

R.C. Haag
R. Haag, Material and Quality Programs
Section, Division of Reactor Safety

2-22-88
Date

[Signature]
H. F. Bundy, Project Engineer, Project
Section D, Division of Reactor Projects

2/22/88
Date

Other
Assisting
Personnel:

J. P. Clausner, French Commissariat A L'Energie
Atomique, Institute De Protection Et De Surete
Nucleaire

Approved:

[Signature]
G. L. Constable, Chief, Project Section D
Division of Reactor Projects

2/22/88
Date

Inspection Summary

Inspection Conducted December 1-31, 1987 (Report 50-498/87-75;
50-499/87-75)

Areas Inspected: Routine, unannounced inspection including licensee action on previous inspection findings, licensee action on previously reported items, slave relay surveillance deficiency due to personnel error, TMI and GL 83-28 action item followup, IE Circulars, Class 1E batteries inoperable, cold weather preparations, chemical detection system inoperability, safety injection pumps recirculation flow, Unit 2 preoperational test program, incore thimble tube inspections, Unit 1 significant events, status of incomplete preoperational tests (Unit 1), status of auxiliary feedwater system failures (Unit 1), and site tours.

Results: Within the areas inspected, one violation (paragraph 10) and no deviations were identified.

DETAILS

1. Persons Contacted

- *J. E. Geiger, General Manager, Nuclear Assurance
- *M. R. Wisenburg, Unit 1 Superintendent
- *W. H. Kinsey, Plant Manager
- *S. M. Dew, Operations Support Manager
- *G. L. Jarvela, Manager, NPOD Technical Support
- *J. A. Brady, Division Manager, Emergency Preparedness
- *T. E. Underwood, Chemical Operations and Analysis Manager
- *G. L. Parkey, Manager, Plant Engineering
- *M. A. McBurnett, Manager, Site Licensing
- *S. M. Head, Supervisory Licensing Engineer
- *P. L. Walker, Staff Engineer
- J. A. Constantin, Simulator Training Supervisor

In addition to the above, the NRC inspectors also held discussions with various other licensee, architect engineer (AE), constructor, and contractor personnel during this inspection.

*Denotes those individuals attending the exit interview conducted on January 6, 1988.

2. Unresolved Items

An unresolved item is a matter about which more information is required to ascertain whether it is an acceptable item, a deviation, or a violation.

Unresolved items are identified in paragraphs 5 and 11 of this report.

3. Licensee Action on Previous Inspection Findings

(Closed) Violation 498/8739-02

This violation concerns the failure to follow the procedures for installing temporary modifications. The NRC inspector reviewed the response given by the licensee (Letter ST-HL-AE-2354), the Procedure OPGP03-ZO-0003, "Temporary Modifications and Alterations" Revision 7, effective September 12, 1987, and the records which indicate training in temporary modifications has been conducted for responsible startup personnel.

Corrective action and steps taken to prevent recurrence are considered acceptable.

This violation is considered closed.

(Closed) Deviation 498/8741-01; 499/8741-01

This deviation involved failure to treat components in certain systems as quality related per STP Final Safety Analysis Report (FSAR) requirements in the preventive maintenance (PM) program and maintenance work request (MWR) program. The NRC inspector reviewed records indicating that PMs which might not have had the proper quality control (QC) inspections, have been reviewed and evaluated by the licensee. Out of 11 MWRs/PMs which would have required QC inspection, no discrepancies were found in the work packages. The NRC inspector reviewed Procedures OPGP03-AM-0002, "PM Program," effective September 2, 1987, and OPGP03-AM-0003, "MWR Program," effective November 6, 1987, and they contained adequate clarifications for determining proper quality classifications. The NRC inspector also reviewed records for training conducted during the period of June 29 to July 24, 1987, which indicated training in determining quality classifications had been conducted for key maintenance personnel.

This item is considered closed.

(Closed) Open Item 498/8717-01

This item concerned the completion of emergency lighting installation and testing as well as the development of procedures to periodically check the operability of the lighting units. The installation and initial testing of emergency lighting has been completed. The NRC inspector reviewed the last preventive maintenance check procedure and completed data form EM-1-LB-87013194 and found them acceptable.

This item is considered closed.

