U.S. NUCLEAR REGULATORY COMMISSION

REGION V

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| Report No.: | 50-397/93-11 |
| Docket No.: | 50-397 |
| License No.: | NPF-21 |
| Licensee: | Washington Public Power Supply System (WPPSS) |
| Inspection at: | Washington Nuclear Plant, Unit 2<br>Benton County, Washington |
| Inspection Conducted: | April 5 through 9, 1993 |
| Inspectors: | M. J. Royack, Reactor Inspector<br>M. K. Payne, Reactor Inspector |

Approved by: W. P. Ang 5-7-93

W. P. Ang, Chief, Engineering Section

Inspection Summary:

Inspection during the period of April 5 through 9, 1993, NRC Inspection Report No. 50-397/93-11.

Areas Inspected:

During this routine announced inspection the inspectors reviewed the licensee's maintenance program, Thermo-Lag evaluations, and a licensee evaluation of the 471 foot elevation turbine generator building block wall as a three hour fire barrier. NRC Inspection Procedures 62700 and 92701 were used for this inspection.

Safety Issues Management System (SIMS) Item:

None.

General Conclusions:

The inspectors reviewed two of thirteen component or equipment failures which contributed to or caused a plant shutdown since January of 1991:

- The licensee had performed maintenance and repairs in accordance with procedures and that the maintenance program was being implemented in accordance with regulatory requirements for the two cases.
- A post modification and maintenance test did not adequately demonstrate that systems or components would perform satisfactorily in service. The

result was a challenge to a safety function and an expected timely reactor trip.

- The licensee had performed an evaluation of thermo-lag and determined that the Thermo-Lag was operable but degraded and therefore initiated fire watches as a compensatory measure.

Strengths/Weaknesses:

Strengths

- Licensee engineering staff were knowledgeable and able to diagnose and reach conclusive root causes of problems for the two equipment or component failures inspected.
- The licensee was in the process of implementing a reliability centered maintenance program (RCM), which included data trending to predict problems prior to failures.

Weaknesses

- For one of the two equipment or component failures inspected post maintenance and repair testing procedures did not demonstrate that systems or components would perform satisfactorily in all service conditions.

Significant Safety Matters:

None

Summary of Violation or Deviations:

One non-cited violation was identified during this inspection.

Open Items Summary:

No open items were identified during this inspection. One NRC followup item was updated.

## DETAILS

1. Persons Contacted

Washington Public Power Supply System

J. Baker, Plant Manager
* W. Barney, Mechanical Maintenance Engineering Supervisor
* J. Boesch, Mechanical Supervisor
* R. Burk, Plant Technical Senior Engineer
* E. Culverhouse, Mechanical Maintenance Shop Engineer
* S. Davison, Plant Quality Assurance Manager
* C. Fies, Licensing Engineer
* G. Freeman, Project Management
* J. Gearhart, Director, Quality Assurance
* L. Grumme, Nuclear Safety Assurance Manager
J. Harmon, Maintenance Assistant
* L. Harrold, Maintenance Division Manager
R. Koenigs, Acting Director of Engineering
* J. Little, Maintenance Engineer
T. Messersmith, Maintenance Support Manager
* D. Morgan, Acting Maintenance Assistant
C. Noyes, Engineering Programs Manager
J. Parrish, Assistant Managing director of Operations
S. Peck, Equipment Engineering Manager
* D. Pisarcik, Radiation Protection Manager
* K. Pisarcik, Licensing Engineer
* M. Reis, Technical Programs Manager
* J. Rose, Craft Supervisor
* J. Sampson, Maintenance Production Manager
* W. Sawyer, Shift Manager, Operations
W. Schaffer, Operations Manager
D. Schuman, Plant Technical Engineering
G. Smith, Operations Division Manager
* J. Vause, Reliability Centered Maintenance Program Supervisor
R. Webring, Technical Division Manager
* P. Ziemer, Acting Maintenance Procedure Supervisor

* F. Bartel, Industrial Engineer, Bonneville Power Authority

US Nuclear Regulatory Commission

* R. Barr, Senior Resident Inspector, WNP-2
D. Proulx, Resident Inspector, WNP-2

*Denotes those attending the exit meeting on April 9, 1993.

