APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-397/94-14

Operating License: NPF-21

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

Facility Name: Washington Nuclear Project 2 (WNP-2)

Inspection At: WNP-2 site near Richland, Washington

Inspection Conducted: April 2 through May 14, 1994

Inspectors: R. C. Barr, Senior Resident Inspector
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Approved by: D. F. Kirsch, Chief, Project Branch E — Date 6/17/94

Inspection Summary:

Areas Inspected: Routine, announced inspection by resident and region-based inspectors of control room operations, licensee action on previous inspection findings, operational safety verification, surveillance program, maintenance program, licensee event reports, special inspection topics, and procedural adherence. During this inspection, Inspection Procedures 60705, 60710, 61726, 62703, 71707, 92700, 92901, 92902, 92903, and 93702 were used.

Results:

Operations:

Operations response to events was generally good. Operator performance in refueling requires significant strengthening.

- Operators responded well to a loss of feedwater heaters.
- Foreign material controls require further strengthening to prevent dropping of material in the reactor cavity prior to removing the reactor vessel head.
- Operators conducted a reactor cool down in a formal and deliberate manner.

- Management's expectation associated with the locking of Recirculation Flow Control (RFC) Valve RRC-V-60A in place after a downpower maneuver was not adequately implemented. Because the implementing procedure did not provide adequate guidance and training was not effective, operators did not lock the valve following the isolation of some of the feedwater heaters.

- Independent verification and self-checking by equipment operators (EO) requires strengthening. An error by two EOs, during the performance of a clearance order, resulted in pressurization of the reactor building (RB) and loss of secondary containment.

- Refueling errors occurred due to poor attention to detail, lack of procedure adherence, and poor supervisory oversight.

Maintenance:

The actual performance of maintenance was generally good; however, material storage and procedure adherence requires strengthening.

- Maintenance and surveillance activities witnessed by the inspector were performed and documented properly.

- Due to poor work practices, maintenance personnel dropped two bolts into the reactor cavity.

- Maintenance personnel violated licensee procedures in that compressed gas cylinders were not properly restrained.

Engineering:

Weaknesses were noted in preparation for refueling and in implementation of two plant modifications. Management oversight of engineering activities requires strengthening.

- Weak process controls, which do not provide for fully independent reviews and control over blade guides, resulted in several errors in the refueling sequence procedure (nuclear component transfer list (NCTL)).

- Inadequate implementation of a plant modification associated with turbine building ventilation resulted in overloading a motor control center (MCC) and the tripping of feedwater heaters.

- A licensee engineer manually operated the refueling mast contrary to licensee procedures. This resulted in damage to the mast and required replacement of the refueling mast.

Plant Support:

Plant support activities appeared good.

- Security, radiological controls, and emergency planning activities continued to be performed well during this inspection period.

Summary of Inspection Findings:

- Violation 397/9414-01 was opened (Section 2.1).
- Violation 397/9414-02 was opened (Section 5.3).
- Violation 397/9414-03 was opened (Section 8.5.3)
- Noncited Violation 397/9414-04 was opened and closed (Section 8.5.4).
- Violation 397/9318-03 was closed (Section 9.1).
- Violation 397/93201-02 was closed (Section 9.2).
- Violation 397/9345-02 was closed (Section 10.1).
- Inspection Followup Item (IFI) 397/9313-03 was closed (Section 10.2).
- IFI 397/9324-01 was statused and remained open (Section 11.1).
- Licensee Event Report (LER) 397/93-015 was closed (Section 12.1).

Attachments:

- Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS

At the start of the inspection period, the plant was operating at 65 percent power. Scram time tests were in progress along with maintenance to address concerns with control rod scram solenoid pilot valves (SSPVs). Upon completion of maintenance on the SSPVs, reactor power was increased to 91 percent power in anticipation of power coastdown. Reactor power was reduced to 65 percent several times over the rest of the operating cycle for additional maintenance of the SSPVs. On April 26, 1994, with the reactor at 70 percent power, several feedwater heaters tripped, and operators reduced power to 50 percent in accordance with procedures. Also, on April 26, with the reactor at 50 percent power, operators noted four power fluctuations from approximately 46-54 percent power over a 1 minute period and manually scrammed the reactor. The reactor was cooled down and Mode 4 (cold shutdown) was entered on April 29. The licensee then commenced Refueling Outage 9. The licensee disassembled the drywell and reactor and entered Mode 5 (Refueling) on April 30. The licensee commenced core alterations on May 6. The reactor was in Mode 5 with core alterations in progress at the end of the inspection period.

2 ONSITE FOLLOWUP TO EVENTS (93702, 92901)

2.1 Manual Reactor Scram Due to Power Fluctuations

On April 26, 1994, with the reactor at approximately 70 percent power, feedwater heaters isolated due to inadequate post maintenance testing of a design modification associated with a turbine building fan (refer to the discussion in Section 4.1). Following the isolation of the feedwater heaters, feedwater temperature dropped approximately 8 degrees. In accordance with response procedures, operators decreased power to 50 percent power by decreasing recirculation flow. After approximately 90 minutes at 50 percent power, operators manually scrammed the reactor because they noted that reactor power, as indicated on the average power range monitors, had fluctuated from 46-54 percent power over a 1-minute period for no known reason. The operators considered that the power fluctuations may have been an instance of flow instability.

Following the scram, reactor water level dropped to approximately -10 inches (the top of active fuel is -167 inches) on wide range level instrumentation. The operators entered the emergency operating procedures as level decreased past +13 inches. The reactor feed pumps (RFPs) responded and overfed the reactor such that level reached the Level 8 (+54.5 inches) trip of the RFPs. Operators restarted one RFP and manually controlled level at approximately +36 inches. The operators exited the emergency operating procedures when plant conditions stabilized. The licensee reported this event pursuant to 10 CFR 50.72 (4-hour report) and plans to issue a LER.

