

U. S. ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE

REGION III

CO Inspection Report No. 999-042/72-01

Subject: Babcock & Wilcox Company
Barberton, Ohio

Steam Generators for:

Toledo Edison's Davis-Besse
Facility (50-346)

Duke Power Company's Oconee 2
Facility (50-270)

Sacramento Municipal Utility District's
Rancho Seco Facility (50-312)

License No.: N/A
Priority: N/A
Category: Vendor

Type of Licensee: N/A

Type of Inspection: Special, Announced

Dates of Inspection: January 4 - 6, 1972

Dates of Previous Inspection: N/A

Principal Inspector: *R. E. Oller*
R. E. Oller

3/2/72
(Date)

Accompanying Inspector: *R. E. Oller for*
R. L. Brown

3/2/72
(Date)

Other Accompanying Personnel: None

Reviewed By: *W. E. Vetter*
W. E. Vetter, Senior Reactor Inspector

3-2-72
(Date)

Proprietary Information: None

NOTE: See Section III for R. L. Brown's contribution to the inspection covering the Oconee Unit 2 and the Rancho Seco steam generators.

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SECTION I

Enforcement Action

- A. Noncompliance: None
- B. Nonconformance: See Page 5 of the attachment to this report.
- C. Safety Items: None

Licensee Action on Previously Identified Enforcement Matters: N/A

Unresolved Items: None

Status of Previously Reported Unresolved Items: N/A

Design Changes: N/A

Unusual Occurrences: N/A

Persons Contacted

Babcock & Wilcox Company (B&W) Barberton, Ohio

J. C. Quinn, QA Manager - Engineering and Technology Group (E&TG)
W. C. Buskey, Senior QA Engineer - E&TG
J. Lang, Section QC Manager - E&TG
E. J. Donaleski, Manager - Component Management Unit, Nuclear Power
Generation Department (NPGD)
J. S. Gershom, Section Manager - Nuclear Equipment Quality Control
(NEQC) Engineering
E. Snicer, QC Engineer - NEQC Engineering
D. W. Goddard, Associate Metallurgist - NEQC Engineering
H. L. Helmbrecht, Manager, Manufacturing Materials Technology (MMT)

Management Interview

The same personnel noted in "Persons Contacted" Section of this report were present during the management interview.

During the management interview, Mr. Oller discussed the details of his inspection activities relating to the documentation for the secondary side shell plate, used in the two steam generators for the Davis-Besse facility, and the repair of the Rancho Seco steam generator. Mr. Brown separately discussed his portion of the inspection activities, and the results of this discussion appear in Section III of this report.

Management interviewees were informed that documentation relating to the transfer of plate material for the Midland Unit No. 1, steam generators No. 1 and No. 2, to the Davis-Besse steam generators, appeared to be complete and that the inspector had no further questions. With respect to the quality of the plate, the inspector commented on the fact that there apparently had been considerable confusion, or misunderstanding, concerning the heat treatment requirements of the purchase specifications and ultimate certification of the plate to code requirements. In any event, the inspector said, records reviewed during the inspection indicate that both the 4-7/16" thick and the 7" thick plate have been properly certified to SA-516, Grade 70. (Paragraphs 2 and 3)

The inspector said that a review of B&W process records appeared to establish that, contrary to previous information, radiography was, in fact, performed following complete rewelding of the cracked circle weld between the lower head and the tube sheet of the Rancho Seco No. 1 steam generator, and ultrasonic inspection only was performed on repairs to the weld end preparation of both the tube sheet and lower head prior to joining the two sections with the main circle weld. This, the inspector said, appeared to be satisfactory as opposed to earlier information indicating that the repaired circle weld had been subject to ultrasonic testing only. (Paragraph 4)

SECTION II

Additional Subjects Inspected, Not Identified in Section I, Where No Deficiencies or Unresolved Items Were Found

1. General

In response to a Compliance Headquarters' letter, dated December 9, 1971, an inspection at the B&W Barberton, Ohio plant, of documentation related to the manufacture of steam generators for the Oconee 2, Rancho Seco, and Davis-Besse nuclear facilities was performed by R. E. Oller, Region III, and R. L. Brown, Region I. Mr. Brown examined records for the Oconee 2 and Rancho Seco steam generators. Mr. Oller examined records for the two steam generators for Davis-Besse. In addition, the incident of the lower head circle weld repair was reviewed by both Messrs. Oller and Brown.

