U. S. NUCLEAR REGULATORY COMMISSION
REGION I

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LICENSEE: Philadelphia Electric Company

FACILITY NAME: Limerick Generating Station, Units 1&2

INSPECTION AT: Sanatoga, Pennsylvania

INSPECTION DATES: May 18-29, 1992

INSPECTOR: Robert A. McBrearty — June 18, 1992
R. A. McBrearty, Reactor Engineer, Materials Section, EB, DRS — Date

APPROVED BY: E. H. Gray — 6/19/92
E. H. Gray, Chief, Materials Section, Engineering Branch, DRS — Date

Areas Inspected: An unannounced inspection was conducted of the licensee's inservice inspection program and associated activities to ascertain that program conformed to applicable requirements, and whether the activities were performed in a way that confirmed the plant's acceptability to return to service. Additionally, the licensee's erosion/corrosion (E/C) program was examined to ascertain that related activities were accomplished in accordance with NRC requirements (Generic Letter 89-08), and licensee commitments and procedures.

Results: The licensee's ISI program is being implemented in compliance with applicable ASME Code and regulatory requirements. Examination personnel were properly certified to the appropriate SNT-TC-1A level of competence. The erosion/corrosion program is a generally comprehensive program for monitoring E/C in high energy piping systems. A weakness was identified regarding the lack of permanent reference points to locate inspection grid patterns on the various items to be inspected which could have a negative impact on the reproducibility of inspection results and the accuracy of inspection results trending.

1.0 INSERVICE INSPECTION (ISI) (INSPECTION PROCEDURE 73753)

A nuclear generating facility depends on numerous systems and components for the safe operation and shutdown of the facility. To assure that those systems and components will operate when needed, the NRC requires that an ISI program be established. Specific inspection requirements regarding method and frequency are contained in the ASME Boiler and Pressure Vessel Code, Section XI.

The Limerick Unit 1 facility is in its first 10-year inspection interval, which commenced on February 1, 1986. The ISI program was updated at the end of the third refueling outage, the first outage of the second period, from the ASME Section XI, 1980 edition through Winter 1981 addenda (80,W81) to the 1986 edition with no addenda. Implementation of the 1986 edition commenced with the completion of the third refueling outage. The outage now in progress, the fourth refueling outage, is the second outage of the second period of the interval.

Because the inspection requirements of the 1986 edition of Section XI differ from those of the 80,W81 edition, the licensee had to establish the completion credit which could be applied from the examinations which were performed through the end of the third refueling outage based on the 80,W81 code. To assure that proper credit was applied, and that the 10-year interval requirements were complied with regarding the examination scope, the licensee contracted Gilbert/Commonwealth, Inc to prepare an Examination Reconciliation Report. The report establishes, by examination code category, the percentage of completion of the 80,W81 code and what must be completed under the 1986 code.

1.1 Inspection Data

Data associated with the following welds were selected for inspection to ascertain that the results were clearly documented, and that regulatory and programmatic requirements were complied with.

Reactor Recirculation System

- VRR-1RD-1A-N2H, 12" diameter safe end to nozzle weld
- VRR-1RD-1A-N2J, 12" diameter safe end to nozzle weld
- VRR-1RD-1A-N2K, 12" diameter safe end to nozzle weld
- VRR-1RD-1B-N2B, 12" diameter nozzle to safe end weld
- VRR-1RD-1B-N2C, 12" diameter nozzle to safe end weld
- VRR-1RD-1B-N2E, 12" diameter nozzle to safe end weld

Residual Heat Removal System (RHR)

DCA-318-3-N17C, 12" diameter safe end to nozzle weld

Reactor Water Cleanup System (RWCU)

1AE-208 SW1, 4" diameter pipe extension to N1 nozzle

CC-104-1 FW53, 4" diameter pipe to elbow weld

Reactor Pressure Vessel System (RPV)

Weld AD, shell 3 to shell 4 - bottom side

Weld BH, shell 3 vertical seam - right side

The recirculation system welds and the RHR system weld were subjected to the Mechanical Stress Improvement Process (MSIP) to mitigate intergranular stress corrosion cracking (IGSCC) in stainless steel piping systems. Ultrasonic examination of the welds was performed prior to and subsequent to the application of MSIP as discussed in NUREG-0313, Revision 2, and Generic Letter 88-01.

