

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 50-456
License No.: NPF-72

Report No: 50-456/98011(DRS)

Licensee: Commonwealth Edison Company

Facility: Braidwood Generating Station, Unit 1

Location: RR #1, Box 84
Braceville, IL 60407

Dates: July 7-9, 15-16, August 5-6, 10-13, 26-28, 1998

Inspector: J. Schapker, Reactor Engineer

Approved by: J. Gavula, Chief, Engineering Specialists Branch 1
Division of Reactor Safety

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EXECUTIVE SUMMARY

Braidwood Generating Station, Unit 1
NRC Inspection Report 50-456/98011 (DRS)

This inspection included an announced review of the steam generator replacement program. Specifically, the inspection focused on the welding of steam generator feedwater piping, and preparation activities for replacing the steam generators.

SG Replacement Preparation

- Pre-service eddy current examination of the steam generator tubing was accomplished with conservative procedures, assuring a good baseline inspection data reference for the future inservice inspection examinations. (Section M1.1)
- Welding and nondestructive examination performance for the steam generator feedwater piping surpassed the applicable procedures and ASME Code requirements. Welding quality demonstrated good workmanship. (Section M1.2)
- Changes to tendon tools and fixtures enhanced the tendon removal process. Tendon removal was effectively performed using lessons learned from the Byron steam generator replacement tendon activities. (Section M1.3)
- The pre-service program, procedures and documentation were conducted and complied with the ASME Code and Technical Specification requirements. The steam generator tubing pre-service inspection program and procedures were conservative providing a baseline to track any degradation in the smallest of anomalies. (Section M3.1)
- The welder qualification program was well planned and implemented. Management and Quality Assurance oversight of the welder qualification process demonstrated a good safety perspective. (Section M5.1)

Report Details

II. Maintenance

M1 Conduct of Maintenance

M1.1 Steam Generator (SG) Tubing Inspection

a. Inspection Scope (50001, 73753)

The inspector observed the onsite eddy current examination of SG number four to assure there was no damage to the tubing during shipping. A review of the eddy current data performed by the manufacturer and approved by the licensee was made at the licensee's corporate headquarters. This was the pre-service tubing inspection. The inspection included a review of the applicable procedures and documentation associated with the work, discussions with the eddy current examination inspectors, and a review of their qualification certifications.

b. Observations and Findings

The inspector's review of the pre-service eddy current (ET) examination program for the SG tubing found the inspection was performed using state-of-the-art equipment and conservative procedures, 100% of the SG tubes were examined with a bobbin coil and a 20% sample of conservatively selected tube sections were examined using the plus point coil. The inspector's review of the ET examination data (recorded on optical disc), ET data analysis guidelines, analyst certifications, acquisition procedures and data documentation confirmed compliance to ASME Code and Technical Specification requirements. Eddy current examination inspectors were certified in accordance with SNT-TC-1A requirements. Procedures and analyst guidelines emulated the Electric Power Research Institute steam generator inspection guidelines. No defective tubes were detected, and no evidence of damage to the tubes due to shipping was identified with the supplemental SG tubing examination performed on the site.

c. Conclusion

The pre-service eddy current examination program was found to be conservative assuring a good baseline reference for future inservice inspection examinations. The overall quality of the SG tubes appeared to be very good with low noise level and few manufacturing anomalies.

M1.2 Steam Generator Preparation

a. Inspection Scope (50001)

The inspector observed the preparation of the steam generators for installation, which included welding of portions of the feedwater piping to the SG's feedwater nozzle. Other inspection activities were the observation of weld preparation machining, fit-ups prior to

welding, and nondestructive examinations (NDE) of completed welds. The SGs were visually inspected for damage or anomalies.

b. Observations and Findings

Welding activities were observed for SG nozzles to feedwater (FW) pipe elbows, weld numbers FW-5, FW-7, and FW elbow to pipe, weld number FW-15. The inspector observed welding in progress, and verified that welding consumables were as required by applicable weld procedure specification (WPS), that weld essential variables complied with WPS requirements, and that welders were qualified to perform the applicable welds per the qualified welder's list. Welders' performance appeared to demonstrate good craftsmanship. The inspector's visual examination of root pass welds, from the inside and outside of the piping, confirmed excellent workmanship. Subsequent NDE verified the quality of the welds was very good.