Details of Subjects Discussed in Section I

2. Transfer of Steam Generator Secondary Shells From the Midlands to the Davis-Besse Project

The details of an examination of material documentation for the Davis-Besse steam generators are as follows:

The inspector was told by Mr. Buskey that, early in 1971, B&W determined that some shell plates, 4-7/16" thick, in the secondary side of the two steam generators for the Davis-Besse project, lacked evidence of having been normalized, quenched, and tempered either by the supplier (Lukens Steel Company) or B&W due to an error in a purchase order revision. This error was found after the plates were cold formed and welded into courses. An attempt was then made to normalize, quench, and temper the courses, but severe distortion was experienced and the subject courses were put in quarantine for disposition. B&W then secured concurrence with both Toledo Edison Company and Consumers Power Company to exchange secondary shell courses of the two steam generators with those previously fabricated for the Midland Unit 1 facility. The material for the Midland courses was later considered to have been satisfactorily heat treated based on a letter dated June 18, 1971, from Lukens which B&W used as a basis for certifying that the material meet the heat treatment requirements of Paragraph 4 of SA-516. A further basis for certifying the Midland courses was physical property and Charpy-V impact tests performed by B&W. In addition to the 4-1/16" Midland plates, 7" thick plates were also received for the Midland steam generators and certified on the same basis as were the 4-1/16" thick plates. However, the 7" thick plates were subsequently properly heat treated by B&W (normalized, quenched, and tempered).

A review of all available documentation for the Davis-Besse steam generators (previously assigned to the Midland project) revealed the material is in accordance with Material Specification A-516, Paragraph 4, Grade 70, and ASME Code Section III, Article 3. The only difference between the 4-1/16" thick and the 7" thick plates is that the former was qualified on the basis of a Charpy-V test temperature of 70°F, while the later was qualified with a Charpy-V test temperature of 40°F. Documentation reviewed to support the foregoing statements included original purchase orders, change orders (revisions), Lukens' material test reports (chemistry and UT), a Lukens' letter dated June 18, 1971, (a copy attached to each MTR for the 4-7/16" plate), B&W CTR's for both 4-7/16" and 7" thick plates, and letters of authorization to interchange secondary side shell courses from Midland Unit 1, Nos. 1 and 2 steam generators to Davis-Besse Nos. 1 and 2 steam generators.

In response to questioning, Mr. Goddard told the inspector that the No. 1 steam generator was officially transferred to the 620-0014-55 contract (Davis-Besse) but the No. 2 steam generator, including the records, were not yet officially transferred.

The inspector visually examined both of the steam generator secondary sides in the shop and established that the No. 1 steam generator was marked 620-0014-55-11. The No. 2 steam generator still contained the 620-0012-55-1 designation.

3. Plate Material Test Reports

The following tabulations contain data from the documents examined by the inspector for the steam generator secondary sides designated for the Davis-Besse facility:

a. Material Test Reports (MTR's) and Certified Test Reports (CTR's)

(1) No. 1 Steam Generator (Officially Changed to Contract 620-0055-11)

Shell Course No.	Serial No.	Lukens' Heat No.	Plate Thickness	Charpy-V Test Temperature	Basis of Certification to SA-516, Grade 70
1.	1-212-1	C-5947-2 C-5947-3	7" 7"	40°F 40°F	Lukens' chemical analysis, B&W heat treatment and physical and Charpy-V tests.

Shell Course No.	Serial No.	Lukens' Heat No.	Plate Thickness	Charpy-V Test Temperature	Basis of Certification to SA-516, Grade 70
2.	2-212-3	C-5914-3	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
3.	3-212-1	C-5946-1	7"	40°F	Lukens' chemical analysis; B&W heat treatment and physical and Charpy-V tests.
4.	2-212-4	C-5924-3	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
5.	5-212-1	C-5952-2	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
6.	4-212-2	C-5948-2	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
7.	6-212-2	C-5940-2 C-5947-3	7" 7"	40°F 40°F	Lukens' chemical analysis; B&W heat treatment and physical and Charpy-V tests.

(2) No. 2 Steam Generator (Not Officially Changed to Contract 620-0055-12)

Shell Course No.	Serial No.	Lukens' Heat No.	Plate Thickness	Charpy-V Test Temperature	Basis of Certification to SA-516, Grade 70
1.	1-212-2	C-5965-1 C-5965-2	7" 7"	40°F 40°F	Lukens' chemical analysis; B&W heat treatment and physical and Charpy-V tests.
2.	2-212-2	A-5140-2	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
3.	3-212-2	C-5946-2 C-5924-1	7" 7"	40°F 40°F	Lukens' chemical analysis; B&W heat treatment and physical Charpy-V tests.
4.	2-212-1	C-5946-3	4-7/16"	40°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.
5.	5-206-1	C-3693*	4-7/16"	40°F	Lukens' CTR dated January 12, 1968; complete for all SA-516, Grade 70, and ASME Section III, Class A requirements.
6.	5-212-2	C-5948-1	4-7/16"	70°F	Lukens' chemical analysis; Lukens' letter dated June 18, 1971; B&W physical and Charpy-V tests.

*Plate from 3MI-2 S.G.

