U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-249/91026(DRS)

Docket No.: 50-249 License No.: DPR-25

Licensee: Commonwealth Edison Company
1400 Opus Place
Downers Grove, IL 60515

Facility Name: Dresden Nuclear Power Station - Unit 3

Inspection At: Morris, IL 60540

Inspection Conducted: September 9-12, 16, 18-19, October 7-8, 29-31, and November 12, 1991

Inspector: _____ 12/2/91
J. F. Schapker Date

Approved By: _____ 12-2-91
J. M. Jacobson, Chief Date
Materials and Processes Section

Inspection Summary

Inspection on September 9-12, 16, 18-19, October 7-8, 29-31, and November 12, 1991 (Report No. 50-249/91-026(DRS))
Areas Inspected: Routine unannounced inspection of inservice inspection (ISI) activities including review of program (73051), procedures (73052), observation of work activities (73753), data review and evaluation (73755), and of licensee action regarding reactor vessel closure head studs (92700).
Results: No violations or deviations of NRC requirements were identified.

- ISI activities were accomplished within the guidelines of ASME Code Section XI requirements.
- The licensee's augmented inspection of reactor vessel closure studs demonstrated a positive commitment to safety.
- The licensee has demonstrated the ability to properly implement the ISI Program, including augmented inspection of intergranular stress corrosion cracking (IGSCC) susceptible piping.

DETAILS

1. Persons Contacted

Commonwealth Edison Company (CECo)

*K. Peterman, Regulatory Assurance Superintendent
*G. Whitman, ISI Coordinator
*J. Kotowski, Production Superintendent
*L. Gerner, Technical Superintendent
*J. Harrington, NQP Maintenance Group Leader
M. Harbaczewski, Technical Staff Group Leader

Lambert, MacGill and Thomas, Inc. (LMT)

W. Thomas, ISI Inspector, Level II
J. Newgurd, ISI Inspector, Level II
R. May, ISI Inspector, Level II

U. S. Nuclear Regulatory Commission (NRC)

D. Hills, Resident Inspector
D. Liao, Reactor Inspector

Other licensee personnel were contacted as a matter of course during this inspection.

*Denotes those present at the exit interview conducted November 12, 1991.

2. Inservice Inspection (ISI) Unit 3 (73051, 73052, 73753, and 73755)

a. General (73051)

This was the second outage of the third period in the second ten year plan. The licensee contracted with Lambert, MacGill, and Thomas, Inc. (LMT) to perform ultrasonic (UT), magnetic particle (MT), and liquid penetrant (PT) examinations. The licensee's System Materials Analysis Department (SMAD) nondestructive examination (NDE) section assisted with those examinations and performed independent examinations using UT and MT during the outage. Examinations were performed in accordance with ASME Section XI, 1977 Edition, Summer 1979 Addenda. The procedures utilized for NDE were reviewed and approved by an EPRI certified CECo Level III.

b. ISI Procedure Review (73052)

The NRC inspector reviewed the following NDE procedures:

- CECo, Nondestructive Testing (Inservice Inspection) DAP 11-8, Revision 3.
- CECo, "Preservice and Inservice Ultrasonic Inspection of Similar and Dissimilar Metal Pipe Welds at Nuclear Stations," NDT-C-2, Revision 18.
- CECo, "Ultrasonic Inspection of the Vessel Inner Radii at Nuclear Stations," NDT-C-10, Revision 11.
- CECo, "Ultrasonic Examination of Reactor Vessel Welds to NRC Regulatory Guide 1.150 for Boiling Water Reactors," NDT-C-30-79, Revision 0.
- CECo, "Beam Spread and Refracted Angle Determination to NRC Regulatory Guide 1.150 for Boiling Water Reactors," NDT-C-31-79, Revision 0.
- CECo, "Nonaqueous Red Dye Liquid Penetrant Examination for Section XI Class IWB and IWC Components for Nuclear Stations," NDT-D-2, Revision 7.
- CECo, "UT of Dissimilar Metal Safe-End to Nozzle Welds with Inconel 182 Buttering and Filler Metal.
- CECo, "Visual Examination - Welds, Pressure Retaining Bolting, and Component Internals," VT-1-1, Revision 4.
- CECo, "Visual Examination - System Hydrostatic and Leak Tests," VT-2-1, Revision 1.
- CECo, "Visual Examination - Component Supports," VT-3-1, Revision 1.
- CECo, "Magnetic Particle Examination for ASME Section XI Class IWB and IWC Components for Nuclear Stations," NDT-B-1, Revision 4.

c. Review of ISI Data, Material, Equipment, NDE Personnel Certifications and Audits (73753, 73755)

The NRC inspector reviewed the following documents and determined that the applicable QA/QC requirements were met:

- ISI Data Reports;
- Ultrasonic instruments, transducers, and couplant certifications;
- Liquid penetrant, cleaner, and developer certifications;
- Magnetic particle materials and equipment; and
- NDE personnel certifications compliance to SNT-TC-1A requirements and EPRI certifications for IGSCC examinations.

d. Observations of Work and Work Activities (73753)

The NRC inspector observed the following work activities in progress:

- Ultrasonic examination (UT) of: Reactor vessel (RV) flange to shell weld, isolation condenser piping welds**, recirculation piping welds, core spray piping welds, shutdown cooling piping welds, and high pressure coolant injection (HPCI) safe-end welds.
- Liquid penetrant examination (PT) of isolation condenser welds and shutdown cooling piping welds.
- Magnetic particle examination (MT) of core spray piping welds.
- Visual examination of RV internals*.

