

U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 88-08

Docket No. 50-353

License No. CPPR-107

Category A/B

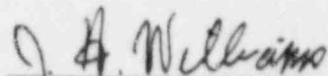
Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia, PA 19101

Facility Name: Limerick Generating Station, Unit 2

Inspection Conducted: February 29, 1988 to April 10, 1988

Inspectors: R. A. Gramm, Senior Resident Inspector, Unit 2
R. L. Fuhrmeister, Resident Inspector, Unit 2

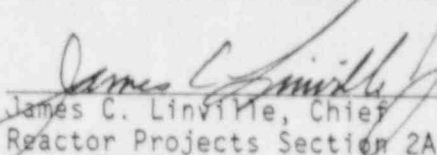
Reviewed by:

J. H. Williams, Project Engineer
Reactor Projects Section 2A

Date

4/28/88

Approved by:


James C. Linville, Chief
Reactor Projects Section 2A

Date

4/28/88

Inspection Summary: Report for Inspection Conducted February 29, 1988 to April 10, 1988 (Report No. 50-353/88-08)

Areas Inspected: Routine inspection by the resident inspectors of work activities, procedures, and records relative to concrete placement and records, Bechtel engineering, crane testing, significant deficiency reports, technical test program, scram discharge volume capability, spent fuel pool and reactor refueling cavity leak tests, preoperational test procedure review and assurance of quality.

The inspectors reviewed licensee action on previously identified items and performed plant inspection tours. The inspection involved 243 hours by the inspectors.

Results: No violations were identified.

DETAILS1.0 Summary

Fourteen NRC open items were reviewed and 13 were closed out (section 3 and 4). As discussed in Section 5, a concrete pour of a reactor building exterior wall was witnessed and civil engineering quality control records were reviewed. The implementation of certain elements of the Bechtel Design Closure Plan were reviewed as discussed in Section 6.0. The performance of reactor building crane load tests were examined (Section 7.0). Implementation of the PECO significant deficiency report system was reviewed (Section 8.0). The technical test program was reviewed and the initial examination found the test procedures adequate (Section 9.0).

The design and installed scram discharge volume was reviewed in accordance with NRC guidance (Section 10). The conduct of spent fuel pool and refueling cavity leak tests was monitored (Section 11). Three preoperational test procedures, for the residual heat removal system, control rod drive and suppression pool and vacuum relief system were reviewed (Section 12.0).

The licensee performance in several areas was found well controlled with the emphasis on assuring nuclear safety (Section 13.0).

The licensee plans to mitigate the impact of testing activities upon the control room environment have been reviewed. This area will be closely monitored during the conduct of future testing.

2.0 Plant Inspection Tours (52051, 52053, 52055, 49065, 49063, 50073, 51051, 51053, 35065, 70311)

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 licensee 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 observed portions of the hydrostatic test performed on the HPCI turbine drain lines in accordance with procedure 2M-52A-09. The inspector verified that test pressure was within the specified range and that the maximum allowable pressure for the barometric condenser was not exceeded. The inspector witnessed the examination walkdown.

- The inspector observed the performance of portions of the Logic Functional Test on the Instrument Air System. The Logic Functional Test is performed to verify proper operation of the controls and logic to fulfill the preoperational or acceptance test requirements. This allows testing of complete control systems prior to the operation of the equipment. The Logic Functional Test is carried out by using specified steps of an approved preoperational or acceptance test procedure, with modifications as necessitated by the equipment availability (for example, "equipment starting" may be redefined as the power supply breaker contactor closing rather than the motor actually rotating). The Logic Functional Test (LFT) procedure is uniquely identified from the preoperational or acceptance test procedure from which it was derived by being printed on paper with a red border. During conduct of the Instrument Air LFT, the inspector noted that the compressor high temperature trip setpoint was set above the procedure specified range. Based upon operating experience from Unit 1, a design change had been submitted to change this setpoint. The temperature switch was set in accordance with that documentation. This discrepancy will be carried as a test exception until the Unit 2 Instrument Setpoint Index is issued for use. At that time, the procedure will be revised to reflect the change and the test exception will be closed. The inspector had no further questions.
- While reviewing daily reports from other regions, the inspector noted that a plant in Region V had experienced two failures of Auxiliary Feedwater Pumps during the past year. Due to the similarities between the turbines and pumps used for Auxiliary Feedwater (AFW) and Reactor Core Isolation Cooling (RCIC) service, the inspector investigated the pump failure causes and associated pump design. It was determined that the pump used in the Limerick 2 RCIC system is of a different design, and would not be subject to the same failure. The inspector had no further questions.
- The inspector was informed that the licensee had identified wiring deficiencies in the Hydraulic Control Unit (HCU) scram pilot valve junction boxes. The deficiencies included loose lugs, poor crimps and nicks in the wires. The PECO Finding Report 2E-514 was reviewed and the inspector was informed that Bechtel is reworking all the HCU scram pilot valve junction box wiring terminations and performing the requisite quality inspection. The licensee has evaluated the potential for an electrical failure, and determined the control rod drive system would perform in a fail-safe manner and the affected control rods would scram into the core or remain fully inserted. Unit 1 was notified of the problem and has instituted a reinspection program of the terminations.
- The inspector was provided with PECO chemical and mechanical test results for two flange samples which had been manufactured by Piping Supplies, Inc. and West Manufacturing, Co. The flanges satisfactorily met the required chemical, tensile and hardness requirements of ASME SA182 grade F304 and SA105.