Ultrasonic examinations of recirculation system weld VRR-1RD-1A-N2H, which were performed during the second refueling outage in the Spring of 1989, detected evidence of IGSCC. Examinations performed during the third refueling outage in the Fall of 1990, detected some growth in length and through-wall dimension of the originally reported flaw. The pre and post-MSIP ultrasonic examinations which were performed during the current 1992 refueling outage confirmed that no appreciable change in length or through-wall dimension had occurred since 1990, and that no change had occurred as a result of the MSIP.

Examination limitations were documented regarding the two RPV welds, and the welds were rescheduled for examination during a subsequent refueling outage at which time the examinations will be completed.

Action Request (AR) number A0391367, Nonconformance Report (NCR) number LG-92-0016-000, and Station Work Order (WO) number C0085167 C01 were issued to document a rejectable liquid penetrant indication on RWCU weld DCC-104-1 FW53. The documented disposition was appropriate for the reported condition, and the corrective action to remove the defect was completed and defect removal was confirmed by a liquid penetrant examination. The wall thickness after defect removal was determined by ultrasonic thickness measurements which confirmed that the minimum wall thickness was not violated.

The reviewed data complied with code and regulatory requirements and confirmed that the associated welds were acceptable for continued service.

1.2 Nondestructive Examination Personnel Qualification/Certification Records

Records of the examination personnel responsible for performing the examination of the above listed welds were reviewed to ascertain that the examiners were properly qualified to perform their assigned responsibilities.

The records confirmed that each examiner was qualified and certified in accordance with the applicable provisions of SNT-TC-1A, the governing document. Additionally, the individuals who performed the ultrasonic examinations of the recirculation system and RHR system welds were listed by the latest edition of the Electric Power Research Institute (EPRI) Registry of Qualified Personnel for UT of IGSCC as required by NUREG-0313, Revision 2, and Generic Letter 88-01.

Conclusions

The Examination Reconciliation Report is a comprehensive document that is used by the licensee to implement its 1st ten year interval ISI program, and to assure that ASME code Section XI required examinations are completed.

Inservice inspection examinations are documented in accordance with regulatory and ASME code Section XI requirements, and clearly confirm that the associated components are acceptable for continued service. Further, the licensee showed initiative by the performance, on selected welds, of the mechanical stress improvement process to mitigate intergranular stress corrosion cracking. Nondestructive examinations are performed by qualified examiners, and nonconforming examination results are appropriately dispositioned with effective corrective action.

2.0 EROSION/CORROSION (E/C) PROGRAM (49001)

2.1 Background

Concerns regarding erosion and corrosion in balance of plant piping systems have been heightened as a result of the December 9, 1986, feedwater line rupture that occurred at Surry Unit 2. This event was the subject of NRC Information Notice 86-17, Bulletin 87-01 and Generic Letter (GL) 89-08.

The need for an erosion/corrosion inspection program with respect to the safety of the public is exemplified by the personnel fatalities and injuries that have occurred as a result of pipe failures at various nuclear plants in the United States. An effective E/C program will detect problem areas before a significant failure occurs.

2.2 Inspection Objective

The inspection was conducted to determine whether licensee activities relative to the long-term erosion/corrosion monitoring program are being accomplished in accordance with NRC requirements and licensee commitments and procedures.

2.3 Licensee Response to Generic Letter 89-08

Generic Letter 89-08, "Erosion/Corrosion - Induced Pipe Wall Thinning," dated May 2, 1989, required licensees, including Philadelphia Electric Company (PECo), to provide assurances that a program, consisting of systematic measures to ensure that erosion/corrosion does not lead to degradation of single phase and two phase high energy carbon steel systems, has been implemented. Licensees were required to respond within 60 days of their receipt of the GL.

The licensee's response to the GL was provided by letter dated July 21, 1989, which was within the time frame required by the letter and provided the information requested by the GL.

2.4 Program Implementation

The Nuclear Engineering Department (NED) is responsible for selecting areas and lines to be included in the E/C program. Other NED responsibilities include selecting the location for inspection and the inspection method, determining the frequency of inspection for each location, and establishing acceptance criteria for each location. Additional responsibilities include inspection results analysis, recommending corrective actions and notifying the station of inspection locations, methods of inspection, analysis results and the recommended corrective actions. The Limerick Station is responsible for implementing the program including planning and scheduling the inspection of locations identified by NED and notifying NED of inspection results.

The initial selections for the Limerick E/C program were made using the CHEC and CHECMATE computer models developed by the Electric Power Research Institute (EPRI). All high-energy (greater than 200°F), carbon steel, single phase and two-phase systems with an estimated total operating life greater than 12,000 hours must be included in the program. Other lines may be included at the discretion of the responsible engineer who considers industry experience in the selection process.