Licensee investigation identified that the power fluctuations were due to erratic response and movement of RFC valve RRC-V-60A. In August of 1993, operators observed that valve RRC-V-60A moved erratically, without operator action, following decreases in flow. The system engineer (SE) issued a memorandum that recommended that the Hydraulic Power Unit A be secured and valve RRC-V-60A be locked in place to preclude unintentional movement and power excursions.

The licensee changed PPM 2.2.1, "Reactor Recirculation System," to include this recommendation in August 1993. However, on April 26, 1994, operators chose to not lock the RFC valve in place and secure the hydraulic power unit following the decrease in power from 70-50 percent. Because the RFC valve was not locked in place, valve RRC-V-60A erratically repositioned causing reactor power fluctuations. After reviewing the licensee's post trip review package, which included alarm typer printouts and transient data acquisition system traces, the inspector concluded that the licensee's investigation of the event was satisfactory.

During interviews with the inspector, the shift manager (SM) stated that he interpreted the direction of PPM 2.2.1 to allow the plant to stabilize prior to locking the RFC valve in place. He also noted that operators had not seen the RFC valve responding erratically for a long time. The Operations Manager stated that the operating crews had not been locking the RFC valve in place during recent downpower maneuvers to support control rod scram time testing, indicating that it was not a common practice among the operators to lock the RFC valve in place after repositioning the valve. The Operations Department Manager considered that while his expectations had not been fully met, he considered the actions of the operating crew not to be examples of procedure nonadherence.

The inspector noted that shift personnel performed a number of routine evolutions (e.g., cooling tower discharges to the river) during the approximate 1.5 hours after the plant was stabilized following the isolation of the feedwater heaters. The inspector considered that the operators had more than enough time to lock valve RRC-V-60A, but elected not to lock the valve because the SM believed the return to 70 percent power would occur within a short time.

The inspectors reviewed the initial problem evaluation request and interoffice memorandum that was provided, in August 1993, to the operators to communicate the licensee management's expectations on locking of RRC-V-60A. These documents appeared to be clear that the intent of the procedure change to PPM 2.2.1 was to minimize the amount of time in which the valve was unlocked. Therefore, the procedure revision, which appeared to allow for latitude in determining when the valve was required to be locked in place, was insufficient in communicating management's expectations and was insufficient to prevent additional valve erratic operation and power fluctuations. Therefore, the licensee's corrective actions from the erratic valve operation noted in August 1993 were inadequate, and resulted in an undesired plant

transient. The failure to provide effective corrective action is a violation of 10 CFR 50 Appendix B, Criterion XVI (Violation 397/9414-01).

2.2 Conclusions

Operations management did not clearly translate their expectations for the locking of valve RRC-V-60A into plant procedures. Thus, the licensee's corrective actions for the erratic operation of the valve were inadequate, which was a violation of 10 CFR 50 Appendix B, Criterion XVI. As a result, SMs nonconservatively interpreted PPM 2.2.1. This nonconservative interpretation resulted in the undesired erratic operation of valve RRC-V-60A. Licensed operators actions to shut down the reactor were conservative and timely when they observed the unexpected power fluctuations.

3 PLANT OPERATIONS (71707, 92901)

3.1 Plant Tours

The inspectors toured the following plant areas:

- Reactor Building
- Control Room
- Diesel Generator Building
- Radwaste Building
- Service Water (SW) Buildings
- Technical Support Center
- Turbine Generator Building
- Yard Area and Perimeter

3.2 The inspectors observed the following items during the tours:

3.2.1 Operating Logs and Records

The inspectors reviewed operating logs and records against Technical Specification (TS) and administrative control procedure requirements.

3.2.2 Monitoring Instrumentation

The inspectors observed process instruments for correlation between channels and for conformance with TS requirements.

3.2.3 Shift Manning

The inspectors observed control room and shift manning for conformance with 10 CFR 50.54(k), TSs, and administrative procedures. The inspectors also observed the attentiveness of the operators in the execution of their duties. The control room was observed to be free of distractions such as nonwork-related radios and reading materials.

3.2.4 Equipment Lineups

The inspectors verified that valves and electrical breakers were in the position or condition required by TSs and administrative procedures for the applicable plant mode. This verification included routine control board indication reviews and conduct of partial system lineups. TS limiting conditions for operation were verified by direct observation.

3.2.5 Equipment Tagging

The inspectors observed selected equipment, for which tagging requests had been initiated, to verify that tags were in place and the equipment was in the condition specified. The inspectors did not identify any deficiencies in observing clearance orders.

One self-disclosing event resulted from a clearance order error. On May 4, 1994, two EOs were hanging Clearance Order 94-05-0078 when they mistakenly pulled the wrong fuse. The clearance order prescribed that the operators pull Fuse E-FUSE-RWHVA-TB1FU6. However, because the EOs were already at the reactor building heating ventilation and air conditioning (RBHVAC) panel for hanging a related tag, the EOs mistakenly pulled Fuse E-FUSE-RBHVAC-TB1FU6.

Immediately after pulling the fuse, the reactor exhaust dampers closed resulting in a pressure increase in the RB. Pressure increased to approximately +4.2 inches of water. At this time, due to an overpressure interlock being challenged, all of the RB ventilation fans tripped resulting in a loss of secondary containment. After approximately 14 minutes, the EOs realized their error, the fuses were reinstalled, and RB ventilation was restarted. No damage to plant equipment resulted from the event.

This event was similar to a RB pressurization event in 1988. In 1988, a clearance order error resulted in pressurization of the RB to over +7 inches of water. Because the RB fans did not trip in this instance, the RB roof was damaged. The inspector noted that one of the corrective actions from the 1988 event included the installation of a damper on the suction side of the RB ventilation system that would aid in preventing overpressurization of the RB. The inspectors noted that this event emphasized the need for attention to detail in performing clearance orders to prevent undesired challenges to interlocks.

3.2.6 General Plant Equipment Conditions

The inspectors observed plant equipment for indications of system leakage, improper lubrication, or other conditions that would prevent the system from fulfilling its functional requirements. Annunciators were observed to ascertain their status and operability.

