U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-213/90-19

License No. DPR-61

Licensee: Connecticut Yankee Atomic Power Company
P. O. Box 270
Hartford, CT 06141-0270

Facility: Haddam Neck Plant

Location: Haddam Neck, Connecticut

Inspection Dates: November 1 to December 18, 1990

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Date

Inspection Summary: Inspection on November 1, to December 18, 1990
(Inspection Report No. 50-213/90-19)

Areas Inspected: Routine safety inspection by the resident inspectors. Areas reviewed included plant operations, shutdown monitor inoperability, response to a reactor coolant system leak, individual rod position indication system repairs, steam binding of an auxiliary feedwater (AFW) pump, AFW pump corrective maintenance, emergency diesel generator troubleshooting and modification, responses to steam generator water level control system and feedwater transmitter anomalies, refueling water storage tank leakage monitoring, and Plant Operations Review Committee activities.

Results: See Executive Summary

EXECUTIVE SUMMARY

Haddam Neck Plant

NRC Region I Inspection Report No. 50-213/90-19

Plant Operations

The licensee identified a non-cited violation of Technical Specifications (213/90-19-01) in that only one shutdown monitor was operable when two were required on November 6 and November 7. The failure of multiple shifts to detect this violation indicates a lack of attention to detail during a plant condition (cold shutdown) that requires only a few essential systems to be operable.

Increased operator attention has been necessary for the frequent steam generator level and feedwater control systems fluctuations and malfunctions.

Operator response to plant events continues to be good. During this period a power reduction in response to a reactor coolant system leak and steam binding of the auxiliary feedwater pumps occurred.

Radiological Controls

Good radiological controls performance was noted during this inspection period.

Maintenance and Surveillance

Maintenance efforts were good in response to surveillance test failures of both an auxiliary feedwater pump and an emergency diesel generator. Activities were expeditiously performed and well controlled.

The steam generator level and feedwater flow control systems continue to perform erratically. Although troubleshooting and repair efforts were hampered by equipment age, there was little impact on plant operations.

Security and Safeguards

Good security performance was noted during this inspection period.

Engineering and Technical Support

Emergency diesel generator start failures continued into this inspection period. Maintenance and modifications were performed on the governor system and subsequent testing has been satisfactory.

Refueling water storage tank leakage has increased noticeably. The licensee delayed performance of accurate leak rate measurements and trending until the end of this inspection period. A tank operability evaluation was completed on December 17. Allowable leakage rates were established as well as a minimum required tank level. These actions are appropriate but would have been more timely if taken when the leakage was discovered in September.

Safety Assessment and Quality Verification

An inspector review of plant information reports (PIRs) for the year 1990 noted increased personnel errors during and following plant startup, a relatively smooth transition to revised technical specifications and, with one exception, a very low threshold for PIR initiation. A PIR was not written concerning a plant cooldown event which occurred when the high pressure steam dump controller malfunctioned on August 15.

During this period the licensee has implemented corrective actions for the recurring emergency diesel generator failures and auxiliary feedwater system steam binding events. Increased attention is warranted for refueling water storage tank leakage and steam generator level and feedwater control system problems.

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* The NRC Inspection Manual inspection procedure or temporary instruction that was used as inspection guidance is listed for each applicable report section.

DETAILS

1. Summary of Facility Activities

At the beginning of this inspection period the reactor was shut down and a short maintenance outage was in progress. Outage activities included cleaning of the containment air recirculation fan coolers and inspection and repair of a leaking steam generator tube.

Outage activities were completed and operational mode 4 (hot shutdown) was entered on November 12 at 1:35 p.m.

The "A" emergency diesel generator (EDG) experienced a start failure on November 13 during surveillance testing. The engine starting time was too slow; this is similar to the failure experienced on August 7. The engine was subsequently tested satisfactorily and the test frequency was increased to weekly.

A plant heatup was conducted and operational mode 3 was entered on November 14 at 3:03 a.m. The reactor was made critical on November 15 at 4:00 a.m. The plant was phased onto the grid at 5:18 p.m. on November 15, and the power ascension sequence was initiated. Full power operation was achieved on November 18 at 12:25 a.m.

An increase in the containment particulate radiation monitor indication was noted on November 20. A containment entry was made and a leaking fitting in the reactor coolant system (RCS) flow transmitter tubing was identified. Technical Specification (TS) 3.0.3 was entered and a load reduction was started at 10:30 a.m. Concurrently, personnel entered containment to repair the fitting. The repairs were completed and reactor power stabilized at 39% power at 2:45 p.m.

As a result of the change in plant load, the rod position indication (RPI) system required recalibration. During this evolution the main control board digital voltmeter (DVM) failed. The licensee processed a jumper to utilize the calibration standard until the DVM could be repaired. These actions were completed promptly, thus preventing a plant shutdown in accordance with TS 3.1.3.2.C.

