U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-388/84-21

Docket No. 50-388

License No. NPF-22 Priority - Category C

Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna-2 Steam Electric Station, Unit 2

Inspection At: Salem Township Pennsylvania

Inspection Conducted: April 23-24 and May 7-10, 1984

Inspectors: L H Bettenhausen for 6/14/84
D. J. Florek, Reactor Engineer date

Approved by: L H Bettenhausen 6/14/84
L. H. Bettenhausen, Chief, date
Test Programs Section

Inspection Summary: Inspection on April 23-24 and May 7-10, 1984 (Report No. 50-388/84-21)

Areas Inspected: Routine unannounced inspection of the startup test program including preparations for initial criticality, initial criticality, startup procedure review, test witnessing, test results evaluation and tours of the facility. The inspection involved 41 hours on site by one region based inspector.

Results: Within the scope of this inspection violations were identified.

DETAILS

1.0 Persons Contacted

T. Clymer, Nuclear Quality Assurance (NQA) Coordinator
J. Doxey, Reactor Engineer Supervisor
K. Hillman, Nuclear Plant Specialist
H. Keiser, Superintendent of Plant
J. Klucar, Lead Shift Test Engineer
T. Markowski, Day Shift Supervisor
C. Myer, Assistant Plant Superintendent Outages
T. Nork, Startup Coordinator
L. O'Neil, Maintenance Supervisor
*H. Palmer, Operations Supervisor
R. Prego, Operations QA Supervisor
*R. Sheranko, Startup Test Group Supervisor
T. Slusser, Quality Control Senior Specialist
C. Smith, Assistant Superintendent of Plant
D. Thompson, Assistant Superintendent of Plant
*J. Todd, Compliance Engineer
R. Whery, Startup Test Engineer

General Electric Corporation

T. Czubakowski, Lead Startup Test Engineer

U. S. Nuclear Regulatory Commission

R. Jacobs, Senior Resident Inspector
L. Plisco, Resident Inspector

The inspector also contacted other licensee employees, members of the technical and engineering staffs and operations staff including shift supervisors, unit supervisors and reactor operators.

*Denotes those persons in attendance at the exit meeting as discussed in Section 4.0 of this report.

2.0 Startup Test Program

References

- Susquehanna Steam Electric Station SSES Final Safety Analysis Report (FSAR)
- SSES Safety Evaluation Report and Supplements 1, 2, 3, 4 and 5
- Regulatory Guide 1.68, "Initial Test Programs for Water Cooled Reactor Power Plants"

- SSES Startup Test Schedule
- AD-TY-460, "Startup Test Administration Procedure"

2.1 Startup Test Procedure Review

Scope

The nine procedures listed in Appendix A of this report were reviewed in accordance with the scope as defined in inspection report 50-388/84-12, Section 4.1.

Findings

The procedures reviewed were issued procedures with appropriate management review indicated. QA comment and resolution were observed on selected procedures. The inspector discussed these procedures and changes to previously reviewed draft procedures with the Startup Test Group Supervisor. Based on the review of the procedures and discussions, the inspector verified that the test procedures reviewed are consistent with the FSAR commitments.

2.2 Pre-Critical Technical Specification Compliance

Scope

The inspector continued the assessment of the licensee complianc with Technical Specifications to support initial criticality as described in Inspection Report 50-388/84-18, section 5.0. The surveillance tests noted as not yet completed in the above inspection report were reviewed. The surveillances reviewed include SO-255-001, SO-231-001, SO-256-004, SI-258-203, SI-273-310 and SO-267-001. Additional surveillance tests reviewed and required for initial criticality include SI-214-201, SI-214-202, SI-258-201, SI-258-202, SI-264-203, SI-283-413, SI-267-301, SO-256-004 and SO-200-007. During several tours the inspector also assessed by direct observations of instrumentation the status of the Standby Liquid Control System, Core Spray Systems, Residual Heat Rejection System (RHR) and Neutron monitoring systems in support of the technical specification for initial criticality.

Findings

All surveillance tests reviewed were found to be current to support initial criticality. At the time of the inspection the Standby Liquid Control System tank levels and temperature were within technical specification limits. Both loops of core spray were in standby readiness and both loops of RHR were aligned in the low pressure coolant injection mode of RHR. The source range monitors (SRM) and intermediate range monitors (IRM) were all fully inserted into the core and operable with SRM count rates in accordance with technical specifications. The shorting links which place the nuclear instrumentation in a noncoincidence trip mode were removed. No violations were observed. The inspector had no further questions at this time.