The inspector observed the ultrasonic examination (UT) of weld numbers FW-5 and FW-7, and verified that the examination conformed to procedure UT NDT C-72, Revision 0. Weld surface preparation for these UTs was very good. Radiographs of the following welds were reviewed and found to be acceptable, further evidence of good quality welds. Only minor weld anomalies were identified, and only the initial weld for FW-1 required any repair. Radiography and UT performance surpassed the applicable procedures and ASME Code requirements. The NDE data evaluation was considered timely and accurate.

Radiographs Reviewed

RT NUMBER	WELD NUMBER	PIPE DIAMETER	SYSTEM
RT-98-010	FW-3	6"	Recirculation
RT-98-017	FW-5	3"	"
RT-98-019	FW-7	3"	"
RT-98-020	FW-9	3"	"
RT-98-018	FW-11	3"	"
RT-98-042	FW-1 R1	16"	Feedwater
RT-98-043	FW-3	16"	"
RT-98-045	FW-5	16"	"

No shipping damage to the SGs was identified during the visual examination of exposed surfaces. However, on SG-C, the NRC inspector noted a cavity in the weld surface on the water level nozzle number six. The licensee informed the inspector that this cavity was caused by the removal of a liquid penetrant indication, performed by the fabrication contractor, Babcock & Wilcox International (BWI), and accepted per BWI nonconformance report (NCR) 16910, prior to shipment. The inspector requested a copy of the referenced NCR, to verify the method of disposition, and compliance to the ASME Code requirements. Review of the NCR disclosed the disposition to be "accept as is" based on structural analysis performed by BWI. The calculation performed and documented in NCR 16910 referenced two additional BWI calculations which were necessary to complete the review. These calculations were requested, and acquired by

the licensee for NRC review. The calculations were received just prior to the exit, and will require additional review prior to determining the adequacy of the analysis. This is identified as an inspector follow up item (IFI) 50-456/90011-01(DRS).

c. Conclusion

Welding and NDE performance surpassed the applicable procedures and ASME Code requirements. Welding quality demonstrated good workmanship.

M1.3 Tendon Removal Prior to Shutdown

a. Inspection Scope (50001)

During reinstallation of horizontal tendons for the Byron SG replacement, the licensee encountered difficulty, which required extensive rework of the containment. To assure that the tendon work at Braidwood would not encounter the same problems, the licensee elected to remove two horizontal tendons prior to the start of the SG replacement outage to evaluate new tooling and procedures. The inspector observed mock up training for tendon work, the removal of one horizontal tendon, and visual inspection of the tendon gallery after tendon removal.

b. Observations and Findings

The licensee performed a safety evaluation in accordance with 10 CFR 50.59 to verify that the structural integrity of the containment would not be jeopardized by the removal of two adjacent tendons. The NRC staff reviewed portions of the licensee's safety evaluation and associated engineering calculations and confirmed that the removal of two adjacent horizontal tendons would not jeopardize the structural integrity of the containment. The horizontal tendon removal was accomplished with ease. The licensee inspected the tendon galleries by using a remote video camera traversing the gallery, and did not identify any damaged tendon sheathing.

c. Conclusions

Changes to tendon tools and fixtures enhanced the tendon removal process. Tendon removal was effectively performed using lessons learned from the Byron SG replacement tendon activities.

M3 Maintenance Procedures and Documentation

M3.1 Procedure and Documentation Review

a. Inspection Scope (50001,73052)

The inspector reviewed and evaluated the pre-service program for compliance with ASME Code and Technical Specification requirements, reviewed welder and NDE

personnel certifications of qualification, and reviewed procedures for compliance to Code and applicable Standard requirements.

b. Observations and Findings

The inspectors' review of the pre-service inspection program and procedures, Bechtel Special Processes manual, and documentation of inspections, confirmed compliance to the ASME Code and Technical Specification requirements. Pre-service examinations were performed on all welds in accordance with ASME Code, Section XI requirements. Examinations were performed in accordance with procedures which comply with ASME Section V requirements. Steam generator tubing pre-service examination was documented to identify all anomalies for tracking in future inservice inspection examinations and recorded on digital optical disks. Documentation of welding and NDE activities, performed on the SGs prior to installation, was performed as required by approved procedures. Welding and NDE personnel qualifications were reviewed and found to be documented as required by applicable Codes and Standards.

c. Conclusions

The pre-service program, procedures and documentation were conducted and complied with the ASME Code and Technical Specification requirements. The SG tubing pre-service inspection program and procedures were conservative providing a baseline to track any degradation in the smallest of anomalies.