The return to full power operation was initiated at 4:30 p.m. on November 20. Full power was attained at 4:30 p.m. on November 21, and continued through the end of the inspection period.

The "B" auxiliary feedwater (AFW) pump became steam bound following surveillance testing on November 21. Both AFW pumps were declared inoperable for a period of about two hours due to feedwater check valve back leakage. The "A" AFW pump was returned to service but the "B" pump inboard packing had failed and required repairs. Repairs were completed and the "B" AFW pump was returned to service on November 21 about five hours after it had initially become steam bound.

The "A" EDG experienced another start failure on November 27 during the weekly surveillance test; the engine starting time again was too slow. As with the previous two start failures, the engine was subsequently successfully retested. The engine remained available but was not declared operable until a successful test was performed the following day. The surveillance was completed with satisfactory results on November 28.

The "A" EDG was removed from service on November 29 for modifications. Under consultation of vendor representatives, the licensee changed the governor, governor booster pumps, and air start solenoid valves. The engine was successfully retested and returned to service on November 30. The weekly surveillance frequency will continue until the TS requirements for remedial testing are met.

On December 5 a steam flow/feed flow mismatch trip signal was inserted into the reactor protection system (RPS) as a result of failure of the No. 3 feedwater flow transmitter. The transmitter was repaired and placed in service on December 6. The trip signal remained until December 7 after a period for observation of flow transmitter performance. Flow transmitter performance became erratic again on December 12. A trip signal was reinserted into RPS and remained through the end of the inspection period.

In addition to normal utility working hours, the review of plant operations was routinely conducted during portions of backshifts (evening shifts) and deep backshifts (weekend and night shifts). Inspection coverage was provided for 33 hours during backshifts and 8 hours during deep backshifts.

2. Plant Operations

2.1 Operational Safety Verification

The inspectors observed plant operation and verified that the plant was operated safely and in accordance with licensee procedures and regulatory requirements. Regular tours were conducted of the following plant areas:

- -- control room
- -- primary auxiliary building
- -- radiological control point
- -- electrical switchgear rooms
- -- auxiliary feedwater pump room
- -- security access point
- -- protected area fence
- -- intake structure
- -- diesel generator rooms
- -- turbine building

Plant areas were observed to be in generally good condition.

2.2 Follow-up of Events Occurring During Inspection Period

During the inspection period, the inspectors provided on-site coverage and follow-up of the unplanned events discussed below. Plant conditions, alignment of safety systems, and licensee actions were reviewed. The inspectors confirmed that required notifications were made to the NRC. During event follow-up, the inspectors reviewed the corresponding plant information report (PIR) package, including the event details, root cause analysis, and corrective actions taken to prevent recurrence.

2.2.1 Inoperable Shutdown Monitors

On November 8, at 7:45 a.m. with the plant in cold shutdown, operations personnel observed that only one shutdown monitor was operable. The second monitor had been removed from service on November 7, at 11:30 a.m., for modification to its associated wide range nuclear instrumentation channel. Technical Specification (TS) 3.3.3.9 requires that both shutdown monitors be operable with the plant in this condition. The requirements of the accompanying action statement were immediately initiated; continuous monitoring of the source range channels and alignment of the charging system to preclude a boron dilution event. The modifications to the wide range instrument were completed and the shutdown monitor returned to service at 9:00 a.m. on November 8.

Licensee investigation identified that a similar configuration existed on November 6, when another channel of wide range nuclear instrumentation was modified.

During these periods of degraded shutdown monitoring capability, one monitor remained operable and no boron dilution events occurred. Therefore, this incident was of minor actual safety consequence. The failure of multiple shifts to detect this violation of TS 3.3.3.9 indicates a lack of attention to detail during a plant condition (cold shutdown) that requires only a few essential systems to be operable, however, upon discovery, adequate immediate corrective actions were taken. This TS requirement and other new requirements included in the revised TS will be emphasized by the licensee in the upcoming operator training sessions. The inspector determined that this is a licensee-identified violation having low reactor safety significance. The inspector verified that the criteria of 10 CFR Part 2, Appendix C, Section V.G.I, Exercise of Discretion were met and therefore no Notice of Violation is being issued (90-19-01).

2.2.2 Load Reduction in Response to Reactor Coolant System Leak

On November 20 operators noted an increase in the containment particulate radiation monitor indication. A containment entry was made and a leaking fitting was identified in the reactor coolant system (RCS) flow transmitter tubing. The location of the leak rendered all three of the RCS loop No. 1 flow transmitter inoperable. Technical Specification (TS) Table 3.3-1 requires that with the plant above 10% power two flow transmitters per operating RCS loop are operable. The inoperable transmitter is to be placed in the trip condition; but actuation of two channels will result in a reactor trip. The plant was beyond the conditions of TS Table 3.3-1. Therefore TS 3.0.3 was entered and a load reduction to less than 10% power was initiated at 10:30 a.m.

