U. S. ATOMIC ENERGY COMMISSION
REGION II
DIVISION OF COMPLIANCE

Report of Inspection
CO Report No. 50-269/70-9

Licensee: Duke Power Company
Oconee 1
License No. CPPR-33
Category B

Date of Inspection: September 1-4, 1970

Date of Previous Inspection: August 3-7, 1970

Inspected By: C. E. Murphy, Reactor Inspector (In Charge) — 9/25/70 Date

W. D. Kelley, Reactor Inspector (Construction) — 9/25/70 Date

Reviewed By: W. C. Seidle, Senior Reactor Inspector — 9/30/70 Date

Note: The sections of this report relating to Table A Requirements and the fire in the primary system piping were prepared in the main by W. D. Kelley.

Proprietary Information: None

SCOPE

A routine, announced inspection was made of the 2568 Mwt pressurized water reactor under construction near Seneca, South Carolina, known as Oconee Station No. 1. Purposes of the inspection: (1) to determine the construction status and significant changes to schedule dates; (2) to review the problem of primary piping clad fissures; (3) to review the information relating to the fire in the primary loop piping; (4) to review records relating to mechanical equipment and piping systems; and (5) to review test procedures.

SUMMARY

Safety Items - None

Nonconformance Items - None

Unusual Occurrences - None

Status of Previously Reported Problems -

1. The licensee now plans to load test the polar crane. (See Management Interview.)

2. A review of the records relating to the Table A Requirements indicates that the licensee is properly auditing these records. (See Section L.)

3. The licensee is continuing his review of the main steam pipe hanger design. (See Management Interview.)

Other Significant Items -

1. During the process of modifying the primary loop piping for the Westinghouse pumps, B&W found evidence of microfissures in the stainless steel cladding. (See Section F.)

2. A fire occurred in a section of the primary loop piping which was being cleaned. Although the licensee has not completed his investigation, available information indicates that the pipe was not damaged. (See Management Interview and Section M.)

3. During the baseline inspection of the steam generator skirt, defects were found in the adapter section which joins the skirt to the vessel head. (See Section K.)

Outstanding Items - See Exhibit A for current status of outstanding items.

Management Interview - The management interview was attended by Beam, Smith, Hampton, Curtis, and Freeze.

1. The inspector advised Curtis that in reviewing the records relating to the high pressure injection pumps, he had noted that one pump curve had been mislabeled and that some data sheets were barely legible. In addition, one pump had been repaired subsequent to its performance test; and, although the records indicated that a second test had been run, documentation of this test and the final cleaning of the pump was not in the records. Curtis advised the inspector that the cleaning records and the correct performance curve for the repaired pump were available in Charlotte and that this information would be inserted in the records. He also stated that the mislabeled pump curve would be corrected and that new data sheets were being supplied by B&W to replace those that were

barely legible. The inspector advised the licensee that these items would be reviewed during the next inspection. (See Section G.)

2. The inspector stated that in reviewing the records relating to both the high pressure injection pumps and the low pressure injection pumps, the mill certification sheets referenced an Ingersoll-Rand (I-R) specification for the metallurgy requirements. Although I-R had certified that the materials met their requirements, there was no way in which the inspector could verify this. Curtis stated that he would have this information placed in the files and it would be available on the next inspection. (See Section G.)

3. The status of the B&W review of the fissures in the primary coolant piping was discussed. Beam stated that it was likely that the defective pipe would be replaced. (See Section F.)

4. In response to the inspector's question, Beam stated that the licensee expected to complete his review of the main steam piping hanger design and that the hangers would be redesigned if the review indicated the need for stronger hangers. The inspector advised Beam that he would review this item on the next inspection.

5. Beam advised the inspectors that the licensee was evaluating the significance of the indications that had been noted in the steam generator skirt during the baseline tests. He stated that the results would be given the inspector upon completion of the evaluation. (See Section K.)

6. The inspector asked if further information was available relative to the control rod drives. (During the previous inspection, the inspector had witnessed an examination of some of the mechanisms; of forty mechanisms examined, eight had been found to be incorrectly assembled and the guide bushings of three others were out of tolerance.) [1] Smith stated that the remaining thirty mechanisms had been examined but that he had not as yet been advised of the results. The inspector said that he would review this item on the next inspection.

7. The information available relative to the fire in the primary system piping was discussed. Beam stated that they planned to determine the amount of heat released during the fire and to conduct tests to further support their position that the piping had not been damaged.

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[1] CO Report No. 50-269/70-8.

