; August 5-14; and October 22-24, 1986 NRC fire inspections (the findings collectively identified in Inspection Report 50-397/86-25), the inspectors observed that the protection provided for Division 1 ADS valve circuits from the effects of a control room fire was inadequate. Amendment No. 37, FSAR Section 4.4.3 (9/22/86) requires Division 1 control for three ADS valves at one of the two remote shutdown panels. Also, during the August 1986 NRC inspection, the inspectors noted that the then existing Control Room Fire/Evacuation Procedure No. 4.12.1.1, Rev. 6, Appendix C, required the operator to install short circuit screws on the short circuit strip in the current transformer shorting terminal block located in each of the switchgear circuit breaker cubicles of SM-8. The SM-8 cabinets contain the 4160 volt, 3-phase power buses from Diesel Generator No. 2 and these provide power to Division II safe shutdown equipment.

The inspectors considered installation of the short circuit screws in the SM-8 cubicles as hot shutdown repair, which is not allowed per Appendix R, Item III.G.1. Additionally, during the January 12-15, 1987 inspection (Inspection Report 397/87-02) the inspectors noted that the then existing Control Room Fire/Evacuation Procedure (No. 4.12.1.1) called for closing of all eight MSIVs as the preferred single manual action in the control room (instead of manual scram) prior to control room evacuation. Per Generic Letter 86-10, Enclosure 2, Paragraph 3.8.4, the only manual action in the control room prior to evacuation for which credit is permissible, is the manual scram in the control room. For the reasons stated above, the three concerns mentioned above were collectively identified as unresolved Item No. 86-25-05 in Inspection Report 50-397/87-02.

During this current inspection, the team verified the completion of the following licensee actions:

- (1) Installation of transfer switches at the Alternate Remote Shutdown Panel for protecting Division I controls for the needed three ADS valves from the effects of a control room fire;
- (2) Issuance of a procedure deviation to the Control Room Fire/Evacuation Procedure (No. 4.12.1.1), which identifies a manual scram as the preferred single manual action in the control room prior to evacuation; and
- (3) Installation of transfer switches in all the SM-8 cabinets to preclude the previously identified need for hot shutdown repairs involving shorting screws.

Based on the licensee's corrective actions and the team's review, this item is considered closed.

F. (Closed) Unresolved Item 86-25-06 "Safe Shutdown Procedures"

During the July 14-18; July 28-31; August 5-14; and October 22-24, 1986 NRC inspections, the inspectors noted that the Control Room Fire/Evacuation Procedure (No. 4.12.1.1, Section 4A, Step 18 and Section 4B, Step 17) cautioned operators about the lack of interlocks to prevent the drainage of the Reactor Pressure Vessel (RPV) into the suppression pool due to the spurious actuation of a RHR valve (RHR-V-4, 24, 27, or 6) during a control room fire. These valves are downstream of the two RHR suction line, High/Low Pressure Interface valves (RHR-V-8 and RHR-V-9) and represent a potential for drainage of the RPV when the RHR shutdown cooling mode of operation is utilized.

Furthermore, during these inspections and a January 1987 inspection, the inspectors identified concerns relating to the preferred single manual action inside the control room prior to evacuation following a control room fire (closing all the eight MSIVs), and the proposed installation of shorting screws in the SM-8 cabinets (hot shutdown repairs).

The concerns relating to the preferred single manual action inside the control room prior to evacuation following a control room fire and proposed installation of shorting screws in the SM-8 cabinets were resolved during this inspection as discussed under Item 3.E. above. During this inspection, the licensee informed the inspection team that for a control room fire event, which requires use of the Division II RHR system (controlled from the Remote Shutdown Panel), the only spurious actuation that could result in an inadvertent Reactor Vessel drain to the suppression pool is the opening of RHR Valve V-6A when in the normal shutdown cooling mode. This was verified by the team's review of the applicable P&IDs to be correct. The licensee provided the inspection team with a copy of revised procedure "RPV Remote Cooldown" (PPM 4.12.1.2) which requires valve RHR-V-6A control switch to be placed in the "CLOSE" position, and the transfer switch in the "EMERGENCY" position at the remote shutdown panel prior to opening the normal shutdown cooling line.



This appears to effectively prevent this RPV drainage concern. Based on the team's review, this item is considered closed.