Concurrent with the load reduction, personnel entered containment to isolate and repair the leak. The system was isolated and reactor protection system (RPS) trip signals were inserted for RCS loop 1 low flow at 1:35 p.m. Both ends of the fitting were found to be loose. The fitting was tightened and leak checked. The RPS trip signals were removed and the flow transmitters returned to service. The power reduction stopped at 2:46 p.m. with the plant at 39% power.

The affected portions of the RCS flow indication had been modified with the installation of the new RPS during the previous refueling outage. The licensee is still investigating the cause for the loosened fitting. During the subsequent containment entry on November 29 personnel inspected the similar RPS tubing fittings in the containment outer annulus. No leaks were identified.

The inspector observed control room activities during portions of the load reduction. Associated Plant Operations Review Committee meetings were attended. Adequate consideration was given to reactor safety and employee safety when entering containment during power manipulations.

2.2.3 Inoperable Individual Rod Position Indication System

During the plant load reduction on November 20 it became necessary to recalibrate the computer individual rod position indication (IRPI) system due to inaccuracies caused by sensitivity to temperature changes. During the calibration evolution, the main control board digital voltmeter (DVM) (credited as IRPI during this process) became inoperable. Technical Specification (TS) 3.1.3.2 requires IRPI to be operable; with more than one IRPI inoperable the plant is to be placed in hot standby within six hours. This TS action statement was entered at 2:43 p.m. with the plant at 39% power. The licensee immediately took corrective action to avert an unnecessary plant shutdown.

Jumper/bypass evaluation 90-50 was prepared to install the calibration standard used to calibrate the DVM as a temporary meter for completion of the IRPI calibration and until the DVM could be repaired. The jumper was prepared, reviewed and installed. The TS action statement was exited at 3:30 p.m., without necessitating a plant shutdown.

At 4:30 p.m. on November 20 a power increase was initiated. Full power operation was achieved at 4:30 p.m. on November 21.

The inspector observed control room conduct during the IRPI calibration and attended the Plant Operations Review Committee meeting for approval of the jumper evaluation. Applicable TS requirements were met.

2.2.4 Auxiliary Feedwater Pump Steam Binding

On November 21, steam binding of the "B" auxiliary feedwater (AFW) pump occurred. Operators had completed SUR 5.1-13B, "Auxiliary Feed Pump (P-32-1B) Monthly Functional Test", that morning. Approximately five minutes following completion of the surveillance test the AFW header high temperature alarm was received in the control room; header temperature had reached 160 degrees F. This signifies back leakage of feedwater through two sets of check valves in series into the AFW system.

Immediate actions were taken in accordance with ANN 4.13-21, "Auxiliary Feedwater Header High Temperature". When an attempt was made to run the "B" AFW pump the overspeed trip mechanism actuated, the steam admission relief valve lifted, and the pump inboard packing failed. Operators also noted that the "A" AFW pump casing was very hot. Both AFW pumps were declared inoperable at 11:50 a.m. and technical specification (TS) action statement 3.7.1.2.b was entered; this requires that at least one pump be restored within 24 hours.

At 1:50 p.m. the "A" AFW pump had cooled and was tested satisfactorily by the applicable portions of SUR 5.1-13A, "Auxiliary Feed Pump (P-32-1A) Monthly Functional Test". With the restoration of one AFW pump the requirements of TS 3.7.1.2.a become applicable; 72 hours permitted to restore the inoperable pump.

Maintenance personnel completed the pump packing replacement and the "B" AFW pump was tested and returned to service at 4:45 p.m. on November 21.

The inspector observed control room and AFW pump room activities throughout the event. This event is identical to the October 10 steam binding of the "B" AFW pump (see NRC Inspection Report 50-213/90-15, section 2.3.3). In both cases back leakage through two sets of check valves caused overheating of the AFW pump.

Until long-term corrective actions can be implemented, short-term actions were taken to prevent pump steam binding during the monthly surveillances. SUR 5.1-13A and SUR 5.1-13B were revised on November 21. Delaying the performance test of the feedwater bypass valves until after the AFW pumps are shut down prevents cycling of the affected check valves. The revised monthly surveillance was performed for the "A" AFW pump on December 4; AFW header temperature did not increase. The licensee is developing a long-term corrective action plan which includes replacement of several system check valves.

3. Radiological Controls

During routine inspections of the accessible plant areas, the inspectors observed the implementation of selected portions of the licensee's radiological controls program. Utilization and compliance with radiation work permits (RWPs) was reviewed to ensure that detailed descriptions of radiological conditions were provided and that personnel adhered to RWP requirements. The inspectors observed controls of access to various radiologically controlled areas and the use of personnel monitors and frisking methods upon exit from those areas. Posting and control of radiation areas, contaminated areas and hot spots, and labelling and control of containers holding radioactive materials were verified to be in accordance with licensee procedures.