The inspectors agreed that based upon presently available information, it did not appear that the pipe had been damaged. The inspectors stated that if the tests and heat release calculations tend to support this position, they would take no further action. Beam said that he would attempt to have this information available during the next inspection. (See Section M.)

8. In response to the inspector's question, Beam stated that the polar crane would be tested prior to the handling of critical components since the modifications to the crane included changes to the brake control circuit.

9. Wells had advised the inspector on the first day of the inspection that tendon grease had been found seeping through a construction joint at the construction access opening. He stated that the licensee had not as yet completed an evaluation. During the management interview, Beam told the inspector that the licensee was continuing to evaluate the significance of the tendon grease seeping through the construction joint. The inspector advised Beam that this would be a followup item on a future inspection.

10. The inspector advised Smith and Hampton that he had been unable to determine the basis for the times specified for flushing sections of piping nor for the maximum particle size permitted. Smith stated that they would be able to provide justification for these items during the next inspection. (See Section N.)

11. In response to the inspector's questions, Smith stated that the hydrotest procedures would contain a list of instrumentation that must be protected from hydrotest pressures. He also stated that deviations from procedures would receive proper review and approval prior to conducting the specific tests. (See Section N.)

12. The inspectors advised Beam and Curtis that a Compliance audit of the records relating to pipe and valve nondestructive testing indicated that the Table A requirements had been met. (See Section L.)

DETAILS

A. Persons Contacted

Duke Power Company (Duke)

J. C. Rogers - Project Engineer
D. B. Beam - Assistant Project Engineer
J. R. Wells - Principal Field Engineer

J. E. Smith - Plant Superintendent
J. W. Hampton - Assistant Plant Superintendent
J. M. Curtis - Quality Assurance Engineer
J. L. Oestertag - Mechanical Engineer
R. E. Blaisdell - Welding Engineer
D. L. Freeze - Office Engineer

Babcock and Wilcox Company (B&W)

W. Faasse - Field Supervisor
*W. W. Spangler - Assistant Project Manager
*W. C. Buskey - Manager of Quality Control, Mt. Vernon

*By telephone.

B. Administration and Organization

J. W. Beeson, Assistant Field Engineer, Civil, Duke Power Company, has resigned.

C. Quality Assurance

1. No changes have been made in the licensee's quality assurance program since the previous inspection.

2. Quality assurance items are discussed in the individual report sections.

D. Construction Progress

1. Turbine generator erection is on schedule and all major sections are in position and alignment is in progress.

2. Electrical work is continuing in the control room and installation of cables is in progress in the spreading room.

3. The auxiliary building structural work has been completed. The installation of the hot and cold laboratory walls is underway.

4. One Westinghouse pump volute is being installed.

5. The pressurizer has been set in position.

E. Construction Schedule

1. Erection of the turbine generator is expected to be complete by January 15, 1971.

2. Vessel internals are scheduled for installation during November 1970.

3. Core loading is now scheduled for early March 1971.

4. Installation of the Westinghouse coolant pumps is scheduled for completion in November 1971.

F. Primary Coolant Piping

The replacement of the Bingham primary coolant pumps with Westinghouse pumps necessitated the modification of the primary coolant piping. Four sections of pipe had been returned to the B&W Mt. Vernon shops for the installation of reducing sections. The licensee had advised Compliance by telephone on August 20, 1970, that fissures had been found in the cladding of one pipe section.[1] R. E. Oller, Region III, was at the vendor's facility at the time and submitted a report of his inspection to Region II (Exhibit B). The inspector received additional information during this inspection. The following report contains the information available at the present time.

The primary coolant pipe had been fabricated from A106, Grade C, seamless carbon steel pipe and had been clad with 18-8 stainless steel using a semiautomatic 6 wire submerged arc process. In order to control the final chemistry of the cladding, the flux was doped with chromium and nickel. Two flux types were used. The first type was designed to add 2% chromium and 1% nickel to the clad, and the second to add 4% chromium and 2% nickel. All of the pipe had been fabricated and clad in the B&W Barberton shops. The pipe had been fabricated in two sizes; 36-inch pipe is required for the line from the pressure vessel to the steam generators and 28-inch line is required from the steam generators to the four coolant pumps and from the pump discharges to the pressure vessel. Two of the sections of 28-inch pipe had been assembled at Barberton with elbows at one end for attachment to the steam generators and stainless steel safe ends at the other end for attachment to the coolant pump sections. The remaining sections had been sent to the Mt. Vernon shop to be similarly assembled.