The inspectors also held discussions with other licensee personnel.

2. Objective

The objective of this inspection was to perform a performance based inspection of the licensee's maintenance program implementation and to followup on NRC Thermo-Lag open items.

This inspection would determine, a) if the licensee's maintenance program was being implemented in accordance with regulatory requirements, b) the effectiveness of the plant maintenance program on plant equipment, and c) the ability of the maintenance staff to conduct an effective maintenance program.

Additionally the inspection would determine if the licensee was taking appropriate actions to resolve NRC Thermo-Lag operability concerns.

3. Maintenance Program Implementation (62700)

a. Inspection Guidelines

To assess the maintenance program the inspectors reviewed two of thirteen licensee event reports (LER's) from January 1991 through March 1993. The two of thirteen LER's were chosen because they met one or more of the following criteria: safety related equipment failures leading to plant shutdown, non-safety-related equipment failures leading to a plant shutdown, equipment failures leading to reduced capability of a safety-related system, and recurring safety-related equipment failures. Additionally, the inspectors reviewed in-process maintenance and repair packages and observed a repair of a non-safety-related piece of equipment. The inspectors noted that a refueling outage for the facility was scheduled within 30 days of the inspection. The licensee had scheduled safety-related equipment work for the outage.

Each item was evaluated to determine if: a) the cause of the failure was evaluated and adequate corrective action was taken to reduce the probability of recurrence, b) procedures were adequate for the scope of the maintenance performed, c) current vendor information was included and followed in the procedures, and d) periodic surveillance testing could have provided indication of an impending failure.

The LERs were not reviewed for complete licensee evaluation, corrective actions, or operational concerns. Therefore, the LERs will be reviewed in future inspections.

b. Item Selection

The inspectors reviewed equipment failures associated with LER's 50-397-93-002-00, and 50-397-93-005-00.

c. Item Review

LER-50-397-93-002-00

LER-50-397-93-002-00 reported that on January 21, 1993, a low reactor pressure vessel (RPV) level reactor scram was initiated by the reactor protection system (RPS) in response to an actual low water level condition. The low water level condition was due to the failure of reactor recirculation (RRC) pump flow control valves, RRC-FO-60 A/B, to reposition to a lower flow on the trip of the 1A reactor feedwater pump (RFW) turbine. The RRC pump flow control valves were designed to runback to reduce power and steam flow to within the capacity of one RFW pump.

Reactor feedwater pump turbine 1A tripped on a "high thrust bearing wear" signal as a result of a wetted vibration sensing circuit which was caused by an inadvertent actuation of the RFW pump room "A" fire protection deluge system. The remaining operating feedwater pump was unable to supply sufficient water to maintain RPV level above the scram setpoint when the RRC pump flow control valves failed to run back.

The licensee had performed design changes, modifications, and maintenance to the flow control valves hydraulic power units and associated electronics in 1990 using Maintenance Work Requests (MWRs) AS3040, "Actuator Has Slight Leak Around Shaft and Drifts in Position (Replace), and AS6085, "Install Term (terminal) Box, Flex Conduit and Extension Cable for RRC Position and Velocity Transmitters." MWRs AS3040 and AS6085 were completed on June 25, and June 22, .1990, respectively. The valves were satisfactorily tested in accordance with the associated MWR test requirements.

The licensee found that a contributing cause to this event was the failure of system design reviews and analysis to determine the combined negative effect of the tightening of valve shaft seals and the negative effect of voltage changes due to the addition of an extension cable to valve position and velocity transmitters. These changes both reduced the valves' response time. Failure to adequately perform these reviews and to functionally test the system resulted in the failure of the valves to runback to their full runback positions.

As part of their response to the event the licensee issued NCR 293-055, which required that a fault analysis of the event be performed. The fault analysis concluded that initial power ascension and engineering tests for operability did not have conditions that would have identified the failure mode. Also the plant procedure manual (PPM) procedure 8.3.120, "Recirculation Flow Control Valve - Alignment/Calibration," Revision 1, did not provide adequate test criteria for demand and velocity loop voltage integration that controls valve movement.