Health physics technician control and monitoring of station activities were determined to be adequate.

4. Maintenance and Surveillance

4.1 Maintenance Observation

The inspectors observed various corrective and preventive maintenance activities for compliance with procedures, plant technical specifications, and applicable codes and standards. The inspectors also verified the appropriate quality services division (QSD) involvement, use of safety tags, equipment alignment and use of jumpers, radiological and fire prevention controls, personnel qualifications, post-maintenance testing, and reportability. Portions of activities that were reviewed included:

-- Inspection of "B" auxiliary feedwater pump discharge check valve (FW-CV-153)

-- "A" emergency diesel generator troubleshooting, repair, and preventive maintenance

-- "B" auxiliary feedwater pump inboard packing replacement

-- Troubleshooting and repair of No. 3 steam generator feed flow transmitter

-- Troubleshooting and repair of No. 3 feedwater regulating valve control system

Maintenance activities were determined to be acceptable; the following observations were made.

4.1.1 Inspection of Auxiliary Feedwater Pump Discharge Check Valve

During the previous inspection period steam binding of the "B" auxiliary feedwater (AFW) pump occurred (See NRC Inspection Report 50-213/90-15, section 2.3.3). At that time the plant was operating at full power and back leakage passed through two sets of check valves in series. Valves FW-CV-156-2 & 4 in the discharge to the feedwater (FW) system and FW-CV-153 at the "B" AFW pump discharge provided the pathway for feedwater to enter and heat the "B" AFW pump which resulted in steam binding. Plans were made to open and inspect FW-CV-153 at the next plant shutdown.

On November 1, the inspector observed maintenance personnel working under AWO 90-11913 open and inspect FW-CV-153. The valve seating surfaces were found to be smooth and without interference. Valve motion was simulated and determined to be satisfactory. It was noted that this valve is designed to be leak limiting, not leak tight. The system is designed such that leakage is limited by the series of check valves which themselves are not leak tight. The cover to FW-CV-153 was replaced and the system returned to service on November 1.

4.1.2 Auxiliary Feedwater Pump Repairs

As described in section 2.3.1 of this report, the "B" auxiliary feedwater (AFW) pump became steam bound on November 21. During attempts to run the pump, the pump inboard packing failed. Maintenance efforts to replace the packing were immediately initiated. AWO 90-11959 was issued for removal and replacement of the old packing and to change the pump oil. The inspector observed portions of maintenance in progress. Proper system tagging, supervisory oversight, and knowledgeable personnel were noted.

Maintenance was completed within several hours. The pump was retested satisfactorily and well within the 72-hour time limit permitted by technical specifications.

4.1.3 Emergency Diesel Generator Repairs

On two occasions during this inspection period, maintenance personnel conducted troubleshooting and repair efforts on the "A" emergency diesel generator (EDG). These activities were performed in conjunction with engineering and vendor diagnostic testing of EDG start failures. The diagnostic testing methods and problem resolution are discussed in Section 6.2 of this inspection report.

On November 16, troubleshooting activities were conducted under AWO 90-11828. The troubleshooting involved tagging of the air start system, running of each governor booster pump to verify discharge pressure, and bleeding air from the governor and governor booster pump oil system.

On November 29, modifications were conducted under AWOs 90-12096, 90-12102, and 90-12103. These AWOs provided for governor booster pump replacement, air start solenoid replacement, and governor and speed setting motor replacement, respectively.

The inspectors observed portions of both maintenance activities. Adherence to procedures and proper system tagging were verified. The inspector noted good control of vendor personnel and frequent management presence.

4.1.4. Troubleshooting and Repair of No. 3 Steam Generator Feed Flow Transmitter

On December 5, operators noted erratic performance of the No. 3 steam generator level control (SGLC) system. The No. 3 feedwater regulating valve (FRV) was placed in manual control and instrumentation and controls (I&C) personnel were notified.

I&C personnel determined that the No. 3 feedwater flow transmitter was degraded and the feedwater flow signal to the reactor protection system (RPS) was unreliable. Feedwater flow is an input to the steam flow/feed flow (SF/FF) mismatch parameter in the RPS. The SF/FF mismatch signal for the No. 3 steam generator was declared inoperable at 6:10 p.m. on December 5. A trip signal was inserted into RPS at 6:38 p.m. in accordance with Technical Specification Table 3.3-1, Item 9. Feedwater flow was manually controlled by operators. The SF/FF mismatch signal concurrent with a low steam generator level in the same generator will initiate a reactor trip.

Troubleshooting efforts were initiated. The feed flow transmitter invertor was observed to be oscillating. A capacitor was replaced in the inverter and the feed flow transmitter was placed back in service on December 6. The No. 3 feed water controls remained in manual overnight for observation. The feedwater flow indication operation was normal; the flow controller was placed in automatic on December 7 at 9:07 a.m. and observed to operate properly.