G. (Closed) Unresolved Item 397/86-25-07 "Associated Circuit Analysis"

This item identified the NRC concern that there appeared to be no system in place that permits identification of non Class-1E circuits and their association with safe shutdown circuits by the licensee.

The inspection team randomly sampled licensee raceway Nos. 3177-3178, 4581-4584, 2MISC-0001-017 and conduit No. BMISC-9204-001. Based on the team's review and information provided to the team by the licensee about non-class 1E circuits within the enclosures, the team determined that the licensee's analysis of common enclosure associated circuits of concern was acceptable. Based on the team's review, this item is considered closed.

H. (Closed) Unresolved Item 86-25-08 "High-Low Pressure Interface Analysis"

This item is closed based on the discussion provided in paragraph 4.A.(1) of the report.

I. (Closed) Unresolved Item 397/86-25-11 "Cable Spreading Room Design"

This item identified that the WNP-2 cable spreading room contained both redundant Divisions of safe shutdown trains, but the licensee did not provide alternative shutdown capability for the cable spreading room, in accordance with NRC guidelines. Instead, the licensee elected to meet the requirements of section III.G.2 of Appendix R to 10 CFR 50 in the cable spreading room by separation of redundant safe shutdown Divisions and providing fire detection and suppression for the fire area. To accomplish this, the licensee coated all electrical cables traversing a 20 foot separation area between redundant safe shutdown trains with a spray application of Thermo-Lag fire barrier material to eliminate the cables as intervening combustibles. In addition, this item identified that there were cables for redundant safe shutdown trains located within the licensee's designated 20 foot separation area which are required to be protected by a 1-hour fire rated barrier.

During previous NRC inspections, the NRC questioned the adequacy of the spray application of Thermo-Lag in this configuration for the purpose of eliminating intervening combustible materials (cable insulation). The NRC's position was that the Thermo-Lag material applied in this configuration had never been tested to establish a level of fire resistance.

In response to the NRC's concern, the licensee contacted the manufacturer of the Thermo-Lag fire barrier material (Thermal Science Inc.) by letter dated January 16, 1987 and requested an evaluation of the licensee's use of the material for the purpose of eliminating cables as intervening combustibles in the 20 foot separation area. By letter dated January 30, 1987, Thermal Science

Inc. responded to the licensee and stated that the spray application of Thermo-Lag in this configuration would not permit flame propagation of cable insulation for the 20 foot area in which it was applied by the licensee. Based on the Thermo-Lag material manufacturer's confirmation that the material applied in this configuration provides a level of fire resistance that will not permit flame propagation of cable insulation installed in the 20 foot area of the cable spreading room, this item is considered closed.

J. (Closed) Unresolved Item 86-25-13 "Fire Detection System Design"

This item identified that the NRC questioned the adequacy of the licensee's fire detection system design in the Remote Shutdown Panel room and Switchgear Room No. SM-8. Specifically, the NRC was concerned that fire detector spacing in these areas was not in conformance with governing code requirements for ceiling pockets created by beams. At the time, the licensee indicated that the entire plant fire protection system was under evaluation by an outside consultant and the results of this evaluation would be forwarded to the NRC for review.

The evaluation was completed in early 1987 and forwarded to the NRC by the licensee's correspondence dated April 13, 1987. According to the licensee, the evaluation identifies all fire detection system deviations from governing code requirements and provides justification for each deviation or identifies plant modifications made to bring the system design into conformance with the code requirements. The Remote Shutdown Panel Room and Switchgear Room No. SM-8 fire detector spacing are identified in the evaluation as code deviations and justification for the deviations is provided. The evaluation is currently under review by the NRC and the acceptability of fire detector spacing deviations in the Remote Shutdown Panel Room and Switchgear Room No. SM-8 will be discussed in a supplemental Safety Evaluation Report (SER) by the NRC. Therefore, this item will no longer be carried as an open inspection item.