Eight-foot-long sections had been cut from each of the pump suction assemblies and returned to Mt. Vernon for the attachment of transition pieces to match the Westinghouse pumps' 31-inch-diameter inlet. (See Exhibit B.) Two inches of safe end material were included on each of

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[1] Inquiry Memorandum dated August 21, 1970, from Region II (Seidle) to Compliance Headquarters (O'Reilly).

the pipe sections. Approximately 15 inches of each section were not required in the new arrangement and this excess pipe was removed from the end opposite the safe end. A weld preparation was machined onto the end from which the excess pipe had been removed. The Mt. Vernon shop procedure for machining the weld preparations required that the weld preparation and 1/2 inch of the adjacent interior cladding be given a liquid penetrant test. The penetrant test of one section, identified as a part of assembly SN B67, revealed numerous small indications in the cladding extending the full 360° around the pipe. A complete penetrant test of the interior cladding revealed two additional large areas containing indications. The carbon steel pipe contained no indications.

The cladding in the pipe was machined down 1/8 inch and was again penetrant tested. Nine small areas continued to exhibit indications. These areas were ground until no indications remained. The ground area sizes were as follows:

Depth (Inch)	Width (Inch)	Length (Inch)
1/16	1	1-3/8
1/16	1-3/8	1-1/2
1/16	3	1-3/4
*1/8	1-3/4	2-3/4
3/32	3/4	3
1/16	1-5/8	2-1/4
1/16	1-3/8	1-3/8
1/8	2	13
1/16	1-1/2	1-3/4

*This indication extended the depth of the cladding which is 1/4-inch thick.

The inspector was advised by Buskey that the fissuring was probably due to low delta ferrite content. B&W had made two sets of chemical analyses from four sets of samples. The results in percent were as follows:

	Carbon	Chromium	Nickel	Manganese	Silicon	Sulphur	Phosphorous
Analysis 1	0.106	17.19	8.44	1.44	0.61	0.016	0.011
Analysis 2	0.111	16.70	8.07	1.47	0.61	0.019	0.015
Acceptance Criteria	0.08 Max.	17.00 Min.	7.00				

Buskey advised that they had plotted Schaeffler diagrams from this data and had determined that the delta ferrite content was between 2.5% and 5%. He stated that it had been B&W's experience that a content less than 5% was prone to hot cracking. The tests indicated that the material was in the austenitic range rather than the brittle martensitic range. This was confirmed by making two guided bend tests of samples in accordance with ASME Section IX. Both samples passed these tests. Buskey felt that the high carbon content was caused by the samples being taken from the weld metal close to the carbon steel base metal at which point there would be a considerable amount of dilution. Buskey stated that B&W then sent an NDT technician to the site with a calibrated magnet gauge to make ferrite measurements of the remainder of the 28-inch piping. The technician measured ferrite of the pipe in each quadrant in six-inch intervals. The results of these tests are summarized below:

Pipe SN	Test Results
B-67, 0-24"	Less than 5%, mostly 2.5%
B-67, 24-60"	7.5%
B-67, 66-114"	10%
B-67, 120-206"	7.5% and 10%, mostly 7.5%
A-67	Mostly 7.5%
B-45 A	7.5 - 10%
B-45 B	5.0 - 7.5%
B-40 A	5.0 - 7.5%
B-40 B	5.0 - 7.5%
B-46 A	5.0 - 7.5%
B-46 B	5.0 - 10%, mostly 7.5% and greater
B-41 A	7.5 - 10%, mostly 10%
B-41 B	7.5 - 10%, mostly 10%
A-57	7.5 - 10%, mostly 7.5%
B-57	10 - 15%

*Measurements are from point of removal of eight-foot section down to first elbow.

Sample No.	Carbon	Chromium	Nickel
1	0.102	18.02	8.68
2	0.120	17.95	8.71
3	0.111	17.43	8.58
4	0.205	17.57	8.64

Buskey stated that the carbon contents are probably high because of contamination from the carbide burr. Two new samples are to be taken using a chipping hammer.

Metallographic samples that had been retained when the pipe was fabricated were removed from storage and analyzed. No real correlation could be obtained, however, and Buskey postulated that this was probably caused by the samples being taken from the surface of the stainless steel prior to machining.

A penetrant test was then made of the remainder of piece B-67. Indications were found for the full length of the piece. These indications were small and randomly spaced. The licensee has stated that he will penetrant test the remainder of the pipe including the 38-inch-diameter hot leg piping between the reactor vessel and the steam generator. He now plans to replace the defective section of pipe with a section from Unit 2 and will either repair any other defective areas or replace the pipe where they occur.[1]

Note: On September 22, 1970, the inspector received a telephone call from W. H. Owen, Mechanical Engineer, Duke Power Company. Owen stated that the licensee planned to repair the defective pipe and to use it for Unit 1.