The RPS trip signal was removed on December 7 at 11:41 a.m. Feedwater flow indication and control remained normal until December 12 when feedwater flow indication began oscillating again. I&C personnel determined that the transmitter output was inaccurate and the channel was declared inoperable. The RPS trip signal was reinserted for the No. 3 SF/FF mismatch and repair activities initiated.

Due to difficulties with replacement parts procurement, the trip signal remained inserted through the end of the inspection period. Repair activities will be monitored as part of the routine resident inspection.

The inspector observed portions of the troubleshooting and repair activities during this report period and monitored feedwater flow transmitter and steam generator level controller operation during tours of the control room. No significant observations were noted.

4.1.5 Repair of No. 3 Feedwater Regulating Valve Control System

On December 12, at 9:26 a.m., an unexpected increase in the No. 3 steam generator water level was noted. Operators placed the corresponding feedwater regulating valve (FRV) controls in manual and restored normal steam generator levels.

Investigation revealed a malfunctioning electronic/pneumatic (E/P) converter in the No. 3 FRV control system. This component converts a one-to-nine volt signal into a six to 30 psi air pressure for valve manipulation. The maximum air pressure which the converter created was about 23 psi. This prevented normal FRV control at plant full power.

Plant power was decreased about 2% to facilitate operator control of the FRV while repair methods were developed and implemented.

Jumper/bypass No. 90-054 was prepared to permit replacement of the faulty E/P converter with the plant operating. This jumper bypassed the existing E/P converter and duplicated the normal convertor output pressure with an air supply and regulator. FRV position was then controlled locally. Constant communications with the control room were essential.

The jumper and associated safety and technical evaluations were reviewed and approved by the Plant Operations Review Committee (PORC). The jumper was installed, the E/P convertor replaced, and the jumper removed with little impact on plant operation. The FRV control system was returned to normal operation at 7:30 p.m. on December 12.

The inspectors observed operator response to the rising steam generator level and portions of the E/P converter troubleshooting activities. The PORC meeting was observed as well as the E/P converter replacement evolution. No safety concerns were identified by the inspector.

4.2 Surveillance Observation

The inspectors witnessed selected surveillance tests to determine whether: properly approved procedures were in use; plant technical specification frequency and action statement requirements were satisfied; necessary equipment tagging was performed; test instrumentation was in calibration and properly used; testing was performed by qualified personnel; and, test results satisfied acceptance criteria or were properly dispositioned. Portions of activities associated with the following procedures were reviewed:

-- SUR 5.1-17A (B), "Emergency Diesel Generator EG-2A (EG-2B) Manual Starting and Loading Test"

-- SUR 5.1.157A, "Emergency Diesel Generator EG-2A Fast Start and Load Test"

-- SUR 5.1-13A (B), "Auxiliary Feed Pump (P-32-1A[B]) Monthly Functional Test

Surveillance activities were determined to be acceptable; the following observations were made.

4.2.1 Increased Diesel Generator Test Frequency

The "A" emergency diesel generator (EDG) experienced start failures on August 7, November 13, and November 27. Following the second failure the test frequency was increased to weekly in accordance with Technical Specifications (TS) Table 4.8-1. This specification implements portions of Regulatory Guide 1.108, Revision 1, August 1977.

The inspectors observed portions of several weekly surveillance tests during this report period and verified that the licensee complied with the TS requirements for testing.

5. Security

During routine inspection tours, the inspectors observed implementation of portions of the security plan. Areas observed included access point search equipment operation, condition of physical barriers, site access control, security force staffing, and response to system alarms and degraded conditions. These areas of program implementation were determined to be adequate.

6. Engineering and Technical Support

The inspectors reviewed selected engineering activities. Particular attention was given to safety evaluations, plant operations review committee approval of modifications, procedural controls, post-modification testing, procedures, operator training, and UFSAR and drawing revisions.

6.1 Relocation of Feedwater Regulator Bypass Line Check Valves

During this inspection period, the licensee implemented a feedwater (FW) system modification to resolve a recurrent problem with back leakage of FW regulator bypass line check valves FW-CV-135-1, 2, 3 & 4.

The valves are designed to prevent diversion of AFW flow to the main feed system instead of the steam generators. These check valves are located in the FW regulator bypass line upstream of the FW regulator bypass valves and the discharge of the auxiliary feedwater (AFW) system.

Physically, the check valves are immediately downstream of the 18-inch main FW header and experience turbulence induced seat wear. Some additional seat wear has been caused by valve chattering when small flow rates exist due to FW regulator bypass valve seat leakage.

On December 7, 1989, these check valves were leak tested and exhibited leakage greater than the maximum allowable of 0.5 gallons per minute (gpm). The valves were refurbished and the bypass valves were repaired to lessen the flow rate while isolated. The failure of these valves to perform their function was determined to be reportable on March 2, 1990, in accordance with 10 CFR 50.73. LER 90-04 was submitted to NRC and included a retest of the valves during the subsequent cold shutdown as a corrective action.