(Closed) Open Item 498/8717-02

This item concerned the completion of installation of all fire barriers, seals, wraps, detection devices, and fireproofing. The constructor has turned over to the licensee all systems and items related to these areas. The licensee's fire protection engineers have completed a review of all documentation and have conducted a satisfactory walkdown of all items. The NRC inspector completed a tour of selected plant areas that provided an adequate sampling of the items of concern. Discrepancies noted were minor in nature and found to be already identified in the licensee's work item tracking system.

This item is considered closed.

(Closed) Open Item 498/8727-05

This item concerned smoke stratification effect on smoke detectors in rooms with tall ceilings, large volumes, and low ventilation air flow rates. The licensee responded to this concern in Letter ST-HL-AE-2053, dated April 17, 1987. The response determined that these areas were not a concern based on the location of combustible materials and detectors. The

NRC inspector toured each of the rooms identified in the above letter and agrees with the licensee's assessment based on detector location and quantity of installed combustibile material.

This item is considered closed.

(Closed) Open Item 498/8727-06

This item concerned installed noncollapsible fire hoses which were not Underwriters Laboratory (UL) listed. In a letter dated April 17, 1987, the licensee committed to hydrostatically test all of these hoses, and to replace them with UL listed hoses at the first hose maintenance changeout. The hydrostatic testing has been satisfactorily completed. The NRC inspector has reviewed the documentation on this item and finds it acceptable.

This item is considered closed.

(Closed) Open Item 498/8727-07

This item concerned the installation of portable fire extinguishers in the essential cooling water intake structure in accordance with National Fire Protection Association (NFPA) Standard No. 10. The NRC inspector verified that the fire extinguishers were permanently mounted in the intake structure as required.

This item is considered closed.

(Closed) Open Item 498/8727-08

This item concerned the development of procedures to maintain the emergency communication systems. The NRC inspector reviewed Station Procedures OPGP03-CN-001, "Radio Communication," Revision 0, dated June 16, 1987; OPGP03-CN-0002, "Telephone Communications," Revision 0, dated June 9, 1987; OPGP03-CN-0003, "Plant Public Address and Alarm System," Revision 0, dated June 9, 1987; and OPGP3-CN-0006, "Communication Systems Testing Program," Revision 0, dated April 24, 1987. These procedures appear to satisfy the commitments.

This item is considered closed.

(Closed) Open Item 498/8726-08

This open item concerns the classification of the Interim Storage Facility (ISF) as a records storage facility per American National Standards Institute (ANSI) N45.2.9-1974. HL&P Technical Support conducted an evaluation of the ISF and questioned whether the ISF can be classified as a records storage facility. This uncertainty involves paragraphs 5.6.7, 5.6.8, and 5.6.9 of ANSI N45.2.9-1974 which addresses: (a) use of halon as the suppression agent, (b) conduit penetrations, and (c) heating, ventilation, and air conditioning (HVAC) duct penetrations.

The existing halon suppression system appears to provide "adequate fire protection" as required by ANSI N45.2.9-1974. The licensee verified that conduit penetrations are properly sealed and the supply and return HVAC ducts contain dampers which exceed the required fire rating. This verification also meets the requirements of ANSI N45.2.9-1974. The NRC inspector has reviewed this evaluation and agrees with the conclusions reached by the licensee on these issues.

This item is considered closed.

4. Licensee Action on Previously Reported Items

The NRC inspectors reviewed the following incident review committee (IRC) reports and determined that the licensee has taken adequate action on the subject items, except as noted.

(Open) IRC 400, Inadequate Cooling of Standby Diesel Generator (SDG) High Voltage Cubicle Panels

This item concerned inadequate cooling of the Unit 1 SDG high voltage cubicle panels which was discovered when a high temperature alarm actuated during a 100 hour test run of SDG 13. It was reported to the NRC under 10 CFR 50.55(e) and 10 CFR 21. HL&P completed a design modification which involved installing a second fan and removing drip shields over the vents to provide additional cooling to the Unit 1 panels. Completion of a second 100 hour test run for SDG 13 without experiencing abnormally high panel temperatures verified the adequacy of this modification. The NRC inspectors have reviewed both the field installations and the documentation of this modification and consider it acceptable. This item is considered closed for Unit 1. A similar modification is planned for Unit 2 panels. This item will remain open for Unit 2 pending installation of this modification.