The inspector asked Spangler and Buskey if the defective pipe had received a dye penetrant test prior to its shipment to the site. They stated that the tests had been performed, but it was later determined that the tests on this section had been performed prior to stress relieving but not after. In response to the inspector's question, Buskey stated that B&W felt that the fissures were caused by improper flux. At approximately the time that this pipe had been clad, they had become aware that some of the flux which they received had not been completely mixed. For this type operation, they use either of two types of flux as required. One type is designed to add 2% chromium and 1% nickel to the clad and the second adds 4% chromium and 2% nickel. B&W's practice had been to take one flux sample from a 200-pound lot for analysis. If the analysis proved good, the lot was accepted. After it was determined that some of the flux received was poorly mixed, B&W changed their procedure to take samples from each of three lots. If the analyses were correct, the three lots were then blended together to make one 600-pound lot. Buskey further stated that they had been unaware that any of the defective flux had been used.

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[1] Statement at ACRS Subcommittee meeting, September 10, 1970, W. S. Lee, VP Engineering, Duke Power Company.

G. High Pressure Injection Pump - Attachment L

Followup Record Review (4905.05)

The inspectors reviewed the licensee's quality assurance data packages for the high pressure injection pumps, Serial Nos. 1HP-P1A, 1HP-P1B, 1HP-P1C. Each data package contained the following: (1) transmittal slip from B&W to the licensee; (2) QA data sheet listing applicable specifications and requirements; (3) material verification; (4) liquid penetrant test data; (5) hydrostatic test data; (6) performance test data; (7) cleanliness data; (8) ultrasonic test data; (9) assembly records; and (10) clearance inspection records.

In reviewing these records, the inspector noted that although the material certifications appeared to be in order and had been reviewed and approved by B&W, they referenced an Ingersoll-Rand specification for chemical and physical requirements. The data packages did not contain a copy of this specification and the inspector could not verify that the requirements had been met. The inspector also noted that many of the data sheets were barely legible and the performance curve for the 1B pump had been mislabeled 1A. In addition, the records indicated that the 1B pump had been repaired and a second performance test had been conducted. The results of this test and the final cleaning records were not in the 1B data package. The performance curves for the 1A and 1C pumps and the initial curve for the 1B pump indicated that the pumps met the FSAR performance requirements. Curtis advised the inspector that the cleaning records and the correct performance curve were in the licensee's files in Charlotte. He also stated that a copy of the Ingersoll-Rand material requirements would be obtained and that all the missing documents would be included in the site records. The inspector will review these records during the next inspection.

H. Low Pressure Injection Pumps - Attachment L

Followup Record Review (4905.05)

The inspector reviewed the licensee's QA data packages for the low pressure injection pumps, Serial Nos. 1LP-P1A, 1LP-P1B, and 1LP-P1C. The data packages contained the same items of information as did the data packages for the high pressure pumps. The records were in order except for the Ingersoll-Rand material certification requirements. Curtis advised the inspector that this data would be included in the data packages. The inspector will review this item during the next inspection.

I. Letdown Coolers - Attachment L

1. Followup Record Review (4905.05)

The inspector audited the data packages for the letdown coolers. The types of information contained in these packages were the same as for the injection pumps. No discrepancies were noted by the inspector.

2. Followup Observations of Work (4905.06)

The inspector reviewed the installation of the letdown coolers and did not note any deviations from the installation drawings. The coolers are located in a relatively isolated area and no special protective measures are required.

J. Pressurizer Safety Valves

Followup Record Review (4905.05)

The inspector audited the licensee's data packages for pressurizer safety valves, Serial Nos. 1RC-V1, 1RC-V2, and 1RC-V3. The type information contained in these packages corresponded with that for the injection pumps. No deficiencies were noted.

K. Steam Generator

1. Laminations in the Steam Generator Skirt Adapter

The baseline inspection of the steam generator using ultrasonics revealed defects in the adapter between the support skirt and the vessel head. The adapter for one steam generator contained in excess of 400 indications and the second contained over 200 indications. While the number of defects exceeded the number permitted, the size of the indications was small and the problem had been referred to B&W, Lynchburg, for disposition. The adapters were originally ultrasonically tested at B&W, Barberton, but a different technique was used at that time. In the technique in use at Barberton, the scanning was done from inside the vessel; whereas at the site, the scanning is done from the outside. This item will be reviewed during the next inspection.