- The inspector reviewed Bechtel QC inspection data for the week of March 7, 1988. The data for inspection of instruments and instrument tubing runs appeared to show a relatively high rejection rate. The inspector was informed that the negative results had been simultaneously observed by Bechtel and PECO quality organizations. Bechtel initiated a process of performing a second independent walkdown of hardware by a field engineer prior to turning the equipment over to QC for inspection. The PECO QA trend data that normalizes the inspection data with respect to the quantity of hardware inspected (feet of tubing) showed no change in the QC rejection rate. The inspector reviewed the Inprocess Rework Notices associated with the adverse hardware and noted the deviations were minor in nature but could have been precluded by a more thorough construction verification. The second tier construction walkdown should reduce the QC rejection rates in these areas.
- The inspector noted that augmented inspection requirements had been invoked on the piping between the vacuum relief valves and the downcomers in the wetwell area. The inspector reviewed QC Inspection Reports HBD-815-1-55-1 and HBD-815-1-63-1 and found satisfactory documentation for QC inspection on the pipe spool installation, welding and nondestructive examination.
- The inspector observed torquing operations on a residual heat removal pipe flange. The work package BB-208-1 was reviewed. The flange stud record indicated that five passes were required to fully tension the stud. The hydraulic torque unit was inspected and found calibrated.
- The inspector observed uncoupled alignment operations on core spray pump 20P206. The QC inspector and field engineer were present. The pump installation vendor manual (8031-M-1-E21-C001-K-2.1) was reviewed and found consistent with the work package for the equipment alignment operations.
- The inspector observed the initial uncoupled motor run on service water pump 2BP502. The test engineer was interviewed and found technically familiar with the equipment and test procedure. The data sheets from PECO procedure EE11.4, "Procedure to Inspect and Test Medium Voltage Motor Circuits" were reviewed. The test involved data collection of: motor starting current, running current and bus voltage on a visicorder trace; bearing and winding temperatures on a hard copy printer; shaft velocity and velocity probes that yield vibration and displacement data. The vibration monitoring equipment which was run by PECO inhouse test engineers was found to be state-of-the-art. The test engineer coordinated personnel from operations, test and laboratories, field engineering and Bechtel construction to properly perform the test.

- The inspector met with Bechtel Quality Control and procurement engineers to discuss the development of a commercial grade materials program. A draft copy of procedure CP-C-7 was reviewed. The program intent is to review installed commercial grade items and to evaluate future procurement. Critical verification factors will be identified for the commercial grade material. This process will facilitate the dedication of the commercial grade items in safety related systems. This program will be further reviewed when the procedures have been approved.
- The inspector met with licensee startup personnel and discussed operational staffing requirements for Limerick during the startup phase. The available licensed, non-licensed, helpers and other support for the operations staff was discussed. The licensee also discussed plans to mitigate control room congestion and distractions during the test program.

No violations were identified.

3.0 Licensee Action on Previously Identified Items (92700, 92701, 92702)

- a. (Closed) Construction Deficiency Report (81-00-08): Nonconformance with equipment mounting instructions. This deficiency was originally reported to NRC on May 26, 1981. Subsequent analysis resulted in a determination that the deficiency was not reportable under 10 CFR 10.55(e) and the report was withdrawn on June 24, 1981. This report was based upon three separate PECO QA finding reports which identified inadequacies in the mounting of seismically qualified electrical equipment. The potential difficulties were identified as: potentially overtorqued mounting bolts for hydrogen recombiner control panels in the control room; inadequate instructions for mounting of instrument racks and remote shutdown panels supplied by GE; and conflicting installation instructions for DC fuse boxes. The inspector reviewed the following documentation:
 - Telecon Record, PECO QA to USNRC, dated May 26, 1981
 - Telecon Record, PECO QA to USNRC, dated June 24, 1981
 - PECO Reportability Evaluation, Evaluation No. 41, dated September 8, 1981
 - PECO Reportability Evaluation, Re-evaluation No. 41, dated June 29, 1984
 - PECO Finding Report E-090, dated November 24, 1980
 - PECO Finding Report E-098, dated February 4, 1981
 - PECO Finding Report E-121, dated November 15, 1981
 - Acton Environmental Testing Corporation Test Report No. 15150, dated May 15, 1983

It was determined that the instrument racks and remote shutdown panels were properly mounted in accordance with General Electric design drawings. The potentially overstressed expansion anchors used to mount the Hydrogen Recombiner Control Panels were removed and replaced with grouted in bolts. Seismic mounting and qualification data on the DC fuse boxes was not available from the vendor in 1981. The vendor subsequently performed seismic qualification tests on DC fuse box assemblies that simulated the plant configuration. The mounting was simulated in the seismic qualification tests, which were performed in 1983. The inspector verified that the as-installed configuration is similar to the as-tested configuration. This item is closed.

- b. (Closed) Construction Deficiency Report (83-00-08): Anchor Darling valve stem anti-rotation collar. The following documents were reviewed by the inspector:

- PECO Finding Report 2G-661
- Bechtel Nonconformance Report 12326
- Balance of Plant Condition Report M-2460
- Bechtel Letter BLP-31475
- Vendor print 8031-P-103-101-1

During a PECO Quality Assurance review of this open item for Unit 2 applicability, QA determined that the appropriate corrective actions had not been invoked for the Unit 2 valves. Bechtel issued a nonconformance report that identified the 39 affected safety related valves. The vendor approved a rework program to drill the stem and apply loctite to the collar set screw. The valves were reworked accordingly. This item is closed.

- c. (Closed) Construction Deficiency (85-00-01): Limitorque operators worm shaft gear failures. The inspector reviewed the following documents:

- PECO Significant Deficiency Report (SDR) 176-2
- Bechtel Management Corrective Action Report (MCAR) 37
- Nonconformance Report 10627
- GE Field Deviation Disposition Request HH2-8335
- PECO Alert List
- Specification G11 section G11.10
- Bechtel Interoffice Memorandum 0217355
- Limitorque Certification of Compliance for Valve HV-55-2F105

Licensee review identified 24 Q-listed Size 2 type SMB, SB or SBD Limitorque operators that were potentially susceptible to the gear failures. Twelve of the operators were assigned to Unit 2, of which six were passive Q valves with non-Q operators. The remaining six Q operators were reviewed further and three containment purge and vent

isolation valves were determined to have helical gear sets which were not susceptible to failure. The operators on the remaining three valves (HV-52-2F005, HV-52-2F037 and HV-55-2F105) were replaced with Size 1 operators to preclude the gear failures. This item is closed.

