

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 50-352/84-50

Docket No. 50-352

License No. CPPR-106

Licensee: Philadelphia Electric Company

2301 Market Street

Philadelphia, Pennsylvania 19101

Facility Name: Limerick Generating Station, Unit 1

Inspection At: Limerick, Pennsylvania

Inspection Conducted: September 6, 7, 10-14, 17 and 21, 1984

Inspectors: *L. Blumberg* 10/15/84  
N. Blumberg, Lead Reactor Engineer date

Approved by: *L. Betterhausen* 10/15/84  
L. Betterhausen, Chief, Test Programs date  
Section, Engineering Programs Branch

Inspection Summary: Inspection on September 6, 7, 10-14, 17 and 21, 1984  
(Inspection 50-352/84-50)

Areas Inspected: Routine, unannounced inspection of startup test program procedures and QA/QC interfaces with the startup test program. The inspection involved 45 inspector hours onsite and 8 hours in-office by one region-based inspector.

Results: No violations were observed.

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## DETAILS

### 1. Persons Contacted

- \*G. Bell, Bechtel Quality Assurance (BQA)
- \*J. Corcoran, Field Quality Assurance Branch Head (PECO)
- \*V. Cwietniewicz, Performance Engineer (PECO)
- \*P. Duca, Jr., Technical Engineer (PECO)
- \*C. Endriss, Regulatory Engineer (PECO)
- \*J. Franz, Assistant Station Superintendent
- \*G. Gilbody, Quality Assurance Engineer (PECO)
- A. Jenkins, Startup Test Program Supervisor (General Electric (GE))
- \*G. Kelly, BQA
- \*G. Leitch, Station Superintendent
- \*S. McAinsh, Supervisor, Quality Assurance Audit Section (PECO)
- \*K. Meck, Quality Assurance Engineer (PECO)
- \*P. Pagano, Lead Startup Test Engineer (GE)
- \*J. Phillabaum, Staff Engineer (PECO)
- \*K. Stout, Bechtel Quality Control (BQC)

#### U. S. Nuclear Regulatory Commission

- \*J. Wiggins, Senior Resident Inspector

\*Denotes those present at joint exit interview (Inspections 352/84-50 and 84-52) conducted on September 21, 1984.

### 2. Startup Test Procedure Review

#### 2.1 References

- Regulatory Guide 1.68, Revision 2, August 1978, Initial Test Programs For Water-Cooled Nuclear Power Reactors
- ANSI 18.7 - 1976, "Administrative Controls and Quality Assurance For the Operational Phase of Nuclear Power Plants"
- Technical Specifications - Limerick Generating Station, Proof and Review Copy
- Limerick Generating Station FSAR, Chapter 14, "Initial Test Program"
- General Electric (GE) - NEBO 23A1918, Revision 0, Limerick 1 and 2 Startup Test Specification
- A-200, Startup Test Procedure Format and Content, Revision 1, June 27, 1984
- A-201, Startup Test Procedure Control, Revision 1, June 27, 1984

-- A-202, Startup Test Implementation, Revision 1, July 10, 1984

-- A-203, Startup Test Program Personnel Training and Qualification,  
Revision 0, May 30, 1984

## 2.2 Startup Test Procedure Review

2.2.1 During the startup test phase of reactor operations, a sampling of licensee startup test procedures (STP's) are to be reviewed for their conformance to the requirements and guidelines of the standards and procedures referenced above. Startup test procedures will be reviewed for the following attributes:

- Appropriate management review and approval has been accomplished.
- Appropriate Committee review has been accomplished.
- Procedures are in proper format.
- Initial test conditions are specified.
- Prerequisites and precautions have been included.
- Test equipment and/or in-plant instrument calibrations have been performed.
- Test objectives are clearly stated.
- Procedure is technically adequate and workable.
- Provisions are made for identifying personnel performing the test.
- Temporary jumpers and lifted leads are properly restored.
- Provisions are made for recording and approving test data.
- Acceptance criteria are specified.
- Methods for identifying test deficiencies and exceptions and their resolutions are provided.

During this inspection the following procedures were reviewed to the above criteria:

- STP 3.0, Fuel Loading - Main Body (Preliminary Copy - Procedure Not Issued)

-- STP 3.1, Fuel Load (Preliminary Copy - Procedure Not Issued)

-- STP 99.1, Test Phase II - Initial Fuel Loading and Zero Power Testing Master Check List (Preliminary Copy - Procedure Not Issued).

