

U.S. NUCLEAR REGULATORY COMMISSION

Region I

Report No. 50-388/84-23
Docket No. 50-388
License No. NPF-22 Priority - Category B
Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna Steam Electric Station, Unit 2

Inspection At: Salem Township, Pennsylvania

Inspection Conducted: May 14 - June 1, 1984

Inspectors: J. W. Chung
J. W. Chung, Lead Reactor Engineer
H. H. Nicholas
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D. J. Florek
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6-15-84
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Approved By: L. H. Bettenhausen
L. H. Bettenhausen, Chief, Test Programs
Section, DETP

6/25/84
date

Inspection Summary: Inspection on May 14 - June 1, 1984 (Report No. 50-388/84-23)

Areas Inspected: Routine unannounced inspection of preoperational test program followup, startup test program, startup test witnessing, startup test results evaluation, investigation of startup transient occurring on May 28, 1984 and tours of the facility. The inspection involved 80 hours onsite by three region-based inspectors.

Results: No violations or deviations were identified.

Region I Form 12
(Rev. February 1982)

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DETAILS

1. Persons Contacted

Pennsylvania Power and Light Company

- G. Butler, I&C Supervisor
- + T. Clymer, NQA Coordinator
- A. Domingueg, Technical Staff
- J. Doxey, Reactor Engineering Supervisor
- R. Harris, Senior Licensing Specialist
- T. Iorfida, Plant Engineering Supervisor
- +* H. Keiser, Superintendent of Plant
- J. Klucar, Lead Shift Test Engineer
- D. Lauer, ISG Coordinator
- * C. Myer, Assistant Plant Superintendent, Outages
- T. Nork, Startup Coordinator
- C. Osborn, Electrical Maintenance
- H. Palmer, Operations Supervisor
- * R. Prego, OQA Supervisor
- M. Sages, NPE
- + R. Sheranko, Startup Test Group Supervisor
- C. Smith, Power Production Engineer Nuclear
- o D. Thompson, Assistant Superintendent of Plant
- +* J. Todd, Compliance Engineer
- * J. Vambaco, ISG Engineer
- R. Whery, Startup Test Engineer

General Electric Corporation

- T. Czubakowski, Lead Startup Test Engineer
- K. Mertes, Operations Marager

Bechtel Power Corporation

- E. Figard, ISG Supervisor
- P. McDaniel, Engineering
- J. Zentz, RCG Supervisor

U.S. Nuclear Regulatory Commission

- * R. Jacobs, Senior Resident Inspector
- L. Plisco, Resident Inspector
- R. L. Perch, Division of Licensing, Licensing Branch 2
- T. Alexion, Division of Licensing, Operating Reactors Assessment Branch
- M. Caruso, Division of Licensing, Operating Reactors Assessment Branch
- F. Liederbach, Division of Human Factors Safety

The inspector also contacted several other licensee employees including members of the technical and engineering staffs and reactor and auxiliary operators.

* Denotes those present at exit on May 16, 1984.

+ Denotes those present at exit on May 25, 1984.

o Denotes those present at summary of investigation on June 1, 1984.

2. Licensee Action on Previous Inspection Items

(Closed) Unresolved Item (388/84-12-01) These unresolved items are exceptions to completed preoperational and acceptance tests, many of which have been resolved. The remaining test exceptions that are still unresolved were not required to be completed for criticality, and will be incorporated and tracked as Unresolved Item (388/84-23-01).

(Closed) Violation (388/83-25-13) (387/83-30-13) Control of the temporary setpoint change activities was contrary to 10 CFR 50, Appendix B, Criterion II. Inspection Report 50-388/84-12 verified licensee compliance in response to the identified violation and indicated closure of this item was dependent on issuance of the revision to AD-QA-402. The inspector reviewed AD-QA-402, Revision 5, dated May 16, 1984 and verified procedure revision implemented licensee response in PLA-2086 dated February 25, 1984. The inspector had no further questions. This item is closed.

(Open) Deviation (388/84-12-02) Surveillance procedure to test suppression pool drywell vacuum breakers did not provide any quantitative values or instructions to calibrate or verify settings of the vacuum breaker position indication switches as stated in FSAR Paragraph 6.2.1.1.3.2.

