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

Report of Inspection

CO Report No. 50-269/70-10

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

Date of Inspection: September 28 - October 2, 1970

Date of Previous Inspection: September 1-4, 1970

Inspected By: C.E. Murphy 11/6/70
C. E. Murphy, Reactor Inspector (In Charge) Date

Uldis Potapovs 11-6-70
U. Potapovs, Reactor Inspector (Metallurgy) Date

Reviewed By: W.C. Seidle 11/9/70
W. C. Seidle, Senior Reactor Inspector Date

Note: The section of this report relating to the primary pipe fissures was prepared in the main by U. Potapovs.

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 were: (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 problem of welding structural steel; and (4) to review progress in the installation of electrical and instrumentation systems.

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SUMMARY

Safety Items - None

Nonconformance Items - None

Unusual Occurrences - None

Status of Previously Reported Problems -

1. The main steam pipe hangers are being redesigned. (See Section G.)

2. The licensee and Babcock and Wilcox Company (B&W) are continuing their investigation of the fissures in the primary pipe cladding. (See Management Interview and Section J.)

3. The licensee has not as yet determined a resolution of the steam generator skirt adaptor defect problem. (See Management Interview.)

4. The licensee has completed his evaluation of the control rod drive bearing and torque tube alignment problem, but has not as yet issued a report. (See Management Interview.)

5. The licensee has not performed a load test on the polar crane. (See Management Interview.)

Other Significant Items -

1. The licensee has experienced considerable difficulty in welding A36 structural steel. This problem now appears to be resolved. (See Section F.)

2. The inspector was advised that a fuel transfer tube was damaged during installation. (See Section K.)

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

Management Interview - The management interview was held on October 2, 1970, and was attended by Rogers, Wells and Hunnicutt.

1. The problems associated with the welding of A36 structural steel were discussed. Wells stated that since revising the welding procedures they were no longer experiencing problems with welding this material. In response to the inspector's questions, Wells stated that the licensee planned to retest all the welds in the turbine building steel that had not been tested using the revised

ultrasonic test procedure. In addition, the licensee plans to test, on an audit basis, welds adjacent to repaired welds to verify that they had not been adversely aff cted by the repair operations. (See Section F.)

2. The main steam pipe hangers were discussed. The inspector stated that he had been advised by Miller that the hangers were being redesigned to ensure that they could withstand the applied loads without exceeding code requirements. The inspector advised Rogers that he would review this item during the next inspection. (See Section G.)

3. The baseline inspection program was briefly discussed. In response to the inspector's question, Wells stated that the licensee had not as yet determined what would be done about the indications that had been previously found in the steam generator skirt adapter.[1] The inspector will review this ite- -- the .ext inspection.

4. The inspector advised Wells tha. .e hydrostatic test procedures which had been reviewed specified a test pressure of 150% of the system design pressure. This method of determining the test pressure does not correspond with the method specified in the Nuclear Power Piping Code, USAS B31.7. This code relates the test pressure to both the design pressure and temperature. The inspector was advised that the procedures would be revised to ensure that the code requirements would be met. (See Section L.)

5. The problem of the primary piping clad fissures was discussed in detail. The inspector advised Rogers that B&W had presented insufficient data to demonstrate conclusively that the causes of the fissures in the cladding had been determined. B&W had also not been able to present data that would give assurance that the piping for Units 2 and 3 would not also contain fissures. The inspector pointed out that techniques and procedures would need to be developed to determine that the cladding in the pipe being repaired at the site was not ground down below the minimum one-eighth-inch thickness permitted. Because of the complexity of the clad fissure problem, the inspector asked Rogers if the licensee had considered reporting the matter to the AEC. Rogers stated that this was being considered but made no commitment. (See Section J.)

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6. In response to the inspector's question, Wells stated that the licensee had completed the inspection of the control rod drive mechanisms and that an in-house report had been prepared conce...ng the guide bearings. He further stated that he understood that no problem existed, but that he had not as yet received a copy of the report. He expected the report to be available for the inspector's review during the next inspection.

7. Wells advised the inspector that the polar crane test had not been performed but that the crane would be tested prior to handling the core internals in November 1970.

8. The inspector advised Wells that he had observed safeguards systems cables looped outside the cable trays. He pointed out that this routing made the cables susceptible to mechanical change Wells agreed that this was contrary to the licensee's installation practices and that he would followup on this item. The inspector reminded Wells that the FSAR placed limitations on the quanti · of cable that could be placed in a cable tray and he advised Wells that the tray fill would be reviewed on future inspections. (See Section H.)