3.2.7 Plant Chemistry

The inspectors reviewed chemical analyses and trend results for conformance with TS and administrative control procedures. The licensee continued to operate with slightly elevated reactor water conductivity. The licensee controlled reactor conductivity at less than 0.15 microSiemens by frequent condensate filter demineralizer changeouts.

3.3 Engineered Safety Features Walkdown

The inspectors walked down selected engineered safety features (and systems important to safety) to confirm that the systems were aligned in accordance with plant procedures. During the walkdown of the systems, items such as hangers, supports, electrical power supplies, cabinets, and cables were inspected to determine that they were operable and in a condition to perform their required functions. Proper lubrication and cooling of major components were also observed for adequacy. The inspectors also verified that certain system valves were in the required position by both local and remote position indication, as applicable.

The inspectors walked down accessible portions of the following systems on the indicated dates:

System	Dates
Diesel Generator Systems	May 3 and 10
Divisions 1, 2, and 3 Hydrogen Recombiners	May 3, 6, and 10
Low Pressure Coolant Injection (LPCI) Trains A, B, and C	May 3, 6, and 10
Low Pressure Core Spray (LPCS)	May 3, 6, and 10
High Pressure Core Spray (HPCS)	May 3, 6, and 10
Reactor Core Isolation Cooling (RCIC)	May 3, 6, and 10
Residual Heat Removal, Trains A and B	May 3, 6, and 10
Scram Discharge Volume	April 14 and May 6
Standby Gas Treatment	May 3, 6, and 10
Standby Liquid Control	May 3, 6, and 10
Standby SW	May 11 and 12
125-Vdc Electrical Distribution,	April 13

Divisions 1 and 2

250-Vdc Electrical Distribution April 13

3.4 Conclusions

The inspectors concluded that poor self-checking, and the lack of independent verification while establishing a clearance, resulted in the undesired pressurization of the RB. Routine plant operations were adequate during this inspection period. ESF systems were in good order and aligned in accordance with plant procedures.

4 ONSITE ENGINEERING (37551, 92903)

The inspectors performed followup of the following engineering-related activities during this inspection period:

4.1 Feedwater Heater Isolation

On April 26, 1994, feedwater heaters isolated resulting in a power decrease to 50 percent power. After observing power fluctuations (as described in Section 2.1), operators initiated a manual reactor scram. Isolation of the feedwater heaters resulted from a number of problems in implementing an engineering design change.

In 1992, the Supply System project engineering organization initiated a design change package to replace TB ventilation fans to address chronic concerns with high temperatures in the TB, and to support the planned power uprate. The design change replaced the four 100 horsepower (hp) turbine building exhaust air (TEA) fans with 200 hp fans. Because the four TEA fans were powered from two MCCs, design engineering calculations determined that the supply breaker for MCC MC-3A would trip if two 200 hp fans were powered from the same MCC.

The original project engineer (PE), who was in charge of tracking implementation of the plant modification request (PMR), and the design engineer determined that TEA-FN-1C would be replaced, but then the supply breaker for TEA-FN-1A (powered from MCC E-MC-3A) would be moved to MCC E-MC-1E, prior to energizing TEA-FN-1C. Then TEA-FN-1A would be replaced. The inspectors reviewed Plant Operations Committee (POC) Minutes 94-12 that approved PMR-92-0220-0. The POC based its approval on the understanding that this PMR would be carefully implemented, but during the Refueling Outage 9. This item was not returned to POC for approval when management decided to perform the PMR during plant operation.

The original PE for PMR 92-0220-0 left this project prior to the project's implementation. Due to an incomplete turnover, the new PE did not understand the need to carefully sequence the work and testing. The new PE forwarded the PMR to the maintenance field engineer to write the work instructions. The maintenance field engineer included no precautions or limitations describing the careful sequencing required to prevent overloading of the MCC.

Additionally, the SE was not provided the opportunity, nor did he seek the opportunity, to ensure that the work instructions were adequate. The prework release review performed by the work control center personnel reviewed only the work instructions and not the design change package. Therefore, their review did not identify that the work instructions did not include precautions with respect to operation of the fans. Based on the information provided, the work control senior reactor operator (SRO) assumed that the TEA fan replacements were one-for-one replacements and not design changes.

On April 26, 1994, work was completed in replacing TEA-FN-1C with a 200 hp fan. The existing 100 hp TEA-FN-1B was connected to the same MCC and was in operation. After completion of the fan replacement, the work instructions required the post maintenance test to be completed for TEA-FN-1A. Supply System personnel ran the new TEA-FN-1A motor uncoupled from the fan without problems. Ten minutes after TEA-FN-1A was operated in a coupled condition, the supply breaker for MCC E-MC-3A tripped, which tripped all of the loads on the MCC and caused the isolation of some of the feedwater heaters (Section 2.1). Licensee calculations determined that MCC E-MC-3A was overloaded due to running the 200 hp and 100 hp fans, concurrently, on the same bus.

The Supply System was still developing corrective actions for this event at the end of the inspection period. The inspectors will review the licensee's corrective actions during the next inspection period.

4.2 Conclusions

Engineering associated with the implementation of PMR 92-0220-0 was incomplete, principally due to the following interorganizational communication breakdowns: (1) the turnover of responsibilities between PE's was not thorough, and (2) the PE did not involve the SE in the implementation of the PMR. Additionally, management oversight of this PMR was not effective in that: (1) the POC did not ensure that the decisions made in the POC meeting were adequately implemented, and (2) engineering supervision was not effective in ensuring smooth coordination throughout the engineering disciplines to ensure adequate project implementation.

5 PLANT SUPPORT ACTIVITIES (71750)

The inspectors evaluated plant support activities based on observation of work activities, review of records, and facility tours. The inspectors noted the following during this evaluation.

5.1 Fire Protection

The inspectors observed fire fighting equipment and controls for conformance with administrative procedures. Due to concerns with Thermolag and fire seals, and because a number of fire doors were propped open to support outage work, the inspectors noted that a very high number of fire impairments existed for which fire watch tours were in place.