SUR 5.7-129, "Leak Testing of Feed Reg. Valves, Bypass Line Check Valves FW-CV-135-1, 2, 3 and 4" was performed on November 3, all four valves exhibited back leakage greater than 0.5 gpm.

To correct this recurring condition, PDCR 1033, "FW-CV-135-1, 2, 3 and 4 Relocation" was implemented. The modification included relocation of the check valves to about three feet downstream of their current location and refurbishment of the valves' seats and plugs.

Post installation testing results were well below the maximum allowable leakage. The valves were returned to service and will be leak tested during the next cold shutdown to verify the effectiveness of this modification.

The inspectors observed portions of valve installation and reviewed the completed modification package. Modification activities were conducted safely and in accordance with station procedures; no safety concerns were identified.

6.2 Emergency Diesel Generator Diagnostic Testing and Start Failure Resolution

The "A" emergency diesel generator (EDG) has experienced three start failures since August. The failures occurred on August 7, November 13, and November 27. Testing and maintenance activities conducted during previous inspection periods are discussed in NRC Inspection Reports 50-213/90-13 and 90-15.

Two of the start failures occurred during this inspection period, as well as extensive diagnostic testing and maintenance efforts supported by station engineering and vendor personnel. Maintenance activities are described in section 4.1.3 of this report.

Following the start failure on November 13, the diesel engine vendor arrived at the site to support troubleshooting and repair activities. The engine was started twice on November 14 for vendor observation. It was noted that the fuel rack moved to about two thirds open rather than the full open position. This could indicate governor or booster pump malfunction or oil system air entrapment.

The EDG was taken out of service on November 16 for troubleshooting and maintenance. Both governor booster pumps were verified to be operating properly and the oil system was bled. Post maintenance tests included three starts, one each with each air start bank and one with both banks together. The engine performed satisfactorily during these tests and the fuel rack was observed to open fully. The cause for the start failure was suspected to be air entrapment or blockage in the governor oil system. The engine was returned to service on November 16.

Surveillance testing resumed at the increased frequency in accordance with Technical Specification (TS) Table 4.8-1. The first weekly test on November 20 was satisfactory. However, the subsequent test on November 27 was unsuccessful. The engine failed to reach 450 rpm within 10 seconds; TS 4.8.1.1.2.a.4) requires that the EDG attain 900 rpm within 10 seconds.

As with the previous start failures, the engine was retested successfully following the start failure. The Plant Operations Review Committee (PORC) met on November 27 following both engine tests to discuss corrective action plans and EDG operability. Based on previous testing experience, the PORC concluded that it was prudent to continue with daily tests to ensure engine operability pending EDG modifications. The EDG remained available but was not declared operable by TS until the first daily test. The engine was declared operable following a successful start on November 28.

The engine and governor vendor personnel arrived on November 28. A test start was performed for vendor observations. The fuel rack was observed to not open fully. On November 29, the engine was removed from service for modification. The air start system solenoid valves, governor, and governor booster pumps were replaced. The original governor model is no longer manufactured; the governor was replaced with a newer model under Plant Design Change Record 1040, "Diesel Generator EG-2A and EG-2B Governor Replacement." Post modification testing included several engine starts during which fuel rack operation, governor settings, and governor booster pump performance were verified. Testing was completed and the engine was declared operable on November 30 at 2:00 a.m.

To verify that the air entrapment did not recur, a surveillance test was performed on December 3. The engine started and reached 450 rpm in 2.8 seconds. The weekly surveillance frequency was resumed. The old governor has been sent to the vendor for investigation into the cause of the failures. The "A" EDG remains on a weekly test frequency in accordance with TS Table 4.8-16.

The inspectors observed portions of both troubleshooting and modification activities and verified compliance with TS. Associated PORC meetings were attended. Thorough preplanning and coordination efforts were noted. The department representatives responded well to unexpected complications such as the need to replace the governor oil tubing. Management oversight and support were noted. The vendor involvement and actions were well controlled.

6.3 Refueling Water Storage Tank Leakage Monitoring

During the previous inspection period, the refueling water storage tank (RWST) developed a leak (see NRC Inspection Report 50-213/90-15). The licensee took adequate immediate actions to contain the water and prevent release to the yard drainage system.

The leak has increased noticeably during this inspection period. Initially five to eight gallons per day in September, it has increased to about 50 gallons per day. Also, the affected area of the RWST appears to have expanded; additional points around the tank perimeter have begun to exhibit signs of the leakage.

To contain the increased leakage two dikes have been erected to prevent water intrusion into the yard drains. The dikes are located in between the RWST and primary auxiliary building at the area with the most leakage. A tent was constructed over this area and a heater installed to prevent freezing in order to minimize its potential impact on the RWST structural integrity.