- d. (Closed) Unresolved Item (86-12-06): Control of outside laydown storage areas and closure of Inprocess Rework Notices (IPRNs). The North Gate laydown area was enclosed to restrict unauthorized access. The storage concerns identified on IPRN-1406 were resolved and QC closed the finding. Due to untimely response, IPRN-1408 was escalated to NCR 11418 to put the components on dunnage as needed. Subsequent Bechtel audit findings regarding IPRN closure and storage conditions identified by audit 757 were rectified in later 1986. In late 1987, Bechtel audit 861 found further problems in the storage conditions. Augmented surveillance of storage areas was instituted by Bechtel personnel. The individual storage conditions were rectified.

PECo Finding Report 2P-784 was issued in late 1987 because the Control Rod Drive support steel was not segregated in the outside laydown area. The steel was identified and segregated. The appropriate construction personnel were retrained.

The inspector toured the outside site laydown areas for pipe, HVAC duct, cable reels, electrical raceway and structural steel. The items were found properly segregated and on dunnage. Items were stored to prevent standing water accumulation. The inspector was informed that PECO personnel are charged with responsibility to maintain the laydown area conditions. During the tour, a non-safety related cable reel was found intermixed with the safety related Q-reels. The non-Q reel was relocated. The small pipe storage building was found exposed to particulate contamination and not all pipes had end caps affixed. The area was cleaned up, pipe covers were added, and instructions were provided to construction personnel for augmented cleanliness checks of the pipe before use in the plant.

This item is closed based upon licensee corrective actions implemented to date and the expectation that appropriate controls will be enforced for the duration of project activities.

- e. (Closed Construction Deficiency Report (87-00-04): Pacific Scientific Mechanical Snubber (PSA-10) Overgreasing. This issue was initially reported to the NRC pursuant to 10 CFR 50.55(e) on August 19, 1987. It was noted during Technical Specification surveillance of Limerick 1 snubbers that approximately 30% of all PSA-10 snubbers tested were found to have acceleration values greater than that allowable by design. In most cases, this was found to be due to an excessive amount of grease applied to internal parts. After

cleaning and reassembly, all but five showed drastic reductions in acceleration values. These five required replacement of clutch and capstan strings with ones of a new design. Pacific Scientific notified PECO that they formerly applied grease to snubber internals to reduce break-away friction forces. It was subsequently discovered that heat, radiation, and time caused degradation of the lubricant, resulting in increased forces. Pacific Scientific discontinued use of grease in the capstan for this reason in 1985. Nonconformance Report (NCR) 12275 documents 78 Unit 2 PSA-10 mechanical shock arrestors located by serial number. Included in that NCR is shipping data showing that all but one of these snubbers were manufactured after June 1985. That one snubber was deleted and transferred to NCR 12420 for disposition. Fourteen other snubbers were subsequently identified as being subject to the same condition. These 15 have been removed from the site and returned to the manufacturer for repair and recertification. This item is closed.

f. (Closed) Violation (87-02-04): Control of equipment installation rigging operations. The inspector reviewed the following documents:

- PECO Finding Reports 2N-551, 2N-569 and 2G-649
- Nonconformance Report 12112
- Specification P-301-2, Appendix E

Bechtel engineering evaluated the rigging of the pipe restraint steel member from the eye bolt on the main steam isolation valve. The eye bolt capacity was found sufficient to accommodate the imposed loading. A training bulletin was disseminated to construction personnel on March 23, 1987 to reiterate the site rigging requirements.

The inspector subsequently identified another example where a valve was rigged from a pipe support. This situation was reviewed by engineering and found to have not overstressed the support member or weldments. Construction superintendents received additional training on rigging requirements. Personnel disciplinary actions were formulated for rigging violations and the responsible superintendent for the valve rigging incident received a formal reprimand. A plant walkdown was performed by project construction supervision to assure proper equipment rigging.

Further dissemination of the site rigging policy outlined in construction procedure CP-C-8, was accomplished by incorporation of the rigging requirements into the piping installation specifications.

The inspector toured areas of the reactor building and drywell and found no adverse rigging practices. This item is closed.

- g. (Closed) Deviation (87-06-03): Class IE circuit undervoltage. As reported in Inspection Report 88-01, a revised commitment date of March 1989 has been made by PECO for correction of the undervoltage conditions. PECO has reviewed other correspondence for Unit 2 commitment dates that were not met because of the deferral of Limerick 2 construction activities from 1984-1986. Revised commitment dates have been forwarded to the NRC. PECO QA currently maintains an NRC open items list that ensures corrective action dates are met. Construction Deficiency Report 81-00-12 regarding the undervoltage condition will remain open pending review of the licensee corrective action. This deviation for failure to meet a corrective action completion commitment date is considered closed.

4.0 Licensee Action on IE Bulletins and Circulars (92703, 92701)

The inspector reviewed licensee records related to the IE Bulletins and 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:

- a. (Closed) Bulletin 79-15: Deep draft pump deficiencies. This bulletin identified manufacturing deficiencies which were discovered in new pumps at a facility under construction, and similar deficiencies identified at several operating plants. All the pumps were identified as being "deep draft". The deficiencies were characterized as design and workmanship deficiencies which required extensive inspection, replacement of parts, and major redesign. Concern was expressed that pumps of this type might not be sufficiently reliable for use in Emergency Core Cooling Systems, or for applications providing long term core cooling. Licensees were required to submit information regarding the number and identity of similar pumps in use at the site and their operation and maintenance history. PECO's response, dated September 7, 1979, was reviewed for completeness and accuracy of the information requested. Data on operation and maintenance history of the pumps was not supplied due to both units being still in the construction phase. In February 1988, licensee personnel performed a review of the operation and maintenance histories of the pumps in use at Limerick 1. One notable problem had occurred when the 'A' residual heat removal service water pump failed to provide required discharge pressure and flow during routine testing. This condition was resolved by removing a block of wood which had become lodged in the pump suction bell. In addition, the suction bells for the residual heat removal service water and emergency service water pumps which are deep draft pumps were inspected in response to the experience at Susquehanna Steam Electric Station. No irregularities were discovered. Based upon the lack of problems at Unit 1, PECO plans no special testing of pumps for Unit 2. This item is closed.