5.2 Radiation Protection Controls

The inspectors periodically observed radiological protection practices to determine whether the licensee's program was being implemented in conformance with facility policies and procedures and in compliance with regulatory requirements. The inspectors also observed compliance with radiation work permits, proper wearing of protective equipment, personnel monitoring devices, and personnel frisking practices. Radiation monitoring equipment was frequently monitored to verify operability and adherence to calibration frequency. The inspectors noted that the licensee was below their prorated exposure goal for the outage at the end of the inspection period.

5.3 Plant Housekeeping

The inspectors observed plant conditions and equipment storage to determine the general state of cleanliness and housekeeping. Housekeeping in the radiologically controlled area was evaluated with respect to controlling the spread of surface and airborne contamination. Overall, plant housekeeping was good for most of the inspection period. However, during work associated with the SSPVs, equipment storage did not meet management's expectations.

On April 21, 1994, while the reactor was at 73 percent power, the inspectors toured the 522-foot elevation of the RB and noted a number of equipment storage discrepancies. The inspector noted seven ladders, two unsecured compressed gas cylinders, and an unrestrained maintenance cart near safety-related control rod drive hydraulic control units. Work was not in progress nor were any licensee personnel in the vicinity of these discrepancies. The inspector informed the maintenance production manager, who directed maintenance personnel to correct these deficiencies. The maintenance production manager stated that these items were in the area to support the rebuilding of SSPVs. He confirmed that these items did not meet his expectations, nor adhere to plant procedures.

WNP-2 PPM 1.3.19, "Plant Material Condition Inspection Program," Revision 15, paragraph 4.1.5(a)(8) states, "When using gas bottles, whether flammable or nonflammable, they must be properly secured against a substantial structural member with heavy rope or, preferable, chain or cable, in such a manner as to preclude them from falling over. Bottles are to be tied off both at top and at bottom (to preclude 'kick out' and falling to the floor). Bottles shall be removed from the building at the end of the work function if not permanently secured in bottle racks." Because two unrestrained compressed gas cylinders existed near safety related equipment, the inspector concluded that the licensee did not follow PPM 1.3.19. The failure to follow PPM 1.3.19 is a violation of 10 CFR 50, Appendix B, Criterion V (Violation 397/9414-02).

The inspector noted that two examples of unsecured compressed gas cylinders had been identified in NRC Inspection Report 50-397/93-50. The licensee received a Notice of Violation for those examples. Because additional examples of unsecured compressed gas cylinders were identified during this inspection, the inspector concluded the licensee's corrective actions for the

previous violation were not fully effective. The inspector also noted that the work associated with the repair of the SSPVs had been closely observed by licensee management and quality assurance (QA) personnel, and that they had not identified these obvious discrepancies.

Licensee's procedures also recommended that: (1) ladders should be returned to their storage racks or laid on their sides when not in use, and (2) maintenance carts should be tied down or a brake applied to the wheels. Although these recommendations were not requirements, the licensee stated that they do reflect management's expectations. The licensee stated that they would continue to emphasize proper housekeeping controls during continuing training.

5.4 Security

The inspectors periodically observed security practices to ascertain that the licensee's implementation of the security plan was in accordance with site procedures, that the search equipment at the access control points was operational, that the vital area portals were kept locked and alarmed, that personnel allowed access to the protected area were badged and monitored, and the monitoring equipment was functional.

5.5 Emergency Planning

The inspectors toured the emergency operations facility, the operations support center, the technical support center and ensured that these emergency facilities were in a state of readiness. Housekeeping was noted to be good and all necessary equipment appeared to be functional.

5.6 Conclusion

The licensee continues to implement an effective day-to-day security program and was making positive changes in the emergency support centers. Oversight of work activities has not been fully effective in assuring proper storage of equipment, such as compressed gas bottles, ladders and carts.

6 SURVEILLANCE TESTING (61726)

The inspectors reviewed surveillance tests required to be performed by the TS on a sampling basis to verify that: (1) a technically adequate procedure existed for performance of the surveillance tests, (2) the surveillance tests had been performed at the frequency specified in the TS and in accordance with the TS surveillance requirements, and (3) test results satisfied acceptance criteria or were properly dispositioned.

The inspectors observed portions of the following surveillances on the dates shown:

Procedure	Description	Dates Performed
7.4.8.2.1.22B	Battery B1-2 Monthly Surveillance	April 14
7.4.3.1.3.16	Time Response Testing of MS-LIS-24D	May 9

The inspectors concluded that these surveillances were performed and documented properly.

7 MAINTENANCE OBSERVATIONS (62703)

During the inspection period, the inspectors observed and reviewed documentation associated with maintenance and problem investigation activities to verify compliance with regulatory requirements and with administrative and maintenance procedures, required QA/QC involvement, proper use of clearance tags, proper equipment alignment and use of jumpers, personnel qualifications, and proper retesting. The inspectors verified that the licensee had correctly evaluated reportability for these maintenance activities.

The inspectors witnessed portions of the following maintenance activities:

Description	Dates Performed
JS-4301, Replace Cell 40 for B1-2	April 13
HU-9401, Rebuild SSPVs for Control Rod 38-59	April 14
FA-2201, Overhaul RCIC-P-3	April 18
HW-1501, Clean and Inspect E-MC-1C/1D	May 9
EL-0701, Overhaul Diesel Generator 1	May 9-13
DK-7703, SW-V-2A Pipe Weld Repairs	May 11-12

The inspectors determined that these maintenance activities were performed and documented properly.

8 PREPARATION FOR REFUELING, REFUELING OPERATIONS (60705, 60710)

During this inspection period, the inspectors reviewed documentation and observed performance associated with refueling preparations and refueling. In addition, the inspectors observed the licensee's control of foreign material above the open reactor cavity. This inspection included interviews with

personnel and followup of other concerns to verify compliance with regulatory requirements, and that evolutions were performed in a safe and conservative manner. Several problems were identified during refueling.