DETAILS

A. Persons Contacted

Duke Power Company (Duke)

J. C. Rogers - Project Engineer
D. G. Beam - Assistant Project Engineer
J. R. Wells - Principal Field Engineer
G. L. Hunnicutt - Senior Field Engineer
C. B. Aycock - Field Engineer, Electrical
G. W. Grier - Field Engineer, Nondestructive Testing
J. E. Smith - Plant Superintendent
J. W. Hampton - Assistant Plant Superintendent
J. M. Curtis - Engineering QC Supervisor
J. L. L. Ostertag - Mechanical Engineer

Babcock and Wilcox Company (B&W)

W. H. Spangler - Assistant Project Engineer
H. L. Helmbrecht - Engineer Department, Barberton
D. F. Levstek - Materials Engineering, Akron
G. A. Walton - Nondestructive Testing, Mt. Vernon

B. Administration and Organization

The licensee is in the process of reorganizing the Oconee quality control section. The nondestructive test unit is being upgraded to have equal rank with the civil, mechanical and electrical engineering units. Grier has been promoted from Assistant Field Engineer to Field Engineer (NDT). J. T. Moore, Supervisor Technician (Welding), is being made Supervisor (NDT) for the day shift and A. R. Thornton, NDT Technician (Radiography), is being promoted to Supervisor (NDT) for the night shift. In anticipation of the start of construction at the McGuire Nuclear Station next year and the transfer of some personnel to that site, Hunnicutt has been promoted to the position of Senior Field Engineer. In this position, he is assuming the responsibility for the administration of the QC section. Wells will retain responsibility for all technical matters. T. E. Touchstone, Assistant Superintendent, Construction, is being transferred into the organization and will assume the duties of Field Engineer (Civil).

C. Quality Assurance

1. Curtis advised the inspector that the licensee had instituted a procedure for certifying that vendor quality assurance records had been audited by the licensee and found to meet applicable code and contract requirements. When an audit has been completed, the cognizant Duke QA engineer prepares a Form QA-6, "Quality Assurance Records Final Certification." (See Exhibit B.) This certification is sent under cover letter to C. E. Watkins, Assistant Vice President, Construction, Duke. The inspector was shown copies of the certifications for the following items:

   a. Steam Generators 1A and 1B
   b. Pressurizer
   c. Core Flood Check Valves and Outlet Valves
   d. Decay Heat Isolation Valves
   e. Low Pressure Injection Valves
   f. Pressurizer Power Actuated Isolation Valve
   g. Pressurizer Safety Valves

   The inspector was told that the licensee would soon have certifications for all items of Class I equipment.

2. Curtis advised the inspector that the mill certification requirements for the HP and LP injection pumps had been received and found to agree with the certification records supplied with the pumps. He stated that the HP-1B pump performance curve and the cleaning record had not been received as yet but were expected prior to the next inspection. The inspector advised Curtis that these items would be reviewed during a future inspection.

3. Changes to the licensee's QC organization are discussed in Section B.

4. Other quality assurance items are discussed in the individual report sections.

D. Construction Progress

1. Turbine-generator erection continues on schedule.

2. The emergency feeder cable from the Keowee Hydro Station has been installed and given a high potential test.

3. Repairs to the primary pipe cladding are in progress.

4. Three Westinghouse Electric Corporation (W) pump volutes have been installed.

5. All the tendons have been installed and buttonheaded. Approximately 80% have been stressed and greased.

E. Construction Schedule

1. Vessel internals are scheduled for installation in late November 1970.

2. The internals for the first coolant pump are scheduled for shipment on October 28, 1970, and for the last pump one month later.

3. Core loading will probably be in April 1971.

4. Tendon installation is expected to be completed during October 1970.

F. Structural Steel Welding

After upgrading his ultrasonic test procedure in April 1970, the licensee began detecting a significant number of cracks in the welds made on ASTM A36 structural steel members. The turbine building steel, the pressurizer support and the main steam pipe hangers were fabricated from this material. Wells advised the inspector that the licensee had attempted to determine the cause of the cracking but initially was unsuccessful. The weld procedure used in making the welds had been properly qualified according to ASME, Section IX, for the P-1 series of steels using SA53, Grade B pipe and E7018 electrode.[1/]

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

The weldors who had worked on these structures had been properly qualified to this procedure. In an attempt to determine the cause of the cracks, welds were made by the welding supervisor under closely controlled conditions. Cracks were found in these welds. The steel manufacturer was requested to send representatives to the site in July, but Wells stated that they provided very little help. A revised welding procedure was developed by the end of August, however, that has proven successful. This revision requires that the rolled surface in the weld area be ground down approximately 1/16 inch to remove mill scale and surface-hardened material. In addition, the weld area is preheated to approximately 200°F using strip heaters. Since modifying the weld procedure, the rate of defective welds has dropped from approximately 90% to about 5%. Wells stated that the licensee planned to retest all accessible welds that had been made prior to time that the UT procedure had been revised. Some welds have been embedded in concrete and cannot be tested. In response to the inspector's question, he stated that they would also test some of the welds adjacent to repaired welds to ascertain whether or not the repair operations had an adverse effect on the adjacent welds. He stated that a sufficient number would be tested to determine if there was an effect but unless defects were noted that they would not retest all of these welds.