- b. (Closed) Circular 80-05: Emergency diesel generator lubricating oil addition and onsite supply. The inspector reviewed licensee correspondence that directed 24 barrels of emergency-use-only lubrication oil be maintained for eventual two unit operational needs. The cycle 6 licensed operator lesson plan and attendance records were reviewed. The lesson plan 87-06-D addressed the diesel generator auxiliary systems. Procedures S92.1.0, S.92.1.N and S92.9.N for diesel startup and operation were reviewed and found to include provision for checking lubricating oil level and necessary actions to add oil. Procedure RT-1-092-641-1 was reviewed and found to address maintenance actions to fill the lubrication oil makeup tank when needed. The lubrication oil consumption rates will be verified during future diesel engine operation. This item is closed.
- c. (Closed) Circular (80-10): Failure to maintain environmental qualification of equipment. The inspector reviewed station administrative procedure A-25.2, "Environmental Qualification Program". The station equipment that is covered by electrical and mechanical Environmental Qualification (EQ) is documented in Appendix B of the Limerick Environmental Qualification Report. The EQ Maintenance Coordinator will review Preventive Maintenance (PM) and maintenance procedures to assure that EQ requirements are addressed. Training will be provided to all maintenance personnel that work on EQ equipment. This item is closed.
- d. (Closed) Circular 80-18: 10 CFR 50.59 Safety evaluations for changes to radioactive waste treatment systems. The following documents were reviewed by the inspector:
- PECO Engineering Procedures ERDP 2.2, 3.1 and 3.3
- In accordance with federal regulations, the PECO procedures allow for facility modifications as described by the Final Safety Analysis Report (FSAR) provided an Unreviewed Safety Question does not exist. The engineering procedures specifically reference this circular for guidance on safety evaluations associated with radwaste system modifications. This item is closed.
- e. (Closed) IE Bulletin 84-03: Refueling cavity water seal. This bulletin described an event in 1984 at the Haddam Neck plant in which an inflatable seal was displaced, permitting a rapid draining of the refueling cavity.

The inspector reviewed the following documentation:

- Temporary instruction 2515/66, Inspection Requirements for IE Bulletin 84-03

- IE Bulletin 84-03, Refueling Cavity Water Seal, dated August 24, 1984
- PECO Response to Bulletin 84-03, dated November 6, 1984
- GE Drawing 105D4614, Rev. 2, Refueling Bellows
- Bechtel Drawing 8031-C-778, Rev. 11, Pool Liners and Accessories, Reactor Well and Spent Fuel Pool
- Bechtel Drawing 8031-C-781, Rev. 6, Refueling Pool Seals, Plans, Sections and Details

The inspector determined that the design of the seals at Limerick differs significantly from that at Haddam Neck in that the seal between the reactor vessel flange and the inner circumference of the bulkhead plate consists of a stainless steel bellows, backed up by a self-energizing spring seal. The seal between the reactor cavity and the reactor enclosure consists of two redundant pneumatic seals, each of which is capable of withstanding the full static head of water during refueling. These seals completely fill the annular space, preventing lateral displacement, and are restrained from vertical displacement by steel plates attached to the reactor enclosure side of the annulus. These seals are tested by pressurizing the space between them to a pressure equivalent to the full standing head of water.

The annular space is covered by a segmented plate which rests on elastomeric seals. In the unlikely event that both pneumatic seals might fail, leakage would be limited to that which can flow through the gaps at the ends of the cover plate segments. This leakage flow has been calculated, and determined to be less than the makeup capacity available to the pools. The redundant pneumatic seals are served by separate air supplies from the service air system, each of which is provided with a check valve and backup from a nitrogen bottle to provide seal inflation in the event of a complete loss of service air. Both the inner and outer peripheral seals are provided with monitored drain lines and an alarm in the event that high leakage flow is detected. The inspector determined that the type of failure described in the bulletin is not a credible event at Limerick. As documented in Section 11.0 of this report, the inspector monitored the refueling cavity leak test. This item is closed.

- f. (Open) Bulletin 87-02: Fastener testing to determine conformance with applicable material specifications. The inspector reviewed the licensee efforts associated with the bulletin in accordance with NRC Temporary Instruction 2500/26. As documented in NRC Inspection Report 50-353/87-16, the inspector had previously reviewed the licensee selection of fastener material. Bechtel Nonconformance Report 12853 was issued to evaluate the six nonconforming specimens. Two types of ASME studs were purged from the site inventories and recalled from field installation points. The licensee is considering the implementation of a receipt inspection sampling plan to test delivered fasteners prior to construction use. This proposal has not been adopted to date.

The inspector reviewed the following Bechtel procedures:

- PSP G-5, "Material Receiving and Storage Control"
- CP-F-2, "Receipt Inspection, Storage and Withdrawal of Materials/Equipment"
- QCI R-1.00, "Receiving Inspection"

The Bechtel QC Instruction R-1.00 defines the receiving inspection program for all safety related and ASME Section I&III material. Random checks are made of critical dimensions and material marking to assure that the procurement requirements are satisfied.

The warehouse material is segregated by safety versus non-safety related and by grade and size of fastener material.

This bulletin remains open pending further licensee evaluation of the site material receiving practices.

- g. (Closed) Information Notice 88-03: Cracks in shroud support access hole cover welds. At another BWR-4 facility, cracks were identified in a crevice area at the bottom of the manways. The licensee has evaluated the Limerick manway design and concluded that it is less susceptible to crack initiation because the crevice geometry has been eliminated by use of seal welds and stress corrosion cracking resistant materials have been utilized. The inspector visually examined the manway geometry in the Limerick 2 internals. This item is closed.