The inspector reviewed the licensee's draft response to the deviation. The inspector also reviewed SE-00-004, "Primary Containment Bypass Leak Test" Revision 0, dated May 2, 1984 and SM-259-001 "18 Month Vacuum Relief Breaker Valve Position Switch Channel Calibration" draft copy. Information was also obtained regarding the sensitivity and accuracy of the vacuum breaker position indication. A review of the documents and Standard Review Plan, paragraph 6.2.1.1.c plus discussions with other BWR Mark II containment facilities indicated that the identified deviation may have generic implications. Assistance to resolve this item has been requested from NRR Containment Systems Branch.

3.0 Preoperational Test Program Followup

3.1 Unit 2 Test Exceptions

The inspector verified that all open test exceptions to Unit 2 completed preoperational and acceptance tests have been resolved and approved with exception of the following completed tests.

- 3.1.1 S = Required For Startup
P252.1A HPCI
- 3.1.2 T = Required For Gen. Sync.
P234.1A RBHV
P234.3A SPDS Power Supply HV
A211.1A Service Water
A246.1A Extraction Steam
A272.1B Gaseous Radwaste
A276.2A Sampling
A290.1A SPDS
A292.1A Turbine Steam Seals and Drains
A293.2A Main Turbine Controls
A295.1B H₂ Seal Oil
A297.1A Stator Cooling
A298.1A Main Gen and Excitation
- 3.1.3 U = Required For Specific Startup Test
P250.1A RCIC
P261.1A RWCU
- 3.1.4 X = Required For Commercial Operation
P245.1A FW
P269.1A Liq. Radwaste
P279.1A Area Rad Monitor
P281.1A Fuel Handling
P283.3A Leakage Control
A203.1A 13.8 KV
A232.2B South Gatehouse
A237.1A Makeup, Cond, Refuel Water
A239.1A Cond. Demin
A241.1B Cooling Towers
A243.2A Cond. Tube Cleaning
A276.2A Sampling
A299.2B P.A. Communications
A299.4A Rad. Area Doors
- 3.1.5 Y = Required For 1st Refueling Outage
P249.1A RHR
P281.1A Fuel Handling
- 3.1.6 Z = Optional - No Requirement
A219.1A Service Air

- 3.1.7 These test exceptions are to be resolved by the priority code definitions established. This is Unresolved Item (388/84-23-01).

3.2 Unit 2 Incomplete Tests

- 3.2.1 The following tests will be completed as a requirement for T = Gen. Sync.:

A272.2B Gaseous Radwaste
A239.2A Ultrasonic Resin Cleaner

- 3.2.2 The following tests will be completed as a requirement for X = Commercial Operation:

P281.1B Fuel Handling
P299.1B RB Cranes
A239.1B Cond. Demin
A235.1B Fuel Pool Cooling

- 3.2.3 These items, as well as any test exceptions that may occur, will be tracked in the same manner. This is Unresolved Item (388/84-23-02).

3.3 Unit 1 Test Exceptions

The inspector verified that all open test exceptions to Unit 1 completed preoperational and acceptance tests have been resolved and approved with exception of the following completed tests and their exceptions.

3.3.1 Completed Tests and Exceptions

<u>Number</u>	<u>Title</u>	<u>Exceptions</u>
P45.1	FW	004
P55.1	CRD	015
P81.1	Fuel Handling	002, 003, 005, 018
P85.1A	Cathodic Prot.	003
P99.1	RB Cranes	011
A41.1	Cooling Towers	002
A67.1	Loose Parts Monitoring	001
A76.2	Sampling	002, 005, 007, 008
A85.2	Freeze Prot.	001, 002, 003, 004

- 3.3.2 These test exceptions are to be resolved and approved by the 1st refueling outage of Unit 1. This will be Unresolved Item (388/84-23-03).

