U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-440/85-007(DRS)

Docket No. 50-440 License No. CPPR-148

Licensee: Cleveland Electric Illuminating Company
Post Office Box 5000
Cleveland, OH 44101

Facility Name: Perry Nuclear Power Plant, Unit 1

Inspection At: Perry Site, Perry, OH

Inspection Conducted: February 4-6, 1985

Inspector: K. D. Ward 2/25/85
K. D. Ward Date

Approved By: J W Muffett for 2/26/85
D. H. Danielson, Chief Date
Materials and Processes Section

Inspection Summary

Inspection on February 4-6, 1985 (Report No. 50-440/85-007(DRS))
Areas Inspected: Announced, special safety inspection to review Cleveland Electric Illuminating Companies (CEI) ultrasonic examination technique for the detection and discrimination of intergranular stress corrosion cracking (IGSCC) in pipe welds and piping welds with corrosion resistant clad (CRC). The inspection involved a total of 24 inspector-hours by one NRC inspector including nine inspector-hours off-shifts.
Results: No items of noncompliance or deviations were identified.

DETAILS

1. Persons Contacted

Cleveland Electric Illuminating Company (CEI)

*C. Shuster, Manager, QA
*E. Mead, Senior Project Engineer
*H. Walls, Jr., Senior NDE Administrator
*C. Wirtz, Senior Engineering Technician
*J. Rivers, ASME Code Engineer
*W. Elgin, Engineer
M. Edelman, Vice President
E. Riley, General Supervisor
K. Kaplan, Senior Engineering Technical

Gilbert Associates, Incorporated (GAI)

*A. Bradshaw, NDE Level III
R. Matthys, Lead Piping

Nuclear Energy Services (NES)

*R. Bott, Site Manager

Hartford Steam Boiler Engineering and Insurance Company (HSB)

T. Laps, ANII

The inspector also contacted and interviewed other licensee and contractor employees.

*Denotes those attending the exit meeting.

2. Intergranular Stress Corrosion Cracking (IGSCC) and Piping Welds with Corrosion Resistant Clad (CRC)

General

CEI contracted with Nuclear Energy Services (NES) to perform the ultrasonic examinations (UT) on their Type 304 austenitic stainless steel recirculation system. The UT is being performed in accordance with the ASME Code Section XI, 1977 Edition, Summer 1978 Addenda, and NES Procedures: "Ultrasonic Examination of Stainless Steel Piping for Intergranular Stress Corrosion Cracking." No. 83A0811 Revision 0, and "Ultrasonic Examination for Austenitic Piping Welds," No. 80A0187 Revision 4. Both procedures utilize manual examinations. There are 218 shop and longitudinal welds that will be UT'd for IGSCC and 48 CRC field welds that will be UT'd with CRC techniques. The UT is scheduled to be completed by February 8, 1985.

The NRC inspector observed UT on several welds including calibration of equipment and found all the UT to be acceptable. The inspector also toured the warehouse where the Unit 2 pipe spools are stored and visually examined the inside diameter (ID) and the outside diameter (OD) surfaces of a 12" jet pump riser spool piece with surface geometry typical of what is being UT'd in Unit 1. ID and OD cladding of spool ends is machined and ground smooth providing for ease in UT and welding. The inspector reviewed certifications of transducers, instruments and couplant and found them to be acceptable.

The calibration standards were fabricated by the same fabricator utilizing the same material fabrication process and welding procedures as the pipe and fittings being UT'd.

IGSCC

IGSCC is typically detected in the area between the weld root to approximately 1/2" out from the weld, especially in the heat affected zone adjacent to the weld.

The UT is performed using the UT pulse echo nominal 45° angle shear wave techniques. The 60° shear wave and the 0° longitudinal wave techniques are also used where required. The 45° pitch/catch method is also being utilized.

Each weld and required adjacent base material is ultrasonically examined using angle beam techniques applied in two directions parallel to the weld axis on each side of the weld, in two directions perpendicular to the weld axis, and in two directions skewed toward the weld root at a nominal 45° angle on each side of the weld, where geometry permits. Where allowed by weld contour, the scanned area includes the weld crown.

The examination angle is nominally 45° in the material. A greater angle is used (e.g. 60° or 70°) if the weld root cannot be seen using a 45° angle. As an alternate, a 45° full vee technique from both sides of the weld may be used to achieve coverage except where limited by part geometry or access.

In order to accurately plot indications, the OD and ID weld contour is established where possible. The OD contour is recorded with the use of a contour gauge. The ID contour is established by performing a thickness check of the weld and adjacent base material to establish the location, depth, and slope of any existing counterbore and to locate the weld root, if possible. Thickness measurements are performed in at least seven places where possible: three on the weld, two on the counterbore, and two one inch from the weld centerline.

The thickness and contour data is then plotted on a full scale weld profile. Angle beam recordings are transferred to this plot. In addition, individual profiles for areas with indications may be performed, where necessary, for aid in evaluation.