K. (Closed) Unresolved Item 86-25-14 "Emergency Lighting"

During the NRC inspections conducted in July, August and October of 1986 (Inspection Report 50-397/86-25), the inspectors found some of the emergency lighting units provided by the licensee to support the safe shutdown functions inadequate. Specifically, the lighting provided at the remote shutdown panel and in switchgear room No. SM-8 were found to be inadequate. Additionally, during the inspection conducted January 12-15, 1987 (Inspection Report No. 50-397/87-02, Details, Item M), the inspectors noted poor lighting of the remote shutdown panel, no self-contained battery powered lights in the alternate remote shutdown room, poor emergency lighting in the SM-8 switchgear room and no light on the SM-8 panels or within the SM-8 cabinets. Per SRP 9.5-1, Section C.5(g), the licensee committed to provide fixed 8-hour battery pack emergency lighting units in all areas of the plant needed for operation of

safe shutdown equipment and in access and egress routes thereto. Section F.4.2(J) of Appendix F to FSAR Amendment No. 19 (approved fire protection plan) requires the above emergency lighting to be provided.

During this inspection, the team made the following determinations:

- (1) Adequate 8-hour battery power lighting in access and egress routes and plant areas containing safe shutdown equipment had been provided.
- (2) Adequate battery powered lights in the remote shutdown panel room and proper illumination of the remote shutdown panel were observed.
- (3) Provision for adequate battery powered lights in the Alternate Remote shutdown Panel room and proper illumination of the Alternate Remote Shutdown Panel were observed.
- (4) Adequate lighting in the SM-8 switchgear room had been provided.

Based on the team's observations, this item is considered closed.

L. (Open) Violation 87-02-01 "Failure to install Qualified Fire Barrier to Protect Safe Shutdown Trains."

This item identified the licensee failure to install qualified fire barriers to protect safe shutdown trains located in the cable spreading room, cable chase and Reactor Building.

According to information provided to the team by the licensee, the unqualified applications of the fire barrier material has been replaced with a qualified fire barrier material configuration. However the inspection team identified additional examples where the licensee failed to apply the material in a tested configuration that affords adequate protection of safe shutdown trains from fire damage. This issue is further discussed in paragraph 5 of this report.

M. (Open) Unresolved Items 87-19-07 "Loss Of All AC Power Due To Fire" and 87-19-08 "Fire Threat to Shutdown Divisions and Fuel Oil Transfer Pump Rooms".

These items identified the NRC's concern that the apparent lack of adequate drainage in the Diesel Generator Rooms and Fuel Oil Transfer Pump Rooms represents a potential common mode failure of redundant safe shutdown Divisions in addition to the potential loss of all emergency onsite AC power.

During the inspection, the licensee indicated that resolution to this concern was under evaluation. The inspection team reviewed the licensee's calculation No. 05.51.55, Revision No. 3, which calculates the flooding potential of the HPCS Diesel Generator Room.

The calculation is based on establishing a flooding level within the room due to actuation of automatic sprinkler heads. The HPCS Diesel Generator Room sprinkler system includes 28 sprinklers installed at the ceiling and protecting localized fire hazards. Two flooding levels were evaluated in the calculation. One calculation assumed all 28 sprinkler heads actuating and another calculation assumed that 12 of the 28 sprinkler heads actuating. Flooding levels were calculated based on the assumption that the fire brigade would respond within 10 minutes and take action to mitigate flooding of the room.

Plant Modification (PMR) No. BDC-02-87-0295 will implement modifications to the room which will allow for adequate drainage from the room. The plant modification package was preliminary at the time of the inspection and was not reviewed by the inspection team. However, discussions with the licensee's fire protection engineer indicated that the modification would be based on the flooding level reached from only 12 of the 28 sprinkler heads actuating. The licensee's engineering staff feels that the actuation of all 28 sprinklers in the room by fire is not credible. Therefore, the engineering staff has assumed that only 12 sprinklers will operate within the 10 minutes prior to the fire flooding problem.

The inspection team disagreed with the licensee's assumption that only 12 of the 28 sprinkler heads installed in the HPCS Diesel Generator Room could be actuated by fire. Because of the room configuration and the potential for all 28 sprinklers in the room to be actuated by an oil fire, the inspection team advised the licensee that this assumption appeared to be unacceptable. The licensee indicated that further evaluation of their position would be made prior to implementing the modification for adequate drainage of the room specified in PMR No. BDC-02-87-0295. This item remains open pending further licensee action and Region V review.

N. (Open) Violation 87-19-29 "Instrument Rack Electrical Terminations"

The team verified that the licensee took corrective action for the drain wire deficiencies in Instrument Rack (IR) No. 69. However, regarding IR Nos. 62, 63, 67, 68 and 69, the team did not agree with the licensee's response indicating acceptance of the original condition "as-is" for the previous condition, as stated in the violation. The inspection of additional cabinets (other than those identified in the Violation) disclosed similar deficient Instrument Rack terminations. A total of seventeen apparent deficient terminations were identified during this inspection. In addition, the licensee identified a number of similar termination deficiencies in QCIRs attached to NCR No. 284-02-72.