4. Startup Test Program

References

- SSES Final Safety Analysis Report
- 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 Administrative Procedure

4.1 Startup Test Administrative Procedure

Scope

Startup Test Administrative Procedure AD-TY-460, Revision 6, dated May 8, 1984 was reviewed to assure that administrative procedure requires, test procedure is current prior to use, test personnel are knowledgeable of test procedures, methods to change a test procedure during the conduct of testing, criteria for interruption of a test, coordination of testing, methods to document significant events, unusual conditions or interruptions to testing, methods to identify deficiencies documenting their resolutions, test results evaluation, test results compared to acceptance criteria, per failed tests after corrective actions completed tests rerun as necessary, test results reviewed by appropriate personnel and the people originally approving the procedure.

Findings

AD-TY-460 was found to contain the items described above. An official test copy is utilized, test briefings are conducted with the startup test personnel and operations personnel, procedure change control is imposed, data is properly recorded in the test procedure or attached, test exception reports are required for abnormal results, test results are evaluated via the Technical Review Committee (TRC) and PORC, all procedure changes and test exceptions must also receive TRC and PORC approval. No violations were identified.

4.2 Startup Test Witnessing

The inspector witnessed portions of the following tests:

ST-5.2 CRD Friction Measurements

ST-14.1 RCIC Condensate Storage Tank Injection

ST-25.1 MSIV Functional Test

Inspection Report 50-388/84-21, Section 2.5 describes the scope of the test witnessing inspections.

Findings

- ST-5.2 Testing was observed on several occasions. Testing was being conducted on the fully withdrawn control assemblies in the B sequence. Control assemblies 46-07 and 06-31 passed the acceptance criteria of 15 psi variation on a continuous insert, control assemblies 06-47 and 30-31 did not pass the acceptance criteria for continuous insert and required a setting test which was successfully conducted. The test instrumentation calibration was current. Communication between the test setup at the hydraulic control units and the control room was maintained. Each rod was individually assessed against the acceptance criteria as it was completed. The crew members were knowledgeable of the procedure. An official test copy of the procedure was utilized for data recording. No unacceptable conditions were noted.

- ST-14.1 The test consisted of two parts. The first part verified performance and stability to step changes in both the automatic and manual control. The second part was a quick start of RCIC. The rated steady state conditions established with RCIC suction and discharge to the Condensate Storage Tank were 600 gallon per minute flow, discharge pressure 1030 psig, turbine speed 4000 revolutions per minute, 922 psig steam pressure and 10 psig turbine discharge pressure.

The RCIC response to step changes was performed as required per procedure. Communication between the control room and GETARS operator was maintained. Communications between the operator running RCIC and the operation at the control rod position of the panel was observed. The quick start of the RCIC turbine met the level 1 acceptance criteria. The average pump discharge flow must be equal to or greater than 600 gpm after 30 seconds at any reactor pressure between 150 psig and rated. The observed response achieved 600 gpm in approximately 20 seconds. In addition, the RCIC turbine did not trip or isolate during the quick start test. The two hour run of RCIC was conducted following the RCIC quick start. The test was also witnessed by INPO and the licensees Nuclear Safety Assessment Group.

ST-14.1 was conducted during portions of two shifts. The inspector observed that because of poor communication between the startup and operating personnel on the second shift, portions of the already completed ST-14.1 had to be reperformed to conduct the RCIC quick start test.

The inspector brought this to the attention of the Startup Test Group Supervisor. The Startup Test Group Supervisor stated that he would investigate the cause of this event, (i.e. isolated event or was it caused by complications due to shift turnover) and take actions as necessary. This item will be pursued in a subsequent inspection.

- ST-25.1 A recent issue of procedure of ST-25.1 was used to conduct this test. The inspector observed that Revision 4 dated May 18, 1984 was in use. The PORC and TRC had reviewed the procedure and it was issued by the plant superintendent. The inspector observed communication between the control room and GETARS operator, data was recorded as required per procedure. The MSIV met the Level 1 acceptance criteria of closure between 3-5 seconds. The operators were conducting their surveillance test concurrently with the conduct of this startup test. The inspector also observed that the Operations QA was performing an audit of the startup program during the performance of this startup test.