2.2.2 The procedure index was reviewed to determine if the guidelines of R.G. 1.68 - Revision 2 were incorporated into the startup test program. In addition, discussions were conducted with licensee representatives. The inspector determined that an informal cross reference between R.G. 1.68 and the startup test program had been established. Attachments A and B to this report list the basic startup test procedures and their conformance to R.G. 1.68. This conformance will be further verified on a sampling basis during future procedure review inspections.

## 2.3 Findings

2.3.1 FSAR Section 14 specifies the following fuel load sequence:

"Fuel loading begins at the center of the core and proceeds radially to the fully loaded configuration. The following checks are performed as each cell is loaded.

- a. Subcriticality Check - A control rod, surrounded by fuel in the vicinity of the cell to be loaded, is completely withdrawn; the core must remain subcritical. Then the rod is re-inserted.
- b. Control Rod Function Test - The rod in the cell to be loaded is completely withdrawn and re-inserted.
- c. Fuel Loading - Two fuel assemblies are loaded, the blade guide removed, and the remaining two fuel assemblies loaded to complete the four assembly cell.
- d. The Subcriticality Check - is repeated.
- e. The Control Rod Functional Test - is repeated. This also serves as a Subcriticality Check on the loaded fuel cell."

STP-3 requires only one control rod functional test which follows fully loading all four fuel assemblies. This CRD functional test also serves as a subcritical test for loading the next fuel cell.

A General Electric (GE) startup test engineer stated that the FSAR sequence was not desired and that an FSAR change would be submitted. The inspector stated that he saw no difficulties with the STP-3 sequence as written. Prior to the conclusion of the inspection, an FSAR change had been written but not yet approved. This item is open pending submittal and approval of the FSAR change (50-352/84-50-01).

2.3.2 The inspector noted that the following procedures required to directly support fuel load operations had not been issued as of September 21, 1984.

-- STP 3.0

-- STP 3.1

-- STP 99.1

\*-- Surveillance Test (ST) 6-107-591-1

\*-- ST 6-107-594-1

\*-- ST 6-107-631-1

\*-- ST 4-094-320-0

\*These tests were identified by the Technical Engineering Surveillance Test Coordinator as surveillance tests for verifying some of the surveillance requirements of Technical Specification Sections 4/9 - "Refueling" and 4/10 - "Special Test Exceptions". Test titles were not available.

During this inspection, the inspector reviewed preliminary copies of STP's - 3.0, 3.1 and 99.1. Licensee representatives stated that the above had been written and were awaiting approval. The inspector noted that the above procedures were required to be issued prior to fuel load. This item remains open pending licensee approval and issuance of the above procedures and a NRC:RI selective sampling review (50-352/84-50-02).

### 3. Quality Assurance/Quality Control Interfaces

The Quality Assurance program was reviewed for its interfaces with the startup test program and fuel storage and handling. This review included discussions with the Operational Quality Assurance (OQA) audit group and review of the following Quality Assurance Plan sections and Quality Assurance procedures:

- \*QAP, Volume III, "Startup", Revision 0, January 1984
- \*QAP, Volume III, Fuel In-vessel Material, Revision 0, February 1984
- \*QAP, Volume III, Maintenance of Instruments, Revision 0, July 1984
- \*QAP, Volume III, Training, Revision 0, May 1984

\*Section 10 of each procedure, "Inspection", and Section 18, "Audits", were reviewed

- QAPD-5, Procedure For The Performance of Quality Assurance Division Audits, Revision 11, March 1984
- QAPD-6, Quality Assurance Division Audit Program - Preoperational and Operational Phases, Revision 9, June 1984
- QAPD-9, Procedure For Control of Apparent Deficiencies and Auditor follow-up Required Items, Revision 10, January 1984
- QAPD-12, Procedure for Performances of Quality Assurance Division Surveillances, Revision 9, June 1984
- QAPD-25, Procedure for the Verification of LGS Startup Personnel Qualification Records, Revision 1, June 1984
- QAPD-26, Quality Control Inspections of LGS Startup Preoperational Activities, Revision 2, January 1984
- QAPD-27.1, Procedure for Performance of Startup Nonconformance Report Trend Analysis, Revision 3, June 1984
- QAPD-30, Procedure for LGS Startup Quality Control Surveillances, Revision 0, January 1984
- QAPD-101.1, Conduct of Quality Control Inspection Activities, Revisions 0, January 1984
- QAPD 104.1, Scheduling, Performing, Documenting Status Tracking, Quality Control Monitoring Activities, Revision 0, February 1984

The OQA Audit Section will perform periodic audits of the Startup Test Program and occasional surveillance monitoring. Quality Control will perform inspection of witness and hold points. As of the date of this inspection, only one startup audit has been scheduled. The implementation of the Quality Assurance audit and inspection program will be the subject of future NRC:RI inspections.



