

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-352/85-20

Docket No. 50-352

License No. NPF-27

Priority

Category C

Licensee: Philadelphia Electric Company

2301 Market Street

Philadelphia, PA 19101

Facility Name: Limerick Generating Station, Unit 1

Inspection At: Limerick, Pennsylvania

Inspection Conducted: April 1-4, 1985

Inspectors: D. Florek
D. Florek, Lead Reactor Engineer

5/6/85
date

J. Hodson
J. Hodson, Reactor Engineer

5/6/85
date

Approved by: L. Bettenhausen
for L. Bettenhausen, Chief
Operations Branch, DRS

5/7/85
date

Inspection Summary: Inspection on April 1-4, 1985 (Inspection Report No. 50-352/85-20)

Areas Inspected: Routine, onsite, unannounced inspection of the startup program including startup test results evaluation; main turbine testing activities; previous inspection findings; QA/QC interfaces and tours of the facility. The inspection involved 48 hours onsite by two region based inspectors.

Results: No violations were identified.

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Details

1.0 Persons Contacted

J. Armstrong, Assistant Operating Engineer, PECO
C. Bruck, Project Site Manager, GE
J. Doering, Operations Engineer, PECO
*P. Duca, Technical Engineer, PECO
*J. Erhm, Start Test Program Scheduler Bechtel
C. Endriss, Regulatory Engineer, PECO
*K. Folta, Site QC Supervisor, Gilbert
*G. Gilbody, QA Engineer, PECO
*C. Hermon QA Engineer, PECO
K. Hunt, Reactor Engineer, PECO
*A. Jenkins, Startup Test Program Supervisor, GE
*G. Leitch, Plant Superintendent, PECO
*J. Lisa, QA Engineer, PECO
*R. Mandick, Test Engineer PECO
J. Murphy, BOP Test Supervisor, Bechtel
*P. Pagano, NSSS Test Supervisor, GE
*W. Rekito, Regulatory Engineer, Bechtel
C. Williams, QA Engineer, PECO
L. Wink, Lead Shift Test Coordinator, GE

US Nuclear Regulatory Commission

*J. Wiggins, Senior Resident Inspector

*Denotes those present at exit meeting conducted on April 4, 1985.

The inspector also contacted other licensee and contractor personnel in the course of the inspection including reactor operators, startup test engineers and technical staff.

2.0 Licensee Action on Previous Inspection Findings

(Closed) Unresolved Item (352/85-06-01), Revisions to STP-14.7 and STP-14.8 to assure discharge pressure is greater than reactor pressure and performance of a breaker operation assessment for those breakers operated during performance of STP-14.9. The inspector reviewed STP-14.7 Revision 1 and STP-14.8 Revision 1 for verification of adequate discharge pressure. The inspector also reviewed letters S. Rowe to P. Fleckser "STP-14.9 RCIC Loss of AC Power", dated November 21, 1984 and P. Fleckser to R. Ballou "Advance Test Planning Response RCIC and HPCI Valve Throttling/Battery Loads - RCIC Loss of AC", dated December 7, 1984. The licensee evaluation considered battery capacity and energization of connected loads during the test with the breaker lineup as identified and determined that adequate battery capacity exists to support startup testing. This item is closed.

3.0 Startup Program

3.1 References

- Regulatory Guide 1.68, Revision 2, "Initial Test Program for Water-Cooled Nuclear Power Reactors"
- ANSI 18.7 - 1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants"
- Limerick Generating Station (LGS) Technical Specification
- LGS Final Safety Analysis Report
- LGS Safety Evaluation Report
- NEBO 23A1918, Revision 0, "Limerick 1 and 2 Startup Test Specification"
- LGS Startup Program Schedule
- Administrative Procedure A-200, "Startup Test Procedure Format and Content"
- Administrative Procedure A-201, "Startup Test Procedure Control"
- Administrative Procedure A-202, "Startup Test Implementation"
- Administrative Procedure A-203, "Startup Test Program Personnel Training and Qualification"

3.2 Startup Test Results Evaluation

Scope The startup tests listed in the findings section below were reviewed for the attributes identified in inspection report 50-352/84-70 Section 3.3

Findings

Except as noted below all the startup test results were found to meet the attributes referenced above. The inspector also assessed that STP-5.6, 14.1 and 14.2 were reviewed and accepted by management. The data was assessed by the inspector in a previous inspection. A summary of each startup test result follows.

STP-1.2 "Chemistry Data", Revision 0, PORC reviewed results March 15, 1985.

All acceptance criteria were satisfied except for CRD oxygen content and analysis not available for feedwater metals. TER-90 was identified to document this exception and the resolution was accepted by management.

STP-5.5 "Rated Reactor Pressure Friction Testing", Revision 1, PORC reviewed results March 14, 1985.

Acceptance criteria were satisfied. Several test exceptions were identified during the test which affected test methodology. All were resolved and accepted by management.

STP-5.7 Rated Reactor Pressure Insert/Withdraw Checks and Scram Testing of Selected Rods", Revision 1, Test implemented January 27, 1985.