For geometric and nongeometric indications, weld profiles are taken in one location per indication, where possible.

The 70° longitudinal wave (creeping wave) technique may be used by the Level III to confirm cracks that are suspected of being $\geq$ 50% through wall. Other techniques and calibrations may be used as required for evaluation.

The nominal examination frequency is 5.0 MHz for all straight beam examinations. Other frequencies may be used if such variables as material attenuation, grain structure, etc., necessitate their use to achieve penetration or resolution.

The nominal examination frequency is 1.0 to 2.25 MHz for all angle beam examinations. The initial examination frequency is nominally 1.5 MHz. Other frequencies may be used as required to enhance resolution or for evaluation purposes.

Calibration techniques and recording criteria are specialized to enhance IGSCC examination as allowed by the ASME Code, Section XI, IWA-2240.

During actual weld scanning, the reference sensitivity level is increased at least 10dB plus the acoustic compatibility correction. A greater increase in sensitivity is permitted for scanning but is used with caution. A noise level of at lease 10% to 20% FSH at the ID surface was present during scanning.

NOTE: Acoustic compatibility correction for shear wave angle beam examinations (45° Pitch/Catch Method) is accomplished using the thru-transmission technique and is performed in the axial direction (where applicable). This technique is performed on both sides of circumferential piping welds. If the two sides of the circumferential weld require different amounts of gain for acoustic compatibility correction, the amount of gain required for each side of the weld is added to that side during examinations.

Scanning sensitivity is the sensitivity used for recording all indications.

All nongeometric indications showing a signal amplitude response $\geq$ 20% of DAC and all geometric indications $\geq$ 50% of DAC (at the scan sensitivity) are recorded on the appropriate examination data sheet at the time of examination.

In addition, any indications showing a signal response $\leq$ 20% of DAC (at the scan sensitivity) which are considered relevant are recorded for further evaluation.

For examinations in which there is a high noise level, signals which are above the noise level are recorded on the appropriate examination data sheet at the time of examination. In this case, the resolvable recording level is recorded on the Calibration Data Sheet. The inspector reviewed selected calibration Data Sheets and audits of this activity conducted by CEI.

Nongeometric indications are evaluated using a minimum of two angles, where practical.

Instances where plots yield inconclusive information are reported to the examination supervisor for disposition.

Instances where plots confirm that indications are flaws are reported to the examination supervisor who will notify the Plant Owner.

When available, radiographs may be used to aid in evaluation of indications.

Examination crews have a minimum of two members. At least one member of each crew has a minimum Level II qualification in accordance with SNT-TC-1A. The remaining member(s) have a minimum Level I qualification. In addition, each crew has at least one Level II who has had training in the examination for and detection of IGSCC and is certified in accordance with the individual EPRI qualification examination.

CRC

The UT is performed using the ultrasonic nominal 45° angle refracted longitudinal wave and 0° straight beam technique applied to the outside surfaces of the piping or fitting. The transducers are dual (pitch/catch), 3/4" by 3/4" or 1" x 1" in size, with contoured wedges, and have roof angles such that they are focused for the area of interest.

The required examination volume includes the weld metal and adjoining base material for a distance of 1/4" beyond the edge of the weld crown within the inner 1/3 thickness. During the perpendicular examination of piping welds, the scanning is performed by a half vee technique from two sides, where practical. During the circumferential examination of piping welds, the scanning is performed by a 1/2 vee technique in two directions along the weld and the weld crown to examine the weld root. A straight beam examination of the base material through which the angle beams will travel is required if an initial base line examination has not been performed. The nominal examination angle is 45°. Where part geometry necessitates, alternate angles are required to be utilized. This information is annotated on the calibration data sheet.

Straight beam techniques are applied, where part geometry permits, to all base material through which the angle beams will pass during angle beam examinations. Indications detected are recorded and the data is used during evaluation of angle beam examination results.

NOTE: Where constant non-parallel surfaces occur (e.g., sweepolets), refracting the beam angle more normal to the ID surface may be used with alternate search unit wedge configurations.

When required, calibrated straight beam techniques may be used where no back echo can be obtained.

The nominal examination frequencies are 1.0 and 1.5 MHz for all refracted longitudinal angle beam examinations and 2.25 MHz for all straight beam examinations. A 5.0 MHz transducer may be required to achieve resolution during 0° straight beam examinations.

Examination crews have one or more members as necessary. At least one member of each crew has a minimum Level II qualification in accordance with SNT-TC-1A. The remaining member(s) have a minimum Level I qualification. To ensure high examiner skill level, the utility requested that the CRC examinations also be performed with each review having one Level II who is certified through EPRI for detection of IGSCC.

The office of Nuclear Reactor Regulation (NRR) has been informed of the techniques and observations described herein.

No items of noncompliance or deviations were identified.

3. Exit Interview

The inspector met with site representative (denoted in Paragraph 1) at the conclusion of the inspection. The inspectors summarized the scope and findings of the inspection noted in this report. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.