NRC Review

The inspectors reviewed licensee procedure 8.3.120, Revision 1. The inspectors found that reactor recirculation pump flow control valves RRC-FO-60 A/B were required to be adjusted to runback RRC flow from 100% to 20% position upon the loss of one RFW pump. During the event when RFW pump turbine 1A tripped RRC-FO-60A repositioned to 82% and RRC-FO-60B repositioned to 26%.

The inspectors reviewed the licensee's NCR 293-055, the resultant "Fault Analysis" for RRC-FO-60 A/B, MWRs AS3040 and AS6085, in process changes to PPM procedure 8.3.120, and General Electric document GEK-90434, "Hanford 2 Operation and Maintenance Instruction Recirculation Flow Control Valve Control System." The inspectors also reviewed MWR AP2142, "The Recirc Flow Control Valve Velocity Amplifier is Showing the Wrong Gain. Adjust Gain for the Present Application," which took the corrective actions to modify and test controls to assure proper operation of the RRC flow control valve runback. MWR AP2142 was completed on January 25, 1993.

The inspectors found that the fault analysis for RRC-FO-60 A/B appeared to determine the cause of the failure and that NCR 293-055 and LER-50-397-93-002-00 corrective actions were being implemented to reduce the probability of recurrence. The corrective actions were to, a) replace resistor cards for coarse velocity gain adjustments and adjust velocity amplifiers until feedback signals matched actual valve velocities, and b) revise PPM procedure 8.3.120 to include acceptance criteria for demand and velocity loop voltage and loop integration for control of valve movement.

Conclusions

The inspectors concluded that: The licensee had determined the cause of the failure of RRC-FO-60 A/B to runback to their correct position and had taken corrective actions to prevent recurrence. Procedures to perform maintenance and modifications in MWRs AS3040 and AS6085 were adequate and the packages were complete. However, post modification and maintenance testing procedures did not demonstrate that RRC-FO-60 A/B would runback to their set conditions during a loss of RFW pump event. Vendor information for valve maintenance and repair was available, current, and included in the MWRs. However, the vendor information was generic and did not provide acceptance criteria for demand and velocity loop voltage and loop coordination. The inspectors also concluded that periodic surveillance testing in accordance with licensee procedures prior to the event would not have predicted the failure.

Failure to provide adequate procedures to demonstrate that systems or components perform satisfactorily in service is a violation of 10 CFR Part 50, Appendix B, Criterion XI. However, this violation has not been cited in a notice of violation because the criteria set forth in 10 CFR

Part 2 section VII.B.2 have been satisfied.

One non-cited violation was identified.

LER-50-397-93-005-00

LER-50-397-93-005-00 identified that the plant had entered an operational condition where the wetwell purge exhaust valves (CEP valves) were required to be operable, without performing maintenance necessary to satisfy Technical Specification requirement 4.6.1.8.2.b. The valves were secured closed when their leak rate was measured to be greater than allowed by Technical Specifications Surveillance Requirement 4.6.1.8.2.b (0.05 percent of containment allowable leakage per 24 hours (La)). Prior to entry into Mode 3 from Mode 4, CEP valves CEP-V-3A and CEP-V-4A were required to have maintenance performed to reduce leakage below 0.05 La.

Wetwell exhaust and purge valves are organized in pairs of valves aligned in series and tested as a pair during leak rate testing. CEP-3A and 4A were such a pair.

NRC Review

The inspectors reviewed wetwell purge supply and exhaust valve leak rate testing failure and maintenance history. The inspectors found that since a 1989 valve seal modification CEP-3A and 4A had failure rates (6 failures for 23 tests over a three year period) higher than other similar design CEP and wet well purge supply (CSP) valves (zero failures in 16 tests for CSP-V-3 and 4; two failures in 26 tests for CEP-V-1A and 2A; three failures in 18 tests for CSP-V-1 and 2).

Evaluations of CEP valves were performed by the licensee. The evaluations were unable to determine why CEP-3A and 4A had a higher failure rate than the other similar design valves. In the interim the licensee had reduced the leak rate to within Technical Specification acceptance criteria by incorporating alternate seal designs and valve linkage adjustments.