Throughout the inspection period, operators have pumped the collected water out of the dikes on a shiftly basis. The water is diverted to the aerated drains tank via a floor drain in the primary auxiliary building.

Until the week of December 10, the licensee had not accurately quantified or trended the leakage rates. On December 13, a more accurate leakage rate measurement method was developed and the rate was determined to be 50 gallons per day. Leakage trending of daily measurements was initiated.

On December 17, an RWST operability evaluation was reviewed by the Plant Operations Review Committee. The evaluation concluded that the tank is operable and a maximum leak rate of four gpm is acceptable for continued plant operation. This value is based on tank makeup capability and maintenance of a minimum RWST inventory of 240,000 gallons. It was also stated that a reevaluation of tank operability will be conducted when predicted or actual leakage increases to one gpm.

Currently the licensee is pursuing methods to prevent tank perimeter leakage in areas not protected by the dikes. Also, tank bottom inspection methods are being evaluated.

The inspectors will continue to monitor licensee activities in this area during routine inspections.

7. Safety Assessment and Quality Verification

7.1 Plant Operations Review Committee

The inspectors attended several Plant Operations Review Committee (PORC) meetings. Technical specification 6.5 requirements for required member attendance were verified. The meeting agendas included procedural changes, proposed changes to the Technical Specifications, Plant Design Change Records, and minutes from previous meetings. PORC meetings were characterized by frank discussions and questioning of the proposed changes. In particular, consideration was given to assure clarity and consistency among procedures. Items for which adequate review time was not available were postponed to allow committee members time for further review and comment. Dissenting opinions were encouraged and resolved to the satisfaction of the committee prior to approval. The inspectors observed that PORC adequately monitors and evaluates plant performance and conducts a thorough self-assessment of plant activities and programs.

7.2 Review of Written Reports

Periodic and Special Reports, and Licensee Event Reports (LERs) were reviewed for clarity, validity, accuracy of the root cause and safety significance description, and adequacy of corrective action. The inspectors determined whether further information was required. The inspectors also verified that the reporting requirements of 10 CFR 50.73, Station Administrative and Operating Procedures, and Technical Specification 6.9 had been met. The following reports were reviewed:

LER 90-22 Error Identified in Calibration of Auxiliary Feedwater Flow Transmitters

LER 90-23 Plant Shutdown due to Inoperability of Containment Fan Coolers

LER 90-24 Containment Isolation Valve CC-TV-920 Declared Inoperable

LER 90-25 Auxiliary Feedwater Flow Instrumentation Potentially Unqualified

LER 90-26 Feedwater Regulator Bypass Check Valves Failed Leakage Test

LER 90-27 Temporary Loss of Spent Fuel Cooling Due to Loss of Power

LER 90-28 Inadequate Numbers of Shutdown Monitors in Service

LER 90-29 Leak on Sensing Line to Reactor Coolant Flow Transmitters Due to Loose Fitting

Haddam Neck Plant Monthly Operating Report 90-10, covering the period October 1, to October 31, 1990

Haddam Neck Plant 1990 Steam Generator Plugging Report, dated November 7, 1990

Haddam Neck Plant Containment Operation and Testing Report, dated November 16, 1990

Haddam Neck Plant Special Report Concerning an Inoperable Emergency Diesel Generator, dated December 12, 1990.

Haddam Neck Plant Monthly Operating Report 90-11, covering the period November 1, to November 30, 1990.

The reports reviewed were acceptable.

7.3 Follow-up of Previous Inspection Findings

Licensee actions taken in response to open items and findings from previous inspections were reviewed. The inspectors determined if corrective actions were appropriate and thorough and whether previous concerns were resolved. Items were closed where the inspector determined that corrective actions would prevent recurrence. The following items were reviewed:

7.3.1 Incorporation of License Commitments Into Plant Procedures

(Closed) Unresolved Item 87-08-01. Licensee to ensure that commitments are incorporated into plant procedures. This item was initiated in May, 1987 after several instances of failure to completely follow through with license commitments by modifying the associated station procedures. These omissions involved requirements for fire protection, low temperature overpressure protection, three loop operation prohibition and radiological technical specifications. The inspectors have followed licensee implementation of commitments and regulatory requirements during routine safety inspections. Since that time, the licensee has implemented a more comprehensive commitment tracking system and no further examples of missed commitments have been identified. The inspectors have determined that based on licensee performance this item is closed.

7.3.2 Recording as Found Conditions During Preventive Maintenance

(Closed) Unresolved Item 87-22-01. This item was identified as unresolved based on finding a lack of consistency in the requirement for recording as-found data during preventive maintenance. The licensee has completed work on procedure revisions. The inspector selected a sample of procedures from each working group (operations, maintenance, instrument and controls, etc.) and verified that critical parameters are identified and as-found values are recorded. This item is closed.