The time between inspections, initially based on engineering judgement and/or analysis, is adjusted, as required, based on inspection results and frequency criteria of specification P-508, Revision 0. The specification contains the Unit 1 and Unit 2 single phase and two phase schedule, a discussion of the parameters affecting E/C and the E/C inspection program acceptance criteria. The P-508 specification is in the process of being revised at this time.

Erosion/Corrosion inspections at Limerick are performed by the licensee's ISI contractor under licensee direction. The contractor technicians are responsible for marking the appropriate inspection area with either a band or grid pattern as defined by the P-508 specification, and for taking thickness measurements at the specified locations. Thickness readings are sequentially recorded using an ultrasonic data logger which stores each reading until the data are loaded into a computer. The logger identifies the grid location that should be measured allowing the technician to confirm that the ultrasonic transducer is at the correct location. Additionally, the logger permits inspection personnel to review the data base prior to leaving the inspection site, thereby assuring that all required inspection points have been measured. The use of the data logger helps to assure that data are accurately recorded and, by speeding up the data acquisition process, helps reduce personnel exposure to radiation. After loading the data into a computer, the information is printed on a hard copy report and submitted for review to the licensee's representative.

An apparent weakness in the program has to do with the application of the appropriate band or grid pattern which is marked on the item to be inspected. Specification P-508 provides instructions regarding the type of pattern and how it should be applied to the various pipe and fitting configurations. In practice, the datum points locating the inspection bands and grids are not permanently marked on the item, but are applied each time an inspection is performed. This practice could result in inaccuracies in repeating measurements from one inspection to the next, and in trending the results of those inspections. This was discussed at the exit meeting with the licensee, and was acknowledged by the licensee representatives present.

Information Notice 92-35, "Higher Than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping Inside Containment at a Boiling Water Reactor," is dated May 6, 1992, and was issued to alert licensees of feedwater system piping wall thinning reported by the Pennsylvania Power and Light Company (PP&L) at the Susquehanna steam Electric Station, Unit 1. The Limerick Unit 1 E/C program required that certain feedwater piping inside containment be inspected, but the locations identified by the notice were not included. The licensee's E/C coordinator did not have a copy of the information notice and was unaware of those locations. After being provided by the inspector with a copy of the information notice, the E/C coordinator reviewed inspection records and determined that feedwater system piping inside containment was inspected during the current outage, but not the precise location identified by the notice.

At first glance, it appeared that PECo management did not provide the E/C coordinator with a copy of the NRC information notice in time to perform the inspection of the appropriate piping while it was accessible during the outage. In response to the inspector's questions, the licensee searched its records and determined that, as of May 29, 1992, PECo had not received a copy of the notice from the NRC.

When made aware of the problem location, the responsible engineer contacted the cognizant individual at PP&L to get more detailed information. Based on its assessment of the potential for a similar problem at Limerick, which included pertinent information from PP&L, the licensee scheduled an inspection of the location for the next Limerick Unit 1 refueling outage (R105). The licensee's conclusion to operate the system without inspection until R105 was based on Limerick having experienced two years less service than the Susquehanna facility at the time of discovery. The inspector agreed with the licensee's conclusion in that regard.

Conclusion

The Limerick erosion/corrosion program is a generally comprehensive program for monitoring E/C in high energy piping systems which is still evolving. The program includes the monitoring of single phase and two phase systems.

The engineer responsible for the program at Limerick is relatively inexperienced in this area. He has attended an EPRI seminar on the use of the CHEC and CHECMATE computer models, and is a participant in the CHEC/CHECMATE users group.

3.0 EXIT MEETING

The inspector met with licensee representatives (denoted in Attachment 1) at the conclusion of the inspection on May 29, 1992, and summarized the scope and findings of the inspection.

ATTACHMENT 1

Persons Contacted

Philadelphia Electric Company (PECo)

W. Barnshaw, Superintendent - Technical Monitoring
P. Berry, Analyst
K. W. Boyce, Maintenance Superintendent
U. J. Cietniewice, Superintendent - Training
J. Doering, Plant Manager
I. A. Hopkins, Operations
K. M. Knaide, Inservice Inspection Coordinator
R. C. Lesnefsky, Quality Verification Superintendent
G. J. Madsen, Regulatory Engineer
T. A. Shea, Maintenance Engineer
R. Swenk, Erosion/Corrosion Program Coordinator