(Closed) IRC 399, Failure of Standby Diesel Generator (SDG) Fuel Injector Nozzle

This item concerns a SDG fuel injector nozzle failure during a 100 hour SDG 13 endurance run. A previous failure had occurred on February 25, 1987, during the 24 hour preoperational test run of SDG 11. During an IRC meeting on July 27, 1987, the licensee determined that this item was reportable pursuant to 10 CFR 50.55(e).

Based on failure analysis results performed by Southwest Research Institute and on site testing of all spray nozzle tips (169) there were 20 tips with internal cracks identified, all from the same manufacturers Lot No. 001124. The licensee concluded that the most probable cause of cracking appeared to be due to manufacturing deficiencies associated with this lot. All spray nozzle tips from Lot No. 001124 were considered to be potentially susceptible to cracking and have been replaced.

This item also concerns SDG fuel line leaks which were found during a 24 hour preoperational test performed on SDG No. 11. The root cause has been identified as being improper machining of the fuel line ferrule nuts. Corrective actions have been taken, fuel line repairs are complete and have been satisfactorily tested.

The NRC inspectors have observed portions of the field testing and maintenance activities, and have reviewed the associated documentation. The licensee's corrective actions appear to be acceptable.

This item is considered closed.

5. Slave Relay Surveillance Deficiency Due to Personnel Error (LER 87-019)

The NRC inspector reviewed Licensee Event Report (LER) 87-019 which identified improper slave relay testing deficiencies due to personnel error. The licensee also discovered that the required slave relay testing for "degraded undervoltage coincident with safety injection" had not been properly performed. The licensee has committed to review the criteria for slave relay testing. This review will be addressed in a LER which the licensee plans to submit to NRC. This item will remain an unresolved item (498/8775-02) until the LER has been issued and corrective action has been implemented by the licensee and verified by the NRC inspector.

No violations or deviations were identified.

6. Three Mile Island (TMI) and Generic Letter Action Followup (GL) 83-28

(Closed) TMI Item I.G.1.3 and (Open) Open Item 498/8708-19, Training Requirements During Low Power Testing

Open Item 498/8707-19 tracked completion of the training required by TMI Item I.G.1.3 in the STP FSAR, Appendix 7A. The licensee committed to satisfying this requirement by training operators on Procedure 1PEP4-ZX-10, "Natural Circulation Verification," Revision 0, utilizing the plant simulator. The NRC inspector examined training records verifying that training on this procedure had been completed for appropriate personnel at the simulator during the period of June 1 to July 3, 1987. However, it was established that this training did not involve accomplishing and verifying natural circulation from the remote shutdown panel. TMI Item I.G.1.3 is considered closed. Completion of appropriate training on the remote shutdown panel will be tracked by Open Item 498/8708-19 and must be completed prior to exceeding 50% of full power.

(Closed) GL 83-28, Item 2.2 and (Closed) Open Item 498/8739-04, Equipment Classifications and Vendor Interface

The open item tracked licensee response to questions contained in NRC letter of May 4, 1987, which related to the Nuclear Utility Task Action Committee/Vendor Equipment Technical Information Program (NUTAC/VETIP) as

it is implemented at the STP Electric Generating Station and the quality assurance controls over vendor supplied service on safety-related equipment. The NRC inspector reviewed the licensee's letter of January 5, 1988 (ST-HL-AE-2470), which appeared to be responsive to the NRR questions. Therefore, GL 83-28, Item 2.2 and Open Item 8739-04 are considered closed. However, these closures do not preclude further NRR questions on these subjects.

(Closed) TMI Item II.B.4 and (Closed) Open Item 498/8723-09, Training for Mitigating Core Damage

TMI Item II.B.4 was open pending closure of Open Item 498/8723-09 regarding completion of training of health physics personnel on mitigation of core damage. The NRC inspector reviewed records which indicate appropriate personnel completed course RPT905, during the period of May 8 to August 4, 1987, which covered the radiological aspects of a core damage accident.

The TMI item and associated open item are considered closed.

(Closed) TMI Item III.D.1.1, Primary Coolant Outside Containment

This item concerns the review of the TMI followup actions and the implementation of a program to reduce leakage from systems outside containment, that would or could contain highly radioactive fluids during a serious transient or accident, to as-low-as practical levels as required by NUREG-0737.