2. Followup cord Review (4905.05)

The inspector was shown a copy of a report entitled, "Steam Generator Vessel Fabrication Report." This report contained the following information:

a. Certification by F. A. Perrera, Manager, B&W Quality Control that the vessel complied with the ASME Code, Section III.

b. A copy of QC Specification 2E4-171, the controlling specification for the vessel.

c. ASME Form N-1, Manufacturer's Data Report for Nuclear Vessels, which was certified by a representative of the Hartford Insurance Company.

d. A rubbing of the N stamp on the nameplates.

e. Certification of stress reports signed by J. P. Butler, B&W.

f. Variation notices with resolutions.

g. NDT procedures for radiography, magnetic particle, penetrant testing, and ultrasonic testing together with acceptance standards.

h. General fabrication procedures.

i. List and description of all welds required.

j. Weld data sheets including details of heat treating and NDT.

k. Weld procedure qualification and operator qualifications for each type weld.

l. General welding specifications.

m. Material certifications including chemical, physical, and Charpy V-Notch test results.

In an audit of these records, the inspector did not note any deficiencies. Since the remainder of the records for the steam generator will remain at the B&W Barberton shops, the inspector plans no further action on this item.

L. Table A Requirements

The licensee's records were audited to determine if the NDT requirements of Table A had been met. The inspectors were shown data packages relating to all the valves, pipe, and pumps that are covered by Table A. Records relating to a 12-inch, 1500-pound, 316 stainless steel Walworth valve were reviewed in detail. The records indicated

that the valve had received the NDT tests required by Table A. Records relating to a 14-inch, 1500-pound, gate valve were also reviewed, and it was determined that the NDT requirements of Table A had been met. Operating stated that the records relating to Class I equipment had received a 100% audit by the licensee where the licensee had made the purchase. For B&W fabricated equipment, Curtis stated that the licensee has audited almost 100% of the records; and for B&W purchased equipment, the licensee has audited approximately 50% of the records and is satisfied that the NDT requirements of Table A have been met. It appears that the licensee is properly auditing the vendor NDT records. No further action is planned by the inspectors on this item.

M. Fire in Primary System

The licensee had notified Compliance of a fire in the primary system piping.[1] During this inspection, the results of the licensee's investigation of the fire were reviewed to determine the extent of the damage, if any, to the nuclear plant components.

The licensee had not as yet completed his investigation of the fire, but the results of a preliminary investigation indicated that no damage was done. Blaisdell had conducted a visual examination of the piping and adjoining steam generator on August 21, 1970. The exterior revealed that (a) grease in bolt holes was not damaged; (b) the aluminum type primer paint on the exterior of the equipment was not charred; (c) grease on the main manhole seat was liquid; (d) studs for the drain cover plates had a black residue which was easily removed by wiping; and (e) no metallic surface exposed in the area showed any evidence of temper color from heating. The examination of the interior of the steam generator and piping revealed that (a) no temper color indication was found on any clad surface (temper color indications were still present in the area of stress relieving in the 28-inch pipe); (b) grease and oil from the machining operation were still present in liquid form in the interior of the pipe; and (c) the tape used to hold a plastic barrier over the steam generator tube sheet was not charred and the plastic barrier was charred in only one small area. Additional information relating to the fire is as follows: (a) The fire appeared to have ignited in a bucket of acetone located in the steam generator. This bucket was subsequently overturned and some of the acetone spilled through a four-inch nozzle to the area under the steam generator skirt. (b) The fire melted the galvanize coating in the bucket. The position of the melt line indicates

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1/ Inquiry Memorandum dated August 21, 1970, from Region II (Seidle) to Compliance Headquarters (O'Reilly).

that approximately two quarts of acetone were involved. (c) Plywood steps used to enter the steam generator manway were charred. Wells advised the inspectors that the licensee planned to test the plastic barrier and the tape to determine the temperatures at which they will char. The investigation is to continue and an in-house Duke report relating to the fire will be issued. The inspector will review this item during a subsequent inspection.

N. Test Procedure Review

The inspector advised Smith and Hampton that a review had been made of the following test procedures:

Number	Title
TP/1/A/200/8-A	Reactor Coolant Temperature Narrow Range
TP/1/A/150/5	Electrical Penetration O-Ring Seal Leak Test
TP/1/A/200/1	Reactor Internals Vent Valve Inspection
TP/1/B/202/8	High Pressure Injection Flush
TP/1/B/203/7	Low Pressure Injection and Core Flood Systems Flush

Smith was asked if the pickup and transport times of particles had been considered when determining the length of time that a section of pipe would be flushed. He was also asked the basis for 45 micron mean dimension being the largest acceptable particle size. The inspector pointed out that the inlet strainers in some of the systems were sized to permit the passage of a 50 micron particle. Thus, if 45 microns were the largest permissible size, the filters would pass particles larger than should be permitted. Smith stated that the 45 micron size had been selected since it was about the minimum size that could be detected with the naked eye. He further stated that he would review the equipment involved to determine if some other size would be warranted based upon possible damage. He also advised the inspector that the flushing procedures would be reviewed to determine if the flushing times were adequate.