*Visual examination of jet pump restrainer clamp bolt keepers was performed utilizing the "bump" method to verify that the keepers tack welds were intact. The NRC inspector observed this examination in progress (via video camera). During the examination, one keeper weld was observed to have failed. The bump method uses a crows foot type device which is manipulated to lift or jar the keeper to detect whether the tack weld is sound. The tack weld is not visually accessible for inspection in some cases and it is not always possible to discern the soundness of the weld, therefore, the bump method was devised to inspect for security of the keeper. The bolt keeper was repair welded and reinspected for adequacy.

**The isolation condenser safe-end to nozzle welds are comprised of a stainless steel safe-end welded to a carbon steel nozzle that has been buttered and cladded

with stainless steel. The licensee fabricated two mockups (8" and 12" diameters) to determine the best ultrasonic technique for the examination. Through the use of these mockups it was determined that the Refracted-Longitudinal Wave (RL) technique, using both 45° and 60° angles, provided the best examinations. Ultrasonic procedure NDT-C-2, Revision 18, with some modifications, was used as the governing procedure. A two-inch depth range was established using the 10% and 50% deep axial notches in the respective mockups. The sensitivity was established by setting the 1/8" diameter 3/4 T side drilled hole to 80% full screen height. The scan gain was adjusted to maintain a 10 to 30 percent noise level as required by the procedure and recorded on the data sheets. The NRC inspector observed the UT examination and calibration checks, no defects were identified.

A PT examination of the safe-end to nozzle weld detected an indication located in the safe-end material at the toe of the weld to the nozzle. The indication was surface oriented with no appreciable depth. The maximum length was .3 inches. Due to the nature of the indication, the licensee contacted SMAD to perform field metallography which revealed numerous discontinuous cracks not connected to the main indication. The cracks contained no oxide and appeared to be sharp with no evidence of blunting. Subsequently, SMAD removed the indication (boat sample) for laboratory analysis. The sample was prepared, mounted and etched with a 10% oxalic acid to accommodate viewing the indication in the radial direction. The area surrounding the PT indication contained the discontinuous cracks which etched differently than that of the base or weld metal. From this, it was apparent that the indication was directly adjacent to the field weld, but was not part of the field weld. The maximum depth of the indication measured .030 inch. A longitudinal cross section through the PT indication exhibited a dendritic microstructure. The cracking observed was interdendritic. The cracks did not extend into the base material and terminated at the interface between the dendritic structure and the base metal.

Semi-quantitative chemical analysis was performed using the energy dispersive x-ray spectrometer (EDS). Results of the analysis revealed that the base metal appeared typical of a stainless steel (SS) type 304, and the weld metal appeared typical of SS type 308. The area containing the indications revealed a composition of approximately 53% nickel, which is

typical of Inconel material. It is possible that a thermocouple or other type of attachment weld was the cause of the foreign material. During solidification of the tack weld, interdendritic cracks may have developed in the area of dilution.

The NRC inspector observed the initial PT and UT examinations, the boat sample removal and subsequent UT examination after repair welding. Review of the repair documentation was performed with no discrepancies noted.

The licensee conservatively exceeded the ASME Code requirements to assure the root cause of the cracking was identified.

No violations or deviations were identified.

3. Inspection of Reactor Vessel Studs (92700)

In the spring outage of 1989 for Unit 2, ultrasonic examinations performed as part of the Section XI Inservice Inspection (ISI) Program identified cracks in the lower threaded portion of two reactor vessel (RV) head closure studs. The two studs were removed and replaced with spare studs during that refueling outage. Subsequently, a metallurgical evaluation on a sample from one of the cracked studs determined the cracking mechanism to be Intergranular Stress Corrosion Cracking (IGSCC), and that the material toughness of the stud was lower than previously reported in the original Certified Material Test Report. Due to the possibility of stud cracking in other CECo BWR units, the licensee elected to perform augmented inspections of (100%) of the RV studs at each of the six BWR units, utilizing an enhanced end-shot ultrasonic technique (enhanced from the original UT procedure which identified the cracks). In addition, further metallurgical evaluations are being performed by the licensee and General Electric Company.

During the current outage for Dresden Unit 3, all RV studs were examined via the enhanced UT end shot method. In addition, a sample of 16 studs were removed and magnetic particle examined (wet fluorescent) with no cracking identified. The NRC inspector observed the UT calibration for the end shot stud UT. The licensee fabricated a new calibration stud assembly made from material similar to the actual stud material, to duplicate the acoustic properties.

The NRC inspector observed that during the initial calibration attempts, a high amplitude signal was interfering in obtaining a clean UT setup to perform the examination to procedure requirements. The licensee changed

equipment to lower the pulse repetition rate which was causing the nonrelevant signal due to the length and geometric configuration of the stud. With the change of the UT equipment, the nonrelevant signal was still present but the amplitude was reduced so that the calibration was achievable. During the examination of the RV studs, identical nonrelevant signal responses of lower amplitudes were detected. These signals were recorded per procedure requirements. No cracking was detected during the examination of the RV head closure studs.

The licensee's augmented inspection program for the RV studs along with the metallurgical analysis and evaluations as to the root cause of the cracked studs, demonstrates a positive attitude to assuring the safe operation of the plants.

No violations or deviations were identified.

4. Exit Meeting

The NRC inspector met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on November 12, 1991. The inspector summarized the scope and findings of the inspection activities. The licensee acknowledged the inspection findings. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector. The licensee did not identify any such documents/processes as proprietary.