To comply with this requirement, the licensee has established a program covering the systems (or portions) outside containment defined in FSAR Appendix 7A (7A.III.D.1.2, Amendment 53) and Technical Specification (TS) 6.9.3a.

This program is described in the contaminated system leakage test program Procedure OPGP03-ZE-0028, Revision 0, effective date October 24, 1986.

The inspector reviewed this program and the procedures for Contaminated System Leakage Test as follows:

- . 1PSP11-SI-0018, "Safety Injection System Train 1C," Revision 0
- . 1PSP11-CM-0005, "Containment Monitoring System," Revision 0
- . 1PSP11-AP-0005, "Post Accident Sampling System," Revision 0
- . 1PSP11-CS-0008, "Containment Spray System Train 1C," Revision 0

The NRC inspector considers these documents acceptable. However, the Safety Evaluation Report (SER) NUREG-0737, Supplement 2 (13.5.2.6, Item III.D.1.1) recommends that the applicant should also apply the leakage reduction program to the Chemical Volume and Control System (CVCS). STP TS, Section 6.8.3a requires the CVCS to be included in the program for systems to be tested.

The NRC inspector discussed the above subject with licensee's representatives who stated that the CVCS was excluded because it is part of the inservice leakage test program in accordance with American Society of Mechanical Engineers (ASME), Section XI. This position was stated by the licensee in the Letter ST-HL-AE-2001 on May 1, 1987. The NRC inspector observed that the licensee scheduled some tests on the CVCS prior to initial criticality.

Although the TS, Section 6.8.3a requires the licensee to include the CVCS in their program, NUREG-0737 allows delaying compliance until receipt of a full power license. Inclusion of the CVCS in the leak reduction program and review by the NRC prior to issuance of the full power license will be an open item (498/8775-03).

7. IE Circulars (IEC)

(Closed) IEC 80-09, Internal Plant Communications

This IEC had been closed with the exception of followup on training for plant personnel. The NRC inspector has reviewed plant procedures OPGP03-CN-001, "Radio Communications," Revision 0, dated June 6, 1987; OPGP03-CN-0002, "Telephone Communications," Revision 0, dated June 9, 1987; OPGP03-CN-0003, "Plant Public Address and Alarm System," Revision 0, dated June 9, 1987; and OPGP3-CN-0006, "Communication Systems Testing Program," Revision 0, dated April 24, 1987; and the revised General Employee Training I plan to ensure incorporation of the IEC concerns. They have been addressed in an acceptable manner.

This IEC is considered closed.

8. Class 1E Batteries Inoperable LER 87-27

During this inspection period, the licensee declared all four trains of Unit 1 Class 1E 125 volt batteries inoperable because previous surveillance testing per Station Procedure 1PSP06-DJ-0004 had been performed using incorrect amperage values for the 120 minute discharge service test.

The plant was subsequently placed in a Mode 5 (depressurized) status to satisfy the TS 3.8.2.2 Action Statement requirements.

The cause of the inadequate testing appears to be due to an anomaly which exists in the numbering system used to identify the four trains. Specifically, Channels I, II, III, and IV are identified as Trains A, D, B, and C, respectively (a nonlogical letter sequence). Also contributing to the potential for error is the fact that Channels I, II, III, and IV have plant equipment designation numbers of 3E231EBT045A, 3E231EBT045B, 3E231EBT045C, and 3E231EBT045D, respectively (a logical letter sequence). The amperage values for the 120 minute discharge service test were provided by Bechtel Engineering Calculation EC-5008, Revision 5. The amperage values were incorrectly entered into the surveillance test

procedure for battery Trains B, C, and D. This error caused these battery trains to be tested using incorrect values. The new amperage values of Revision 7 of calculation EC-5008 had not been entered into the surveillance test in a timely manner (approximately six months). The licensee has completed retesting of all four Class IE battery trains using the correct amperage values provided by Revision 7 of calculation EC-5008. All four battery trains are now considered operable by the licensee.

The licensee's long term corrective action to prevent recurrence is unclear at this time. It should include, as a minimum, steps to ensure that revised calculations are correctly entered into the appropriate procedure immediately upon approval and the anomaly which exists in the identification of the battery trains is corrected. The corrective actions to prevent recurrence will be tracked as open item (498/8775-04).

No violations or deviations were identified.