8.1 Background

During the 1993 Refueling Outage 8, a number of refueling errors occurred which indicated that increased management attention and control of refueling activities were warranted. These errors, which were described in NRC Inspection Report 50-397/93-18, were discussed during an Enforcement Conference as apparent violations. As corrective actions for these problems, the licensee trained and briefed personnel on previous problems and encouraged improved performance in 1994. In addition, to preclude problems with the entry of foreign material into the reactor, the licensee required all personnel entering the area of the spent fuel pool or the reactor cavity to be trained and qualified prior to entering these areas. The licensee also completed a design change to replace the old refueling mast with a new design that employed a cylindrical, hollow mast design.

8.2 Refueling Preparations

The inspector reviewed the licensee's procedures for new fuel receipt, refueling, and foreign material controls. The procedures appeared to be adequate to perform the necessary operations.

The inspector witnessed portions of the receipt of the new fuel. This evolution appeared to be controlled in a conservative manner, with the licensee carefully documenting inventories and locations of new fuel. Personnel appeared to adhere to all of the applicable procedures.

The inspectors also reviewed the NCTL, the licensee's process for developing the refueling sequence. The Technical Services Division was responsible for preparation of the NCTL. The process for developing the NCTL consists of: (1) the fuel vendor providing the operating Cycle 10 core map to the Supply System; (2) loading Cycles 9 and 10 core maps into the computer code, COSMOS; (3) going through the refueling sequence on a mimic board to verify the procedure's adequacy; (4) correcting identified errors; and (5) issuing the reviewed and approved NCTL for use. Four individuals signed for approval of the NCTL; however, only one person actually performed a technical review of the process. That employee performed all five steps of the process described. The only step that included other persons was during the verification sequence on the mimic board. In this verification, one individual read the step as the other individual moved the markers. The inspector concluded that this process had little, if any, independent review because the reader did not actually independently assess the adequacy of the move. This lack of independent verification contributed to the errors noted in Section 8.5. The inspector noted that the NCTL did not control the location of blade guides in the spent fuel pool. This also appeared to contribute to the errors described Section 8.5.

8.3 Bending of the Refueling Mast

On May 2, 1994, improper actions by a licensee engineer resulted in bending of the refueling mast. The inspectors followed up on the licensee's investigation and corrective actions. The inspectors concluded that the licensee performed a satisfactory evaluation.

On May 2, 1994, the refueling mast was located and fully extended within the transfer cask pit inside of the spent fuel pool. Other work in this pit was commencing; however, the refueling mast interfered with this work. The craftsmen then requested the refueling floor coordinator have the refueling mast moved to allow for their task to be completed. The refueling floor coordinator personally proceeded to move the mast; however, the engineer was not familiar with the motorized controls of the mast. Therefore, the refueling floor coordinator moved the mast manually using the emergency hand crank. This individual continued to manually operate the mast until it impacted the cask pit wall. These actions allowed work to continue. Later, on May 2, operations personnel attempted to retract the refueling mast to move it from the transfer cask pit. However, sections of the mast appeared to bind in place, and the EOs determined that the refueling mast had bent and was inoperable. The licensee replaced the refueling mast.

The licensee initiated Procurement Evaluation Request (PER) 294-338 and convened an Incident Review Board to investigate this event. The licensee determined that the individual's actions in repositioning the mast were contrary to licensee procedures and policies. Procedures were available for manual operation of the refueling bridge; however, these procedures were only applicable to emergency situations, such as loss of power during refueling. In addition, PPM 1.3.8, "Conduct of Operations," requires that only qualified operations personnel should operate this type of equipment. Although, on rare occasions in the past, engineering personnel had manipulated plant equipment, the Technical Services Division manager stated that it was management's expectation that engineering personnel never operate plant equipment.

The inspector reviewed the licensee's corrective actions. These actions included evaluating the need for administrative action and training engineering personnel on Supply System policy for operating plant equipment. The inspector concluded that the licensee's corrective actions were satisfactory.

8.4 Foreign Material Controls

During the Refueling Outages 7 and 8, the NRC inspectors identified violations of licensee foreign material control requirements. These issues were cited as violations in NRC Inspection Reports 50-397/93-19 and -92-14. As corrective actions for these previous problems, the licensee initiated significant revisions to the foreign material control procedure, PPM 1.3.18, "Foreign Material Control around the Reactor Cavity, Spent Fuel Pool, and Dryer-Separator Pit," and required all individuals to be trained on these new requirements prior to entry into the areas covered by PPM 1.3.18. The

inspector noted that the licensee was tightly controlling entry of items past the boundaries. All items that were required to be logged and controlled appeared to be entered in the foreign material control log. Despite the licensee's significant efforts to improve foreign material control, these improvements did not preclude maintenance personnel from dropping two unsecured bolts into the inner bellows area of the reactor cavity.

On May 4, 1994, during installation of stud covers and hold down bolts ("stud plugs"), maintenance personnel dropped two stud plugs into the inner bellows area. The craft personnel were handling too many bolts to adequately control the work activity. At the time, the licensee had not established foreign material controls because the reactor head was not fully removed. The licensee had not yet recovered these bolts at the end of the inspection period.

8.5 Refueling Performance

On May 6, 1994, the licensee commenced the refueling sequence. The NCTL had 941 steps. The inspector witnessed a number of different personnel operating the refueling bridge with two different SROs directing the refueling activities. The inspector observed a sampling of core alterations that included only fuel movement. Control rod replacement will be monitored during the next inspection period.

8.5.1 New Mast Installation Deficiencies

Because the replacement refueling mast was a different design, the licensee altered the limit switch setpoints on the refueling bridge. Prior to the start of the outage, the licensee requested and received an amendment to the TSs to reflect the new setpoints. However, the design change package that installed the new mast did not require verification of the zero reference of these indicators.

