

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
REGION IV

Report No. 99900029/79-01

Program No. 51300

Company: Youngstown Welding and Engineering Company
3700 Oakwood Avenue
Youngstown, Ohio 44509

Inspection Conducted: November 2-3, 1978
Investigation Conducted: January 23-25, 1979

Inspectors: R. E. Oller 4/6/79
R. E. Oller, Contractor Inspector, Vendor
Inspection Branch Date

H. W. Roberds 4/6/79
H. W. Roberds, Contractor Inspector, Vendor
Inspection Branch Date

D. M. Hunnicutt 4/6/79
D. M. Hunnicutt, Chief, Components Section II,
Vendor Inspection Branch Date

Approved by: D. M. Hunnicutt 4/6/79
D. M. Hunnicutt, Chief, Components Section II,
Vendor Inspection Branch Date

Summary

Inspection on November 2-3, 1978, (99900029/78-02) and investigation on January 23-25, 1979 (99900029/79-01).

Areas Inspected: Implementation of 10 CFR 50, Appendix B, other NRC requirements, and applicable codes and standards, including, assessment of the cause, corrective action, and generic considerations relative to rejection of SA-312 austenitic stainless steel piping identified in the 10 CFR 50.55(e) report for Palo Verde Nuclear Generating Station Units 1, 2, and 3 facilities. The investigation involved forty-eight (48) inspector-hours on site by two (2) inspectors on January 23-25, 1979.

311 179

7907090 474

Results: Deviations: None

Unresolved Items: See Details Section II, paragraph C.3.b.

INSPECTION

Details Section I - November 2-3, 1978

(Prepared by R. E. Oller)

A. Persons Contacted

- *D. E. Lewis, QA Manager
- *E. E. Sigle, Vice President

*Attended exit meeting on November 3, 1978.

B. Preliminary Review of Possible 10 CFR 50.55(e) Deficiencies

1. Objective

The objective of the inspection conducted on November 2-3, 1978, was to meet with Youngstown Welding and Engineering (YW&E) management to make a preliminary assessment of possible deficiencies in SA-312 seam welded austenitic stainless steel piping supplied by Youngstown Welding and Engineering (YW&E) to Pullman Power Products (PPP) for use in Palo Verde Nuclear Generating Station, Units 1, 2, and 3.

2. Method of Accomplishment

The preceding objective was accomplished by a verbal presentation by YW&E management.

3. Findings

The following information was furnished verbally by Mr. E. Sigle and Mr. D. Lewis on November 2, 1978:

Youngstown Welding and Engineering was notified by Pullman Power Products (PPP) that SA-312 piping furnished for Palo Verde Units 1, 2, and 3, was found to contain possible unacceptable lack of fusion and porosity in the longitudinal seam welds. Messrs. Sigle and Lewis visited PPP at the Paramount, California, plant to review the problem. Mr. Lewis visited the site and was involved in the ultrasonic examination on the suspect pipe using Peabody Testing Service.

The suspect SA-312 piping consisted of 10, 12, and 24 inch nominal diameter pipe furnished in 20 foot random lengths to Pullman Power Products, Paramount, California, for

fabrication into subassemblies. The original purchase order was for SA-312 to ASME Code, Section III, Class 2 which required only ultrasonic examination of the long seam.

Part of the SA-312 piping was fabricated into approximately 104 subassemblies and four (4) support spools. Of the 104 subassemblies, 41 contained YW&E piping which was suspect based on the UT indications of unacceptable porosity and lack of fusion. PPP believed that 41 subassemblies should be rejected.

All involved parties, i.e. YW&E, PPP, Bechtel and Arizona Public Service are aware of the problem. The investigation is continuing.

The suspect piping was manufactured at YW&E's plant during October and November, 1977. YW&E indicated that the cause of the failure of final ultrasonic examination at YW&E to detect the defects, could have been that the piping welds were examined with the postweld heat treatment black oxide still on the pipes which YW&E believed interfered with the testing results.

YW&E provided a list of their customers who received SA-312 piping manufactured during the period of October - November, 1977. This matter remains unresolved pending determination of the cause of the weld defects; the cause of failure of the original UT to detect the defects; the extent to which other YW&E customer SA-312 pipe is affected, and YW&E corrective and preventive actions with regard to welding and ultrasonic examination of SA-312 piping.

C. Exit Interview

An exit meeting was held with YW&E management representatives denoted in paragraph A of this section of the Inspection Report.

