U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-277/87-33
50-278/87-33

Docket No. 50-277 and 50-278

License No. DPR-44 DPR-56

Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia Pennsylvania 19101

Facility Name: Peach Bottom Atomic Power Station Units 2 and 3

Inspection At: Delta, Pennsylvania

Inspection Conducted: November 3-4 and 16-20, 1987

Inspectors: E. H. Gray — 1/13/88
E. H. Gray, Senior Reactor Engineer, DRS, MPS — date

H. J. Kaplan — 12-31-87
H. J. Kaplan, Senior Reactor Engineer, DRS, MPS — date

Approved by: Jack Strosnider — 1/13/88
J. R. Strosnider, Chief, Materials and Processes Section, EB, DRS — date

Inspection Summary: Inspection on November 3-4 and 16-20, 1987 (Report Nos. 50-277/87-33 and 50-278/87-33

Areas Inspected: Announced inspection of licensee actions taken to implement Generic Letter 84-11 on Units 2 and 3. Routine unannounced inspection of pipe replacement program activities including recirculation and RHR piping on Unit 3.

Results: No violations were identified.

Details

1.0 Persons Contacted

1.1 Philadelphia Electric Company (PECO)

*G. R. Rainey, Superintendent of Services
*J. M. Pizzola, Quality Assurance
*F. A. Cook, Mechanical Engineer
*T. Bazzani, Project Manager
*D. Potocik, Health Physics
J. Stanley, ISI Coordinator
R. Lesnefsky, P. E. QA Engineer
T. Sisson, Radiographer (Level II)
J. Cockroft, QA Supervisor
J. Kowalkowski, Mechanical Engineer

1.2 Chicago Bridge and Iron (CBI)

J. Matthews, Welding Engineer
K. Wayman, QA Supervisor

1.3 General Electric (GE)

J. Leonard, Project Manager

1.4 Nuclear Regulatory Commission

*T. Johnson, Senior Resident Engineer

* Indicates presence at exit meeting on November 20, 1987.

2.0 Licensee Actions on Previously Identified Items

(Closed) Unresolved Item (277/84-05-01, 278/84-05-01). Resolution of indications found in PECO review of Eastern Testing and Inspection (ETI) radiographs. The inspector reviewed PECo documentation of the scope of the ETI radiographic problem and the results of the PECo review of ETI radiographs on 124 welds. Of these, 23 welds had code unacceptable indications for which non conformance reports were issued. A fracture mechanics evaluation, report 14006.24-J(B)-133, was conducted to establish the fitness for service of those indications not removed. The fracture mechanics evaluation was based on the requirements of the ASME code, Section XI, 1983 Edition, and Winter 1983 Addenda. This evaluation concluded that the calculated number of cycles based on the indication sizes and code requirements by far exceeds the estimated number of service

cycles. A microdensitometer was used in establishing the indication dimensions. The inspector reviewed the above documentation and sampled non conformance reports (CD-P-239-1 and CD-P-219-1/2) concluding that ASME code and regulatory requirements had been adequately addressed.

(Closed) Unresolved Item (277/85-05-01). Reference to "Reflective Interface" as characterization of ultrasonic indications in stainless steel welds. The letter dated May 24, 1985 by J. Madara discussing PECo actions to discontinue use of "Reflective Interface" by SWRI and steps to review each indication designated as such to properly identify the cause of the indication were reviewed. The inspector sampled UT data from Unit 2 and Unit 3 to determine if UT indications evaluated by SWRI subsequent to this finding were properly characterized as IGSCC, counterbore, root geometry or other descriptive term. This review included welds 10-1A-11, 1A-14, 1B-3, 1B-10, 0-4, 0-12 and 14-A-3940 from the Unit 3, 1985 ISI outage. The inspector concluded that PECo had taken steps to cause indications due to surface conditions be properly evaluated and described.

