U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 86-21

Docket No. 50-353

License No. CPPR-107 Category A

Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia, PA 19101

Facility Name: Limerick Generating Station, Unit 2

Inspection Conducted: December 22, 1986 to February 2, 1987

Inspectors: R. A. Gramm, Senior Resident Inspector
J. E. Kaucher, Resident Inspector

Approved by: Robert M. Gallo 2/13/87
Robert M. Gallo, Chief Date
Reactor Projects Section 2A

Inspection Summary: Report for Inspection Conducted December 22, 1986 to February 2, 1987 (Report No. 50-353/86-21)

Area Inspected: Routine inspection by the resident inspectors of work activities, procedures, and records relative to reactor pressure vessel and internals, piping and pipe supports, electrical cable and raceway, safety related components and supports, and a special startup meeting.

The inspectors reviewed licensee action on previously identified items and performed plant inspection tours. The inspection involved 186 hours by the inspectors.

Results: Two violations were identified: Issuance of an unapproved data sheet for electrical cable characteristics that was utilized by Field Engineering personnel (paragraph 7e) and engineering errors on the Residual Heat Removal heat exchanger support (paragraph 8c).

DETAILS

1.0 Summary

In-process welding operations were observed for the core spray header, in-core housings, and control rod drive housings. Work activities on several safety related pipe welds were monitored. Engineering specifications and calculations associated with electrical cable and raceway were reviewed. Electrical Quality Control and Field Engineering activities were reviewed and several field installations were examined. The licensee was asked to clarify the requirement on which raceway configurations need associated cable pull calculations to be performed. The distribution of an unreviewed and uncontrolled data sheet to field engineering personnel is a violation. The installation and quality records for a feedwater isolation check valve and two unit coolers were reviewed. A second violation was identified regarding deficient engineering review of the Residual Heat Removal heat exchanger support drawings. The licensee resolution of problems in the Computer Assisted Design (CAD) issuance of plant drawings will be closely monitored.

2.0 Plant Inspection Tours

The inspector observed in-progress work activities, completed work, and plant status in several areas during inspection tours. Work was examined for defects and compliance with regulatory and license requirements. Particular note was taken of the presence of quality control inspectors and quality control evidence such as inspection records, material identification, nonconforming material identification, housekeeping and equipment preservation. The inspector interviewed craft supervision, craft and quality control personnel in the work areas. Observations are noted below:

- The inspector interviewed several Construction Quality Engineers (CQE). The CQE processing of quality documents including Nonconformance Reports (NCRs) and In Process Rework Notices (IPRNs) was reviewed.

- The installation of an instrument support stand was examined. The associated work package JML-52-01-14Q-A was reviewed and no concerns were identified by the inspector.

- The installation of a wall mounted electrical panel was observed. The work activities were found in accordance with work package E104-007-2BC240

- The inspector was informed that plant Piping and Instrument Diagrams (P&IDs) had been converted onto a Computer Assisted Design (CAD) system and reissued. During the conversion process, numerous errors were introduced into the drawings. The licensee determined that both Unit 1 and 2 drawings were affected. The licensee has further determined that the problem would be reviewed under reportability

requirements in 10 CFR 21 and 10 CFR 50.55e. This item is unresolved pending further licensee investigation and corrective action implementation. (86-21-01)

No violations were identified.

3.0 Licensee Action on Previously Identified Items

(Closed) Unresolved Item (78-03-01): Snubber acceptance criteria for stroke and rear bracket clearance. The inspector reviewed Specification P-319-2, "Field Fabrication and Installation of Q-Listed and Seismic Category I Pipe Supports, Hangers and Restraints" and Procedure FM-10, "Installation and Inspection of Mechanical Snubbers". Acceptance criteria are provided for minimum clearance between the snubber body and the rear bracket assembly. The snubber is determined acceptable if no binding occurs through the full stroke in tension and compression directions. This item is closed.

(Closed) Violation (86-12-05): Woodward Governor vendor long term maintenance requirements. In response to this violation PECO issued Finding Report 2N-532. The cited condition was identified and documented on Nonconformance Report (NCR) 11211. A Woodward Technical Representative inspected the governors and found them undamaged. The resolution to NCR-11211 was to accept "as is" the governors, to fill the governors to the full level on the site glass with rust and oxidation-inhibiting oil, and to keep the governors in a temperature and humidity controlled environment. A Surveillance Check 2M-499 was performed by PECO QA to verify that the oil fill requirements for the governors has been added to the Long-Term Maintenance (LTM) requirements, that they have been properly filled with oil, and that the storage requirements have been properly implemented.