The licensee was requested to provide documentation of a "pull test" performed in response to the violation and associated records. The Licensee had no procedure or records for the pull test. The licensee's acceptance of these conditions in 1985 was based on determinations that circuits functioned "as-is" rather than

conformance with plant installation procedures or plant specifications. The licensee indicated that an additional inspection would be performed to verify the integrity of the terminations. The licensee further indicated that the inspection criteria would be based on plant electrical specifications and their original response to the Notice of Violation would be revised and resubmitted to the NRC. This item remains open pending further licensee and Region V action.

LICENSEE EVENT REPORTS (LERs)

O. (Closed) LER No. 84-31 (Rev 1 - Rev 6) - Appendix R Deficiencies

While performing a review and update of the WNP-2 Appendix R safe shutdown analysis, the licensee identified ten cables that were required for safe shutdown of the plant following a fire which were not protected from the fire (i.e., no Thermo-Lag fire protection material had been applied to these cables). This was reported in LER 84-031 dated May 10, 1984. Subsequent to this finding, further analyses and reviews were conducted by the licensee which identified additional unprotected cables and several safe shutdown circuits that were not provided with the remote transfer switches for isolating those circuits from the main control room in case of a fire in the main control room. These discrepancies were reported in revision 1 thru revision 6 of LER No 84-031. In each revision of the LER, both new and previously identified discrepancies were listed with the proposed engineering direction for short term and long term corrective actions.

The team reviewed the licensee's documents (Nonconformance Report-NCR, Design Change Package-DCP, Maintenance Work Request-MWR, and Quality Control Verification) in order to sample items from each of the six revisions of the LER. The team verified correct changes on final drawings and correct implementation of wiring changes inside the motor control center for one of the sample items. The results of the team's review was satisfactory. Based on the team's review, inspection follow-up of this LER IS considered complete.

P. (Open) LER 87-29 "Fire Rated Floor Penetrations"

The licensee reported in LER 87-29 that a floor penetration of a plant fire barrier was impaired but appropriate compensatory measures had not been taken. The licensee determined that the cause of this event was inadequate training of personnel and failure of personnel to follow plant procedures for breaching and resealing of fire barriers.

At the time of the inspection, corrective action for this event was ongoing. The licensee was in the process of performing a 100 percent walkdown of all fire barrier penetration seals. This walkdown resulted in the licensee's submittal of LER 88-08 which identifies additional fire barrier penetration seal deficiencies.

During the inspection, the licensee indicated that the walkdown of fire barrier penetration seals would be completed within a week and that plant personnel involved in the inspection of the seals would be retrained. The licensee further indicated that plant personnel would be provided with additional resealing information on future fire barrier penetration seal work and a review would be performed of all open Plant Modification Requests (PMR's) to determine appropriate measures for fire barrier penetration seal impairments.

This item remains open pending further licensee's action and Region V verification.

Q. (Open) LER No. 87-30 "Unqualified Fire Wall"

On November 6, 1987 during a review of fire-rated assemblies and walls, the licensee discovered that a Plant Technical Specification required fire wall was not qualified as a three-hour barrier and a penetration in the wall consisting of a 12" hole with an 8" remote air supply pipe, was not sealed as required by the Plant Technical Specifications. LER No. 87-030 dated December 12, 1987 documents the licensee's reporting of this deficiency. The wall is located between Fire Areas TG-1 (Turbine Generator Building- Elevation 471') and RC-1 (Radwaste Building-Elevation 487').

As required by the Plant Technical Specifications, the team verified that the wall and penetration had been placed on an hourly fire tour. In addition, the licensee has generated Technical Evaluation Report 87-0414 which will dictate the design basis for the three-hour fire wall. This LER remains open pending the completed installation of the three-hour fire wall and verification by Region V.

INFORMATION NOTICES

R. (Closed) Information Notice No. 84-16 (Part 21 Report) "Failure of Automatic Sprinkler System Valves"

This information notice transmitted a part 21 report from the manufacturer regarding the potential failure of automatic sprinkler system deluge valves.