YW&E's verbal presentation of the PPP reported SA-312 piping problem was included in the meeting discussion.

INVESTIGATION

Details Section II - January 23-25, 1979

(Prepared by R. E. Oiler)

A. Person Contacted

- R. Cleghorn, Project and Welding Engineer
- V. Dunnam, Welding Foreman
- D. Lasko, Tube Mill Superintendent
- **D. Lewis, QA Manager
- **F. Watson, President
- **E. Sigle, Vice President

**Attended the exit meeting on January 25, 1979.

B. Preinvestigation Conference

A preinvestigation conference was held on January 23, 1979, with Messrs. Lasko, Lewis, Watson and Sigle. The inspector stated the purpose of the investigation was to review basic information and data related to the possible deficiencies in the welds of the SA-312 piping supplied by YW&E to Pullman Power Products for use in Palo Verde Units 1, 2, and 3, as reported by Arizona Public Service Company in accordance with 10 CFR 50.55(e) requirements. The purpose of the review was to enable the Nuclear Regulatory Commission to make an independent assessment of the cause of the weld defects and the failure to detect the defects during manufacture of the piping. Also, to assess the extent to which this problem may relate to SA-312 piping supplied to other YW&E customers for nuclear use. The YW&E management stated they would cooperate 100 percent.

C. Reported 10 CFR 50.55(e) Deficiencies - Welding

1. Objectives

The objectives of this area of the inspection were to try to determine the cause of the welding deficiencies and generic implications of these deficiencies which occurred in the weld seam of SA-312 austenitic stainless steel piping supplied by YW&E to Pullman Power Products for use in the Palo Verde Units 1, 2, and 3, as reported by Arizona Public Service Company in accordance with 10 CFR 50.55(e) requirements.

Based on ultrasonic and radiographic testing by both YW&E and their customer PPP, the deficiencies include ASME Code, Class 2 unacceptable lack of fusion and porosity in the long seams of the piping.

2. Method of Accomplishment

The above objectives were pursued by examination of procedures and records, discussions with cognizant personnel, observation of in-process welding of SA-312 piping and examination of automatic welding equipment used for manufacturing SA-312 piping. The following items were reviewed and/or examined:

- a. "Welding Procedure Specification for continuous Butt Welding With No Filler Metal - Type GTA Automatic" No. 750, Revision -, dated May 18, 1972, and "Record of Welding Procedure Qualification", dated May 19, 1972, for specification No. 750.
- b. "Welding Procedure Specification" No. 750, Revision 2, dated March 12, 1975, and the procedure requalification record test No. SD-458-3, dated March 12, 1975.
- c. "Welding Procedure Specification" No. 750, Revision 3, dated August 30, 1978; Supporting PQR No. SD-458-3, dated August 30, 1978, (Corrected for type process-automatic and position 1G and 4G), and record of Revision dated August 31, 1978.
- d. Records of performance qualifications for nine (9) Tube Mill Welder Operators qualified for the Gas Tungsten Arc Weld process used in welding the SA-312 piping.
- e. Record of "Tube Mill Welders - Symbols, Initials and Signatures."
- f. Records of "Weld Procedure 750 Supplement" for Welding Machine No. 8 (for 6½" through 7 1/8" O. D. Pipe), Welding Machine No. 7 (for 7 3/4" through 12 3/4" O. D. Pipe), and Welding Machine No. 30 (for 12 3/4" through 24" O. D. pipe). These supplements, part of YW&E's corrective actions, specify specific and restrictive ranges for amperage, voltage, travel speed and shielding gases for given tube wall thickness.
- g. Inter-Office Memorandum dated December 5, 1978, from the Welding Engineer to the Tube Mill Superintendent and Welding Foreman directing that all A-312 and SA-312 Tube Mill Shop Orders shall specify the Weld Procedure and Revision, with the Weld Procedure 750 Supplement of wall thickness to be welded.