4.3 Test Results Evaluation

Scope

The following completed startup tests were reviewed:

- ST-5.5 Scram Testing of Selected Rods at 600 psig
Test Implemented May 20, 1984
- ST-5.5 Scram Testing of Selected Rods at 800 psig
Test Implemented May 21, 1984
- ST-12.1 Low Power APRM Calibration
Test Implemented May 18, 1984
- ST-8.1 Suppression Pool Cooling Mode - Loop A
Test Implemented May 14, 1984
- ST-8.1 Suppression Pool Cooling Mode - Loop B
Test Implemented May 15, 1984
- ST-26.1 Relief Valve Low Pressure Test
Test Implemented May 11, 1984

Inspection report 50-388/84-21 Section 2.6 describes the scope of the reviewed items.

The inspector also witnessed conduct of TRC Meeting 84-014 held on May 23, 1984 to verify implementation in accordance with the administrative procedures.

Findings

The completed startup tests have not yet completed the post test review process. TRC meeting 84-014 reviewed the results of each of the above tests. Subsequent review by the PORC and Superintendent of Plant is also required. The complete review cycle will be assessed in a subsequent inspection.

- ST-5.5 No test changes were required and no test exceptions were noted. Test steps and data sheets were properly recorded. The maximum scram time of each control rod drive from the fully withdrawn position to match position 05 upon deenergization of the scram pilot valve at time equal to zero did not exceed the 7 second criteria.
- ST-12.1 One test procedure change was required and properly processed. No test exceptions were noted. Data was properly recorded. The APRM was calibrated to read equal to or greater than actual core thermal power as required per Level 1 acceptance criteria.
- ST-8.1 No test procedure changes and no test exceptions were noted. The TRC meeting review noted a discrepancy in the calculation of heat transfer when using the process flows and using the RHR Service Water Flows. While the heat transfer from either calculations exceeds the Level 2 acceptance criterion, this discrepancy may lead to problems in further startup tests. A TRC action was identified. This will be pursued in a subsequent inspection.
- ST-26.1 There were two test procedure changes required and properly processed. Two test exceptions to Level 2 acceptance criteria were noted based on the change in bypass valve position for each SRV opening being less than a valve corresponding to the average change minus 10% of one bypass valve. Similar test exceptions were noted on Unit 1. The licensee has evaluated the situation and found the actual results to be acceptable to proceed.

The TRC meeting was chaired by the Operations Supervisor, Representatives from GE and Bechtel were present. The Startup Test Group and PP&L Nuclear Plant Engineering were also represented in accordance with the administrative procedure. The inspector observed a recording secretary taking minutes of the meeting. In addition to the above test results, the results of ST-4.1, Test Exception Reports 7, 8 and 11 and Startup Test Change Notices 38, 45, 46, 47, 48 and 49 were also reviewed.

The inspector also obtained a listing of the 20 Test Exceptions noted as of May 24, 1984. All Test Exceptions are against Level 2 criteria. The listing and resolutions will be reviewed in subsequent inspections to assure all test exceptions are resolved prior to completing the test condition as required per the administrative procedures.

4.4 Startup Personnel Qualifications

Scope

The inspector reviewed the records of 11 startup test personnel to verify conformance to the requirements ANSI 3.1 (BA degree, engineering or related science, two years power plant experience, one at a nuclear plant).

Findings

Of the 11 individual records reviewed, all meet the requirements except one individual's BA degree was not in engineering or related science. The licensee had in process prior to the inspection, documentation to the plant superintendent justifying his assignment on related experience and alternate training. This item will be further assessed in a subsequent inspection. The inspector had no further questions at this time.

4.5 QA Interface

The inspector reviewed the QA plans and accomplishments in the startup program. The inspector observed QA individuals performing an audit of the startup program during the conduct of ST-25.1. The inspector observed that QA had reviewed the results of completed tests 8.1, 10.1 and 10.3. QA review on the remaining completed tests was in process. The inspector reviewed the QA log records for completed QA audits and surveillance. The inspector observed that the logs were not timely. Upon discussion of this item with the OQA Supervisor, additional manpower was assigned to support the QA startup activities on Unit 2. This item will continue to be reviewed in subsequent inspections.