On May 6, 1994, while operators were moving fuel from the reactor to the spent fuel pool, a fuel bundle lightly impacted the transition piece, "cattle chute," between the reactor vessel and the spent fuel pool. The bundle was placed in a safe position, and core alterations were halted until the situation was resolved. The licensee's investigation determined that during previous outages with the old refueling mast, operators only had 2 inches of clearance between the bottom of the fuel bundle and the cattle chute. The inspector noted that unless careful setting of the reference points was accomplished, the two inches of clearance could be challenged. The inspectors reviewed the work order and the design change package associated with the mast replacement. The inspectors noted that no verification of the reference points was required or performed. The licensee initiated a PER to document this event and develop corrective actions. Limit switches were reset to ensure that adequate clearance would exist between the fuel bundles and the chute. The licensee successfully retested the refueling bridge and recommenced core alterations. The inspector noted that this was a situation in which the engineering work was not thorough in that the design change

package apparently did not ensure that the indicators were properly set to establish a consistent reference.

8.5.2 Fuel Bundle Misorientation

On May 6, 1994, operators were relocating Fuel Bundle UD8023 in the spent fuel pool. The fuel bundle was incorrectly oriented by 180 degrees when set in its final location. The operators detected this error immediately after relocating the bundle and corrected its orientation. The licensee initiated PER 294-0364 to document the problem. The licensee determined that the root causes for this event were informal communications, a lack of independent verification, and inadequate self-checking. The licensee also noted that the EOs and the SRO were not experienced in fuel movement and were not fully proficient in the methods for ensuring proper bundle orientation. These operators were counseled, and core alterations were resumed.

8.5.3 Improper Raising of Fuel Bundle

On May 11, 1994, during Step 689 of the NCTL (Bundle AN3030), the inspector noted that the operators lifted the refueling mast to the -0.87-inch position. The inspector informed the refueling SRO that the EOs did not appear to follow PPM 2.14.1. PPM 2.14.1, Revision 9, "Refueling Bridge Operation," paragraph 5.2, Step 11, states, "CAUTION: Raising the mast into the uptravel stop at high speed may cause overshoot which could cause the top of active fuel to be less than 7' 6" below the water level. DO NOT let mast come above -0.75" on the HOIST position readout." TS 6.8.1.c requires written procedures to be established, implemented, and maintained covering refueling operations. Because PPM 2.14.1 was not properly implemented, this is a violation of TS 6.8.1.c (Violation 397/9414-03).

In discussions with the refueling SRO, the inspector noted that the crew had not been aware of the procedure deviation which introduced the caution step of paragraph 5.2. However, the inspector noted that the other crews were aware that the new caution existed and were ensuring that the EOs were carefully manipulating the refueling mast to preclude exceeding the -0.75-inch limit. Even when the violation of the procedure was brought to the SRO's attention, the SRO continued with the fuel move while the mast was at -0.87 inches. The EOs placed the fuel bundle in the spent fuel pool. The refueling SRO informed the SE and the SM. The SE noted that there was margin to the TS limit of 7 feet 6 inches of water above the top of the fuel bundle. He, therefore, concluded that there had been no violation of TS limits. In addition, the SE noted that the limit switches were not damaged, and the refueling mast was still operable. Even when faced with this information, the crew continued on with the refueling sequence, without stopping to evaluate the error and determine the root causes of the procedure violation.

The inspector left the refueling bridge to notify the OM and the PM of this observation. The OM had core alterations stopped to investigate the procedure violation. The licensee found that PPM 2.14.1 had been revised on May 7, 1994, to include this caution; however, the author and reviewers of the

revision did not direct that any training take place prior to implementation of the revised procedure. The refueling bridge notebook that contained the refueling procedures included a nonproceduralized statement of management expectations. To ensure that the crews were aware of all procedure revisions, management's expectation was that each refueling SRO review each of the refueling procedures prior to assuming the SRO refueling watch. The crew associated with the procedure violation had not reviewed the refueling procedures for several days. As corrective actions, the OM removed the refueling SRO (the same SRO involved with the error in Section 8.5.2) from any further refueling operations; and he conducted a "Timeout" with each of the crews to reiterate management's expectations with respect to procedure adherence.

The inspector noted that this event demonstrated that procedure compliance in the operations department was still a current issue that required close management's attention. The inspector also noted that the procedure revision process appeared to be flawed in this instance in that the process did not result in all of the necessary personnel being made aware of the procedure change.

8.5.4 Second Fuel Bundle Misorientation

On May 14, 1994, when power was temporarily removed from the refueling bridge to support outage work, a refueling SRO performed a review of the core alterations performed to date. Upon a thorough scanning of the core, the SRO noted that a fuel bundle was misoriented by 90 degrees. This fuel bundle was placed in the core in Step 260 of the NCTL. Approximately 900 steps of the NCTL had been completed when the error was discovered.

Licensee's investigation revealed that the refueling crew had followed the NCTL as it was written. However, the procedure was incorrect in that it directed the wrong orientation of this fuel assembly. In addition, the licensee noted that the process problems noted in Section 8.3 of this report were the apparent root causes. The individual that developed the NCTL noted the error in Step 260 in the procedure (as well as two other problems) during the walkdown of the procedure on the board prior to refueling. However, this individual failed to correct the error in Step 260. Because no fully independent reviews of the NCTL were performed following the issuance by its author, no other barriers existed to identify the error. The licensee suspended core alterations to investigate this event. The licensee performed a full review of the NCTL to ensure there were no other errors. The failure to provide an adequate procedure for refueling operations is a violation of 10 CFR 50, Appendix B, Criterion V. However, because the licensee took effective corrective actions, and because the other criteria of Section VII.B.2 of the enforcement policy were met, this violation is not being cited (Noncited Violation NCV 397-9414-04).

The inspector noted that the SRO who performed Step 260 of the NCTL was the SRO that was removed from refueling operations on May 11. The inspector further noted that management's expectation for procedure performance was that

individuals who performed the procedure should be sufficiently knowledgeable and cognizant of the operation so that errors in the procedure should be recognized by the performer.