5.0 Concrete Placement Activities and Records (246053, 246055)

- a. The inspector interviewed Bechtel civil engineering quality control personnel regarding the development of a facility turnover index for QC records. The inspector was informed that the civil engineering inspection records in the document vault had been reviewed and correlated by turnover room area. A computer database was developed which can sort all civil engineering records based on the associated room number. This effort was accomplished in advance of anticipated room turnover to facilitate the QC investigation and record review that must be performed to demonstrate that the necessary inspections have been completed for all items in a given area.
- b. The inspector reviewed the following completed inspection records for the high pressure coolant injection room #180 and the residual heat removal heat exchanger and pump room #174:

QCIRItems Inspected

C-0708-0080-207-1	concrete expansion anchors
FIR C-64-QCG1-23	cut rebar location verification
C-195-W-1-3	plates welded to embedment
C-195-W-1-1	embedment plate fabrication
FIR C-36-SI-1-14	examination of HPCI pump base
FIR C-63-QCG1-Log 65	seismic separation inspection
C-0710-0075-207-1	concrete expansion anchors
C-1168-PL-19100-8-1A	structural steel platform erection
C-104-RS-D-6-5	reinforcing bar cad-welds
C-107-RW-DG-39-1	concrete preplacement
C-108-SL-17700-03-1	grout inspection
C-112-WL-045A-05-1	concrete placement
FIR C-43-C-196-1	gusset plate fabrication
FIR C-64-QCG-1-25	verification of cut rebar location

The inspection records were found completed in accordance with procedural requirements with the associated QC inspector, inspection attributes and inspection results clearly identified. The records were readily retrievable from the document vault.

- c. The inspector reviewed the following documents related to a concrete pour in an exterior wall of the Reactor Building at elevation 217:
- QC Inspection Reports C-0184-WL-000D-04-3, C-0129-SL-2260004-1, C-0722-WL-0109-05-2, and C-0129-SL-22600-05-1
 - Bechtel drawings C-601, C-602, C-603, C-604, C-717, C-129, C-183 and C-184

A pre-placement examination was performed by the inspector which verified: concrete surface preparation, form cleanliness, reinforcing bar size and spacing, location of embedded raceway and proper reinforcing bar cad-welds.

The inspector observed the conduct of the concrete placement operation and verified: presence of four quality control personnel; presence of Bechtel QA auditor and field engineer; grout application; proper concrete mix used; proper consolidation of concrete; use of chutes to limit free fall of concrete; and QC inspection for concrete temperature, unit weight slump, air content and compressive strength samples. The placement activities were well controlled with adequate supervisory and quality oversight.

No violations were identified.

6.0 Engineering (237055)

- a. The inspector discussed the conduct of three elements of the Bechtel Design Closure Plan with cognizant project engineering personnel. The plan involves the reconciliation of the as-built plant with original design calculations and assumptions to assure that no detrimental conditions have resulted during construction activities.
- b. The conduct of the platform and building steel assessment was reviewed. Specification M-400-2 was reviewed which defines the structural steel walkdown program. A series of pre and post room turnover walkdowns will be performed by design engineers to assure that the as-installed structural steel is in conformance with the design requirements. Particular attention will be paid to structural steel connections. Any questionable items are documented and dispositioned as necessary. The inspector reviewed selected documentation from structural walkdowns in the wetwell and rooms 272A and 273A.

All rooms will receive a summary walkdown and selected rooms will receive a detailed walkdown based upon attachment configurations which may not be enveloped by previous designs.
- c. The containment liner plate assessment program described in Specification C-776, "Liner Plate Acceptance Criteria" was reviewed. Liner Plate Attachment Requests are forwarded to project engineering for field run items. As-built drawings for both pre-engineered and field run liner plate attachments are provided by construction engineering and the as-built information is forwarded to project engineering. The attachments are input in a computer data base that provides both a visual display of the liner, stiffener, seam and attachment configuration. The program also performs pull out calculations to assure liner integrity under normal and faulted conditions. The inspector reviewed draft sketch SK-C-2059 and selected Liner Plant Attachment Requests.
- d. The cut reinforcing bar tracking program described in Specification C-105, "Drilling and Chipping of Structural Concrete" was reviewed. Drilling activities that will damage reinforcing bar material are reported to project engineering for pre-approval. The cut locations are plotted by engineering, and the inspector reviewed sketch SK-CR-449. Hand calculations are performed to assure adequate capacity of the structure given the reduction due to the reinforcing bar cut.
- e. The inspector found the engineering programs technically adequate, personnel were knowledgeable of the program requirements, extensive planning had been accomplished to identify engineering closure items necessary to support plant licensing, and the inspector was informed that enhancements had been made in the programs that had been utilized on Unit 1 in these areas.

No violations were identified.

7.0 Crane Testing (370353)

The inspector reviewed the following documents that pertain to the performance of load tests for cranes:

- PECO letter to NRC dated June 18, 1981
- Generic Letter - Control of Heavy Loads
- ANSI N14.6 - 1978, "Special Lifting Devices"
B30.2 - 1976, "Overhead and Gantry Cranes"
- Safety Evaluation Report - NUREG 0991, Appendix G
- PECO Procedures SP-026, "125 Ton Reactor Enclosure Overhead Crane Load Certification"
M-098-003, "Operation of Reactor Enclosure Crane"
A-90, "Control of Heavy Loads"
M-041-011, "Maintenance Procedure for Reactor Vessel Disassembly"

The Limerick Reactor Enclosure crane is inspected and tested in accordance with ANSI B30.2 - 1976 which has been approved by the NRC. The ANSI B30.2 specifies that "prior to initial use, all new, extensively repaired, and altered cranes" should be load tested. After the licensee repaired the crane gearbox, a load test was performed on January 7, 1987 with a 311,100 pound test weight. Periodic inspections are performed in accordance with ANSI B30.2.