The licensee has found additional equipment where the vendor maintenance requirements were not properly incorporated into the site preventive maintenance (PM) program. A 100% licensee re-verification is underway to reconcile those differences. This item is closed.

4.0 Licensee Action on IE Bulletins and IE Circulars

The inspector reviewed licensee records related to the IE Bulletins and IE Circulars identified below to verify that: the IE Bulletin or Circular was received and reviewed for applicability; a written response was provided if required; and the corrective action taken was adequate. The following IE Bulletins and Circulars were reviewed:

-- IE Bulletin 74-13: Improper Factory Wiring on GE MCC's. In addition to the information provided by the Licensee in NRC Inspection Report 86-18, documentation has been provided which verifies that Bechtel has performed a vendor drawing check to assure that the conditions described in the bulletin were not incorporated in the design. Additionally, Philadelphia Electric Company, Field

Engineering has promulgated a Field Engineering Procedure (FE-33) which defines and documents a hands-on inspection of MCC components to ensure that the conditions described in the Bulletin do not exist in the field. This item is closed.

-- IE Bulletin 75-05: Operability of Category 1 hydraulic shock suppressors. This bulletin is not applicable to Limerick 2 as no hydraulic snubbers are used onsite. This item is closed.

-- IE Circular 78-07: Damaged Components of a Bergen-Paterson Series 25000 Hydraulic Test Stand. This Circular is not applicable to Limerick 2 as no hydraulic snubbers are used onsite. This item is closed.

-- IE Bulletin 78-10: Bergen-Paterson hydraulic shock suppressor accumulator spring coils. The inspector reviewed FSAR Section 3.9.3.5.2.1 and Specification P-101, "Pipe Supports". The inspector verified that Bechtel procured only mechanical type snubbers. The inspector was informed that General Electric had provided only mechanical type snubbers. This Bulletin is therefore not applicable to Limerick 2 and is closed.

-- IE Bulletin 86-01, Minimum Flow Logic Problems that could Disable RHR Pumps. The flow logic problem does not exist at Limerick Unit 2 because the RHR system is comprised of four independent and redundant divisions each with its own flow sensing loop and minimum flow return line. The inspector's review was performed in accordance with NRC Temporary Instruction 2515/82, this item is considered closed.

5.0 Reactor Pressure Vessel and Internals

a. The inspector identified that a calibration rod used for the installation of the incore housing was not properly tagged with a calibration sticker. The associated calibration certificate 1268079 from Gage Lab Corporation was reviewed from General Electric Quality Control (QC) records. The inspector verified that Gage Lab Corporation was an approved GE vendor. No violations were identified.

b. In-process welding activities were observed on in-core housing 48-53. The Shielded Metal Arc Welding (SMAW) process was used to weld the housing to the Reactor Pressure Vessel (RPV). The inspector reviewed traveler package 2-180T which included Joint Process Control Sheets (JPCSs) and the Welding Procedure Specification (WPSs) for the work in progress. The assignment of QC and ANI holdpoints was reviewed. The inspector had no concerns.

c. The core spray junction box to the thermal sleeve weld operation was observed. The inspector verified that welding procedure variables for proper filler metal, amperage and torch gas flow rates were

adhered to. The traveler package 2-261T was reviewed by the inspector. The work was found in accordance with the applicable JPCS.

d. The inspector reviewed traveler package 2-200T for the installation of the CRD housings and stub tube welds. The ultrasonic (UT) practice examinations of the CRD housing mockup assemblies were monitored. The inspector reviewed GE procedure 18XA2500, "Ultrasonic Examination of CRD Stub Tube to Housing Welds" and drawing 160-81C-17, "UT Calibration Standard CRD Housing to Stub Tube (Automatic Welding)". The inspector had no concerns on the UT examination. Performance of automatic machine welding on a stub tube to housing weld was observed by the inspector.

No violations were identified.

6.0 Piping and Pipe Supports

a. The inspector selected safety related pipe welds for observation of welding activities and review of documents. The observation of welding consisted of examination of, when applicable, joint cleanliness; joint fitup and alignment; proper electrodes and filler materials; purge and cover gas flow rates; appearance of weld deposit; evidence of quality control inspection; and quality records. Document reviews verified: the use of proper welding procedures; required nondestructive examination was specified; proper pre and post weld heat treatments were specified; and appropriate quality control hold points were assigned and signed off.