2.3 Other Pre-Critical Reviews

2.3.1 Operational Hydrostatic Test

The inspector witnessed portions of the operational hydrostatic pressure test to assess crew performance and compatability with procedural requirements. Procedures reviewed include:

-- SO-200-016, "ASME Class 1 Boundary Leakage/Hydrostatic Pressure Test", Revision 0 dated April 17, 1984

-- NVT-6.2, "Visual Examination VT-2 (Leakage)", Revision 1 dated July 28, 1983.

Findings

The inspector observed that personnel were knowledgeable of the procedural requirements. The inspector accompanied personnel performing the test and observed conformance to procedural requirements. The inspector observed that data in excess of that required by procedure was being obtained by the on shift personnel. The inspector independently traced back accumulations of water to identify the sources of water leakage. The inspector also verified that the licensee did identify the same water leaks, except in one case. The licensee identified RWCU valve HV-2F106 as leaking around the valve packing. The water accumulation under RWCU valve HV-2F106 was in excess of that to be attributed to HV-2F106. RWCU valve HV-2F102 at the next higher elevation was found to be leaking around the packing and was not identified on the RWCU list of leaking components. This was brought to the licensee's attention. The licensee immediately added the valve to the list of leaking valve packings he had been maintaining as an assistance to maintenance and operations. The licensee indicated that the valve packing leaks were not a requirement under his procedure. Valve packing leaks are assessed under surveillances for Technical Specification 3.4.3.2. Based on the observations and interviews, the inspector verified procedure conformance and had no further questions at this time.

2.3.2 Rod Worth Minimizer (RWM)

Scope

The inspector obtained the RWM output to verify conformance with the rod sequence pattern in ST-4.1, "In Sequence Critical", Revision 3 dated April 6, 1984.

Findings

The RWM output was verified to be in accordance with the rod sequence pattern in startup test ST-4.1. The inspector had no further questions at this time.

2.4 Initial Criticality and Shutdown Margin Demonstration

The inspector witnessed the conduct of the initial criticality to assess crew requirements in accordance with the Technical Specification, use of approved procedure and all changes thereto, prerequisites satisfied, adequate on-site technical support, data sheet legibility, prediction of critical rod pattern, reactivity requirements and shutdown margin requirements.

Findings

Susquehanna Unit 2 began withdrawing control rods in support of initial criticality at 1921 hours on May 8, 1984. Initial criticality was achieved at 2140 hours on May 8, 1984. The reactor was critical in step 78 of the rod sequence on control rod 18-43 notch position 8 (2292 notches withdrawn). The reactor coolant temperature was 112°F. The conservative predicted estimated critical position following the ST-4.1 procedure was rod 34-27 notch 10 (2390 total notches withdrawn). The inspector used procedure ST-4.1 and independently predicted the same estimated critical rod position. The licensee best estimate expected critical position was step 80 in the withdrawal sequence, 2300 notches withdrawn. Criticality occurred within the 1% delta k/k of the predicted critical rod configuration (between 1488-2568 notches withdrawn).

The inspector observed that an approved official test copy ST.4.1 "In Sequence Critical" was utilized and maintained. Changes were properly approved for the conduct of the test; and test data was properly recorded on the official test copy. The reactor engineering staff directed initial criticality. The test director briefed the operating staff on the conduct of the initial criticality and shutdown margin demonstration. The licensee maintained an adequate number of personnel to conduct the test. All test prerequisites were satisfied. Control room logs were reviewed and were acceptable. Access to the control panel area was limited to essential personnel; and control room noise levels were minimized. The reactor engineer obtained OD-7 printouts, control rod position, at various times during control rod pulls. The inspector verified that the control rod positions at criticality were in accordance with the control rod sequence.

The inspector witnessed the conduct of the shutdown margin demonstration. Following initial criticality, a stable period of about 233 seconds was maintained for at least two decades. The calculated shutdown margin resulting from the test was 2.6% delta k/k. The minimum shutdown margin at any time in the cycle must be at least

0.38% delta k/k with the strongest rod withdrawn. The 2.6% delta k/k represents the Beginning of Cycle shutdown margin with the strongest rod out. It also represents the minimum shutdown margin for the fuel cycle since analysis of the exposure dependent correction factor shows that the minimum core shutdown margin occurs at beginning of life for this fuel cycle.