4. Management Meetings

Licensee management was informed of the scope and purpose of the inspection on September 6, 1984. The findings of the inspection were periodically discussed with licensee representatives during the course of the inspection. An joint exit interview, this inspection and inspection 352/84-52 was conducted on September 21, 1984 (see paragraph 1 for attendees) at which time the findings of both inspections were presented.

At no time during this inspection was written material provided to the licensee by the inspector(s).

Attachment ASTARTUP TEST PROCEDURES LIMERICK

Note: Basic test numbers only are listed. All tests listed below have subtests which are separately approved

<u>NUMBER</u>	<u>TITLE</u>
STP-1	Chemical and Radiochemical
STP-2	Radiation Measurements
STP-3	Fuel Loading
STP-4	Full Core Shutdown Margin
STP-5	Control Rod Drive System
STP-6	SRM Performance
STP-9	Water Level Reference Leg Temperature
STP-10	IRM Performance
STP-11	LPRM Calibration
STP-12	APRM Calibration
STP-13	Process Computer
STP-14	RCIC System
STP-15	HPCI System
STP-16	Selected Process Temperatures
STP-17	System Expansion
STP-18	TIP Uncertainty
STP-19	Core Performance
STP-20	Steam Production
STP-21	Core Power-Void Mode Response
STP-22	Pressure Regulator
STP-23	Feedwater System
STP-24	Turbine Valve Surveillance
STP-25	Main Steam Isolation Valves
STP-26	Relief Valves
STP-27	Turbine Trip and Generator Load Rejection
STP-28	Shutdown From Outside The Control Room
STP-29	Recirculation Flow Control System
STP-30	Recirculation System
STP-31	Loss of Turbine-Generator and Offsite Power
STP-32	Essential HVAC System Operation and Containment Hot Penetration Temperature Verification
STP-33	Piping Steady State Vibration
STP-34	Offgas System Performance Verification
STP-35	Recirculation System Flow Calibration
STP-36	Piping Dynamic Transient
STP-38	MSIV Leakage Control System Performance Verification
STP-70	Reactor Water Cleanup System
STP-71	Residual Heat Removal System



Attachment BSTARTUP TEST PROCEDURES WHICH IMPLEMENT R.G. 1.68, REVISION 2,  
Guidance for Initial Fuel Load and Startup Test Program

NRC Regulatory Guide 1.68, Revision 2, Appendix A, "Initial Test Program"

-- Appendix A, Section 2, Initial Fuel Loading and Precritical Tests

2.a. Shutdown margin (SDM) verification:

SDM partially loaded core: STP-3  
SDM fully loaded core: STP-4

2.b. Control Rod Drive System testing:

STP-5 and preoperational tests

2.c. Functional testing of the Reactor Protection System and manual scram tests:

Preoperational tests

2.d. Reactor Coolant System leak rate testing:

Preoperational tests

2.e. Measurements of reactor water quality:

STP-1

2.f. Reactor Coolant System flow tests:

STP-30

2.g. Calibration of source range nuclear instruments:

STP-6 and preoperational tests

2.h. Mechanical and electrical tests of traversing in core flux monitors:

STP-13 and preoperational tests

-- Appendix A, Section 3, Initial Criticality:

STP-4  
STP-6

-- Appendix A, Section 4, Low Power Testing:

- 4.a. Not Applicable to Boiling Water Reactors (NA-BWR)
- 4.b. NA - BWR
- 4.c. NA - BWR
- 4.d. Overlap of Source Range and Intermediate Range Film Monitors:  
STP-10
- 4.e. Core performance and fuel loading check:  
STP-5, STP-13 and STP-19
- 4.f. Neutron and gamma radiation surveys:  
STP-2
- 4.g. Response of process and effluent radiation monitors:  
STP-1 and STP-34
- 4.h. Demonstrate chemistry and radiochemistry controls:  
STP-1
- 4.i. Demonstrate controls for operation of control rods:  
STP-5, STP-6, preoperational tests, and routine reactor operation
- 4.j. Demonstrate the capability of the Primary Containment Ventilation System:  
STP-32
- 4.k. Demonstrate operability of steam driven engineered safeguards and plant auxiliary equipment:  
STP-14, STP-15, and STP-23
- 4.l. Demonstrate operability of main steam isolation (MISV) and bypass valves:  
STP-25 and STP-27
- 4.m. Test operability of MSIV leakage control system:  
Preoperational test
- 4.n. Demonstrate operability of the Control Room Process Computer:  
STP-13