3.0 PECO actions taken to implement Generic Letter 84-11 Inspections of BWR stainless steel piping susceptible to Intergranular Stress Corrosion Cracking (IGSCC).

Peach Bottom Unit 2 (U2)

As summarized in the PECO letter on June 4, 1984 (S. Daltroff to D. Eisenhut), the 1984 Unit 2 outage provided for replacement of the recirculation system piping, Residual Heat Removal (RHR) piping up to the penetrations through the drywell and parts of the RHR head spray, the Reactor Water Clean Up (RWCU) penetration and parts of the RWCU piping outside containment. The replacement material was Type 316 stainless steel with 0.02% Max Carbon and 0.1% Max Nitrogen. The RWCU and portions of the Core Spray piping inside containment were previously replaced with type 316 L stainless steel.

The inside containment welds to RHR piping of the two RHR inlet and one RHR outlet containment penetration pipes were UT examined for approximately 50% of the weld circumference on the penetration side during the 1984 pipe replacement work as part of the preservice examination. UT of two of these was done again during the 1987 refuel outage on approximately 50% of the weld circumference. The penetration pipes, N12, N13A and N13b, are the remaining Reactor Coolant Pressure Boundary parts susceptible to IGSCC in Unit 2. Relief requests 2.4.5 and 2.4.7 dated September 1985 for the second interval provide for relief from the ASME Section XI required UT examination for the portions of welds inside containment penetrations and for those having material constraints (outside containment on N12, N13A and N13B.) The internal surfaces of welds on the pressure piping of penetrations N12, N13A and 13B were PT examined during the U2 pipe replacement. The result to date is no finding of IGSCC on the containment side

of penetration 12, 13A or 13b. Penetration pipes N12, N13A, and N13B are the only IGSCC susceptible reactor coolant pressure boundary piping in U2 and have only one weld scheduled for UT during the next refuel outage, that is the GL 84-11 20% sample scope will not be applied. Another weld 10-1A-2 located outside containment to the penetration pressure piping has relief from ISI examination (RR 2.4.7) due to inaccessibility but is scheduled for an attempt to UT during the next U2 outage. During the exit meeting on 11/20/87, PECo stated the intention to review the scheduled UT on the N12, N13A and N13B containment penetration pressure piping and clarify the steps to be taken during the remainder of the second 10 year ISI interval to identify IGSCC should it occur in these susceptible welds.

For Unit 2, competence of UT examiners, Leak Protection including leakage limits and review of UT Records indicated conformance to requirements as discussed for Unit 3 below.

Peach Bottom Unit 3 (U3)

During a meeting with NRR on September 19, 1987, PECo presented plans to replace the Unit 3 recirculation and residual heat removal piping. This pipe replacement program includes replacement of the RHR inlet and outlet containment penetration and the RWCU containment penetration. The objective of this pipe and penetration replacement is to provide reactor coolant pressure boundary materials that are not susceptible to intergranular stress corrosive cracking. The pipe replacement program preparations were inspected prior to pipe removal as discussed in part 4.0 of this report.

Unit 3 activities in meeting the requirements of Generic Letter 84-11 are discussed in inspection reports 278/84-17 and 278/85-14. The inspectors found the program scope, procedures and qualification requirements to conform to the GL 84-11 requirements. During this inspection (278/87-33) aspects of the GL 84-11 program were sampled. This inspection included review of a sample of UT data sheets, the scope of examination including expansion of examination sample and review of documentation for qualification of Ultrasonic test personnel at EPRI. The plant technical specifications for U2 and U3 require measurement of reactor coolant leakage to be made at four hour intervals during operation. For Unit 3, an increase in unidentified leakage of more than 1 gallon per minute (gpm) in 24 hours requires plant shutdown to be initiated. For Unit 2, an increase in unidentified leakage of more than 2 GPM in 24 hours requires initiation of plant shutdown. The inspector concluded that UT inspection program and technical specification requirements as submitted to the NRC meet or exceed the GL-84-11 requirements.