The following welds were examined:

Isometric	Weld	Class	System	Status
GBB-219-9	FW-1	2	RHR	Root pass
GBB-202-1	FW15	2	RHR	Root pass
EBB-242-K15-1		2	CRD	Socket weld
EBB-205-1	FW2	2	Main Steam	Hot pass
JBD-461-4	FW1	4	DG Air Intake	"Q" Alignment
VRR-2RD-2A	FW-A17	1	Recirc	Purge gas check oxygen content

All observed activities were in accordance with applicable procedure and associated documentation. No concerns were identified.

b. The inspector observed in-process installation activities on two Residual Heat Removal (RHR) system pipe supports GBC-212-H20 and GBC-212-H31. The work activities were found in accordance with the associated work packages. The weld requisitions were checked by the inspector. The craftsmen were knowledgeable of the installation requirements. The inspector additionally observed installation activities on several Main Steam Safety and Relief System steam quenchers.

No violations were identified.

7.0 Electrical Cable and Raceway

a. The following documents were reviewed by the inspector regarding cable raceway design and cable pulling tension:

- FSAR Section 8
- Bechtel drawing E-1412, "Wire and Cable Notes and Details", Sections 2 through 6
- Philadelphia Electric Company Startup Administrative Procedure AD2.3, "Startup Interface Responsibilities"
- Bechtel Construction Procedures (CP) E-2, "Permanent Plant Cable Installation and Termination"
- Bechtel Electrical Engineering Computer Program Manual for Cable Tension Calculations - EE.350
- Single Line Meter and Relay Diagram E-16
- Cable Pulling Tension Calculation E-559
- Cable Pulling Tension Calculation E-564
- Bechtel Drawing E-1406, Conduit & Cable Tray Notes Symbols and Details

The inspector reviewed calculations E-559 and E-564 including verification of input data, raceway segment design layout and comparison of calculated tension to design allowable tension. A field walkdown of both cable runs was performed to verify the installed configuration with the cable pulling tension calculation data. During the walkdown of the raceway associated with calculation E-559 (power supply cable for Turbine Building Compartment Exhaust Fan 2AV106 - Non 1E load on 1E Bus D21) the inspector identified that the control and instrumentation cables for both turbine building compartment exhaust fans (2AV106 & 2BV106) enter the same non-divisional cabinet and are routed as divisional cable. The inspector questioned why these non-class 1E cables,

which are fed from a class 1E bus (associated circuits), were not identified with other similar loads in Section 6.3.3.5 of E-1412. Bechtel electrical field engineering reviewed the circuits involved, determined that they should have been included in E-1412 and issued DCN 50 to add these circuits to E-1412. The extent to which "associated circuit" cables are not listed in E-1412 is unresolved pending a more detailed review. (86-21-02)

During the walkdown of the raceway associated with calculation E-564 the inspector noted that the measured total angles in the conduit run were 354 degrees, which was less than the 410 degrees used in the calculation for pulling tension. The inspector requested the criteria used to determine when a pull tension calculation was required. The inspector was told that the guidance for the Electrical Construction Engineering Cable group that performs the calculations is CP-E-2, which requires calculations for all 2.3 KV, 5 KV and 15 KV cables. Further, the inspector was told that the Electrical Construction Engineering Raceway group that designs the raceway layouts works to the requirements of E-1406 which provides only a recommended method. The inspector expressed concern over the lack of explicit guidance for the requirement of performing cable pulling tension calculations to Philadelphia Electric Company QA, and was informed that PECO had previously expressed the same concern to the Bechtel Resident Engineering Group. The inspector will review the justification for not having explicit guidance for cable pulling tension calculations. This item is unresolved. (86-21-03)

b. Cable pulling activcities at the site are increasing. The inspector reviewed the following documents regarding cable pulling and inspection:

- Bechtel drawing E-1412, "Wire and Cable Notes and Details", Sections 1 and 7 through 11

- Single Line Meter and Relay Diagrams E-1, E-16, E-21, E-22, E-23, E-24, and E-29

- Bechtel drawing E-1521, "Q listed Electrical Circuit Schedule"

- Bechtel QC Inspection Procedure - E-4.0, "Installation of Electrical Cables"

- Pull cards for cable schemes 2AD101C, 2AD101D, 2AY10136A and 2AY10136B

The inspector witnessed four hand cable pulls, for Q listed cable, in Battery room 1425 and Safeguards Switchgear Room D 21. The inspector verified the proper markings on the cables for divisional identification, size of cable and cable manufacturer, and also verified the acceptability of the cable condition, including

protection of cut ends. The inspector verified the proper routing of the cables in accordance with the pull card, the use of approved lubricants, bend radii not exceeded, proper use of edge softeners and tie downs, cleanliness of tray and conduit, and proper documentation of QC activities. The inspector identified no items of concern.

c. The inspector examined completed cable tray support NS-54 for cable tray ACY027. The following documents were reviewed by the inspector prior to field examination.