8.5.5 Lack of Control of Blade Guides

On May 15, 1994, the licensee recommenced core alterations. Following the event described in Section 8.5.4, the licensee reissued the NCTL for the last 150 fuel moves. Because the COSMOS program prints the NCTL with blade guide (dummy fuel bundle) controls in the spent fuel pool, the NCTL developer had been removing the locations of the blade guides from the NCTL and manually specifying the location of blade guides in the spent fuel pool as "any". The licensee stated that these actions were taken to provide the refueling SRO with "more flexibility." However, on May 15 upon reissuance of the NCTL, the NCTL developer failed to remove all of the specific locations of the blade guides from the NCTL. Because the locations of the blade guides were not previously controlled, this led to confusion during refueling on May 15.

Step 946 of the NCTL directed the operators to move the blade guide in Position 08-R-12 of the spent fuel pool: however, there was no blade guide at this location. The licensee suspended core alterations to correct the NCTL so that blade guide locations were all specified as "any."

Also, on May 15, 1994, after correction of the NCTL, the operators attempted to complete Step 947 of the NCTL to place an irradiated fuel bundle in spent fuel pool Location 05-LL-21. However, this step could not be performed as written because a blade guide was already in this location. The EOs placed the fuel bundle in a temporary location until the discrepancy was resolved. The licensee again suspended core alterations to investigate and resolve this event.

The inspector discussed the problems with the NCTL during a conference call with the licensee. The licensee developed an action plan to ensure that the rest of the NCTL would be performed as written. The locations of all of the fuel in the reactor and the spent fuel pool were verified to be correct and the NCTL was stepped through once more. The licensee also developed long-term corrective actions for future refueling periods that included fully independent reviews of the NCTL prior to use and close control of all components (including blade guides).

8.6 Conclusions

Licensee refueling performance has steadily declined over the past 3 years. The processes, preparation, and individual performance of refueling activities require strengthening. The process for developing the NCTLs does not include sufficient independent verification to ensure the development of a quality product. One refueling crew did not appear to have fully sufficient knowledge of core alterations, indicating that the training program for refueling requires enhancement. In addition, there was evidence of personnel proceeding in the face of uncertainty. Management's oversight of refueling requires

substantial strengthening. Management appeared to be closely involved only after each problem surfaced. In addition, although QA personnel were on the refueling bridge 24 hours a day during the entire evolution, QA had limited value added in the overall performance of refueling. The inspectors noted that additional improvements in the foreign material controls may be necessary.

9 FOLLOWUP OF OPERATIONS CORRECTIVE ACTIONS (92901)

The inspectors reviewed records, interviewed personnel, and inspected plant conditions relative to licensee actions in response to previous violations.

9.1 (Closed) Violation 50-397/9318-03: Improper Method for Locking Valves

This item involved a violation which concerned inappropriate securing of handwheels to nearby seismic restraints. In the two examples cited in the violation, the valves were in the correct position; but, contrary to the licensee's procedures, the handwheels had been removed from the valves before being secured to a nearby restraint. There were other handwheels lying loose in the area which could have been used to change the position of the valves. The inspectors reviewed the licensee's root cause evaluation and proposed corrective actions, concluded that the corrective actions were appropriate, and verified their completion. The licensee's corrective actions included a plant-wide verification that all other valves on the licensee's locked valve checklist were locked in an appropriate manner and that EOs who verified positions of valves on the locked valve checklist were cognizant of the appropriate means for locking valve handwheels.

In reviewing this issue, the inspectors noted that an earlier superseded version of the procedure for locking valves had suggested chaining the valve handwheel to a nearby structure as an acceptable means of securing the valve in position. The inspectors expressed concern that such an arrangement could potentially restrain the valve from moving as analyzed. For example, if tight, the chain could potentially restrain the thermal or seismic motion of the valve. Although the aforementioned method for securing valve handwheels had subsequently been removed from the licensee's procedures, the licensee decided to check the valves on the locked valve checklist during the upcoming refueling outage to confirm that locked valves were not tightly secured to independent structures.

9.2 (Closed) Violation 50-397/93-201-02: Failure to Perform a Valve Lineup Check

This item involved a violation wherein the licensee did not actually verify the position of the standby SW siphon vent line isolation valves as required by procedures. The subject valves were under water and would have required position verification by a diver. The inspectors noted that NRC Inspection Report 50-397/93-201 had previously accepted the licensee's determination of operability verification. At the time of the inspection, the siphon vent line isolation valves had been permanently removed, and the vent lines had been

permanently capped. The inspectors concluded that the licensee's actions to address the specific issues noted in the violation were complete.

10 FOLLOWUP OF MAINTENANCE CORRECTIVE ACTIONS (92902)

10.1 (Closed) Violation 397/9345-02: Scaffolding not Installed per Licensee Procedures

This item reported that an inspector found a scaffold which had been installed within 2 inches of safety-related equipment contrary to licensee procedural requirements for scaffolding installation. In addition, the scaffolding had been partially disassembled and, therefore, did not conform to a previously analyzed configuration. This partially disassembled scaffolding had not been inspected or analyzed by civil engineering personnel. These actions were required by licensee Procedure PPM 10.2.53, Revision 7, "Seismic Requirements for Scaffolding, Ladders, Tool Gang Boxes, Hoists and Metal Storage Cabinets."

The licensee, in the written response to the Notice of Violation, dated January 28, 1994, stated that the root cause of the scaffolding deficiencies was that PPM 10.2.53 did not adequately address conditions for scaffold qualification. Specifically, PPM 10.2.53 only specified the final erected scaffolding qualification requirements. The licensee issued Revision 8 to PPM 10.2.53 which addresses scaffold qualification requirements during scaffolding installation and removal.

The inspector reviewed Revision 8 to PPM 10.2.53 which provides precautions and limitations requiring that scaffolding be left in an acceptable seismic configuration at the end of each shift unless the work is scheduled to continue through multiple shifts. The revision also specifies that, if a scaffold must be left in a partially completed condition not meeting procedural requirements, an engineering evaluation must be obtained.

The inspector concluded that PPM 10.2.53, Revision 8, provided additional guidance, which did not previously exist, for the in-process control of scaffolding. The inspector considered the licensee's actions adequate. This violation is considered closed.