The licensee indicated that the type of automatic sprinkler system valves discussed in the information notice and the part 21 report are not installed at WNP-2. Based on the licensee's statement, this item is considered closed.

S. (Closed) "Information Notice No. 85-09 "Isolation Transfer Switches"

This information notice notified licensees of potential electrical design deficiencies in isolation/transfer switches used to provide electrical isolation in the event of a control room fire.

The inspection team verified that the electrical design of isolation/transfer switches used by the licensee for alternate

shutdown (SRV No. MS-RV-2A,2C,3B and MS-RV-4A,4B and 4C) were acceptable. The design of these circuits include redundant control power fusing as discussed in Information Notice No. 85-09. Based on the team's review, this item is considered closed.

T. (Open) Information Notice No. 86-106, Suppl. No. 2, "Interaction of Fire Protection and Security Systems"

Following a feedwater pipe rupture at Surry Unit 2, automatic initiation of the turbine building fire protection sprinkler system occurred. Information Notice 86-106 Supp. 2, issued to all licensees, identified the concerns raised by this event resulting from fire suppression system effects on plant systems and components. The resulting intrusion of water and steam into control panels and components caused malfunctions in the security card reader/access system and in the halon and cardox fire suppression systems. These occurrences as a result of the feedwater pipe rupture are significant due to the personnel hazards and equipment malfunctions resulting from operation of the fire suppression system.

The team reviewed an Operating Experience Review (OER) that the licensee had initiated to determine the fire suppression system effects on plant systems and components. This OER (No. 82037K/M) is an ongoing review of adverse fire protection system interaction with other plant systems including plant security systems. The review appeared to be in the preliminary stage. Therefore, no determinations for corrective action had been established. This item remains open pending the licensee's completed review and Region V verification.

4. Electrical Design For Fire Protection

The licensee is required by condition No. 2.C(14) of Facility Operating License No. NPF-21 to maintain in effect all provisions of the approved fire protection program. Elements of the approved fire protection program are contained in the FSAR, Appendix F to the FSAR, "Fire Protection Evaluation Report"; the original SER, dated March 1982, supplements 3 and 4 to the original SER, dated May 3, 1983 and December 1983, respectively; and, the licensee's March 21, 1983 Safe Shutdown Analysis submittal to the NRC.

The licensee stated in section F.4 of Appendix F to the FSAR (Amendment No. 19) that this section of the Fire Protection Evaluation Report indicates the manner in which the plant is in compliance with Appendix R to 10 CFR 50. The inspection team's follow-up on previously identified NRC concerns about the manner in which the licensee has achieved compliance with the NRC approved fire protection program and the criteria specified for electrical design for fire protection disclosed the following:



A. Associated Circuits Analysis

Unresolved Item 86-25-08 discusses the NRC's concern that the method used by the licensee for protection of high-low pressure interface was not adequate to prevent spurious operation of low pressure RHR isolation valves. NRR question No. 25 which was transmitted to the licensee by letter dated November 11, 1987, expressed further the concern that the occurrence of three phase hot shorts on power cables for high-low pressure interface valves be properly evaluated and protection provided where needed.

In response to NRC question No. 040.079 of Amendment No. 31 to the FSAR, regarding fire protection of RHR high-low pressure interface motor-operated valves and their associated cables, the licensee states in part, "protection of one of the two valves of any pair... will be included in plant revisions provided as a result of the 10 CFR 50, Appendix R Fire Hazards shutdown analysis".

A review of the licensee's associated circuits analysis by the inspection team disclosed inadequacies in the analysis as follows:

(1) High-Low Pressure Interface Analysis Methodology

The high-low pressure interface concern exists where there is the potential for a single fire to induce the spurious operation of redundant motor-operated isolation valves. Such an event may result in a fire initiated unisolable Loss Of Coolant Accident (LOCA) outside of the primary containment due to the inability of the low pressure system to withstand the substantially higher primary system pressure. The RHR system is typically a low pressure system that interfaces with the high pressure primary coolant system. This interface generally consists of two redundant and independent motor operated isolation valves.