- Bechtel work package R-08-0003

- Bechtel Drawing E-1406-2, "Conduit and Cable Tray Notes, Symbols and Details", Sheets 3.6.54 through 3.6.54.4

- Bechtel Drawing E-1266, "Raceway layout-Reactor Enclosure Unit 2 Columns G-J and 23-27.5 (Area 13) Plan Elevation 283'-0" Slab and Above"

The inspector verified the adequacy of all welds, sizes and shapes of all structural steel, location of support and overall dimensions of the support. The inspector also verified the proper documentation of QC activities. The inspector identified no items of concern.

d. The inspector performed an as-built inspection of conduit runs 2AI214 and 2CI203 and the associated unistrut supports. The following documents were reviewed by the inspector.

- Bechtel Work package R-14-0056

- Bechtel Drawing E-1410, "Terminal Box Notes and Field Option Box Notes"

- Bechtel Civil Engineering Field Survey No. 4983

- Bechtel Construction Procedure (CP) C-7, "Procedure for Preparation of Attachment Requests"

- Bechtel Construction Aid Document (CAD) No. 1, WP-R-14-0056

The inspector verified the location (Azmuth and elevation) of 20 attachments to 10 unistrut supports, the location and size of the 10 unitstrut supports, the proper attachment and final torquing of support bolts, conduit location and markings, and junction box location and construction. Proper documentation of QC inspection records were also verified. The inspector identified no items of concern.

e. The inspectors observed formal classroom training for QC inspectors on Bechtel QC Inspection Procedure E-4.0, "Installation of Electrical Cables." The information presented in the class was consistent with applicable procedures, drawings and inspection process instructions. The knowledge and qualifications of the instructor were adequate. Documentation of the training was in accordance with project procedures.

During the conduct of the class an unapproved, unverified document (which contained cable data such as pulling radius, formed radius, area, weight, tensile strength & sidewall pressure) was distributed to the QC inspectors for use in the conduct of inspections. After the class the inspector questioned the instructor about the origin of the document, and was informed that it was prepared by the Bechtel Electrical Construction Engineering Cable Group on site. The inspector determined that the document was prepared in late November 1986, and is used by the Cable Group as input to cable pulling tension calculations. The inspector expressed his concern to the Philadelphia Electric Company QA department and the document has been retracted and the QC inspectors have been retrained. This is an apparent violation of 10 CFR 50, Appendix B, Criterion VI. (86-21-04)

f. The inspector performed a verification of name plate data of installed equipment with respect to specification and FSAR data for 2 non-safety loads connected to safety buses. The following documentation was reviewed:

- Single Line Meter and Relay Diagram E-16
- Turbine Building Compartment Exhaust Fans 2AV106 and 2BV106 nameplate data
- FSAR table 8.3-3
- Bechtel Equipment Specification 8031-M-54B for Centrifugal Fans

All fan performance data was checked for consistency between design data and installed equipment, including: air flow, RPM, frame size and rated HP. The inspector identified no items of concern.

8.0 Safety Related Components and Supports

a. The inspector reviewed the following documents that describe the design requirements for the feedwater system isolation check valves:

- FSAR section 6.2.4.3.1.2.1.1 and table 6.2-17
- P&ID M-41, "Nuclear Boiler System" Sheet 4 of 6
- Specification P-116, "Design Specification for Spring Loaded Piston Actuated Check Valves for Feedwater Service"

The inspector then reviewed the Material Receiving Report (MRR) and examined the as installed condition of valve 1F074A. The following items were examined:

- Equipment Exchange Authorization 45-370
- Purchase Order 8031-D-116AC
- Valve Data Report NPV-1 for valve 1-521
- Atwood Morrill Certificate of Compliance
- Material Test Reports for the valve body
- Heat Treatment Records for the valve body
- Quaker Casting radiographic film records
- Atwood Morrill Co. final inspection data sheet
- Atwood Morrill Production Test Procedure 501-12521
- Supplier Deviation Disposition Request P116A-003

The inspector verified the valve tagging, proper valve hydrotest pressure, adequacy of quality records, heat treatment temperature heating rates, and proper seat leakage test procedure pressure and allowed leakage rates.