- h. Plant log of required maintenance for the months of October and November, 1977, to determine if there was required maintenance on Welding Machines numbers 7, 8, and 30 which could be related to the welding defects in SA-312 piping.
- i. Reports dated November 6, 1978, and December 15, 1978 of limited welding investigations on SA-312 pipe welding for YW&E by Battelle Columbus Laboratories.
- j. Observations of the calibration status of ammeters, volt meters and welding gas flow meters on welding machines numbers 7, 8 and 30, to verify that these devices were calibrated.
- k. Pipe Welding Records and Ultrasonic re-examination records related to the following nine (9) lengths of SA-312 piping which were verified to have contained unacceptable defects by re-examination in October, 1978, by YW&E's contractor Peabody Testing. This re-examination was made using the original UT Procedure, No. UL-4 Supplement 58. The purpose of review of these records was to attempt to relate welding information to defective pipes.
 - (1) Tube 2, Code 501, 12 3/4" O. D., welded on September 21, 1977 by RG on the No. 7 welding machine.
 - (2) Tube 16, Code 546, 10 3/4" O. D., welded on October 10, 1977 by CP on the No. 7 welding machine.
 - (3) Tube 16, Code 225, 20" O. D., welded on June 1, 1978 by SB on the No. 30 welding machine.
 - (4) Tube 1, Code 708, 12 3/4" O. D., welded on November 8, 1977 by BM on the No. 7 welding machine.
 - (5) Tube 3, Code 716, 10 3/4" O. D., welded on November 14, 1977 by CP on the No. 7 welding machine.
 - (6) Tube 4, Code 716, 10 3/4" O. D., welded on November 14, 1977 by CP on the No. 7 welding machine.
 - (7) Tube 2, Code 716, 10 3/4" D. D., welded on November 14, 1977 by CP on the No. 7 welding machine.

- (8) Tube 14, Code 16, 10 3/4" O. D., welded on November 15, 1977 by WH on the No. 7 welding machine.
- (9) Tube 25, Code 717, 10 3/4" O.D., welded on November 14, 1977 by WH on the No. 7 welding machine.

Note: Discussion and review of the ultrasonic examination records by YW&E's contractor Ultra-Lab, made at the Palo Verde site, established that lengths of SA-312 piping welded into PPP piping subassemblies contained defects indications. However, these lengths of SA-312 piping were identified by Pullman Power Products drawing "F" numbers traceable to heat numbers on the drawings, but not traceable to YW&E original tube and code numbers shown on welding records.

- l. Observation of in-process welding of a 10" OD. x 0.165" wall SA-312 pipe using WPS No. 750, Revision 3 and Welding Procedure 750 Supplement for Machine No. 7, containing the parameters designated for 0.165" wall thickness, to verify that the parameters in the supplement were being followed.
- m. Observation of SA-312 pipe cleaning with swabs and chloroethylene solvent prior to welding.
- n. Review of lists of SA-312 piping manufactured by YW&E for the years of 1975, 1976, 1977, and 1978.
- o. Internal YW&E memorandum dated September 1, 1978, requiring that as of this date all SA-312 piping shall be spot radiographed in three (3) areas.

3. Findings

a. Deviations

None.

b. Unresolved Items

As a result of the review of the above documentation, discussions with cognizant personnel and observations, the following conclusions were reached by the inspector.

- (1) The cause of pipe weld deficiency indications reported in the 10 CFR 50.55(e) report, could not be related to

causes other than a lack of welding arc complete penetration. The Welding Procedure Specification No. 750, Revision 2, used in the welding, was written and qualified in accordance with the ASME Code, Section IX. The wide ranges of welding parameters selected and permitted by the Code, i.e. wall thickness, voltage, amperage, and travel speed are considered to be possible sources of the cause of incomplete penetration. YW&E has developed weld data sheets called "Welding Procedure 750 Supplements," to provide closer control of these parameters.

- (2) There were no records available for manufacture of SA-312 piping to show the defective pipe welds occurred only during the period in 1977 when the piping for Palo Verde was manufactured. Welding procedure No. 750 has been in use since 1972 and although it was requalified in March, 1975, the "Welding Procedure 750 Supplements" limiting parameters to wall thickness, were not implemented until December 1978, and therefore the SA-312 piping welded prior to this date using WPS No. 750 may be considered suspect in quality of the welds.

D. Exit Interview

1. The inspectors met with management representatives denoted in paragraph A of Report Details Section 2 at the conclusion of the inspection January 25, 1979.
2. The following subjects were discussed:
 - a. Scope of the inspection.
 - b. Conclusions regarding the failure of the ultrasonic examinations during manufacture to detect lack of fusion and porosity in the seam welds.
3. The inspector informed YW&E management that the accumulated information will be reviewed by the Vendor Inspection Branch management, and that a report will be written. Also, that further inspections related to the subject problem may be necessary.
4. Other YW&E management questions related to clarification of the above discussion.