The inspector reviewed the UT procedure changes with Grier. Grier stated that the original procedure had met code requirements but because they had been obtaining inconsistent results, the procedure was upgraded. The significant changes were as follows:

1. The ultrasonic test instrument now must be calibrated each time a defect is noted as well as prior to use each day. A Mare Island Test Block is used as the calibration standard.

2. The crystal that had been used in the test instrument has been replaced with a Branson crystal. The licensee stated that the Branson crystal gives a more columnated sound beam and made the location of defects easier.

3. Welds are now inspected from both sides of the plate in order to pick up indications that because of their orientation could be missed when inspecting from only one side.

Grier stated that they used only the UT in locating defects in the welds. The licensee has the capability for making magnetic particle tests and has used this method on the main steam line and on carbon steel plate. Magnetic particle tests have not been used on the structural steel because of the difficulty in working in high locations. The licensee has used liquid penetrant tests on the structural steel welds only to determine when the defect revealed by UT has been removed.

The inspector reviewed the UT procedures which discussed equipment requirements, personnel proficiency standards test methods and acceptance standards. The section relating to equipment discussed the instrument controls, method and intervals for calibration, the couplant to be used and the type crystal. The procedure requires that the UT technician demonstrate his proficiency in UT. The licensee presently has two UT technicians. One of the technicians has been certified to SNT Level II, the second has passed all his tests for Level II but had lacked the required experience at the time of the test. He has now completed the experience requirements and Wells stated that the licensee plans to upgrade him in the near future. The procedure also described shear wave scanning techniques and the acceptance standards to be followed. The inspector did not note any deficiencies in this procedure. The inspector also reviewed the liquid penetrant test procedure and the magnetic particle test procedure. Both of these procedures meet the requirements of the ASTM Code, Section VIII, and USAS Code B31.7. These procedures were found to contain the same type information as the UT procedure. The inspector did not note any deficiencies in either procedure.

The inspector was advised by Grier that only approved procedures had been used in making repairs to the welds. The repairs initially had not been successful but after the procedures were revised to require preheating the weld area, no further problems were experienced. In response to the inspector's question, Grier stated that improper electrode control could have contributed to the welding problem, but he stated that the problem was so universal that he did not believe that this could have been a significant factor since only on rare occasion had his inspectors found the electrode ovens to be below required temperature. In a previous audit,[1/] the inspector had reviewed the procedures and records relative to receiving and storage of the pressurizer supports. No deficiencies had been noted in this audit. The same procedures are used in handling all structural material. An audit of the mill certifications for the pressurizer support structure indicated that the material met both the chemical and physical requirements of A36 steel. In discussing the problems associated with the A36 material during the management interview, Wells stated that all accessible welds made prior to the UT procedure revision would be ultrasonically tested agair He also stated that welds adjacent to repaired welds would be tested on an audit basis

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1/ CO Report No. 50-269/70-7

to ensure that the repair procedure did not affect the adjacent weld. He further stated that he would advise the inspector if further problems are experienced. The inspector does not plan any further action on this item.

G. Main Steam Pipe Hangers - Attachment G

During a previous inspection,[1/] the inspectors had questioned the adequacy of the main steam pipe hanger design. Ostertag advised the inspector that Charlotte engineering had reviewed the design and had found that a majority of the hangers met ANSI B31.1 Code requirements. Some of the hangers were found to be more heavily loaded than originally calculated, however, and the hanger design was revised by the addition of struts between the top and bottom plates in addition to the six bolts presently used. The bolts are now computed at zero loading and are considered backup to the struts. Revised drawings are at the site. The inspector will review the installation of the struts during a future inspection.

H. Electrical - Attachment I

1. Keowee - Oconee Emergency Power Feeder (5205.04, .05, .06)

The inspector reviewed the installation of the 13.8 kv underground feeder from the Keowee Hydro Station. The cables received for this feeder were as specified and did not require special handling. A cable storage yard has been set up by the licensee and all safeguards cable is stored in this area until used. Lagging is left on the cable reels until the cable is pulled. Both ends of the cable are sealed to prevent the entrance of moisture. The emergency feeder consists of two groups of three single conductor 25 kv cables. For the greater part of the distance from the hydro station to the Oconee Station 1, the cable is directly buried in selected backfill. The inspector observed the installation of the upper group of three cables in the trench. The separation of the cables was maintained at one foot or greater, while the backfill was placed by hand until the cable was completely covered. The backfill seen by the inspector consisted almost exclusively of fines and contained no material that would damage the cables. In addition, the electricians removed any lumpy material from the backfill as it was being placed. The licensee's civil engineers had established grade stakes to assure the vertical separation of the cable. The inspector was shown a copy of a report

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

of a high potential test made on this cable. The report stated that the cable had been tested at 36 kv and that the leakage currents of the individual cables were within prescribed limits. No deficiencies in the installation were noted by the inspector.