In response to the inspector's questions, Smith said that instruments which must be protected from hydrotest pressures would be listed in the procedures. He also stated that the polar crane would be tested for overtravel on loss of power prior to being used to lift critical assemblies.

Test Procedure TP/1/A/200/8-A states that the plant status is not applicable for the test. Smith agreed with the inspector that plant status should be specified since portions of the test could be conducted only with the plant shut down, but some sections would be conducted with the plant operating. These items were discussed in the management interview.

Attachments:
Exhibits A thru C

LICENSEE Duke Power Company

FACILITY Oconee Station No. 1

DOCKET & LICENSE NOS. 50-269, CPPR-33

REACTOR OUTSTANDING ITEMS

IDENTIFIED	ITEM	CLOSED
68-2, 3/5/68, NC	Concrete test cylinder breaks below specs	68-3, D.S., 6/19/68
68-3, 6/19/68, NC	Unauthorized revision to Cadweld specifications	68-4, Summary, 9/25/69
68-3, 6/19/68, NC	Failure to provide concrete inspector	68-4, Summary, 9/25/69
68-4, 9/25/68, NC	Failure to properly test Cadweld splices	69-1, Summary, 1/6/69
69-8, 9/9/69, NC	Failure to properly qualify weld procedures	69-9, G, 11/3/69
69-8, 9/9/69, NC	Failure to properly qualify weldors	69-9, G, 11/3/69
IEB, 4/11/69	Procedure for repair of arc strikes not available	70-5, Summary 4/27/70
C , 1/8/70	NDT of core flooding valves	Memo, WCS to HQ, 2/2/70
70-1, 1/6/70, NC	Welding and NDT deficiencies, CDN issued	Memo, WCS to HQ, 3/26/70
Bingham 69-1, 12/9/69, NC	Main coolant pump discrepancies	Closed, Memo, WCS to HQ, 4/21/70
70-4, 4/27/70, NC	Low strength concrete	Memo WCS to HQ 8/7/70
IEB, 5/1/70	Pressure vessel safe ends	Memo WCS to HQ 8/5/70
70-6, 5/25/70, NC	Tendon stressing discrepancies	Memo WCS to HQ 8/7/70
70-8, 8/3/70, NC	Tendons and stress gauges	Closed, No Response Required
50-269/70-8 9/1/70	Fissures in primary coolant pipe cladding	

Fc IDENTIFIED Column: S - safety item; NC - noncompliance or nonconformance item; UN - unresolved item; IN - inquiry item; IEB - Reactor Inspection and Enforcement Branch request; O - other source of identification (briefly specify)

LICENSEE Duke Power Company

FACILITY Oconee Station No. 1

DOCKET & LICENSE NOS. 50-269, CPPR-33

REACTOR OUTSTANDING ITEMS

IDENTIFIED	ITEM	CLOSED
IEB, 9/11/70	a. Determination of safety system response to axial power imbalances.	
	b. Availability of incore detectors.	
	c. Measurements of flow and temperature during initial operation.	
	d. Verification of bypass flow.	
	e. Verification of axial peak effects on DNBR.	
	f. Data during startup for single loop, 2 pump operations.	
	g. Inspection of reactor internals after completion of preoperational tests.	
	h. Field test of steam generator.	
	i. Low strength concrete and omitted tendons.	
	j. Penetration room valves.	
	k. Strain gauge failures.	
	l. HP and LP injection system startup times.	
	m. Core flooding tank MO valve.	
	n. Reactor building spray pump performance.	
	o. Condenser cooling water crossover header valve.	
	p. Spent fuel accident filters.	
	q. Administrative control of MCP startup.	
	r. Flow tests per 200/12 and 200/13.	
	s. Flow distribution chart.	

Fo. IDENTIFIED Column: S - safety item; NC - noncompliance or nonconformance item; UN - unresolved item; IN - inquiry item; IEB - Reactor Inspection and Enforcement Branch request; O - other source of identification (briefly specify)

INTERIM
REPORT TO REGION II
BABCOCK AND WILCOX COMPANY
MT. VERNON, INDIANA
INSPECTION DATED AUGUST 20-21, 1970

By

R. E. Oller, Metallurgical Engineer, CO:III

On August 20, 1970, during the inspection of Oconee 2 primary coolant piping, the inspector was informed by Mr. J. M. Curtis, Duke Power Company, that a cracking problem had been found in the austenitic stainless steel weld clad on the ID of a 28 inch diameter spool piece removed from one of four primary coolant pump suctions on the Oconee Unit 1. This assembly was identified as S-N B-67.