The inspectors reviewed the maintenance and failure data with licensee design engineering personnel. The inspectors found that the licensee Plant Technical Staff System Engineer had performed root cause analysis on the valve failures as requested in material deficiency report (MDR) 290-658 in January 1991. The inspectors found that the licensee had dedicated staff and funding to resolve the valve problem since the original vendor had not been able to resolve the leakage problems. Subsequently the original vendor had sold their valve manufacturing to another organization. The licensee had worked with the new vendor and had developed a new valve seal design which test results indicated would resolve the leak problem. The test results were documented in licensee equipment qualification report EQR 89-01, "Testing of BIF Butterfly Valve Seal," dated April 5, 1990.

The licensee had scheduled replacement of eleven CSP and CEP valve seals during the R-8 refueling outage in 1993.

Conclusion

The inspectors concluded that the licensee appeared to have determined the root cause of the valve failures to pass the valve leak rate tests, and that installation of the new seals will reduce the probability of recurrence. The licensee had incorporated vendor information and worked with vendors to solve the problem. The inspectors concluded that surveillance testing had identified the problems and that the licensee had taken action to evaluate and correct the problem.

No violations or deviations from NRC requirements were identified.

In Process Maintenance and Repair

The inspectors reviewed the daily work schedule for planned maintenance. The inspectors reviewed a sample of the scheduled maintenance activities at various stages of the work process, specifically Maintenance Work Requests (MWR's), to assess compliance with licensee administrative requirements and work control. The inspectors also observed a maintenance package in progress.

MWR Package Review

The inspectors selected and reviewed the following MWR's and work packages:

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| 1) | MWR AP 2956 SW-V-154Y | Could not be operated with just the handwheel |
| 2) | MWR AP 2100 SW-PI-41B | Gage missing |
| 3) | MWR AP 1996 E-SYS-1 | RTR (Repetitive Task Request) battery maintenance |
| 4) | MWR AP 1225 PI-SYS-1 | Replace CRM (Control Room Matrix Printer) P1, P2, A1 and A2 with Mannes Mann tally printers |
| 5) | MWR AP 2624 WEA-FN-6 | Outboard fan shaft bearing hot |

The inspectors reviewed the MWR's for format, approval process and control in accordance with licensee administrative PPM procedures 1.3.7, "Maintenance Work Requests," and 1.3.7.A, "Minor Maintenance." The inspectors reviewed work packages to determine if activities were described in sufficient detail to perform the task and if post maintenance testing requirements were appropriate for the repairs made.

The inspectors determined that the MWR's reviewed were formatted, written and approved in accordance with licensee procedures. The

inspectors determined that procedures used to perform the tasks appeared to be complete and provided sufficient detail for the craft person to perform the task. MWR packages included appropriate post maintenance testing for the repairs or maintenance performed. The inspectors also determined that maintenance and repair procedures included inspection and hold points, supplementary vendor reference material and technical manuals, electrical, mechanical, and radiological precautions.

Work Observation

The inspectors observed work in progress for MWR AP 2624 WEA-FN-6, "Outboard Fan Shaft Bearing Hot." The MWR required that shaft bearing and drive belts be replaced on fan WEA-FN-6.

The inspectors found that the maintenance craft personnel appeared to be knowledgeable and qualified to perform the task and that maintenance personnel maintained good housekeeping and gave proper considerations to safety hazards in the work area. The maintenance personnel kept the procedure and vendor information at the work site and referenced the procedures to assure that the repairs were being performed correctly. The inspectors also noted that an adequate level of supervision was present to assure procedure compliance and proper work performance.

Conclusion

The inspectors concluded that the licensee was preparing, reviewing, and approving MWR's in accordance with approved procedures; licensee maintenance and repair procedures included adequate information for the craft to perform their task and assure the quality of work; and licensee craft persons were performing tasks in accordance with procedures and to their level of skill.

No violations or deviations from NRC requirements were identified.

Reliability Centered Maintenance Program

The licensee was in the process of developing a reliability centered maintenance program. The program was being developed under proposal RCM-R-015, "A Plan For Optimum RCM Implementation." The RCM program was in the pilot (development) stage and was not scheduled for full implementation until FY-95 to meet requirements of 10 CFR 50.65, "Maintenance Rule."