10.2 (Closed) IFI 397/9313-03: Correction of High Battery Electrolyte Level

An NRC inspector had noted comments written on weekly surveillance records which denoted a high electrolyte level in a battery cell. Review of associated documentation indicated that the craftsman who noted this condition had indicated that a repetitive task request (RTR) would be used to lower electrolyte level. The practice of lowering electrolyte level was questioned by the inspector due to concerns over the adequacy of the mixing of the electrolyte and measuring specific gravity.

The inspector reviewed the results of the licensee's investigation which was conducted based on NRC's questions. RTRs are used for routine addition of water to maintain electrolyte level within the required range; however,

licensee's review of RTR records revealed that no RTR had been issued to lower battery electrolyte level. Additionally, licensee's reviews of past work history did not identify any situations where electrolyte had been removed from any battery cell. Subsequent inspection, following initial identification of a high electrolyte level, showed the level for the cell in question to be higher than usual but within the acceptable range. The licensee concluded that no battery electrolyte had been removed from the cell. After discussions with the battery manufacturer, the licensee has confirmed that electrolyte can be removed from a cell, if level is above the allowed range, provided provisions were made to add the electrolyte when required to raise cell level. Based upon the licensee's review of past battery history, which did not reveal any situations where an above normal range electrolyte level had been noted, and the actions which would be taken if a high electrolyte level was noted, this item is closed.

11 FOLLOWUP OF ENGINEERING CORRECTIVE ACTIONS (92903)

11.1 (Open) IFI 397/9324-01: Corrective Actions Program

In response to SALP findings, the licensee committed in a May 27, 1993, letter to the NRC to improve its corrective action program. The proposed improvements were to cover root cause evaluations, identification of appropriate corrective actions to prevent recurrence, and implementation of those actions. The purpose of this followup item was to track the licensee's progress in implementing improvements to its corrective action program. Although the licensee had implemented several substantive changes to its corrective action program, the licensee's QA Report 294-002 dated March 13, 1994, identified the following deficiencies:

- The procedures were still cumbersome.
- The procedures did a poor job of incorporating Generic Letter 91-18 guidelines.
- Although required licensee personnel had been trained in the usage of the new procedures, training was inadequate.
- Procedural noncompliances continued.

The inspectors' independent evaluation of the licensee's progress on the corrective action program confirmed the findings of the licensee's QA audit report. The inspectors also noted that the licensee was making further changes to its corrective action program to resolve identified deficiencies and that the licensee decided to extend the commitment to require PER dispositions to undergo a review by senior management. This followup item remains open pending verification that the above deficiencies have been resolved.

12. ONSITE REVIEW OF LERs (92700)

The inspectors reviewed the following LERs associated with operating events. Based on the information provided in the report, it was concluded that reporting requirements had been met, root causes had been identified, and corrective actions were appropriate. The below LER was reviewed during this inspection period.

12.1 (Closed) LER 397/93-015: HPCS Inoperability due to Inadequate HPCS Pump Room Cooler Flow

This LER documented inoperable HPCS following the discovery of less than required SW flow to the HPCS pump room Cooler RRA-CC-4 during the performance of a HPCS SW system monthly surveillance. Discovery of the low flow condition occurred during a period in which the RCIC system was inoperable which resulted in the licensee entering TS 3.0.3, performing a reactor plant shutdown and declaring an unusual event.

The licensee performed a SW flow balance of HPCS system components. After performing the flow balance the flow to the HPCS pump room Cooler RRA-CC-4 returned to the allowed band. During the flow balance, flow to the HPCS diesel engine heat exchanger was reduced but still maintained within the allowable range.

The licensee canceled the procedure for performing the surveillance and issued two separate procedures in its place, one which performs a monthly SW valve position verification and another which performs a HPCS system SW flow balance. The flow balance procedure now requires recording SW flow rates to all cooled components following any system adjustments.

The licensee has performed analyses which indicate that the HPCS pump room cooler would have adequately performed its design function with the as-found lower than normal flow rate. Additional analyses were performed showing that the specified flow rate to the diesel engine cooling water heat exchanger could be reduced and still be adequate to remove required heat loads. As a result of these analyses, the required flow rates have been changed to these lower values. Flow verification measurements were also performed which demonstrated the measured flow with normal system flow rates were accurate.

The inspector concluded that the licensee's actions appeared appropriate and would prevent a similar occurrence of this nature in the future. Although not explicitly stated in the LER, the root cause appears to have been adjustment of HPCS component SW flow rates without verification of adequate flow to other components following the adjustment. Applicable procedures have been changed to correct this problem.

ATTACHMENT

1 PERSONS CONTACTED

*V. Parrish, Assistant Managing Director for Operations
*M. Flasch, Engineering Director
*J. Gearhart, Quality Assurance Director
*J. Swailes, Plant Manager
*G. Smith, Operations Division Manager
*G. Gelhaus, Project Engineering Manager
*M. Reddemann, Technical Services Division Manager
*R. Koenigs, Design Engineering Manager
*M. Monopoli, Maintenance Division Manager
*R. Webring, Support Services Manager
*R. Noyes, Engineering Programs Manager
*J. Sampson, Maintenance Production Manager
*P. Bemis, Regulatory Programs Manager
*J. Albers, Radiation Protection Manager
*J. Benjamin, Quality Assessments Manager
*S. Davison, Plant Support Assessments Manager
*J. Engbarth, Nuclear Safety Assurance Manager
*W. Shaeffer, Operations Manager
*M. Mann, Assistant Operations Manager
*D. Swank, Licensing Engineer
*B. Hugo, Licensing Engineer
*C. Foley, Licensing Engineer

The inspectors also interviewed various control room operators, shift supervisors and shift managers, maintenance, engineering, quality assurance, and management personnel.

*Attended the exit meeting on May 20, 1994.

2 EXIT MEETING

An exit meeting was conducted on May 20, 1994. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee acknowledged the inspectors' findings. The licensee did not identify as proprietary any of the information provided to, or reviewed by, the inspectors.