Due to the safety implications of this defect finding in the primary coolant piping, the inspector requested from the Duke Power Company QA representative, a review of the B&W (Mt. Vernon) action being taken to analyze the problem in regard to the suspect pipe and the other stainless clad piping for the Oconee Unit. Mr. Buskey, QC Manager, B&W Mt. Vernon plant, presented the following summary of action as of August 21, 1970:

> Four pump seccions spools identified as B-67, A-57, A-67, and B-57 approximately eight foot long, were cut out at the Oconee site due to the change of pumps and shipped to Mt. Vernon for shortening to approximately 3 foot lengths. The modified pieces contained about 4 inches of an austenitic stainless steel safe end, and inconel buttered stainless steel dissimilar metal girth weld and about 2-1/2 feet of austenitic stainless weld clad carbon steel piping. After shortening the B-67 spool and machining the weld preparations at both ends, PT examination of the ID clad revealed numerous small fissures in the cladding adjacent to the weld prep. This was on the carbon steel spool part. No indications were found in the carbon steel itself. Further PT examination of the entire bore revealed other areas of cracking in the cladding. The stainless steel cladding in the surplus carbon steel spool also contains cracking. Mr. Buskey also stated that the modified spool pieces for the other three assemblies had been PT cleared.
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> B&W then proceeded to determine the cause of cracking by making delta ferrite measurements, & chemical analysis for chromium, nickel and carbon, 180° side bend tests and a

microscopic study of the clad grain structure (latter study not completed). The test gave the following results:

a. Delta ferrite content range was between 2-1/2 and 5% which was less than required by specification and indicated a potential for weld clad hot cracking.

b. Chemical analysis for the chromium, nickel and carbon content, when compared with the Schaefler Diagram, showed the material to be in the austenitic range rather than martensitic range. Brittle martensite would have formed with excess arc penetration. The carbon content was found to be .104% and .10% for two samples.

c. Side bend tests on cladding showed no unacceptable defects which indicated ductility and lack of brittle martensite.

d. The photomicrographs study to verify austenitic grain structure, lack of martensitic grain structure, low ferrite, possible other contaminants and type of cracking, was not complete during this inspection for review by the CO inspector.

Mr. Buskey stated that he believed the cracking was related to the six wire clad technique since the cracks were found at the middle of the wide bead (2-1/2 inch). The problem is still under study. He also stated that Mt. Vernon will probably have the Barberton Welding Research Department participate in the study.

In regard to the balance of the Oconee 28" pump suction piping at the Oconee 1 site, a B&W NDT specialist Mr. J. Russell, had been sent to take ferrite measurements and perform PT inspection. The results of this field inspection were not yet available. Mr. Buskey also stated that instructions to Mr. Russell would be modified pending his findings at the site.

On 8-24-70, the CO inspector contacted Mr. J. M. Curtiss of Duke Power by telephone for further results. Mr. Curtiss stated that some PT indications had been found in the old pipe stub of the B-67 assembly but results were not yet complete at this time.

In regard to the modified B-67 spool at Mt. Vernon, Mr. Buskey stated that all cracks had been ground out and PT cleared. The spool

cladding was now ready to be repaired by filling the cavities with manual metal arc welding and then overcladding the entire bore of the old clad with a single wire Type 308 stainless layer using automatic submerged arc welding. The new layer would be PT cleared. This assembly had been supplied by the Barberton Works. The CO inspector was told that the solvent removable red dye PT technique is used at Mt. Vernon.