4.o. CRD scram time testing:

STP-5

4.p. Demonstrate operability of safety relief valves:

STP-26

4.q. Demonstrate operability of the RHR Systems and Turbine bypass valves:

STP-22, STP-24, STP-27, and STP-71

4.r. Demonstrate operability of the Reactor Water Cleanup System:

STP-1 and STP-70

4.s. Vibration test reactor vessel intervals and Reactor Coolant System components:

STP-33

4.t. NA - BWR

4.u. Demonstrate operability of major primary plant control systems:

STP-21, STP-22, STP-23, STP-29, STP-30, and STP-35

-- Appendix A, Section 5, Power-Ascension Tests:

5.a. Determine power to flow characteristics:

5.b. Determine steady state core performance:

STP-19 and STP-21

5.c. Test control rod exchange patterns:

NA - Limerick Generating Station (LGS) has core design which eliminates the need for control rod exchanges.

5.d. NA - BWR

5.e. NA - BWR

5.f. NA - BWR

5.g. Demonstrate controls for operation of control rods:

STP-5, STP-6, preoperational tests, and routine reactor operation

5.h. Check CRD scram times:

STP-5

5.i. NA - BWR

5.j. NA - BWR

5.k. Demonstrate capability of the High Pressure Coolant Injection (HPCI) System:

STP-15

5.l. Demonstrate capability of the Reactor Core Isolation Cooling (RCIC) System, the RHR System Steam Condensing Mode, and turbine bypass valves (BPV's):

RCIC: STP-14

BPV: STP-22 and STP-24

RHR Steam Condensing Mode: NA - LGS for Cycle 1

5.m. Demonstrate reactor coolant system operation including vibration levels:

STP-16, STP-29, STP-30, STP-33 and STP-35

5.n. Establish Loose Parts Monitoring System Baseline data:

Preoperational tests and Hot Functional Test (HFT) - 10

5.o. Demonstrate Reactor Coolant Leak Detection System:

Preoperational tests

5.p. Perform vibration monitoring of reactor intervals:

Preoperational tests

5.q. Verify operation of failed fuel detection systems:

NA - LGS

5.r. Evaluate performance of the process computer:

STP-13 and preoperational test

5.s. Verify the performance of principle plant control systems:

STP-14, STP-15, STP-21, STP-22, STP-23, STP-29, STP-35 and STP-71

5.t. Verify inoperability of safety relief valves and turbine valves:

STP-24 and STP-26

5.u. Verify operability of the MSIV's:

STP-25

5.v. Verify proper operation of the Main Steam and Feedwater Systems:

STP-20, STP-22, and STP-23

5.w. Demonstrate adequate containment cooling:

STP-32

5.x. Demonstrate adequate environmental control of spaces which house engineered safety features:

STP-32

5.y. Verify proper operation of important plant instrumentation:

STP-6, STP-9, STP-10, STP-11, STP-12, STP-13, STP-16,  
STP-18, STP-29 and STP-35

5.z. Demonstrate proper performance of process and effluent monitoring systems:

STP-1, STP-34, and preoperational tests

5.a.a. Demonstrate proper function of chemical and radiochemical control systems:

STP-1

5.b.b. Conduct neutron and gamma radiation surveys:

STP-2

5.c.c. Demonstrate rad waste processing systems operability:  
Preoperational testing, however, no power ascension testing  
will be done

5.d.d. Demonstrate ability to shutdown from outside the control room:

STP-28

5.e.e. Demonstrate containment inserting and purge system operability:

Hot Functional Test (HFT-12)

5.f.f. Demonstrate primary containment HVAC:

STP-32

5.g.g. Determine ATWS operability:

Preoperational test

5.h.h. Demonstrate the dynamic response of the plant to design load swings:

STP-22 and STP-29

5.i.i. Demonstrate the dynamic response of the plant to recirculation pump trips:

STP-30

5.j.j. Demonstrate dynamic response to a turbine trip coincident with a loss of offsite power:

STP-31

5.k.k. Demonstrate dynamic response to loss of feedwater heating:

STP-23

5.l.l. Demonstrate dynamic response to a turbine trip:

STP-27

5.m.m. Demonstrate dynamic response to MSIV closure:

STP-25

5.n.n. Demonstrate dynamic response to a turbine generator load reject:

STP-27

5.o.o. Verify piping expansion and vibration:

STP-17, STP-33, and STP-36