No violations were identified; and, the inspector had no further questions at this time.

2.5 <u>Test Witnessing</u>

<u>Scope</u>

The inspector witnessed portions of the following tests:

- ST-5.1, "CRD Insert-Withdraw Checks"

- ST-10.1, "IRM-SRM Overlap Verification"

- ST-10.3, "Signal to Noise Ratio/Minimum Count Rate"

The tests were witnessed to assess: procedure of appropriate revision is available and in use by all crew members; minimum crew requirements were met; prerequisites and initial conditions were met; test equipment was calibrated and operable per procedure; procedures were technically correct; crew actions were correct and timely; coordination was adequate; and, there was a quick summary analysis of all data collected subsequent to test.

<u>Findings</u>

The inspector verified that an official test copy was maintained for each test. Minimum crew requirements were met both for the operating staff and the startup test engineers. Prerequisites sampled indicated they were satisfied. The inspector observed that the lead startup test engineer briefed the operating staff and other startup test personnel prior to the conduct of the test. Data was quickly assessed. One control rod exceeded the acceptance criteria of ST-5.1 and was repaired and retested satisfactorily. All data was collected as required per procedure.

Some difficulty was realized in the conduct of ST-10.1 IRM-SRM Overlap Verification. Three attempts were required to satisfactorily complete this test. In the first attempt IRM Channels E and H did not respond although other IRM channels were already on range 4. The licensee shift supervisor immediately terminated the test when the reactor operator ranged IRM Channel C to range 5 and the shift test engineer observed that the administrative limit was range 4 power level. The licensee had a self imposed limit for this phase of testing not to exceed the power level of IRM channel 4. (The 5% license limit is approximately range 9). Even though the reactor operator ranged the IRM channel C to 5, the power level was less than that of range 4. The inspector noted that not all on-shift personnel were fully aware of the self-imposed administrative limit. This was brought to the attention of the licensee management. This was of concern to the inspector since administrative limits would be changing during the power ascension phase of the startup program. The administrative limit was controlled by the overall startup test procedure ST-99 detailing the testing that must be performed at each test plateau. The administrative limit was not necessarily included in each individual startup test procedure nor included in the startup test briefing conducted prior to each startup test.

The licensee stated that administrative limits would be affirmed at each shift briefing and that this practice would continue.The inspector observed that at subsequent briefings with the test directors and operators, administrative limits, as well as testing limits for each startup test, were discussed.

The second attempt to perform the SRM/IRM overlap was at a slower period than the first attempt. The testing personnel observed a discrepancy in IRM readings when ranging up. (25 on range 1 would be 45 on range 2). All IRM's responded during this test. Following repair, a third test was conducted successfully, however, it was not witnessed by the inspector.

No items of violations were observed; and, the inspector had no further questdins at this time.

2.6 Test Results Evaluation

Scope

The following completed startup tests were reviewed:

-- ST-1.5, "Chemistry Data Pre-Heatup"
-- ST-4.1, "In Sequence Critical"
-- ST-5.1, "CRO Insert-Withdrawal Checks"
-- ST-10.1, "IRM-SRM Overlap Verification"
-- ST-10.3, "Signal to Noise Ratio/Minimum Count Rate"

The completed startup tests were reviewed to assess that:

-- Each was approved in accordance with administrative procedures;

-- Test changes were annotated and completed if appropriate;

-- Basic test objectives were met;

-- Changes and test exceptions were noted;

-- Test exceptions were resolved and accepted by managerment;

-- Retests were completed if required;

-- System or process changes necessitated by a test deficiency were properly documented and reviewed;

-- Proper reporting of deficiencies;

-- Data sheets were completed;

-- Data was within tolerances;

-- Test steps and data sheets were properly signed and dated;

-- Engineering evaluation of test data;

-- Test results were compared with established acceptance criteria;

-- Documented review and acceptance of tests results;

-- Offsite review committee and followup if audited;

-- QA or independent review of tests results; and

-- Test results have been approved by appropriate management.

Findings

Test packages reviewed have not completed the complete review and approval cycle and will be reviewed in a subsequent inspection.

-- ST-1.5 - All data was completed. An independent review assessment had been completed. No test exceptions were identified. Acceptance criteria were satisfied.