Management review was completed and test results were approved. The four selected rods were 10-39, 26-39, 30-35 and 38-27. These rods will be monitored for scram times during planned scrams. Acceptance criteria were satisfied.

STP-9.1 "Reference Leg Temperature Comparisons", Revision 1, Test implemented January 24, 1985.

Management review was completed and test results were approved. The acceptance criteria were satisfied with the difference between the initial calibrations and actual reference leg temperature producing an end point error of less than 1%.

STP-11.1-2 "Verification of Proper Connection of LPRM Detectors and Readout Equipment", Revision 1, Test implemented January 16, 1985.

Management reviewed and accepted test results.

STP-13.2-1 "TIP Alignment at Rated Temperature", Revision 1, Test implemented January 23, 1985.

One test exception was identified due to TIP-E not being able to be tested during this attempt. It will be tested at a later date. Management review and acceptance of the test results were completed.

STP-14.3 "RCIC- Stability Check CST to CST at 150 psig", Revision 1, PORC reviewed results March 14, 1985.

Two test exceptions were identified. During the quick start portion, RCIC achieved greater than 600 gpm but did not respond to demanded control changes. The test was repeated successfully after valves were stroked. Alignment of the servo will be performed and further tests will be performed. Some oscillatory behavior was noted but was judged to be acceptable for this testing condition.

STP-17.1 "Measured Pipe Displacement (Selected BOP Systems)", Revision 1, PORC reviewed results March 13, 1985.

Test results reviewed were from tests performed at 275°F, 350°F and 450°F. Level two acceptance criteria failures were identified and documented. Test results were accepted by management.

STP-17.3 "Measured Pipe Displacements (Main Steam Inside Drywell and Reactor Recirculation)", Revision 1.

The test was conducted three times at reactor recirculation temperatures of 260°, 450°F and 530°F on December 30, 1984, January 5, 1985 and January 10, 1985. Two test exceptions were identified (TER-22 and 25) for level 1 acceptance criteria failures. These test exceptions were discussed in inspection report 50-352/85-06. The test results were accepted by management.

STP-17.4 "Visual Inspection (Main Steam Inside Drywell and Reactor Recirculation)", Revision 0, PORC results approved March 13, 1985.

Acceptance criteria were satisfied with results accepted by management.

STP-70.3 "RWCU Normal Mode Performance Verification", Revision 1, PORC results reviewed March 15, 1985.

Acceptance criteria were satisfied and results were accepted by management.

4.0 Main Turbine Testing under the low power license.

Scope

The inspector reviewed the licensee plans and procedures used to conduct the planned testing of the turbine generator under the low power license to ensure that there is reasonable assurance that the activities can be conducted in a safe manner and not exceed the license conditions.

The inspector interviewed several senior licensee representatives including the Plant Superintendent, Operations Engineer, Technical Engineer, Reactor Engineer, GE FPS Project Site Manager, GE Startup Test Group Supervisor and members of their staff. The following documents were also reviewed:

- Letter S. Daltroff to H. R. Denton dated March 25, 1985 requesting NRR concurrence in licensee plans to operate the main turbine within the 5% steady state license power limit.
- PECO Safety Evaluation for operation of the Main Turbine Generator under Operating License NPF-27 draft copy.
- SP-GP-006 "Main Turbine Initial Startup", Revision 0
- SP-GP-XX "Shutdown of Main Turbine During Low Power Testing", In-preparation copy, Rev. A.
- GP-2 "Normal Plant Startup", Revision 4, dated February 14, 1985

- Letter C. Bruck to G. Leitch dated December 10, 1984 "Initial Start and Low Power (Main Turbine) Operation".
- Schedule T6-1003 Initial Turbine Roll/Generator Sync
- Schedule STP-3028 Startup Test Program One Week Schedule
- Time history plot from STP-15.2-6 "HPCI Quick Start at Rated CST to CST" performed March 12, 1985.
- Data from Susquehanna Steam Electric Station on turbine roll steam demands dated January 22, 1985 and February 1, 1985
- 1P-93.2 "Main Turbine Control System", Pre-op data for turbine bypass and control valve testing on September 24, 1984.
- Technical paper "Feedwater Flow Measurements" by M. Torres, dated February 10-14, 1985

Findings

Based on the interviews conducted, the licensee plans to roll the main turbine with no additional heat balances conducted to reduce the conservatism in effect with actual core thermal power and indicated core thermal power. If the licensee cannot supply the steam necessary to achieve main turbine rated speed, they may modify their plans and utilize an ultrasonic flow meter on the feedwater lines to improve heat balance accuracy. If this device was used, further information would be required on the previous experience, calibration, testing, and uncertainty analyses to determine acceptability of this approach. This was identified at the exit meeting and was acknowledged by the licensee.

Based on the turbine vendor estimate and data available from Susquehanna the required steam demand to achieve rated turbine speed is between 200,000 - 400,000 pounds per hours. Inspector observations during steady state operation (testing) at less than 5 percent power indicates that approximately 390,000 pounds per hour will be available for turbine testing without exceeding the license power limit. Therefore sufficient steam is probably available to achieve rated turbine speed. Licensee precautions and limits are further discussed below.