2. Safeguards Systems Cables

The inspector reviewed the installation of the safeguards systems cables with Aycock. Only a few cables had been placed in the cable trays at the time. The inspector observed that two of the cables were looped out of the trays and were not protected from physical damage. He pointed these out to Aycock who stated that he had already asked that they be corrected. In discussing the installation of cables with Aycock, the inspector advised him that a close inspection would be made to assure that the provisions of the FSAR relating to cable routing and tray fill limits were observed.

I. Fire in Primary System Piping

The inspector was shown a copy of an in-house Duke report issued as a result of the fire in the primary loop piping.[1] This report indicated that the tape used to hold a plastic barrier over the steam generator tube sheet would begin to show signs of damages at 150°F and would char and lose its adhesive characteristics at 300°F. The tape in the steam generator had shown no signs of charring. Calculations indicated that approximately 75,000 btu had been released by the acetone fire and a considerable portion of this was exterior to the steam generator. Since the results of this investigation (together with the information previously available) tends to support the licensee's contention that the severity of the fire was insufficient to cause damage to the equipment, the inspector plans no further action.

J. Primary Pipe Cladding Fissures

1. Scope of Inspection

A summary of the Oconee 1 primary loop cladding fissure history is contained in CO Report No. 50-269/70-9. The purpose of this site visit was to review B&W analysis and resolution of the problem; specifically, the cause of cracking, extent of the cracking, adequacy of repair and preventative measures taken to assure against future recurrence.

1/ CO Report No. 50-269/70-9

The information obtained during the site visit was insufficient to provide satisfactory answers to the above and, as a result, a meeting was arranged at B&W, Mt. Vernon, plant for October 15 to obtain additional information related to the cladding deficiencies. This section of the report summarizes the results of both the site visit and the meeting at Mt. Vernon.

2. Results of Oconee Site Visit (September 28, 1970)

a. Review of the Problem

Cladding fissures had been detected in two Oconee 1 28-inch main loop pipe segments which make up spool assemblies B67 and B57. In addition, cladding cracks were detected in three main loop elbows. Two of the elbows are components of the above spool assemblies; the third is identified as B40.

The straight segments are ASTM A106 Grade C pipe, clad with 18-8 stainless steel using a six-wire submerged arc process. The elbows are hot formed and weld fabricated from deto-clad (with A240 type 304) ASTM A516 Grade 70 plate.

All spool piece components were manufactured and clad at the B&W, Barberton, facility. The B67 spool assembly was fabricated at Barberton and shipped directly to the Oconee site. The B57 components were shipped to B&W, Mt. Vernon, plant where they were assembled to form the spool piece before shipment to Oconee.

b. B&W Presentation

Helmbrecht summarized the results of B&W's evaluation of the cladding problem. Main points of the presentation are given below.

(1) The defective cladding was produced in 1968 during a period when B&W was having difficulties obtaining satisfactory flux. Segregation of the flux powder, which was responsible for nonhomogeneous weld deposit and low ferrite, was identified by B&W as the cause of cracking.

(2) Based on visual and metallographic examination, the cracks were described as solidification or hot cracks.

Visual estimate of delta ferrite contents (single metallographic specimen) was placed at less than 2%.

(3) Side bend tests on the B67 pipe cladding showed good ductility. This was interpreted as evidence that there was no process breakdown (excessive alloying, martensite formation) which would cause a general deterioration of the cladding ductility.

(4) The probable reason that cracking of the B67 spool piece (shipped from Barberton) cladding was not detected during shop PT was attributed to production sequence which was used at Barberton at that time. According to this procedure, PT was conducted before stress relief treatment. It was theorized that the fissures before the stress relief treatment were too tight to give meaningful PT indications. The fabrication sequence has since been changed to require that PT be conducted after stress relief.

(5) The B57 assembly was shipped from Mt. Vernon. The Mt. Vernon procedures had always required that PT be conducted after stress relief. The fissure indications were apparently overlooked or considered irrelevant. A general pink coloration resulting from insufficient cleaning which would mask the relatively light indications was suggested as a possibility. Fissuring of B57 assembly was much lighter than observed on the B67 spool.

(6) Defects in the deto-clad elbows were attributed to the hot forming operation. They were apparently overlooked during PT because of the rough surface condition.

The B&W proposed repair which was currently being implemented included machining one-eighth-inch layer of cladding from the eight-foot-long section of B67 pipe now at Mt. Vernon, manually repairing any additional defects remaining and submerged arc recladding the entire I.D. After this operation, a new section would be welded to the pipe, the entire assembly stress relieved and PT cleared, and a stainless steel pump adapter section would be welded to this assembly before shipment back to the Oconee site. The B57 spool and deto-clad elbow defects would be removed at the Oconee site by manual grinding. The amount of cladding removed by grinding would be limited to one-eighth inch and the remaining cladding thickness would be verified by the use of a calibrated eddy-current tester. It was noted that 100% of the B67 spool elbow surface would have to be ground to remove all indications.

c. Discussion of the B&W Presentation

Several questions were raised with respect to information presented by Helmbrecht and other data obtained previously. These are summarized below.