NRC question No. 040.079 of Amendment No. 31 to the FSAR requested the licensee to 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 boundary and to identify each location where the device's essential cabling (power and control) are separated by less than a wall having a 3-hour fire rating from cables for the redundant device. Section F.4.4.4.3 of Appendix F to the FSAR required the licensee to perform an analysis to determine the level of fire protection needed to protect these RHR valve cables from fire damage. NRC generic Letter No. 81-12 dated February 20, 1981, and its clarification letter dated March 22, 1982 provided NRC guidelines to all applicants and licensees on the methodology to be utilized in high-low pressure interface analysis. The Generic letter states in part, "We require compliance with the recommendations of Branch Technical Position RSB 5-1...For each case where adequate separation is not provided, show that fire

induced failures (hot shorts, open circuits or shorts to ground) of the cables will not cause maloperation and result in a LOCA".

Additionally, NRC Information Notice No. 87-50, dated October 9, 1987 informed licensees of the potentially significant safety problem pertaining to the possible initiation of a LOCA as a result of fire induced hot shorts which open a high-low pressure interface isolation valve. Information Notice No. 87-50 made specific reference to the potential for this event to occur at WNP-2.

The inspection team's review of the licensee's high-low pressure interface analysis disclosed that the method of protection and control for RHR system motor operated valve Nos. V-8 and V-9 was unacceptable because the analysis incorrectly assumed that three phase hot shorts on power cables will not cause spurious operation of motor operated valves at high-low pressure interfaces.

The inspection team performed a walkdown of the cable routing for RHR valve Nos. V-8 and V-9 in Reactor Building fire area RB-1, where the cabling for both Division I valve No. V-8 and Division II valve No. V-9 was found to be separated by less than 20 feet although on different floors - elevation 501 and 522 - but neither Divisional power cable was protected from fire damage. Thus, a fire occurring in Reactor Building fire area RB-1 may have resulted in damage to redundant circuits and may have caused an unisolatable LOCA outside of primary containment.

This deficiency was not documented by the licensee in LER No. 84-31. Failure to perform an adequate associated circuits analysis (high-low pressure interface analysis) resulted in the failure to protect power cables for RHR valve Nos. V-8 and V-9.

Power cables for RHR valve No. V-9 were not completely protected with a qualified 3-hour in the Reactor Building fire area RB-1. Redundant Division I cables for RHR valve No. V-8 are located in the same fire area within 20 feet of Division II RHR V-9 cables at elevation 552 foot of the Reactor Building (electrical node 4581 to X104D). Between nodes 4581 and 4588, a qualified 3-hour fire barrier is provided for RHR V-9 cables. From node 4588 to approximately one foot from node X104D, a qualified fire barrier is not provided on RHR V-9 cables or RHR V-8 cables. This is considered a violation of Condition No. 2.C(14) of Facility Operating License No. NPF-21 (397/88-16-01).

The licensee's previous position was that the occurrence of three phase hot shorts on power cables was not credible due to low raceway cable loadings and normally de-energized circuits. Furthermore, the licensee's letter to the NRC dated April 15, 1988 documents the licensee's position that the probability of

a pipe rupture following inadvertent opening of the RHR valves V-8 and V-9 at 100 percent reactor power is 3×10^{-7} per reactor year.

During the inspection, the licensee indicated that their associated circuits analysis methodology would be revised to include NRC staff guidelines for high-low pressure interfaces, and appropriate methods of protection and control would be provided where necessary. The licensee also indicated that their response to NRR question No. 25 would be revised and resubmitted to the NRC.

(2) High Impedance Fault Analysis

The high impedance fault analysis is a common power source associated circuits concern which addresses the ability of the power source to supply the necessary fault current for sufficient time to ensure proper protective coordination without loss of function of safe shutdown loads. NRC Generic Letter No. 81-12 provided NRC guidelines to all applicants and licensees on analysis for common power source associated circuit concerns. According to Section F.4.4.4.1 of Appendix F to the FSAR, the licensee was required to perform an analysis to ensure that the effects of fire will not defeat the capability of safety systems to achieve and maintain safe shutdown. Procedures are required to be established to implement the capability.

In response to NRR question No. 12, by letter dated January 11, 1988, the licensee stated that for the control room fire scenario, both Divisions of ADS valve controls must be available and an analysis for this event had been performed which verified that spurious signals resulting from a control room fire cannot inadvertently trip required DC power supplies. Furthermore, the licensee stated in the January 11, 1988 letter that spurious load applications on the DC power supplies are bounded by the high impedance fault analysis.