The inspectors reviewed the licensee's reliability centered maintenance (RCM) proposed program plan RCM-R-92-015 and found that the equipment data trending area of the program predicted maintenance problems. The inspectors reviewed six MWR's written as a result of the predicted problems.

The inspectors found that specific equipment data trending (namely vibration and lube oil conditions) was identified under the program. There was evidence that the licensee was performing equipment

maintenance or repair prior to predicted failures.

The inspectors concluded that data trending under the pilot RCM program was predicting and resolving problems prior to failures.

No violations or deviations from NRC requirements were identified.

4. Onsite Followup of Written Reports (92700)

Thermo-Lag

NRC IE Notices 91-47, "Failure of Thermo-Lag to Pass Fire Endurance Test," and 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials," were issued to alert licensees to the potential existence of variations in Thermo-Lag installations which had not been qualified by independent fire testing or engineering analysis to meet fire rating requirements provided in Generic Letter 86-10, "Implementation of Fire Protection Requirements." In response to guidance provided in NRC IE Notices 91-47 and 91-79 the licensee reviewed their Thermo-Lag installation procedure PPM 10.25.89, 1 Hour - 3 Hour Fire Barrier Installation, Revision 8, against the current Thermo-Lag vendor installation manual, TSI (Thermal Science, Incorporated) Technical Note 20684, Revision V, available fire test information, and existing engineering analysis.

The licensee's review, performed under problem evaluation request (PER) 292-026, determined that there were areas where licensee Thermo-Lag installations differed from vendor installation instructions and/or fire tests. The licensee also determined that additional fire tests or analysis appeared to be required to verify the adequacy of the variations. The licensee developed a justification for continued operation (JCO) in response to the findings.

The inspectors reviewed PER 292-026 and the JCO and determined that the licensee had concluded that the Thermo-Lag fire barriers were degraded but operable. However, as a prudent measure the licensee established fire watches to compensate for the degraded Thermo-Lag fire barriers. Fire watches will be maintained until a resolution to the Thermo-Lag issue is complete. The licensee noted that a Thermo-Lag operability evaluation would be submitted to NRR.

The inspectors concluded that the licensee's evaluation of Thermo-Lag fire barriers were degraded and operability was indeterminate. Fire watches initiated by the licensee appeared to be adequate compensatory measures.

No violations or deviations to NRC requirements were identified.

(Open) Followup Item 50-397/92-002

During an NRR audit of WNP-2 Thermo-Lag fire barrier issues conducted by Messrs. L. Plisco and S. West on November 6 and 7, 1991, four followup

items were identified. One of the four items was for the licensee to provide documentation verifying that the wall at the 471 foot elevation separating the radwaste building and the turbine building met three hour fire rating criteria.

The inspectors reviewed licensee plant modification record (PMR) 87-0414-0 and MWR AT 7669. PMR 87-0414-0 documented the installation of Thermo-Lag to the existing block wall that served as a fire barrier between the elevation 471 foot corridor (fire area TG-I) and the elevation 487 foot radwaste health physics area (fire area RC-I) under direction of MWR AT 7669. The licensee considered that the Thermo-Lag installation upgraded the existing block wall to a three hour fire barrier. The addition of the Thermo-Lag was per recommendations of a Thermal Science Inc. letter, dated June 14, 1988.

The inspectors reviewed the Thermal Science, Inc. recommendation for the addition of Thermo-Lag to the block wall; PMR 87-0414-0, documenting the installation of Thermo-Lag on the block wall; and MWR AT 7669, which specified the installation of the Thermo-Lag on the block wall.

The inspectors concluded that the licensee had provided documentation supporting the three hour fire rating of the wall at the 471 foot elevation separating the radwaste building and the turbine building.

No violations or deviations of NRC requirements were identified.

5. Exit Meeting

The inspectors conducted an exit meeting on April 9, 1993, with Mr. L. Harrold and members of the licensee staff as indicated in Section 1. During this meeting, the inspectors summarized the scope of the inspection activities and reviewed the inspection findings as described in this report. The licensee acknowledged the concerns as identified in this report.

At the conclusion of the exit meeting the licensee was requested to identify any documents that were proprietary and that needed to be returned. No documents were identified.

bcc w/enclosure:

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