(1) Referencing previously-supplied data on the chemical analysis of cladding samples taken by B&W technician at the Oconee site (CO Report No. 50-269/70-9), the inspector inquired whether the unusually high carbon contents of the cladding (.1 to .2%) could be indicative of process breakdown or some form of weld deposit contamination and whether additional samples had been taken.

Helmbrecht said that the high carbon could be attributed to sample contamination with carbide drill used in sampling. Additional samples had been taken, but data was not available.

(2) Again referencing previous data which indicated measured ferrite values of the B67 pipe generally in the range of 7.5 to 10% and never less than 2.5%, the inspector questioned the basis for attributing the cracking to low ferrite.

Helmbrecht replied that the field measurements were probably not very accurate, that there could exist localized ferrite segregation not reflected in the magnagage measurements and that metallographic examination of a sample had shown only about 2% ferrite.

(3) The inspector inquired as to how many metallographic samples had been taken, what procedure was used to estimate the ferrite contents, whether photomicrographs of typical areas were made and were available for review and whether any metallographic specimens had been prepared from the deto-clad elbows.

Helmbrecht said that the data was based on a visual estimate of one sample, no photomicrographs were taken and no metallographic samples had been taken from the elbow cladding.

(4) Since two separate cladding processes were used in the B67 assembly and both cracked, the inspector inquired whether possible contributing factors common to both pieces such as heat treatment irregularities or possible cladding contamination had been considered.

Helmbrecht replied that heat treatment records had not been checked.

(5) The inspector asked on what basis were the cracks in the deto-clad elbows attributed to the hot forming operation.

Helmbrecht said that visual appearance of the cladding surface and knowledge of the forming operation indicated this to be the case.

As a part of the general discussion of the cladding cracks, B&W was asked what changes had been made in the QC procedures or methods to assure against future recurrence of the problem, what was the basis for assuring that similar problems did not exist in Oconee 2 and 3 piping or other components including the reactor vessel, steam generators and pressurizer and how applicable was the eddy-current tester in determining the residual cladding thickness after grinding.

Because B&W was not prepared to discuss all of the above questions and could not supply satisfactory information to the specific questions regarding cladding fissures, a second meeting was arranged at the B&W, Mt. Vernon, plant.

3. Results of Mt. Vernon Meeting (October 15, 1970)

On October 15, U. Potapovs met with Duke and B&W representatives at the B&W pressure vessel plant in Mt. Vernon, Indiana, for additional discussions concerning the Oconee 1 cladding fissures. The meeting attendees included the following:

W. H. Spangler, Assistant Project Manager, B&W, Lynchburg
D. F. Levstek, Materials Engineer, B&W, Akron
F. A. Perrera, NED QC Manager, B&W, Barberton
N. C. Jessen, Director of Technology, B&W, Barberton
H. L. Helmbrecht, Engineering Development, B&W, Barberton
H. F. Dobel, NPGD QA Manager, B&W, Lynchburg
C. D. Thompson, NPGD Resident Inspector, B&W, Mt. Vernon
W. C. Buskey, QC Manager, B&W, Mt. Vernon
R. N. Bottorf, Engineering Manager, B&W, Mt. Vernon
J. R. Wells, Principal Field Engineer, Duke
R. E. Miller, Engineering Department, Duke

a. Scope of Meeting

At the start of the meeting, B&W representatives stated that they were prepared to discuss only the cracking problems related to the weld deposited cladding (straight pipe) at this time and additional work was being done to evaluate cracking of the deto-clad fittings. A separate meeting at the Oconee site was suggested for discussion of the deto-clad problems. The week of October 26 was suggested by B&W and Duke for this meeting. (This date was subsequently changed to November 10 at the request of B&W.)

b. Summary of B&W Presentation and Discussion

(1) The history of the weld deposited cladding problems was reviewed. The cracking mechanism was described as intergranular microfissuring or typical hot-shortness cracking. Helmbrecht produced several photomicrographs taken from samples of the B67 pipe cladding which support the description. He indicated that four samples had been examined. The cause of cracking was attributed to localized chemical segregation resulting in areas of low ferrite contents in the deposit. The chemical segregation, in turn, was attributed to nonhomogeneous flux purchased and used for a period in May 1968. Since that time, the flux blending and sampling techniques used by the supplier had been changed at the insistence of B&W and further recurrences of flux deficiencies have not been encountered.

Because of the localized nature of the chemical segregation and the inherent inaccuracies of the standard ferrite measuring techniques (magna-gage or severn gage), the crack-sensitive condition would not necessarily be indicated by ferrite measurements. The field measurements taken on the B67 pipe which indicated ferrite in the 5% or acceptable range could, therefore, not be considered indicative of proper chemical balance of the deposit. It was noted that the ferrite and chemical checks taken during production cladding are mainly for indication of a major process breakdown and would not necessarily indicate the development of a crack-sensitive condition. Dye penetrant testing (after stress relief) was identified as the only practical positive means of assuring that hot cracking was not occurring. It was noted that with the proper controls on the welding process and flux a crack-sensitive condition should not develop.