5.0 May 28, 1984 Transient Investigation

Transient Summary

While pulling control rods to open #1 Bypass Valve (BPV) in preparation of RCIC Hot Functional (HF-250-010) and RCIC Vessel Injection (ST 14.2) startup tests at 0050 hour, May 28, 1984, the offgas steam dilution flow experienced unstable oscillation. As the control rods were pulled to 50% density with reactor power 2%, the offgas dilution steam flow perturbation was diverging, and the offgas dilution steam valve was finally closed at 0101 hour, apparently triggering a transient event.

To maintain a stable steam throttle pressure EHC system was responding to the apparent steam pressure fluctuation by cycling #1 BPV, and eventually, upon offgas steam isolation the #1 BPV was fully opened, which resulted in rapid decrease in reactor pressure to 896 psi from 916 pressure and subsequent reactor water level swell to 50 inches, according to the process computer data points. One element (reactor water level) Feedwater Control system properly responded by throttling down the feed water flow, and HPCI was isolated on turbine protection actuation signal on the 50" reactor water level.

The feedwater reduction subsequently restored the reactor water level to 30", approximately 33 seconds after the initiation of the transient.

As the water level was responding to the feedwater reduction, the one element control was, in turn, increasing the feedwater demand, and cold feedwater injection into the reactor vessel induced the reactor neutron power increase due to the negative temperature coefficient, and the reactor pressure followed the reactor power. APRM Channel 'B' registered 11% power with Gain Adjustment Factor (GAF) of 1.85, and the computer data points indicated a maximum 42% of the range 9 scale on 'A' IRM, at 42 seconds into the transient. At this point, the control room operator commenced the control rod insertions and two BPV valves, #1 and #2, opened to regulate the reactor pressure.

The transient lasted three minutes, and the reactor pressure and power were stabilized when the feedwater system was transferred into manual control.

Investigative Findings

- 1) The APRM rod block was actuated and APRM reactor trip signal was not actuated. The inspector verified by review of startup test ST12.1, performed May 19, 1984, that GAF valves for APRM's A, B, C, D, E and F were 2.22, 1.85, 2.37, 1.93, 1.95 and 2.01 respectively.

The APRM Rod Block and Reactor Trip setpoints were 11% and 14% respectively, which would have resulted in the rod block at 4.65% rated power (RPS Channel I from APRM A, C and E; GAF from APRM 'C' was 2.37) and a reactor trip at 5.90% rated power (Trip Setpoint = $14/2.37 = 5.907\%$ rated). Since the Rod Block Signal was actuated and the trip signal was not actuated, the peak reactor neutron power exceeded 4.64% but was less than 5.907%. However, the inspector concluded that the real peak power reached 5.9% rated since the observed maximum 'B' APRM reading was 11% during the transient.

- 2) The initiating event of the transient was the Offgas dilution steam flow isolation due to the failure of the pressure regulator for the air ejector steam supply system. The pressure regulator was inoperable because the pneumatic instrument isolation valves, PC 20701A/B, for the pressure regulator were closed and remained closed. A major contributing factor for the power increase above 5% rated during the transient was mechanical failure of #1 BPV. The licensee is currently investigating cause of the #1 BPV failure.

The inspector also determined, based on the following facts, that the failure to open the instrument isolation valves, PC 20701A/B, was an isolated case.

- Licensee conducted a walkdown inspection of all surveilled instrument valves (Q-listed safety valves) and other known-problem-area valves on May 6, 1984, two days prior to the initial criticality.
 - Two I&C technicians were assigned, full time, to inspect visually for the instrument and root valve alignments.
- (3) The inspector reviewed unit 2 control room operator and startup logs, and verified by reviewing computer data points during and prior to the transient that system operations and the reactive actions by the control room operators were adequate.
 - (4) The inspector reviewed startup test data, and GETARS traces, ST 14.2, RCIC Quick Start, performed May 28, 1984 at 0453 hour, that turbine steam flow did not display any abnormal condition and the test results were acceptable.

6.0 Plant Tours

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

The inspector observed work in progress, housekeeping, and cleanliness controls.

No violations were identified and no unacceptable conditions were noted.

7.0 Exit Interview

At the conclusion of the site inspection on May 16, 1984, and May 25, 1984 an exit meeting and on June 1, 1984 an investigation summary 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.