The license plans to conduct turbine testing in discrete steps (shell warming, sounding roll, roll to rated and generator synchronization). The licensee plans to review plant response to the previous testing and extrapolate plant response to future testing and evaluate whether future testing is appropriate. In addition the licensee plans to define constraints in testing beyond which attempts to obtain the desired end point will not be further pursued. These plans have not yet been developed in detail.

While generator synchronization is contained in the test procedure, steam limitations may preclude it from being conducted under the low power license.

Inspector review of the EHC Preoperational data indicated that turbine bypass valve (TBV), control valve (CV), and main stop valve (MSV) stroke time testing satisfied acceptance criteria and that EHC response to simulated turbine roll and pressure changes were acceptable.

Review of HPCI quick start testing which demanded essentially step changes in steam flows of approximately 197,000 pounds per hour were acceptably controlled by the EHC system. This is representative of the low end of steam flows necessary to achieve rated main turbine speed.

Inspector review of the PECO safety evaluation and SP-GP-006 indicates that the licensee plans to perform the turbine testing with the mode switch in "Startup" with administrative controls that require the operator to scram the reactor and close the MSIVs if low pressure is sensed at the inlet to the high pressure turbine. This is an automatic MSIV action when the mode switch is in RUN and is consistent with previous plant operation under the low power license. This also assures more sensitive power level trips from the IRM and APRM.

Inspector review of the interfacing of procedures SP-GP-006 and GP-2 indicated differences in initial conditions for turbine roll activities. The interfacing of GP-2 and schedule STP-3028 also indicated different conditions for performing shell warming operations. The licensee representative indicated the proper interfacing of these documents is in process. In addition the licensee representative indicated that an additional procedure is being developed to assure that the license power limit would not be exceeded when shutting down the turbine. A draft copy was reviewed by the inspector.

The training of the operators in the initial turbine roll has not been completed. Training will be conducted and a walk thru of the procedures will be performed with the operating staff. The normal plant configuration to roll and synchronize the turbine generator is two turbine bypass valves open which is not too different from the conditions planned for the initial turbine roll with one turbine bypass valve open. Mode switch in "Startup" vs "RUN" requires additional monitoring of steam line pressure for manual scram and MSIV closure for EHC failures. Training of the operators in this mode of operation will be accomplished.

Loss of pressure control capability of the EHC will be protected during this event by the RPS and administrative controls. High pressure protection is provided by the pressure and IRM/APRM trips in the Startup Mode. Low pressure protection is provided by operator monitoring of the steam line pressure and scrambling the reactor and closing the MSIVs. This is consistent with previous operation under the low power license. If MSIV closure occurs, RCIC, and CRD pumps are capable of injecting water into the vessel at high and low pressure and have been tested/operated for

vessel injection. HPCI is also capable of vessel injection but is not required to be tested until much later in the startup program. MSIV functional testing has also been successfully completed in the startup program.

In summary, the inspector concluded that initial turbine roll activities under the low power license can be conducted in a safe manner. All planned turbine testing may not be accomplished due to the available steam supply; however, achieving rated turbine speed is expected. Previous plant testing is comparable to conditions expected for turbine roll activities.

The licensee's detailed planning is not complete but must be completed prior to the initial turbine roll activities to assure safe conduct of the test. These activities are listed below and collectively constitute unresolved item (352/85-20-01).

1. Issue final PECO safety evaluation
2. Integrate SP-GP-006 and GP-2
3. Integrate GP-2 and STP-3028
4. Issue procedure for not exceeding low power license constraints on shutdown of the main turbine generator.
5. Training of personnel for initial turbine roll.
6. Review plant response after each test phase and determine acceptability of proceeding into the next phase.
7. Define limits on plant operations in achieving the end point desired in each testing phase.

The licensee representative acknowledged the inspector findings at the exit meeting. The inspector also noted that prior NRC acceptance of the above items is not a constraint on the licensee's turbine roll activities but that the licensee's actions to satisfy the above items will be assessed in a subsequent inspection.

5.0 QA/QC Interfaces

Based on review of STP-99.2, the inspector determined that QC has reviewed completed startup test procedures as required by the administrative procedures. Based on an interview with a QC engineer, QC surveillance of STP-14.5 and STP-17.1 was in process. The inspector reviewed in-process surveillance report CEW-85-X covering the in-process surveillance. No unacceptable conditions were noted.

6. Plant Tours

The inspector made several tours of the facility during the course of the inspection including the reactor building, turbine building, control structure and control room. No unacceptable conditions were noted.

7. Exit Interview

An exit meeting was held on April 4, 1985 to discuss the inspection findings as detailed in this report. (See paragraph 1 for attendees). At no time during the inspection did the inspector provide written inspection findings to the licensee. At the exit, the licensee did not identify any proprietary material that was contained within the scope of the inspection.