Helmbrecht said that he had visually estimated the ferrite content of the sample shown in the submitted photomicrographs to be less than 2%. He also produced a macro-sample taken from the B67 pipe cladding and demonstrated that ferrite as measured by a severn gage on some areas of the sample was less than 2.5%.

The photomicrographs are attached as Exhibit C of this report. The cracking shown does exhibit typical characteristics of hot-shortness cracking, but a meaningful quantitative estimate of the ferrite contents does not appear possible from visual examination of the photomicrographs.

(2) Carbon analyses of four additional weld metal samples removed by hand-chipping from the B67 pipe were reviewed. The reported values were .096, .093, .092 and .115%. These results tend to substantiate the assumption that previously-analyzed samples which showed carbon in the range of .1 to .2% were contaminated by the carbide drill used in the sampling procedure.

(3) Helmbrecht said that a comprehensive document review had been conducted of the Barberton plant fabrication records by a team of nine QC engineers and NDT technicians.

The results of the review showed that PT examination of the B67 spool assembly before stress relief was probably brought about by unauthorized modification of the shop traveler sheet. Operation sequence had been changed to omit an interstage stress relief cycle before the PT examination. The traveler change had been made and initialed by a shop employee although a similar action on a different production order was authorized by a QC engineer. This change was probably considered by the shop man as justification to modify the operation sequence on spool B67. Measures have reportedly been taken to assure against future actions of this nature.

Review of furnace records had shown that the B67 assembly had received a satisfactory stress relief treatment. No evidence of furnace excursions or other unusual occurrences was indicated.

Review of the NDT records had shown that the cladding had been subjected to PT examination (before stress relief) and no rejectable defects were recor[illegible].

(8) A report will be submitted by B&W summarizing the cladding problem. The inspector was asked whether any aspects of the problem were not sufficiently covered. He noted that, as a part of the overall failure analysis, a more detailed chemical composition of defective areas including elements such as manganese and silicon, in addition to the C, Cr, Ni, would be useful for localized ferrite analysis by emperical formulas (Schaeffler diagram). A more comprehensive metallographic review including the comparison of delta ferrite distribution in good and crack-sensitive areas would also serve the same purpose.

K. Fuel Transfer Tube

Beam advised the inspector that one of the fuel transfer tubes had been damaged during installation. A weldor had inadvertently struck an arc on an expansion joint convolute. The licensee ordered a replacement expansion joint but has received a January deliver date. If he is not able to improve this date, it will have an adverse effect upon his core loading schedule.

M. Test Procedures - Attachment M

The inspector discussed the hydrostatic test procedures and the flushing procedures with Smith and Hampton. The inspector was told by Smith that the flushing times specified in the procedures issued to date had been reviewed to ensure that each flush cycle was sufficiently long to pick up any particles in the system and flush them out. He also stated that a review was being made of all components to ensure that particles smaller than 45 microns would not cause damage. The inspector pointed out that the hydrotest procedures which he had reviewed specified test pressures of 150% of design, whereas the FSAR specified that the test pressure would be as required by ANSI B31.7. This code states that the test pressure be not less than 1.25 times the design pressure multiplied by the lowest ratio of the allowable stress intensity value for the test temperature to the allowable stress intensity value for the design temperature. According to the design temperature and material, the test pressure required by B31.7 could be greater or less than 105% of design pressure. Hampton stated that he would review the procedures and would verify that the requirements of B31.7 were met in every case.

L. Pressurizer Safety Valves - Attachment L

Followup Record Review (4905.05)

The inspector audited the licensee's data packages for pressurizer safety valves, Serial Nos. IRC-V4A and IRC-V4B. No deficiencies were noted.