Shell Course No.	Serial No.	Lukens' Heat No.	Plate Thickness	Charpy-V Test Temperature	Basis of Certification to SA-516, Grade 70
7.	6-212-2	C-5965-1 C-5965-2	7" 7"	40°F 40°F	Lukens' chemical analysis; B&W heat treatment and physical and Charpy-V tests.

(3) Authorization Letters For Transfer of Steam Generators' Secondary Shells From Midland Contract 620-0012-55-1 and Contract 620-0012-55-2 to Davis-Besse Contracts 620-0012-55-11 and 620-0012-55-12

(a) B&W letter dated July 23, 1971, from Nuclear Power Generating Department (NPGD) - Lynchburg, to the Vice President of Nuclear Equipment Department (NED) - Barberton.

(b) B&W letter dated December 29, 1971, from NPGD-QA, Barberton, to NPGD components management, Barberton.

(c) B&W letter dated January 3, 1972, from NED-QC engineering to NPGD component management.

(4) B&W Equipment Specification CS-3-33/0570 dated May 8, 1970, for Once-Through Steam Generators

(5) B&W Purchase Orders and Change Orders to Lukens' Steel Company

(a) PO 310591 AC dated November 12, 1968, and Change Order No. 1, which substituted B&W Specification W SPE-4-102, Revision 1, for W SPE-4-102, Revision 0. Revision 0 originally designated plates in thicknesses up to 4½", inclusive, to be supplied in a hot-rolled condition. Revision 1 designated the plates as:

Type 1 - Quenched and tempered for cold forming.

Type 2 - Quenched and tempered for hot forming.

Type 3 - "As rolled" in conformance with SA-516 and will conform to tensile properties after hot forming and quenching and tempering.

The inspector was told by Mr. Buskey that all of the plates were ordered to Type 3.

- (b) Other purchase orders, similar to 310591 AC and the change orders containing the B&W Specification W SPE-4-102, Revision 1, were examined by the inspector. The one exception to the Revision 1 requirements was for plate heat No. C-3693, originally destined for use in a Three Mile Island 2 steam generator which was ordered in a full heat treated condition with all tests performed by Lukens.

4. Rancho Seco No. 1 Steam Generator Weld Repairs

The inspector reviewed the B&W process records related to complete rewelding of the Rancho Seco No. 1 steam generator main circle weld between the lower tube sheet and the lower head. The records established that contrary to previous information that only ultrasonic inspection was used following repair of the main circle weld, 100% radiography was, in fact, used. The "ultrasonic testing only" information, previously obtained, applied correctly to the repair of the weld end preparations of both the tube sheet and the lower head, but the main weld, after repair completion, was radiographed and accepted on the basis of radiographic examination insofar as the B&W process records are concerned.

SECTION III

Prepared by R. L. Brown, CO:1

Enforcement Action

- A. Oconee 2, steam generator 2 material does not conform with the licensee's commitment in Table 4-9, Materials of Construction of the Final Safety Analysis Report. (Paragraph 2)
- B. Rancho Seco, steam generator 2 material does not conform with the licensee's commitment in Table 4-10, Materials of Construction in the Final Safety Analysis Report. (Paragraph 3)

Licensee Action on Previously Identified Enforcement Action: None

Unresolved Items: None

Status of Previously Reported Unresolved Items: None

Design Changes: None

Unusual Occurrences: None

Persons Contacted

Mr. W. C. Buskey, B&W Senior QC Engineer, Engineering and Technology
Mr. E. Snicer, B&W QC Engineer
Mr. H. L. Helmbrecht, B&W Manager, Manufacturing Materials Technology

Management Interview

At the conclusion of the inspection, the inspection results were discussed with the following B&W representatives:

Mr. J. C. Quinn, Manager - Quality Assurance, Engineer and
Technology (E&T)
Mr. J. (NMI) Lang, Section Manager, QC Engineering (E&T)
Mr. W. C. Buskey, Senior QC Engineer (E&T)
Mr. E. J. Domaleski, Manager, Component Management Unit NPGD
Mr. J. S. Gershom, Section Manager, NE QC Engineering
Mr. D. W. Goddard, Associate Metallurgist, NE QC Engineering
Mr. E. Snicer, QC Engineer, NE QC Engineering

The following subject was discussed by the inspector:

The quality control documents should be reviewed for accuracy, completeness, and acceptability by a knowledgeable person. In fact, the inspector noted material test reports that certify the material as SA 516, Grade 70, and the tensile strength values shown are below the specification minimum requirements of 70,000 psi; however, these nonconformances were reported by a contract variation notice to the B&W, Lynchburg engineering department and accepted "to use as is", as SA 516, Grade 65 material. The reports should be revised to show the correct grade of material and a cross reference to the contract variation notice would indicate B&W awareness of the nonconformance, and the material status could be readily determined.