INVESTIGATION

Details Section III - January 23-25, 1979

(Prepared by H. W. Roberds)

A. Persons Contacted

- **D. Lewis, QA Manager
- R. Cleghorn, Project and Welding Engineer
- T. Paterson, Tube Mill Foreman
- S. Sliwinski, NDE Level II
- C. Wagner, Supervisor
- D. Lasko, Tube Superintendent
- J. Evans, Plant Superintendent

**Attended the exit meeting on January 25, 1979.

B. Special Investigation

1. Objectives

The objectives of this inspection was to gather information related to rejectable ultrasonic indications disclosed by Pullman Power Products at Paramount, California, in SA-312 stainless steel pipe manufactured by Youngstown Welding and Engineering Company of Youngtown, Ohio, and reported by Arizona Public Service Company on a 50.55(e) report to IE: Region V, Walnut Creek, California.

2. Method of Accomplishment

The preceding objective was accomplished by:

- a. Review of applicable contracts for SA-312 pipe manufactured for ASME Code, Section III application.
- b. Review of Control Specification UL-4 and Supplement 58, Ultrasonic Test of Pipe and Tube Weldment, dated August 1, 1977.
- c. Review of Ultra-Labs, Incorporated of Cleveland, Ohio, Nondestructive Test Reports for ultrasonic examinations on stainless SA-312 piping for various contracts prior to October, 1978.
- d. Review of Peabody Testing Lab Report No. 5440.
- e. Interviews with cognizant personnel.

3. Findings

- a. Youngstown Welding and Engineering Control Specifications UL-4 does not define how calibration shall be accomplished i.e. relative to the skip distance required or the ultra sound travel distance.
- b. The scanning area defined in the procedure may not allow the transducer to be coupled to the specimen, due to the uneven surface as a result of the manufacturing process.
- c. The procedure defines the use of a 1 MHZ transducer, however, the procedure permits the use of other frequencies that can be calibrated on the notches and inspection reports indicated that the inspection was accomplished using a transducer with a frequency of 2.25 MHZ.
- d. The procedure, Control Specification UL-4, Supplement 58, does not define calibration amplitude for assurance of test results reproducibility.
- e. The procedure does not define test surface requirements as related to the calibration standard.
- f. The company representatives alluded that the reason for failure to detect the rejectable ultrasonic indication was that for a period of time, around October 1977, through December 1977, the ultrasonic inspection was performed on the pipe in the as heat treated condition (Black) instead of the pickled (Cleaned) condition; however, a comparison of the ultrasonic attenuation of the two (2) conditions did not reveal a discernable difference.
- g. A review of Peabody Testing Ultrasonic Inspection Reports indicated approximately twenty-six percent (26%) reject rate of piping previously inspected and accepted by Ultra-Labs, Incorporated with no reportable ultrasonic indications as outlined in UL-4, Supplement 58.
- h. After review of the records presented and interviews with cognizant personnel, it is concluded that the Ultrasonic inspection technique used to inspect the weld area of SA-312 pipe, welded without filler metal, did not detect rejectable and reportable ultrasonic indications in piping inspected prior to October, 1978.

The procedure, Control Specification UL-4, Supplement 58, that was used, did meet the basic requirements of NC-2552 in that the procedure defines the reference specimen or the calibration standard, frequency of calibration, acceptance criteria, records, and personnel requirements but standard industrial inspection practices would warrant that the statements outlined in paragraph a. through e., above, should be included in the procedure for consistent and reproducible inspection results.

- i. It is the inspectors' consensus the reason the inspection technique that was used failed to detect rejectable ultrasonic indications was that the intensity of the ultrasonic energy transmitted into the reference calibration standard was greater than the ultrasonic energy transmitted into the test specimen's area of interest (weld area), and could be the results of one or any combination of the following conditions:
 - (a) The inspection of the area of interest was made using a longer sound beam travel path than the sound beam travel path used for calibration.
 - (b) The irregular surface of the scanning area did not permit complete transfer of the ultrasonic energy. As compared to smooth contoured surface of the reference calibration standard.
 - (c) The couplant used (glycerin) did not maintain the required coating, due to the viscosity, to completely transmit the energy from the transducer to the material under test because of run off as a result of the curved inspection surface.
 - (d) The improper contour of the transducer shoe to permit a consistent transfer of ultrasonic energy into the test specimen.