Attachments:
Exhibits A through C

LICENSEE Duke Power Company

FACILITY Oconee Station No. 1

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

REACTOR OUTSTANDING ITEMS

IDENTIFIED	ITEM	CLOSED
1. 68-2, 3/5/68, NC	Concrete test cylinder breaks below specs	68-3, D.5., 6/19/68
2. 68-3, 6/19/68, NC	Unauthorized revision to Cadweld specifications	68-4, Summary, 9/25/69
3. 68-3, 6/19/68, NC	Failure to provide concrete inspector	68-4, Summary, 9/25/69
4. 68-4, 9/25/68 NC	Failure to properly test Cadweld splices	69-1, Summary, 1/6/69
5. 69-8, 9/9/69, NC	Failure to properly qualify weld procedures	69-9, G, 11/3/69
6. 69-8, 9/9/69, NC	Failure to properly qualify weldors	69-9, G, 11/3/69
7. IEB, 4/11/69	Procedure for repair of arc strikes not available	70-5, Summary, 4/27/70
8. CDN, 1/8/70	NDT of core flooding valves	Memo, WCS to HQ, 2/2/70
9. 70-1, 1/6/70, NC	Welding and NDT deficiencies, CDN issued	Memo, WCS to HQ, 3/26/70
10. Bingham 69-1, 12/9/69, NC	Main coolant pump discrepancies	Memo, WCS to HQ, 4/21/70
11. 70-4, 4/27/70, NC	Low strength concrete	Memo, WCS to HQ, 8/7/70
12. IEB, 5/1/70	Pressure vessel safe ends	Memo, WCS to HQ 8/5/70
13. 70-6, 5/25/70, NC	Tendon stressing discrepancies	Memo, WCS to HQ 8/7/70
14. 70-8, 8/3/70, NC	Tendons and stress gages	Memo, WCS to HQ 10/8/70
15. 70-8, 9/1/70, UN	Fissures in primary coolant pipe cladding	
16. IEB, 9/11/70, UN	a. Determination of safety system response to axial power imbalances b. Availability of in-core detectors	

For 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
	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, two 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	Memo, WCS to HQ, 10/8/70
	j. Penetration room valves	
	k. Strain gauge failures	Memo, WCS to HQ, 10/8/70
	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	
	[illegible]. Flow distribution chart	

For 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)

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FACILITY Oconee Station No. 1

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

REACTOR OUTSTANDING ITEMS

	IDENTIFIED	ITEM	CLOSED
17.	70-2, 2/19/70, UN	Vendor NDT records for safeguards systems cables	
18.	70-4, 3/23/70, UN	Verification of separation of transducer tubing	
19.	70-8, 8/3/70, UN	Control rod drive guide bushings and torque tubes	
20.	70-8, 8/3/70, UN	Completion of HP facilities	
21.	70-8, 8/3/70, UN	Completion of HP procedures	
22.	70-8, 8/3/70, UN	Completion of HP personnel training	
23.	70-8, 8/3/70, UN	Crane load test	
24.	70-8, 8/3/70, UN	Verify that test procedures are properly revised and approved when changes are required	
25.	70-8, 8/3/70, UN	Verify that analysis of containment is made	
26.	70-8, 8/3/70, UN	Approved fuel handling procedures	
27.	70-8, 8/3/70, UN	Main steam pipe hangers	
28.	70-9, 9/1/70, UN	Steam generator skirt adapter indications	
29.	70-9, 9/1/70, UN	HP injection pump QC records	
30.	70-9, 9/1/70, UN	Basis for particle size in flushing procedures	
31.	70-9, 9/1/70, UN	Protection of instrumentation during hydro test	
32.	70-10, 9/28/70, UN	Fuel transfer tube expansion joint replacement	
33.	70-10, 9/28/70, UN	Routing of cables exterior to cable trays	

For 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.

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

REACTOR OUTSTANDING ITEMS

IDENTIFIED	ITEM	CLOSED
34. DRL Rpt. No. 1, 7/24/70, UN	Installation of additional environmental monitoring equipment	
35. DRL Rpt. No. 1, 7/24/70, UN	Vent valve replacement test	
36. DRL Rpt. No. 1, 7/24/70, UN	Strong motion accelerometer installation	
37. DRL Rpt. No. 1, 7/24/70, UN	Penetration room flow indication and adjustment	
38. DRL Rpt. No. 1, 7/24/70, UN	Instrumentation bypass keys	
39. DRL Rpt. No. 3, 9/15/70, UN	Internals vibration test	
40. DRL Rpt. No. 3, 9/15/70, UN	Core flooding tank valves	

For 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)

FORM QA-6

DUKE POWER COMPANY
OCONEE 1-3

NUCLEAR STEAM SUPPLY SYSTEM
QUALITY ASSURANCE RECORDS
FINAL CERTIFICATION

DATE 9/21/70

1 - Unit Number Oconee 1 Component Steam Generator (B&W)

2 - Component Identification Number 620-0003-51-1B

3 - Status of Vendor Certification Design Certification 11/20/69 to ASME Section III-A. Fabrication certification on record.

4 - Status of Duke QA Record Review An audit of the records was made at Barberton, Ohio

5 - Location of QA Records B&W Barberton Works

6 - Status of Table "A" NDT Not applicable

7 - Status of Vendor Auditing Auditing and surveillance were performed by Duke Power