No violations were identified.

8.0 Significant Deficiency Reports (235060)

PECO initiates a Significant Deficiency Report (SDR) for items that receive further evaluation with respect to the reportability criteria of 10 CFR 21 and 10 CFR 50.55(e). The following SDRs were reviewed:

<u>SDR</u>	<u>Topic</u>	<u>Reported</u>
199	Pipe restraint welding	No
202	Foxboro components	No
229-2	ESW pump circuit not isolated	No
227-2	Handshake splices in 480 load centers	Yes
226-2	Agastat relay bases	No
223-2	Brown Boveri undervoltage relays	No
221	Westinghouse DC MCC	Yes
220	Installation of fire dampers	No
219-2	PGCC wiring	Yes
218-2	Offskid DG piping	No
215	DG tripped from fire protection system	Yes
214	Conduit couplings	No
217-2	Voltage transients	No
216	DG fuel oil line failures	No
212	Unit cooler seismic qualification	No
211	Limiter torque limit switches	No
208	E-Brite material	No

The program appears to effectively identify potentially significant concerns for further evaluation. The items were originally identified by many site organizations. Further review and evaluation is ongoing by the licensee on some of the significant deficiency reports.

No violations were identified.

9.0 Technical Test Program (370311)

The startup test program is conducted in several phases. After construction completion, components or systems are turned over via the equipment and system release program to allow testing activities to start. The technical test program involves construction verification tests such as: flushing, flow balancing, logic functional tests, instrument calibration, HVAC and other mechanical equipment tests. These tests are generally pre-requisites for starting preoperational tests and preoperational test acceptance criteria can be fulfilled by the technical tests. The following documents were reviewed by the inspector:

- AD 7.0, Rev. 2, "Startup Technical Program"
- FSAR Section 9.2.8
Table 9.2.21
- 2FB14.1, "Flow Balance Reactor Enclosure Cooling Water"
- TT 1.1, "Driven Mechanical Equipment Testing"
- TT 1.2, "Equipment Vibration Testing"
- TT 1.3, "Relief Valve Inspection"
- TT 1.6, "Initial Operation HVAC Fans"
- TT 1.7, "HVAC Equipment and Duct Inspection"
- TT 1.8, "Instrument Line Routing Verification on Flushing Procedure"
- TT 1.10, "HVAC Air and Hydronic Balance"
- TT 1.11, "Safeguard Piping Fill System Pumps"
- TT 1.13, "HVAC HEPA and Absorber Filter Efficiency"
- TT 1.15, "Initial Operation Functional Test of Cranes and Hoists"
- TT 1.16, "Turbine Tests"

The technical test procedures were reviewed for administrative conformance with the startup manual. The procedures had received the appropriate reviews and approvals. The acceptance criteria were found satisfactory. The procedure data sheets appeared to provide the necessary test documentation. The reactor enclosure flow balance procedure was found consistent with the FSAR system description and associated piping and instrument diagrams. The technical test program implementation will be reviewed in future inspection reports.

No violations were identified.

10.0 Scram Discharge Volume Capability (25590)

The Limerick Safety Evaluation Report (SER) NUREG-0991, Section 4.6, documents the NRC review of the Limerick Scram Discharge Volume (SDV) design with a generic NRC safety evaluation for Boiling Water Reactor (BWR) SDVs. The Limerick design provides two separate SDV headers, with an integral instrument volume at the end of each header. Each instrument volume has redundant and diverse level instrumentation (float sensing and pressure sensing) for the high level scram function. The SDV vent and drain lines are separate and contain redundant vent and drain valves equipped with redundant solenoid pilot valves. High point vents are provided. The system design was found acceptable by the NRC.

The following documents were reviewed by the inspector:

- Limerick Final Safety Analysis Report Sections 4.6.1.2.4, 7.2.1.1.4.2.g, 7.1; Figures 4.6-5, 4.6-6, 7.7-2
- Limerick Safety Evaluation Report (SER) section 4.6
- Limerick FSAR question 410.20
- P&ID M-47, "Control Rod Drive Hydraulic System"
- General Electric preoperational test specification 22A2271AY, Appendix B
- General Electric CRD Design Specification 22A6249 and Design Specification Data Sheet 22A6249AA
- Limerick preoperational test procedure 2P55.1
- Limerick Unit 1 Technical Specifications
- Bechtel drawings M-2217 and M-2219

The following inspection criterion were provided by NRC Temporary Instruction (TI) 2515/90.

1. Criterion 1 - Scram Discharge Header Size

The SDV discharge header piping volume above the scram level trip elevation was designed to provide at least 3.34 gallons per drive. The preoperational test procedure provides acceptance criteria that the SDV, not including the instrument volume, can accommodate at least 3.34 gallons per drive.

The inspector visually examined the SDV discharge header which is an eight inch pipe which is downward sloping to the ten inch instrument volume pipe. There are no reductions in the pipe size. Close hydraulic coupling is thus ensured.

2. Criterion 2 - Automatic Scram on High SDV Level

The inspector examined the level instrumentation provided on the instrument volume. The high level trip signal is provided by either float or differential pressure sensing instruments. The preoperational test conduct will ensure that the SDV can accommodate the drive water exhaust when the trip water level has been reached. The inspector examined Reactor Protection System panels, reviewed plant drawings and reviewed the FSAR to confirm that a high SDV water level will scram the reactor.

3. Criterion 3 - Instrument Taps not on Connecting Piping

The inspector visually examined the instrument volume and confirmed that the instrument taps are not on connected piping.

4. Criterion 4 - Detection of Water in the Instrument Volume

The inspector examined the instrument volume scram instrumentation and reviewed plant drawings related to the level instruments. The instruments were found to employ diverse operating principles and are associated with redundant divisions of the Reactor Protection System. The instruments were redundant in that the instruments have separate taps into the instrument volume.