4.0 Unit 3 Pipe Replacement Program

As a result of finding ultrasonic indications of IGSCC during the 1985 inservice inspection the licensee initiated a program to remove and replace the recirculation and residual heat removal (RHR) piping systems in Unit 3. In order to mitigate the susceptibility to IGSCC the old type 304 stainless piping is being replaced with nuclear grade low carbon type 316 stainless steel welded with controlled heat processes, and other refinements discussed in this report.

The purpose of this inspection was to provide an overview of the licensee's preproduction activities in regard to organization, planning, and installation procedures. The licensee's engineering staff is located at the site along with representatives of principal contractors (CBI and GE). The project's goals, organization, responsibility, schedular communication and cost control requirements are described in Manual PPM-1. The inspector observed that the licensee and his principal contractors appeared to be working in close cooperation with each other.

The inspector reviewed PECo's Engineering Work Letter (EWL) Revision 5 which describes the scope of work to be performed as detailed in GE Specification 23A546 Revision 4. The EWL also included replacement of certain portions of the Reactor Water Cleanup (RWCU) and Core Spray piping systems. The general requirements for removal and installation of the piping systems are to be performed in accordance with ASME Section XI, 1980 Edition through Winter 1981 Addenda. New pressure boundary materials including fabrication and installation are required to meet ASME III, Section NB. Welds of piping to reused pumps and valves are to meet the acceptance criteria of USAS B31.1-1967. The principal contractor for the pipe replacement program is Chicago Bridge and Iron (CBI), who provided the same service in the Unit 2 pipe replacement program.

Prior to removal, the old piping system will be decontaminated with LOMI-NP-LOMI which is a low oxidizing state metal ion - nitric acid potassium permanganate solution that has been selected on the basis of successful plant experience and GE/EPRI test programs. Work has been completed in the RWCU system to accommodate the decontamination equipment.

As specified in GE specification 23A5456, CBI has prepared detailed procedures (Special Instructions) (SIs) covering the prescribed work activities. The inspector reviewed two SIs, SI-RNI Revision 3 and SI-RN-2 covering replacement of N1 (outlet) and N2 (inlet safe ends). After removal of old safe ends (transition piece between buttered reactor vessel nozzle and pipe) a key decision will be made prior to welding the new safe ends to the RV nozzle based on the condition of the existing Ni-Cr-Fe-Alloy 182 butter (weld metal build up on RV nozzle) This determination will be based on the results of liquid penetrant inspection in

accordance with GE specification PMA-86-04. If no indications are evident or the butter is considered repairable, the alloy 182 butter is to be over clad with Ni-Cr-Fe alloy 82 and the new safe ends welded. If the existing alloy 182 butter is judged unacceptable and not repairable, it will be machined off and replaced with a type 309/308 stainless combination. Both SI-RN 1 and SI-RN-2 documents provide precise cutting, machining and welding step by step instructions. These include dimensional determinations, etching, and NDE to assure protection of the alloy steel (Mn-Mo) RV nozzle and conformance to specified weld joint fit-up requirements. The inspector reviewed typical weld joint dimensions for nozzle safe end to pipe transition joints and found them to meet the ASME Code counterbore requirements. The attached sketches in the SIs provide additional clarity to the work instructions. It is noted that the new N2 safe ends incorporate an integral I.D. extension that accommodates the thermal sleeve. The new thermal sleeve is welded to the extension with a full penetration joint. The new design avoids welding directly to the pressure boundary and eliminates a crevice condition which has been identified as a site for IGSCC.

The inspector reviewed three material document packages identified as recirculation spool piece (Part 003-SN29), a recirculation safe end (SN N2015-Item 4) and RHR fitting (SN-3-10-30A-7). A review of certified mill test reports, indicated that all materials conformed to specified nuclear grade type 316L stainless steel specifications SA 403 or SA 182 with regard to chemistry and mechanical properties.