Additional Subjects Inspected Where No Deficiencies or Unresolved Items Were Found

1. Steam Generator Shell Plates for Oconee Unit 2, SG No. 2, Rancho Seco, SG Nos. 1 and 2
 - a. Audit of the equipment specification to determine:
 - (1) Material specifications.
 - (2) Heat treatment requirements.
 - (3) Additional testing requirements.
 - b. Audit of purchasing documents (purchase order, purchase order changes, and specifications) to assure conformance with the specification requirements.
 - c. Inspection of manufacturing records to assure presence of:
 - (1) Material identification (Mark No. and Heat No.).
 - (2) Material certifications including Charpy-V Notch test results.
 - (3) Heat treatment certifications including shop traveler.
 - d. Inspection of deviation reports to determine:
 - (1) Type of deviation.
 - (2) Recommended solution.
 - (3) Acceptance of recommended solution.

- (4) Cause of deviation.
- (5) Corrective action to be taken to prevent a recurrence of similar deviations.

Details of Subjects Discussed in Section I

2. Oconee 2 Steam Generator No. 2 Materials Do Not Conform With the Licensee's Commitment in Table 4-9 "Materials of Construction" of the Final Safety Analysis Report

Table 4-9, "Materials of Construction", of the FSAR, specifies that the steam generator pressure plate be in accordance with either ASME SA 212, Grade B, or SA 533, Grade B, Code Case 1339 (SA 212, Grade B, has been superceded by SA 516, Grade 70).

Contrary to the above, this steam generator contains two SA 516 plates (Heat Nos. C-2_63 and B6606-1) of which the tensile properties are less than the 70,000 psi minimum requirements of SA 516, Grade 70. These valves are Heat No. C2363-1 - 68000 psi and Heat No. B6606-1 - 69000 and 69100 psi.

These nonconformances were reported to and approved by the engineering department of the nuclear steam supplier, but the inspector could not determine if the deficiency has been reported to the licensee.

3. Rancho Seco Steam Generator No. 2 Materials Do Not Conform With the Licensee's Commitment in Table 4-10, "Materials of Construction" of the Final Safety Analysis Report

Table 4-10, "Materials of Construction", of the FSAR, specifies that the steam generator pressure plate be in accordance with either ASME SA 516, Grade 70, or SA 533, Grade B, Class I.

Contrary to the above, this steam generator contains one SA 516 plate (Heat No. C5952-1) in which the yield point is lower than 38000 psi minimum requirements of SA 516, Grade 70. A value of 36,750 psi was reported, also this plate was not heat treated to produce grain refinement as required by SA 516. Per instructions from CO:HQ, these nonconformances will be transmitted to the licensee by CO:HQ.

DIVISION OF COMPLIANCE
MONTHLY REPORT FOR FEBRUARY 1972

Babcock & Wilcox Company, Barberton, Ohio - A vendor inspection was performed at the Babcock & Wilcox (B&W) plant in Barberton, Ohio, on January 4-6. The inspection consisted of an examination of documentation relating to the steam generator secondary side shell plates for the Davis-Besse, Oconee 2, and Rancho Seco facilities, and a record review of the rewelding of a major circle weld on the No. 1 steam generator for Rancho Seco. The rewelding was required as a result of cracking in the original weld.

Examination of the documentation disclosed that the reallocation of secondary side plate material from the Midland 1 steam generators to the Davis-Besse units was properly documented; that B&W certifications relating to non-normalized material used in the Davis-Besse steam generators accurately described the as-fabricated state of the material; and that the remainder of the material used in the secondary side of the above units was properly heat treated and met the specification requirements.

The rewelding of the cracked circle weld between the lower head and tube sheet of the Rancho Seco No. 1 steam generator was found to be in accordance with ASME Code requirements.

The record review further disclosed the use of a single non-normalized plate in the Rancho Seco Unit 2 steam generator (previously reported) which also failed to meet the SA-516, Grade 70 requirement on yield strength. The plate was recalled to Grade 65 and accepted on that basis by B&W and the licensee.

A possible deviation in tensile properties was also noted in the Oconee 2 steam generator material. This matter is currently under review.

The acceptability of non-normalized material in the steam generators of Davis-Besse and Rancho Seco is currently under review by DRL.

50-270
50-312
50-346

DIVISION OF COMPLIANCE
MONTHLY REPORT FOR JANUARY 1972

Babcock & Wilcox Company, Barberton, Ohio - A vendor inspection was performed at the Babcock & Wilcox plant located in Barberton, Ohio, on January 4-6 to examine documentation of secondary side shell plates for the Davis-Besse, Oconee 2, and Rancho Seco

steam generators. The inspection verified that the use of unnormalized plate material was limited to three steam generators previously identified. No other deficiencies were observed.

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✓ 56-346, 312, 270