5. Criterion 5 - Vent and Drain Valves System Interfaces

The SDV vent lines discharges to the dirty radwaste system and is protected by a vacuum breaker PSV-220. The SDV drain lines discharge to the equipment drain collection tank. The elevation difference between the SDV and the equipment drain collection tank will preclude water backup into the instrument volume.

6. Criterion 6 - Vent and Drain Valves Close on Loss of Air

The inspector verified that vent and drain valve position indication is provided in the control room. The vent and drain valves fail in the closed position under loss of air conditions.

7. Criterion 7 - Operator Aid

The inspector reviewed plant drawings and visually verified that an alarm exists in the control room in the event the instrument volume is not fully drained. The level switches provide an alarm if the instrument volume water level is 3 + 2 gallons. The inspector was unable to review the Unit 2 operating procedures at this time.

8. Criterion 8 - Active Failure in Vent and Drain Lines

The inspector reviewed plant drawings and determined that redundant vent and drain valves are provided to accommodate the effects of a single active failure.

9. Criterion 9 - Periodic Testing of Vent and Drain Valves

This will be verified when the Unit 2 procedures are available.

10. Criterion 10 - Periodic Testing of Level Detection Instruments

This will be verified when the Unit 2 procedures are available.

11. Criterion 11 - Periodic Testing Operability of the Entire System

This will be verified when the Unit 2 procedures are available.

The inspector confirmed that the Unit 1 Technical Specifications address the surveillance intervals for the SDV equipment. Since the Unit 2 Technical Specifications, surveillance test procedures, and operating procedures have not been issued, items 7, 9, 10 and 11 will be reviewed at a future date.

11.0 Spent Fuel Pool and Reactor Refueling Cavity Leak Tests (250071, 250073, 250075)

The inspector observed the conduct of leak tests for the Spent Fuel Pool and the Reactor Refueling Cavity. The test director was interviewed and the associated work package (C-45-HY-POOL) was reviewed. The presence of QC personnel was noted. The following documents were additionally reviewed:

- FC-002, "Hydrostatic/Pneumatic Test Procedure for Unit 2 Pools and Seals"
- 2M-77B-01, "Spent Fuel Pool Gates Hydrotest"
- 2M-77B-02, "Reactor Ring Seals Chamber Decay Pressure Test"
- 2M-77B-04, "Spent Fuel Pool Hydrotest"
- 2M-77B-05, "Steam/Dryer Pool Hydrotest"
- 2M-77B-06, "Refueling Cavity Hydrotest"

The control room had been notified of the Spent Fuel Pool (SFP) test and operations personnel were responsible for installation of the gate and seals between the SFP and the common cask storage pit. The temporary nitrogen gas system and calibrated pressure gages were examined which were used to inflate the gate seals. The records for the SFP gate hydrotest were reviewed. A maximum of two gallons of leakage was allowed from between the gates, every 20 minutes for an eight hour test duration. The test had been satisfactorily completed.

The records for the ring seals pressure decay test were reviewed where a minimum of 8.8 psig was allowed after a two hour test duration, the test had been satisfactorily completed.

The SFP was filled to approximately elevation 350 feet, and hourly water level readings were taken. The inspector examined the seven open leak chase drain valves and verified that no water was present from the leak chase collection system.

The records for the steam dryer test were reviewed where the leakage was monitored for a 24 hour duration. The test had been satisfactorily completed.

The conduct of the 24 hour refueling cavity leak test was observed. The two open leak chase valves were examined and no leakage was noted. The QC inspector and field engineer were performing hourly monitoring checks.

The overall conduct of the cavity leak tests was found well controlled, with close quality oversight and availability of well written test procedures.

No violations were identified.

12.0 Preoperational Test Procedure Review (370336, 370311, 370332)

- a. The inspector reviewed Preoperational Test Procedure 2P-16.1, Residual Heat Removal Service Water System, for technical content and conformance to FSAR Preoperational Test Procedure Abstract in Table 14.2-4. Several minor drawing deficiencies were noted and identified to licensee personnel. These drawings will be reviewed at a future date to verify appropriate corrections. The inspector identified no other discrepancies.
- b. The inspector reviewed the following documents that pertain to the suppression pool and vacuum relief system:
 - Preoperational test procedure 2P59.3
 - FSAR section 9.4.5, 7.3.1.1.6.1.1, 7.3.2.6, 6.2.4.3.1.5
figure 9.4-6
table 14.2-4, 6.2-17
 - Test Review Board (TRB) report on 2P59.3 revision G
 - Surveillance Test procedure ST-2-041-400-1, ST-2-060-400-1
 - Logic diagrams M-52FD and M-57FD, Sheet 2
 - Bechtel vendor document 8031-M-263-11-5, 8031-M-81-5-9
 - Electrical schematics E-370, E-368, E-649 sheet 3, E-354 sheets 1-3, E-694, E-620 sheet 1, E-351, E-622 sheet 3, E-684 sheet 1
 - Piping and Instrument Diagram M-55 sheet 2, M-42 sheet 3, M-57 sheets 4-5 and M-52 sheets 3-4

The procedure was checked for administrative conformance to the startup manual requirements. The test procedure format and approvals were found satisfactory. The test objectives and acceptance criteria were consistent with the FSAR test abstract. The containment isolation valve closing times were found satisfactory. The operation of the controls systems for: testing the vacuum relief valves; operation of the cleanup pump flow control and suppression pool makeup control valves; cleanup pump trip on low suction or high discharge pressure; operation of system alarms; and operation of suppression pool pressure instrumentation were checked through review of acceptance criteria, appropriate system drawings and procedure test sequences.