The inspection team's review of the licensee's recently completed high impedance fault analysis disclosed the following:

- * The analysis indicates that in the event of a control room fire, the Division II 125VDC power supply will be lost after approximately two hours. The licensee had not prepared written procedures to mitigate the effects of this condition (i.e. shedding nonessential loads).
- * In addition to the loss of the Division II 125VDC power supply, the analysis also indicates that the Division I 125VDC power supply could be lost in approximately ten minutes. According to the licensee, the only Division I 125VDC loads that are needed

during alternate shutdown outside of the control room are three Division I powered ADS valves. However, the analysis indicates that in the event of multiple high impedance faults during a control room fire, the total fault current of the Division I 125VDC power supply may be 646 Amps. The main fuse protection for the battery power supply is rated at 600 Amps. The time-current characteristic curve for this fuse indicates that the fuse has an average melting time of approximately ten minutes at the calculated fault.

Based on the analysis and the time-current characteristic curve for the main fuse protecting the Division I 125VDC power supply, a control room fire could require the operation of the three Division I ADS valves at the remote shutdown panel within 10 minutes, or all power could be lost to the valves. The licensee had not prepared written procedures governing the loss of Division I 125VDC power supplies. Nor, were written procedures established instructing operators on the time constraint for opening the Division I ADS valves at the remote shutdown panel before power may be lost to the valves.

This deficiency was not documented by the Licensee in LER No. 84-31. The licensee's failure to establish and implement procedures based on their fire hazard analysis, to carry out the alternate control room shutdown operation in the event of a control room fire, is considered a violation of Condition No. 2.C(14) of Facility Operating License No. NPF-21 (397/88-16-02).

During the inspection, the licensee indicated that procedures would be developed and implemented for shedding of nonessential loads from both Division I and Division II 125VDC power supplies and required operator manual actions would be verified achievable in a timely fashion.

B. Conformance With Regulatory Guide 1.75

There are transfer switches installed in the Remote Shutdown Panel for Appendix R Safe Shutdown equipment. In case of a fire in the Control Room, these switches are manually operated to transfer control of the safe shutdown equipment from the Control Room to the Remote Shutdown Panel. The remote shutdown panel contains Division I and Division II components and their associated cabling. Physical separation is required between the two Divisions. However, the Division II transfer switches and their associated cabling did not have adequate separation from the Division I components and associated cabling in the panel. The team identified this discrepancy to the licensee. The licensee acknowledged the discrepancy and initiated a Design Change Notice (DCN) to provide the required separation in accordance with the "Cable and Component



Separation Criteria" specified in Section 8.3.1.4.2 of the FSAR. This is considered an open item (397/88-16-03) pending licensee implementation of the design change and verification by Region V.

5. Fire Protection Features Provided For Safe Shutdown Systems

The licensee is required by section F.4.4.3 of Appendix F (Fire Protection Evaluation) of the FSAR to protect systems required for safe shutdown from the effects of fire. These systems are referred to as Appendix R Division II safe shutdown systems in the licensee's March 21, 1983 Safe Shutdown Analysis submittal to the NRC.

The inspection team determined that the Licensee's fire protection features provided for safe shutdown systems were inadequate in two cases for the following reasons:

The cable tray containing safe shutdown cables 2DG2-107 and 2DG2-106 were not provided with a 1-hour fire barrier at nodes 7914 and 7915. In addition, two cable trays identified by Nodes 8054 and 7584 were not sprayed with fire resistant material throughout the 20 foot exclusion zone.

A fire occurring in these areas could result in damage to redundant safe shutdown circuits to the extent that safe shutdown could not be achieved and maintained. Failure to meet regulatory requirements for protection of trains of equipment required for achieving and maintaining safe shutdown is considered a violation of condition No. 2.C(14) of facility operating license No. NPF-21 (397/88-16-04).

6. Open Items

Open items are matters that have been discussed with the licensee, that will be reviewed further by the inspector, and that involve some action on the part of the NRC, the licensee, or both. Open items disclosed during the inspection are discussed in Paragraphs 2.D, 2.E, 3.L, 3.N, 3.P, 3.Q and 3.T.

7. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. Unresolved items disclosed during the inspection are discussed in Paragraphs 3.C and 3.M.

8. Exit Meeting

An exit meeting was held with the licensee's staff on June 10, 1988. The items of concern in this report were discussed at that time and in previous meetings with the licensee. The licensee acknowledged the content and scope of the inspection findings.