9. Cold Weather Preparations

An inspection was conducted on both units to ensure that adequate protective measures have been taken by the licensee to assure that safety-related process, instrument, and sampling lines will not freeze during cold weather.

The freeze protection systems at STP have not yet been turned over from construction to HL&P for operational control. This is expected to occur in January 1988. The system is currently under the control of startup engineering.

The NRC inspector met with the cognizant startup engineer and the future HL&P plant engineer. Existing records of system status were found to be thorough and complete.

Verification was made that licensee inspections are being conducted on systems susceptible to freezing to ensure the presence of heat tracing and space heaters, insulation is in place where required, proper thermostat settings are utilized, and the required circuits are energized.

Field inspections were conducted in selected plant areas and no discrepancies were identified by the NRC which had not already been identified and tracked by startup engineering. Cold weather protective measures were verified to be reestablished after system maintenance. The NRC inspector was satisfied with the attention that the STP cold weather protection program has received and found no deficient conditions within the existing program.

No violations or deviations were identified.

10. Chemical Detection System Inoperability (LER 87-22)

During this inspection period, it was identified by the licensee that the Chemical Detection System toxic gas monitors were in the "Not in the Analyze Mode" while in Mode 4 of plant operations.

The STP TS, Section 3.3.3.7 requires a minimum of two chemical detection system channels for all modes of plant operation.

From December 4-6, 1987, while the plant was in Mode 4, both toxic gas monitors for the Control Room HVAC were found in the "Not in Analyze Mode" condition. The toxic gas monitors had been in this condition for approximately 42 hours. There were qualified technicians on shift taking data and reviewing sample checks during this period. After identifying the problem, the licensee immediately took corrective action by placing the toxic gas monitors in the "Analyze Mode," and then placing the Control Room HVAC in recirculation as required by the TS. Subsequently the toxic gas monitors were functionally checked with satisfactory results and control room ventilation was returned to a normal status.

The improper status of the toxic gas monitors and resulting inoperability of the Control Room HVAC system to automatically isolate the Control Room in case of an accident is an apparent violation of NRC requirements. (498/8775-01)

11. Safety Injection (SI) Pumps Recirculation Flow

During this inspection period, the licensee discovered that all six SI pumps recirculation flow measuring orifices were not the required size. The installed orifices were not compatible with the installed instrumentation.

An improper condition was suspected during the preoperational test program due to the recorded pump recirculation flow data not being within expected values. The indicated flow was higher than expected and a nonconformance report (NCR) was issued. This was dispositioned "acceptable as is" due to the fact that the indicated recirculation flow values were conservative and the SI pumps delivered the required flow to the reactor coolant system (RCS) meeting their test acceptance criteria. The NCR disposition did not recognize that the wrong size orifices could be the cause of the indicated high recirculation flow condition.

The cause of the incorrect orifice/indicator combinations was due to Westinghouse design errors on the "Shop Order 325" forms. The system construction was in accordance with the above documents.

The licensee took corrective action as follows:

- . New orifices of the correct size were installed.

- . New reference value measurements were obtained on all six SI pump miniflow recirculation lines.
- . The low head SI pump minimum allowed recirculation flow is 186 GPM. The post-corrective flows are:
 - Pump A - 190 GPM
 - Pump B - 185 GPM
 - Pump C - 184 GPM
- . The high head SI pump minimum allowed recirculation flow is 100 GPM. The post-corrective flows are:
 - Pump A - 100 GPM
 - Pump B - 101 GPM
 - Pump C - 92 GPM

Two low head pumps and one high head pump are below the allowed minimum flow value. Westinghouse, the Nuclear Steam Supply System (NSSS) vendor, has accepted this data as satisfactory for operation at this time but not permanently acceptable for long term operation.

HL&P plant engineering has recommended that the SI pump(s) recirculation line pressure breakdown orifices be replaced with larger elements to increase flow for long term acceptability.

Additional corrective action taken by the licensee included inspecting other orifice/flow indicator combinations in the plant which could be affected by similar errors of Westinghouse on design documents.

One additional problem was found during this inspection in which the orifice and indicator were not matched properly by the Westinghouse design document. This orifice is located in the refueling water purification pump discharge (a nonsafety system). The orifice will be changed and retesting performed. This error was not discovered during the preoperational test program.