Several questions were answered by the test procedure writer. The TRB regulatory review list was found to contain a comprehensive delineation of all appropriate portions of the FSAR, Technical Specifications, SER, plant procedures, and previous Unit 1 NRC findings that relate to this system.

c. The inspector reviewed the following documents that pertain to the control rod drive preoperational test 2P55.1:

- Preoperational Test Procedure 2P55.1
- FSAR section 4.6.1, 4.6.3 and 7.7.1.2
table 14.2-4
- SER section 4.6 and 7.7.1.2
- General Electric
Design Specification 22A6249
Design Specification data sheet 22A6249AA
Preoperational test specification 22A2271AY, Appendix B, GE-10
- Piping and Instrument Diagrams M-46, sheet 2 and M-47 sheet 2
- Unit 1 Technical Specifications table 3.6.3-1
- Small pipe isometric SP-DBD-208-E7

The test procedure was reviewed for conformance to the startup manual administrative requirements. The procedure format and approvals were found satisfactory. The acceptance criteria was consistent with the FSAR test abstract. The General Electric test acceptance criteria was properly incorporated into the PECO test procedure. The test procedure steps related to: scram and instrument volume capacity; scram and instrument volume vent and drain valve sequence; CRD pump operation; individual rod scram tests; full core control rod scram test; and instrument volume level instrument operability were reviewed and found technically satisfactory.

The inspector was informed that the high temperature CRD alarm would be verified during system 56B testing and that the accumulator trouble alarm acceptance criteria was verified in procedure 56.1A.

The inspector noted that several acceptance criteria would be fulfilled by Technical Test 1.12 which has not been issued. PECO QA files were reviewed and a cross-reference existed to ensure that during review of TT 1.12, that preoperational test procedure 2P55.1 would be considered for fulfillment of the acceptance criteria. The TRB chairman indicated that a formal review of TT 1.12 would be performed prior to performing 2P-55.1 to assure that all assumed elements of 2P-55.1 had been performed. The inspector was informed that TRB administrative procedures would be rewritten to ensure that prior to preoperational test performance, that all technical tests that fulfilled acceptance criteria would be reviewed for adequacy.

13.0 Assurance of Quality

- a. The inspector reviewed NRC NUREG 1275, "Operating Experience Feedback Report-New Plants." The NRC had evaluated approximately 20 plants with respect to four event classes: reactor scrams, engineered safety feature actuations, technical specification violations and loss of safety system function. A set of recommendations was developed to provide measures that can be instituted during the startup program to minimize the unwanted events. The inspector interviewed the PECO Startup Manager and ascertained that the NUREG had been reviewed by PECO. A PECO site evaluation paper was reviewed that compared the PECO startup program with the NUREG recommendations. Most of the recommendations were found to be enveloped by the current startup program procedures or philosophies. A PECO QA audit is planned for July 1988 to verify implementation of the PECO program facets that fulfill the NUREG recommendations.
- b. The TRB generated Regulatory Review List for preoperational test procedure 2P59.3 was reviewed as discussed in section 12b of this report. The list provided a comprehensive list of applicable licensing and plant procedures that provide requirements related to the proper system testing and operability. The list is partially derived from a search by a TRB member of a computer database of the FSAR. Searches can be made on various keyword descriptions. The regulatory review list was assembled in a thorough manner and ensures that the preoperational test procedure meets the system requirements.
- c. The licensee has instituted a SALP improvement plan to address weaknesses in project programs that were identified in the NRC SALP report (50-353/86-99). One facet of the improvement plan is to perform additional PECO QA technical audits of the design function. The inspector reviewed the following PECO QA technical audits:

<u>Audit</u>	<u>Scope of Audit</u>
2P-555	Small pipe support stress analysis calculations
2G-305	Control of computer program documentation
2G-307	Design change calculation revisions
2G-293	Preparation of nonconformance reports

The associated audit checklists, finding reports and data collection sheets were reviewed. The finding reports did not reflect significant design control problems. The audit checklists were comprehensive in nature. The licensee will assure corrective action implementation through followup to the finding reports.

- d. As documented in section 5b of this report, extensive pre-planning and research was performed by Bechtel QC to correlate QC inspection records by turnover area.

In section 6.0 of this report, good controls were found in place in the project civil engineering control of design closure programs.

In section 2.0 of this report, the licensee has anticipated future problems in the area of commercial grade item procurement and is developing a new program to address future procurement and evaluate equipment prior to dedication in the plant.

- e. The Nuclear Review Board met at the Limerick site on April 7, 1988. The Nuclear Review Board is an independent advisory group dealing with all aspects of nuclear safety. Its purpose is to review, audit, and evaluate both technical and organization matters pertaining to Limerick Generating Station and Peach Bottom Atomic Power Station. The Board consists of 12 technically qualified employees of PECO and other companies or organizations, appointed by the Executive Vice President-Nuclear, and approved by the Office of the Chief Executive. All members and alternates must have an academic degree in an engineering or physical science field, and a minimum of five years technical experience, of which three years must be in areas related to nuclear power plant operation, maintenance, testing, or quality assurance.

The board, during its April meeting, reviewed a number of Unit 1 issues and events, with particular emphasis on whether the issue would apply to, or impact on, Unit 2. On several occasions the board expressed concerns over the attitude which was being "built-in" to the operating staffs at Peach Bottom and Limerick (at Peach Bottom due to some operations personnel being trained in BOP only, and at Limerick by the number of Temporary Circuit Alterations of a long-standing nature which have been allowed to continue). The

board also inquired of the plant staff how many issues identified in Unit 2 design reviews had applicability to Unit 1. It was responded that of the last six or seven, only two had been found to apply to Unit 1 (water curtain flow and HCU wiring). The board reviewed the test program for Unit 2 and found the approach to testing to be very thorough, and that lessons learned during the Unit 1 test program are being considered and included in the Unit 2 testing.

The inspector noted that the charter for the Nuclear Review Board, Revision 10 (dated March 24, 1988) differed slightly from the Unit 1 Technical Specification description. This deviation from Technical Specifications is authorized under the provisions of the Temporary Waiver of Compliance issued by the Office of Nuclear Reactor Regulation for the corporate reorganization.

14.0 Licensee Meetings

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 April 8, 1988. Based on discussions held with licensee representatives on April 8, 1988, it was determined that this report does not contain information subject to 10 CFR 2.790 restrictions.