No violations were identified.

b. The inspector reviewed the following documents for the Reactor Core Isolation Cooling (RCIC) and High Pressure Coolant Injection (HPCI) pump room unit coolers:

- FSAR section 9.4.2.2, figure 9.4-2 and table 9.4-6
- P&ID M-76 sheet 7 of 10
- Bechtel drawings M-1171, M-1001, M-318, M-317, M-1172, and M-131
- Quality Control Inspection Reports 2AV-209-45-1, 2AV-209-54-2, 2BV-208-54-2, and 2BV-208-45-1
- Field Change Requests (FCRs) M20341, ME-2, ME-9, ME-28, ME-68, ME-69, ME-138, ME-259, ME-212 and ME-187.
- Nonconformance Report 11359
- In-Process Rework Notices (IPRN) M-108

- Vendor Prints 8031-M-123-5(1)-11BR and 8031-M-123-4-17BR

The inspector verified consistency of unit cooler capacities with FSAR information. The general configuration and location of the unit coolers was checked. A minor drafting error was identified on FCR M-20341 and the licensee subsequently issued FCR ME-360 to correct the erroneous detail. The final inspections have not yet been performed. The quality record status was consistent with the state of construction completion. The QC inspector was found knowledgeable of the installation progress and requirements. No concerns were identified.

c. The following documents were reviewed by the inspector that pertain to the Residual Heat Removal (RHR) heat exchanger support:

- Bechtel drawing C-196 Rev. 12

- Field Change Requests (FCRs) C-1020, C-1041, C-1078F, C-1545F, C-2044F, C-9463F, C-11007F, C-9665F, C-4727F, C-594 and ME-144

- Drawing Change Notice C-196-003

- Field Deviation Disposition Request HH2-8229

- Vendor prints 8031-M-1-E11-8001-C-2.5 and 8031-M-1-E11-8001-C-28.3

The heat exchanger in Area 18 of the Reactor Building was examined by the inspector. The support configuration, member sizes, weld sizes, weld quality and bolting material were checked. The inspector also reviewed the adequacy of the design documentation. The following concerns were addressed to the licensee:

- The knife plate details depicted in FCR C-4727F were improperly incorporated into drawing C-196.

- Some slightly undersized 1/2 inch fillet welds existed at elevation 206 on the support bracket.

- The design drawing C-196 which specified all around fillet welds on four gusset plates at elevation 189, were shop welded on two sides only. The welds were installed in accordance with the Bechtel approved shop fabrication drawing 8031-C-41A-292-6 depicting a two side fillet in lieu of the Bechtel design for an all around fillet.

Bechtel has subsequently issued drawing C-196 Revision 14 that corrected the FCR incorporation error. The inspector verified that the undersized fillet welds were welded out to full size. The work

had not been QC inspected and Bechtel Field Engineering had independently identified and issued instructions to fix the undersize weld condition.

The failure of Bechtel Engineering to detect the inconsistency between the design drawing and the shop fabrication drawing is an apparent violation of 10 CFR 50 Appendix B, Criterion VI. (86-21-05)

The licensee has issued NCR 11583 to disposition the discrepant welding condition. The inspector notes that the RHR heat exchanger supports were extensively reinspected by the licensee in response to previous NRC findings 77-12-01 and 77-12-02 and that the welding discrepancy was not detected at that time.

9.0 Startup Meeting

A meeting was held on January 27, 1987 between NRC Region I and PECO personnel. The current construction status and the upcoming construction milestones were presented by PECO. An outline was presented regarding the sequence of preoperational test activities. The eventual tie-in of the Emergency Service Water System (ESW) and Residual Heat Removal Service Water System (RHRSWS) was discussed.

Future meetings will be held to assure compatability between the Unit 1 Technical Specifications and the system tie-in methodology. Region I personnel indicated that several team inspections will be performed including a Nondestructive Van inspection, a Regional Construction Team Inspection (CTI) and a final As-Built team inspection.

No violations were identified.

10.0 Unresolved Items

Unresolved items are matters about which more information is required to ascertain if it is acceptable, a violation, or a deviation. Unresolved items were discussed in paragraphs 2 and 7a.

11.0 Exit Meeting

The NRC resident inspector discussed the issues and findings in this report with members of the licensee's staff on a weekly basis, and at an exit meeting held on January 29, 1987. Based on discussions held with licensee representatives on January 29, 1987, it was determined that this report does not contain information subject to 10 CFR 2.790 restrictions.