The cause for the errors on the Westinghouse design installation documents (Shop Order 325 Forms) is considered an unresolved item (498/8775-05).

Assurance that these flow indication discrepancies do not exist in other areas of the plant is considered an open item (498/8775-06).

No violations or deviations were identified.

12. Unit 2 Preoperational Test Program

Preoperational testing is continuing on plant support systems. The resident inspectors have allocated some time to monitoring prerequisite testing. The conduct of testing was satisfactory.

Startup engineering is making preparations for primary and secondary hydrostatic testing. Also, preparations are being made for initial SDG engine runs.

No violations or deviations were identified.

13. Incore Thimble Tube Inspections

Due to the recent thimble tube leakage problems on the European Westinghouse (14 foot core) reactors, the licensee has performed a baseline eddy current inspection of all incore thimble tubes. The inspection results were satisfactory and a report has been sent to NRR for review. Two low pressure seals were observed to be leaking and were replaced. One high pressure seal was leaking due to galling of the seating surface at the reducer and was repaired. For detailed information see NRC Inspection Report (IR) 50-498;499/87-74.

No violations or deviations were identified.

14. Unit 1 Significant Events

The following events resulted in licensee notifications to the NRC during this inspection period. The NRC resident inspectors reviewed these events and initial corrective actions to determine if any immediate safety concern was apparent.

- a. High head SI and low head SI recirculation line flow elements and indicators were not compatible. Indicated flows were not accurate.

- . Discovered December 15, 1987 (No LER)
- . Reported to NRC December 15, 1987
- . LER Number - Not Reportable

See Section 11 for additional information.

- b. Toxic gas monitors discovered "Not in Analyze Mode"

- . Discovered December 6, 1987
- . Reported to NRC December 6, 1987
- . LER No. - 87-022

See Section 10 for additional information.

- c. Key was found out of keyway on two motor operated valves; MOV CC542 and MOV CC297.

- . Discovered on October 10, 1987
- . Reported to NRC December 8, 1987
- . LER No. - 87-023

Licensee investigation revealed that the keys were the wrong size. All potentially affected MOV's have been checked for this condition. The resident inspectors monitored the licensee's actions and consider them acceptable.

- d. Actuation of Engineered Safety Features (ESF) during trouble shooting of ESF sequencer.

- . Occurred on November 30, 1987
- . Reported to NRC December 1, 1987
- . LER No. - 87-021

During trouble shooting of the ESF sequencer, an unanticipated bus strip and "B" ESF SDG start upon being deenergized was experienced. The sequencer was reenergized to release the bus strip. Upon repowering, it correctly started a Loss of Offsite Power (LOOP) sequence.

- e. Inadvertent actuation of control room/auxiliary building ventilation by personnel pressing the wrong flow button on the RM-23A module during surveillance testing.

- . Occurred on December 8, 1987
- . Reported to NRC December 8, 1987
- . LER No. - 87-024

This is another example of toxic gas monitor problems which are of concern to the resident inspectors. An apparent violation due to toxic gas monitors not being in the "Analyze Mode" when required is discussed in Section 10.

- f. "A" Train LOOP instantaneous undervoltage caused an "A" ESF bus strip, "A" ESF SDG start, and sequencing "A" ESF component loads onto the "A" SDG.

- . Occurred on December 9, 1987
- . Reported to NRC December 9, 1987
- . LER No. - 87-025

This occurrence was due to personnel error during surveillance testing. The licensee's actions are considered acceptable to resolve this occurrence.

- g. Failure to meet the required testing for "undervoltage condition coincident with a SI signal."

- . Discovered December 12, 1987
- . Reported to NRC December 12, 1987
- . LER No. - 87-026

See Unresolved Item 498/8775-02 in paragraph 5 for additional information.

- h. Surveillance procedure for Class 1E batteries contained incorrect amperage values.

- . Discovered December 30, 1987
- . Reported to NRC December 30, 1987
- . LER No. - 87-027

See Section 8 for additional information.

These events may be addressed in more detail in the future as the required corrective action is completed by the licensee.

No deviations were identified. An apparent violation involving LER 87-022 is identified in Section 10.