The carbon content ranged between .008-.010 compared to the specified maximum of .020. As required by GE specifications 23A1625 Rev. 3 and B50YP257B1-J Rev 4 the packages showed evidence that all the materials had been solution annealed between 1900°F-2000°F followed by water quenching. This treatment was performed on straight portions of pipe, as well as hot bent pipe.

The records also showed that the materials had successfully passed A-262 sensitization testing for corrosion resistance, grain size and dimensional checks, liquid penetrant and ultrasonic testing. In addition, the records showed that the I.D. of the various piping products had been electropolished and subjected to a preoxidation (passivation) treatment at the Adwin Facility in Eddystone PA in 1987. The procedure consisted of heating the piping between 260°-315°C for 150 hours. The purpose of the treatment is to prevent rapid metal corrosion and to inhibit radioactive contamination.

The inspector reviewed two automatic Tungsten Inert Gas (TIG) welding procedures intended for the installation of the new piping systems. These were ER82A and ER308L. The former will be used if the existing Ni-Cr-Fe alloy 182 butter can be utilized for the safe end to nozzle joints; the latter if the alloy 182 requires removal and replacement with a 309/308L butter combination. The procedures are used with Gold Track II welding

machines. The root pass is deposited by fusing a consumable K type insert without the addition of filler metal. A review of the accompanying procedure qualification records indicated conformance to ASME Code Section IX welding requirements. In addition to review of the implementation of the welder/operator Section IX qualification program, the inspector observed that qualified operators were being trained on special mockups simulating production welds as described in CBI Procedure SI-MUMW-Rev 1.

Welding operators are required to practice on type 304 stainless piping, and following initial training operators are required to weld a type 316L nuclear grade mockup. Acceptability is determined by radiography. Visual examination of the internal root surface of one of the automatic pipe weld mockups identified as M-115G revealed a crease like, convex type of discontinuity in the approximate center of the weld oriented in the circumferential direction. The area containing the discontinuity is the fused insert. It appeared to be located at the bottom portion of the pipe between the 4 and 8 o'clock positions. Although liquid penetrant inspection of the ID surface failed to show an indication, a review of the radiograph disclosed a faint linear indication in the suspect area. The licensee's Level II radiographer had not been requested to review the film as of that time, but indicated that he would consider the indication and similar indications as rejectable unless proven to be irrelevent on a case by case basis.

The discontinuity appears to be due to one or a combination of several possible factors such as insert placement, gravity or heat input of the first hot layer over the previously deposited fused insert. The licensee subsequently stated in a telephone conversation on 11/30/87 that CBI had intentionally introduced the discontinuity in the mockup in order to study the problem. The licensee indicated that CBI would continue to expend the necessary effort to eliminate this root condition which could act as a potential site for corrosion or fatigue. In addition, elimination of the root condition would minimize the possible masking of sub-surface radiographic indications, and also facilitate radiographic interpretation. During the inspector's review of the root layer problem, the inspector was informed that CBI discards weldor qualification radiographs after only two weeks. In view of the root problem the licensee stated that these would be retained for a minimum of one year.

The inspector reviewed the licensee's QA program consisting of auditing, surveillance and document review. The scheduled activities covered various areas including equipment removal, inspection & refurbishment of reused plant equipment, safe end and pipe installation including welding and NDE, and review of Work Controlling Travellers before issue and after completed work. An audit of welder qualification was currently in progress.

In summary, the inspector concluded that the Pipe Replacement Program was well organized and efficiently managed by the licensee's on site engineering personnel. Considerable effort had been expended to prepare detailed procedures and instructions for all phases of the program. Based on the scheduled activities, the licensee's QA department will be playing a key role in assuring project quality and conformance to Code requirements.

Exit Interview

An exit meeting was held with licensee representatives on November 20, 1987. The inspectors summarized the scope and findings of the inspection. No written information was provided to the licensee by the inspectors during the course of the inspection. The licensee representatives did not indicate that this inspection involved any proprietary information.