M5 Maintenance Staff Training and Qualification

M5.1 Observation of Welder Qualifications

a. Inspection Scope (50001)

In-process training and qualification of welders for the replacement SG work were observed by the NRC inspector. Observation of welder qualification included manual and automatic welding processes, with procedure review and material control. The inspector observed in-process welding, and the testing of welder qualification coupons using bend test and radiography.

b. Observations and Findings

The welder qualification process complied with the applicable procedures. Licensee and contractor management oversight of the welder qualification program was particularly evident. Quality Assurance oversight was also observed performing surveillance of the welder qualifications. Destructive testing and nondestructive examination of welders' coupons were performed and evaluated in accordance with the applicable procedures and ASME Code requirements.

c. Conclusions

The welder qualification program was well planned and implemented. Management and Quality Assurance oversight of the welder qualification process demonstrated a good safety perspective.

E8 Miscellaneous Engineering Issues

During reviews of engineering activities for the Byron SG replacement, the NRC noted that the SG feedwater nozzle would not be accessible for the required ASME Code coverage for Section XI inservice inspection, due to the restraint installation on the SG.

The inspector reviewed two proposed examination plans to inspect the feedwater nozzle with the restraint in place. The two methods proposed were the use of a phased array UT method and a manual UT using various transducers with different angles. Both methods appeared to acquire the inspection volume required by the ASME Code. The licensee has not committed to which method will be used at this time. The inspector informed the licensee that the NRC would evaluate the method of examination and the adequacy of the procedure, when the licensee selected the process to be used, and demonstrated the adequacy of the inspection coverage. This is an inspection follow up item 50-456/98011-02(DRS).

V. Management Meetings

The inspector presented the inspection results to the licensee management at the conclusion of the inspection on August 28, 1998. The licensee acknowledged the findings presented and did not identify any of the report input discussed as proprietary.

PARTIAL LIST OF PERSONS CONTACTED

M. Cassidy, NRC Coordinator
G. Caul, SGRP Nuclear Oversight Inspector
J. Enalewajka, Assessment Manager
J. Groth, SGR Site Manager
C. Herzog, Executive Assistant
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M. Sears, SG, ISI Engineer
D. Shamblin, SGR Project Manager
T. Simpkin, Regulatory Assurance Manager
H. Smith, Corporate ISI SG Engineer
R. Wegner, Operations Manager
D. Wheeler, SGR Construction Leader
C. Zavada, SGRP Nuclear Oversight Leader

INSPECTION PROCEDURES USED

IP50001	Steam Generator Replacement
IP37753	Inservice Inspection Observation
IP37755	Inservice Inspection Review of Data
IP37051	Inservice Inspection Procedure Review

ITEMS OPEN, CLOSED, AND DISCUSSED

Opened

IFI 456/98011-01	Review of Babcock & Wilcox calculations to determine adequacy of the weld with the cavity in the water level nozzle weld #117.
IFI 456/98011-02	Accessibility of feedwater nozzle weld for ISI with SG restraint installed.

LIST OF ACRONYMS USED

ASME	American Society of Mechanical Engineers
BWI	Babcock and Wilcox International
ET	Eddy Current
IFI	Inspection Follow-up Item
IP	Inspection Procedure
ISI	Inservice Inspection
NCR	Nonconformance Report
NDE	Nondestructive Examination
SG	Steam Generator
UT	Ultrasonic Examination
WPS	Weld Procedure Specification

PARTIAL LIST OF DOCUMENTS REVIEWED

WQ-1 revision 11	Bechtel Welding Qualification Performance Specification (ASME Section XI)
RT-ASMEIII revision 1	Bechtel Nondestructive Examination Standard Radiograph Examination
GWS-1 revision 4	Bechtel General Welding Standard
WD-1 revision 3	Bechtel Welding Standard Documentation of Welds
PT (SR) - ASME III/XI	Bechtel Nondestructive Examination Standard Liquid Penetrant Examination
SPS-1 revision 5	Bechtel Special Processes Standard
WQ-2 revision 5	Bechtel Welding Performance Qualification Specification (D1.1)
WQ-7 revision 1	Bechtel Welding Performance Qualification Specification (D1.4)