-- ST-5.1 - This was a retest of selected rods from the previous plateau and was a prerequisite for conduct of initial criticality. All data was completed. An independent assessment had been completed. No test exceptions were noted. All control rods retested met the acceptance criteria of 40-60 seconds for insert withdraw times.

-- ST-10.3 - This was a prerequisite for initial criticality. All data was completed. An independent assessment had been completed. No test exceptions were noted. The acceptance criteria signal to noise ratio greater than 2, count rate greater than 3 counts/second) was met.

SRM	Full Inserted	Signal/Noise Ratio
A	25	28.8
B	23	176
C	72	326
D	19	157

-- ST-4.1 - This test is described in section 2.4. All acceptance criteria were satisfied. At the time of this inspection, the independent review had not been completed.

-- ST-10.1 - All data was completed. No test exceptions were noted. The acceptance criteria for the test were satisfied. The SRM's were partially withdrawn for this test but were not withdrawn between IRM onscale and SRM/IRM overlap verification. This is acceptable per procedures. The SRM/IRM overlap verification is repeated during the startup test program after installation of the shorting links. The most responsive and least response IRM values are listed below along with the SRM readings at the time.

IRM	Onscale Target	Actual	SRM-A	SRM-B	SRM-C	SRM-D
C	18	19	1100	430	830	220
F	17	18	5000	1700	3600	920

IRM	Target Overlap	Actual	SRM-A	SRM-B	SRM-C	SRM-D
C	42	43	3600	1200	2200	690
F	38	39	8700	3200	6900	1800

NOTE: C is most responsive, F is least responsive

Subsequent to conduct of ST-10.1, the shorting links were installed on May 10, 1984 at 5:08 A.M.

No violations were observed; and, the inspector had no further questions at this time.

2.7 QA Interface in Startup Program

The inspector reviewed the following QA surveillance reports 84-34, 84-38, 84-39, 84-042 of the startup program conducted by the onsite QA organization. The inspector also reviewed the QA plans for conducting QA surveillance in the future. No problems were identified.

The inspector also reviewed the Startup Test Group Supervisor's method of monitoring resolution of QA comments on completed test packages. This was an identified inspector concern in a previous inspection. The startup test group revised the log to identify satisfactory resolution of QA comments. The inspector had no further questions at this time.

2.8 Technical Support

The inspector interviewed the Reactor Engineering supervisor regarding his manpower allocation to support Unit 1 operation and the Unit 2 startup program. Based on the Reactor Engineering Supervisor's assessment, providing that Unit 1 has no major unscheduled outage (current scheduled outage for refueling is next spring) then manpower peaks, if any, can be accomplished with assistance from the corporate headquarters reactor engineering. If a problem occurs on Unit 1, management has indicated they would set priorities and if necessary slow down the startup program on Unit 2. This was reaffirmed during the exit meeting. Based on the above, the inspector had no further questions at this time.

3.0 Plant Tours

The inspector made several tours of the facility during the course of the inspection including the containment drywell reactor building, turbine building and control room.

The inspector observed work in progress, housekeeping, cleanliness controls, storage and protection of components, piping and systems and preparations for initial criticality.

No violations were identified and no unacceptable conditions were noted.

4.0 Exit Interview

At the conclusion of the site inspection on May 10, 1984, an exit meeting was conducted with the licensee's senior site representatives (denoted in paragraph 1). The findings were identified and previous inspection items were discussed. At no time during this inspection was written material provided to the licensee by the inspector.

Appendix A

Procedure Review

1. ST-19.0 "Core Performance", Revision 2, dated April 2, 1984

2. ST-19.1 "BUCLE Calculation", Revision 2, dated April 2, 1984

3. ST-19.2 "Process Computer Calculation", Revision 2, dated April 2, 1984

4. ST-13.1 "Dynamic System Test Case", Revision 2, dated March 21, 1984

5. ST-14.4 "Low Pressure Auto Quick Start to Vessel", Revision 3, dated March 16, 1984

6. ST-16.2 "Recirculation Pump Trip Recovery Data", Revision 1, dated March 23, 1984

7. ST-23.2 "Feedwwater System Manual Flow Step", Revision 2, dated March 13, 1984

8. ST-39.3 "Recirculation Piping Vibratory Response During Recirc Pump Trips and Restarts", Revision 2 dated March 23, 1984

9. ST-21.1 "Response of Power - Void Loop to Control Rod Movement", Revision 2, dated March 13, 1984