7.3.3 Safety Evaluations to Support Procedure Review and Approval

(Closed) Violation 87-22-06. This item was identified as a violation after it was concluded that inadequate procedural controls led to over heating the lubricating oil of a residual heat removal pump during the performance of a special test. The licensee, in its response letter dated January 6, 1988, stated its belief that the event was due to operator error in the interpretation of the term "throttle" and also due to an inoperable temperature detector.

The licensee's corrective actions included changes to administrative controls to provide more detailed guidance in creating special test procedures; and, emphasis on technical review by key personnel prior to presenting procedures to the on-site safety committee. The licensee also completed a program which functionally tested main control board annunciators. Administrative requirements for safety evaluations for station procedures are stated in ACP 1.2-6.12.

The inspectors have noted strong licensee performance in the procedure review and improvement process. This item is closed.

7.3.4 Conformance Between Emergency and Abnormal Operating Procedures

(Closed) Unresolved Item 88-08-01. This item was identified as unresolved when discrepancies were noted between emergency operating procedures written to the Westinghouse Owners Group (WOG) guidelines and station abnormal operating procedures and non-WOG emergency operating procedures.

The licensee has corrected the conflicting requirements which were discussed in the inspection findings. Additionally, the emergency procedures have been through a major revision process; and, there now is an emergency operating procedure users' guide, ACP 1.2-6.15. That guide addresses the parallel use of non-WOG based emergency and abnormal operating procedures.

The inspector selected procedures within the WOG emergency operating procedures and compared them to other station procedures which address related or supporting topics. There were no inconsistencies of the type previously noted. This item is closed. An NRC inspection team conducted a review of the station emergency operating procedures program on October 9 through 17, 1990. The results of that inspection are contained in report 50-213/90-81.

7.4 Plant Information Report Review

To supplement the routine review of the licensee's self-assessment activities, the inspectors and NRC Office of Nuclear Reactor Regulation project manager reviewed the plant information reports (PIRs) and plant events for this year. Emphasis was placed on evaluating licensee response to the PIR or event; for example, were procedures changed, was corrective maintenance necessary or was there no follow-up action?

The following observations were made:

-- There were a large number of personnel errors during and following startup from the refueling outage. During August, September and October, the inspectors categorized the root cause of 19 PIRs as personnel error. These included: premature shutdown of a condensate pump resulting in a reactor trip, poor communications during troubleshooting activities caused an automatic auxiliary feedwater actuation, jumper installed prior to review by the Plant Operations Review Committee, opening of the service water filter bypass valves, installation of an unqualified part without evaluation of suitability, and maintenance work on an unisolated system.

-- The licensee identified a few missed surveillance tests.

-- The transition to revised technical specifications was relatively smooth. There were three instances of failure to meet the new requirements. These involved the main steam line break flow transmitters, service water headers, and shutdown monitors.

-- PIRs were written for plant events, with the exception of a plant transient on August 15. This is discussed below.

A meeting was held on December 19, with station management to discuss the licensee's self-assessment initiatives. At that time, the above stated observations were reviewed.

On August 15, with the plant at 5% power, a transient occurred when the high pressure steam dumps malfunctioned while operators were phasing the plant onto the grid. With the additional steam demand, the reactor coolant system (RCS) average temperature dropped to about 517 degrees F and pressurizer pressure and level dropped to about 1940 psig and 13%, respectively.

These changes in RCS parameters required entry into two Technical Specification (TS) action statements. TS 3.1.1.6 requires that average RCS temperature be at least 525 degrees F; if temperature drops below this value it must be restored within 15 minutes. TS 3.2.5 specifies that pressurizer pressure be maintained above 2000 psig. The associated action statement permits two hours to restore normal pressure. The inspector reviewed the control room instrumentation charts and verified that plant parameters were restored and that these TS requirements were not violated. It was noted that entry into these action statements was not documented in the control room shift supervisor's log.

Since a PIR was not written for this transient, the inspectors reviewed the requirements of ACP 1.2-16.1, "Plant Information Reports," and noted that plant transients do not specifically require a PIR. Subjective judgment is necessary in determining the applicability of procedure item 6.1.1.r that requires a PIR for "events of concern needing review by station management." The inspectors have observed that, although not procedurally required, it is routine for PIRs to be written for entry into TS action statements and component malfunctions. Normally, the threshold for writing PIRs is very low; this was not the case for the transient on August 15.

In this event a primary plant cooldown transient was experienced when a secondary plant system malfunctioned. No event review or root cause analysis was documented. The inspectors concluded that, although not required by procedures, further management attention was warranted.

8. Exit Interviews

During this inspection, periodic meetings were held with station management to discuss inspection observations and findings. At the close of the inspection period, an exit meeting was held to summarize the conclusions of the inspection. No written material pertaining to this inspection was given to the licensee and no proprietary information related to this inspection was identified.