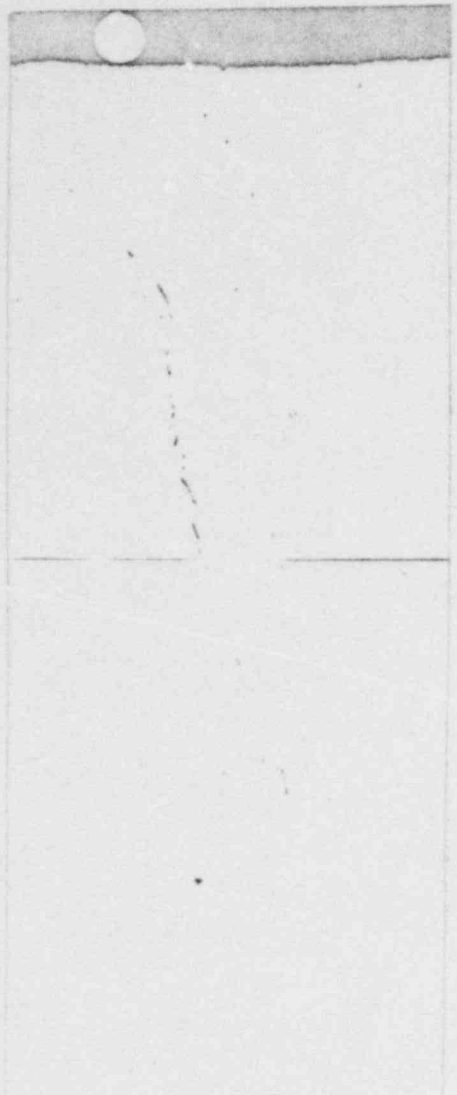
8 - Remarks None

Quality Assurance

Engineering

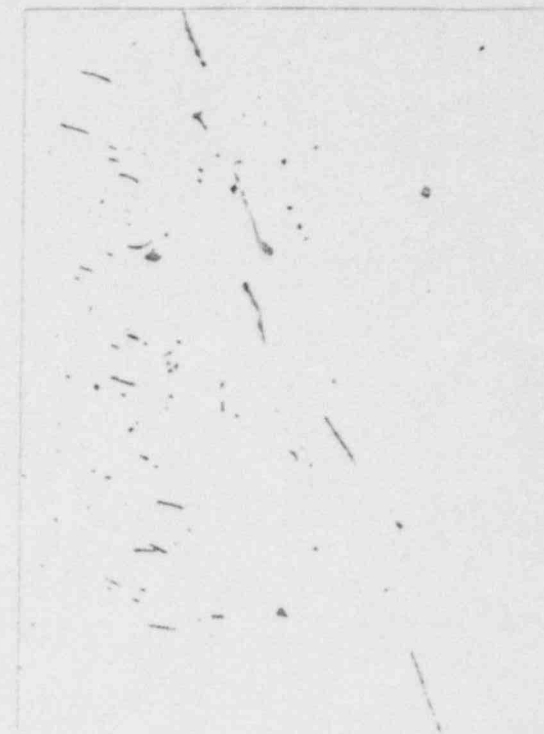
Exhibit B
Page 1 of 1

JMC:je
9/15/70



Unetched - 100X
Magnification

Kallings etch - 100X
Magnification



Kallings etch - 500X
Magnification

TRANSVERSE CROSS SECTION OF TYPICAL MICROFISSURES IN SUBMERGED ARC CLADDING ON B67 RETURN COOLANT PIPING - OCONEE No. 1. THE CENTER PHOTOGRAPH SHOWS A CAST DENDRITIC STRUCTURE. SOME DELTA FERRITE IS VISIBLE AT 500X MAGNIFICATION: THIS IS INSUFFICIENT TO PREVENT MICRO FISSURES DURING COOLING.

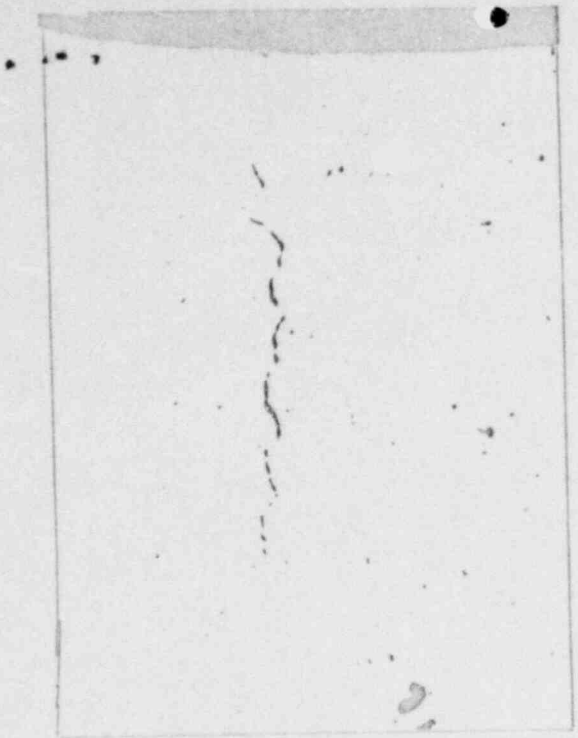


Fig. 1 100X
Unetched

Fig. 2 100X
Kallings

Fig. 3 500X
Kallings

Exhibit C
Page 2 of 2