15. Status of Incomplete Preoperational Tests (Unit 1)

The following Unit 1 preoperational tests have not been completed due to being restrained by plant mode conditions:

. 1-HB-P-01	99%
. 1-PS-P-01	99%
. 1-RC-P-06	99%
. 1-RC-P-07	99%
. 1-RC-P-08	99%
. 1-RC-P-11	98%
. 1-SP-P-03	95%

16. Status Auxiliary Feedwater System Failures (Unit 1)

During the November 1987 inspection period, there were several failures in the auxiliary feedwater (AF) system resulting in the licensee declaring the system inoperable.

The failures were attributed to water hammer events which resulted in significant vibration and failures of AF piping and pipe supports. A detailed description of the failures and subsequent licensee actions is contained in NRC IR 50-498;499/87-71.

During this inspection period (December 1987), the licensee's trouble shooting and test program was successful in duplicating the vibration event which caused the failures.

The testing effort established that the vibration occurred only when the Train A and D flow control valves (FCV) were in a highly throttled, near-seat position. The internal geometry of the FCVs created pressure pulsations at a 24 HZ frequency that matched one of the hydraulic resonance frequencies of the piping system. This resonance provided the cyclic driving force which caused the AF system failures.

HL&P engineering submitted a detailed report to NRR and Region IV inspectors. The report was complete and demonstrates a professional, successful effort on the part of the licensee to resolve the AF system failures.

In their effort to establish root cause for the failures, the licensee examined previous system testing during preoperational testing, performed extensive testing to duplicate the damage causing event, obtained data from other utilities, analyzed potential causes of hydraulic transient events; e.g., fast valve operation, entrainment of noncondensable gases, pump instabilities, check valve closure, and other potential contributing possibilities.

Testing further revealed that no water hammer or initial "kick" was required to trigger the event. It was initially thought that system cross connect header valve operation could be a contributor to the failures since water hammer had been experienced during valve operation.

The pressure pulsations caused by the FCVs being in a highly throttled position were observed to dissipate when the valves were opened to deliver approximately 50 GPM or more flow. The following system modifications have been or will be made to the AF system to ensure future system operability.

- . Five additional high point vents were added to the system to provide additional air removal capability.
- . Nine double valve connections had rejectable indications from nondestructive examination (NDE). These connections were repaired by replacing the schedule 80 piping with schedule 160 material and deleting the second valve.
- . New cross-connect valve actuators will be installed on the Train A, B, and C valves. The actuators contain a higher spring force for closing and will provide a greater margin from the 24 HZ system hydraulic natural frequency.
- . The Train D cross-connect valve exhibited a fast stroke time in the open direction. The valve actuator will be fitted with a needle valve in the air supply line to allow increasing the stroke time.
- . Additional pipe supports were added to the system mainly in the area of the cross-connect valves and FCVs.

The FCVs have been fitted with travel stops to limit their closure to a highly throttled position. This was accomplished by use of a close limit switch backed up by a mechanical stop.

The licensee's efforts have been closely monitored by the resident inspectors and were observed to be professional and thorough. This monitoring will be continued throughout the completion of repairs and performance of proof testing in Modes 4 and 3 of plant operations.

No violations or deviations were identified.

17. Site Tours

During this inspection period, the NRC inspectors continued to conduct tours of all plant areas of both units. Observations have been discussed with licensee management. Those observations requiring licensee attention were resolved in a responsive and timely manner.

The NRC inspector witnessed the conduct of security department operations during this inspection period. Activities observed were the conduct of operations in the Central Alarm Station (CAS), Secondary Alarm Station (SAS), and the badge issue area. The above activities witnessed by the NRC inspectors were in compliance with licensee procedures and were performed in a professional manner.

The NRC inspector witnessed the conduct of the Health Physics (HP) department activities during the inspection period. The NRC inspectors witnessed the use of HP equipment by HP technicians as well as plant workers, use of radiation work permits (RWPs), and general conduct of shift HP activities. The HP activities appear to be acceptable and in compliance with licensee procedures.

Plant maintenance activities were witnessed by the NRC inspectors during the repair process of the various plant system failures during the inspection period.

No violations or deviations were identified.

18. Exit Interview

The NRC inspector met with licensee representatives (denoted in paragraph 1) on January 6, 1988, and summarized the scope and findings of the inspection. Other meetings between NRC inspectors and licensee management were held periodically during the inspection to discuss identified concerns. The licensee did not identify as proprietary any of the information provided to or reviewed by the inspectors during this inspection.