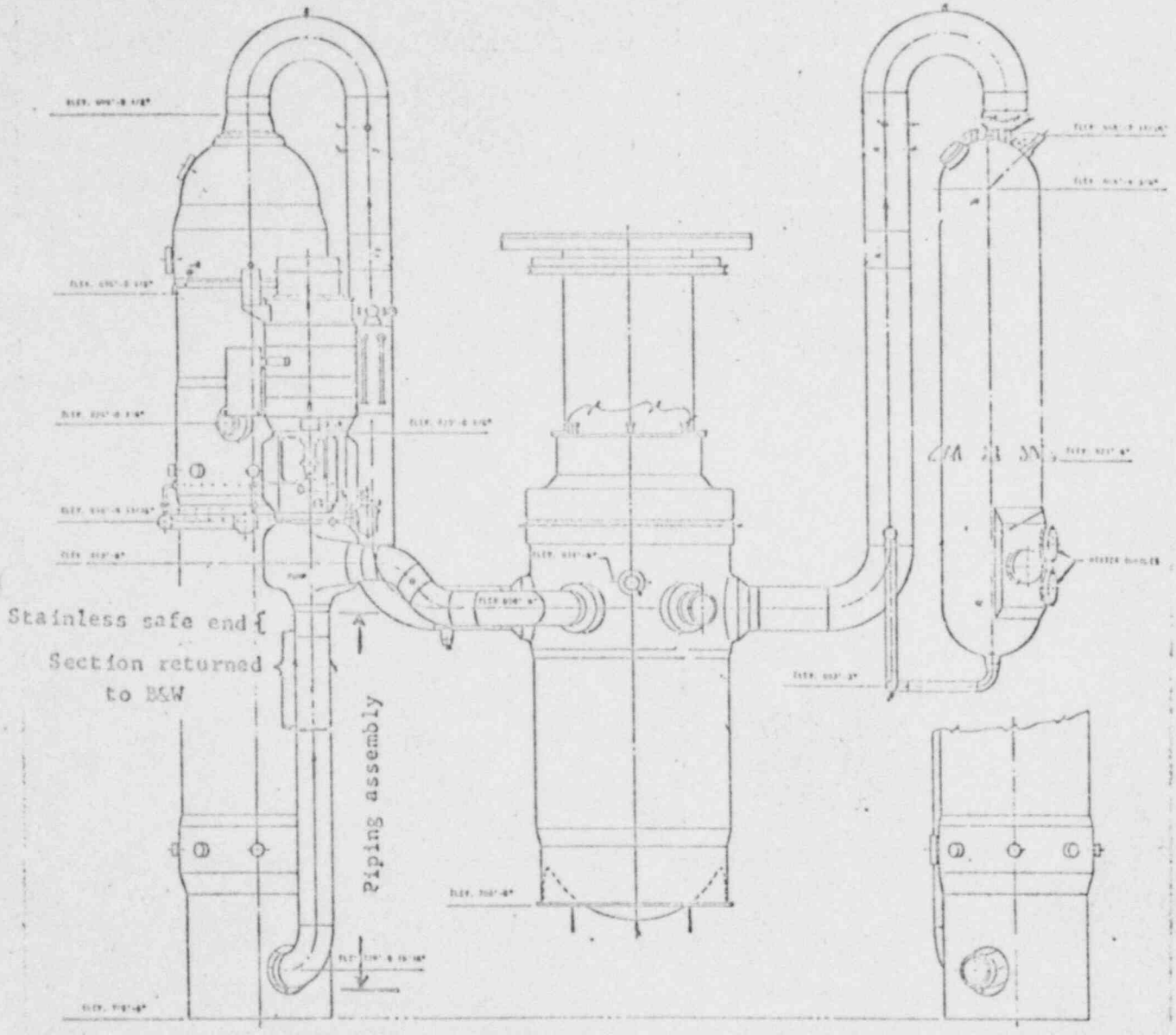
A list of the dimensions of the cavities was given to the inspector as follows:

	Depth	Width	Length
1.	1/16 inch	1 inch	1-3/8 inch
2.	1/16 inch	1-3/8 inch	1-1/2 inch
3.	1/16 inch	3 inches	1-3/4 inch
4.	1/8 inch	1-3/4 inch	2-3/4 inch
5.	3/32 inch	3/4 inch	3 inch
6.	1/16 inch	1-5/8 inch	2-1/4 inch
7.	1/16 inch	1-3/8 inch	1-3/8 inch
8.	1/8 inch	2 inches	13 inches
9.	1/16 inch	1-1/2 inch	1-3/4 inch

The CO inspector examined the ground out cavities in the spool piece and it appeared that they were grouped in three areas, i.e., the 1/8" x 2" x 13" circumferentially adjacent to the weld preparation; a 6" x 6" area (approximately) containing the deepest cavities about 6" inward from the 2" x 13" area, and an 8" x 6" area (approximate), containing shallow cavities.

The inspector questioned Mr. Buskey in regard to inspection of the 36 inch stainless clad pipe. Mr. Buskey stated that they had not yet considered this pipe. He stated further that they had confidence in the piping cladded at Mt. Vernon as 100% PT examination was made as the final inspection and the cladding was checked for proper amount of ferrite as it was welded on and chemical analysis was made on the first and every fifth bead to assure the proper chrome-nickel ratio.

The CO inspector advised Mr. Curtiss of Duke Power Company that Compliance would follow up on the final resolutions of this problem in regard to the suspect pipe and other weld cladded piping.



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