UNITED STATES
ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE
REGION II - SUITE 818
230 PEACHTREE STREET, NORTHWEST
ATLANTA, GEORGIA 30303

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TESTING AND STARTUP INSPECTION REPORT

RO Report Nos. 50-269/72-4, 50-270/72-3 and 50-287/72-2

Duke Power Company
Oconee 1, 2 and 3
Docket Nos. 50-269, 50-270 and 50-287, License Nos. CPPR-33, 34 and 35
Category: A3/B1, A3/B1 and A2
Oconee County, South Carolina

Type of Licensee: PWR - 2452 Mw(t) each, B&W

Type of Inspection: Routine, Unannounced

Dates of Inspection: April 18-21, 1972

Dates of Previous Inspection: March 21-24, 1972 (Units 1 and 2)
February 22-25, 1972 (Unit 3)

Principal Inspector: C E Murphy — 4/5/72
C. E. Murphy, Reactor Inspector — Date
(Testing and Startup Unit)

Accompanying Inspectors: Frank Jape — 6-5-72
F. Jape, Reactor Inspector — Date
(Testing and Startup Unit)

Uldis Potapovs — 6-5-72
U. Potapovs, Reactor Inspector — Date
(Construction Unit)

Other Accompanying Personnel: None

Reviewed By: C M Upright for — 6/6/72
N. C. Moseley, Senior Reactor Inspector — Date
(Testing and Startup Unit)

Proprietary Information: None

SECTION I

Enforcement Action

None

Licensee Action on Previously Identified Enforcement Matters

1. A satisfactory response was received from DPC relating to the items of noncompliance identified in RO Report No. 50-269/72-1.

2. The licensee has been granted a delay in responding to the deficiencies identified in RO Report Nos. 50-269/71-9, 71-10 and 71-11. Their response is now due on May 8, 1972.

3. The deficiencies identified in RO Report No. 50-269/72-2 have not been corrected as yet.

Unresolved Items

1. Determination of tests that must be repeated as a consequence of the failures in the reactor coolant system. (See Management Interview)

2. Plant security. (See Management Interview)

3. Audit by DPC of B&W's quality assurance program. (See Management Interview)

Status of Previously Identified Unresolved Items

1. Comments on the initial fuel loading procedure, reported in RO Report No. 50-269/72-3, are being incorporated into the procedures by DPC. A draft of the rewritten procedure was reviewed at the site. It appears that one comment remains to be completely resolved. This comment involves the location of readout equipment and the type of signal to be provided by the temporary in-core flux monitors. This item was discussed with Hampton by telephone on April 24, 1972, and he stated that they would consider providing an audible and visual indication of the count rate signal in both the control room and the reactor building.

All other comments appear to be resolved satisfactorily. (See Section III, paragraph 3)

2. The licensee does not plan to conduct the following tests that are included in the AEC Startup Testing Guide (See RO Report No. 50-269/71-4):

   a. Pseudo-rod ejection test at a high power level (75%).
   b. Shutdown from outside the control room at a high power level (100%).

3. The repair of both steam generators has been initiated. (See Section IV)

4. An air receiver and an air line for the control air system may compromise the reliability of the battery system. (See Section II, paragraph 4)

Unusual Occurrences

None

Persons Contacted

DPC

J. E. Smith - Plant Superintendent
*J. W. Hampton - Assistant Plant Superintendent
M. D. McIntosh - Operating Engineer
*R. M. Koehler - Technical Support Engineer
*L. E. Summerlin - Staff Engineer
E. P. Stergakos - Engineer
D. G. Beam - Project Manager
*D. L. Freeze - Principal Field Engineer
C. B. Aycock - Field Engineer, Electrical
R. E. Blaisdell - Field Engineer, Welding and NDT
**J. R. Hall - Senior Electrical Engineer, Design
*R. J. Ansell - Steam Production Department
G. M. Thrailkill - Quality Control Engineer
M. Miller - Clerk

B&W

*W. Faasse - Site Construction Manager
*C. D. Thompson - Quality Control Engineer
J. F. Walker - Site Project Engineer

** By telephone
* Attended Management Interview

Management Interview

The management interview was held on April 21, 1972, and the following items were discussed:

1. Hampton confirmed the inspector's understanding that the control air lines located in the Units 1 and 2 battery rooms would be guarded by enclosing them in a four-inch pipe. Hampton also stated that an additional, redundant, safety valve would be installed on the air receiver located in the alcove adjacent to the Unit 2 batteries. He would not, however, commit DPC to testing these valves on a periodic basis. Murphy advised Hampton that he would review these proposals with his management and advise DPC if they were acceptable. (See Section II, paragraph 4)

2. Freeze agreed that the cable tray support extension welds would be repaired by qualified weldors using qualified procedures. (See Section II, paragraph 3)

3. The inspector advised Freeze that his review of the Southwest Research Insitutes (SwRI) report on the Oconee welding indicated that Regulatory's findings had been substantiated. Regulatory would look to DPC to take positive steps to verify that these deficiencies had not adversely affected the quality of the Oconee welding. (See Section II, paragraph 5)

4. The inspector advised Hampton that DPC would be expected to determined the effects that the reactor coolant system failures would have on previously-completed tests. Hampton stated that this evaluation was in progress and that the inspector would be informed of the results.

5. The inspector advised Hampton that he had reviewed the shift supervisor's log for the period of March 1, 1972, to April 15, 1972. The inspector stated that the log did not contain information that would be necessary to reconstruct the plant history or to permit orderly turnover of the plant at shift change. Hampton agreed to strengthen the logging requirements to include the inspector's comments. (See Section II, paragraph 6)

6. Hampton confirmed that DPC did not plan to conduct a pseudo-rod ejection test at high power level or to confirm the ability to shut down the plant at 100% power from outside the control room.

7. Murphy advised Hampton that on two occasions during the week, he had found unguarded and unlocked doors leading into the plants restricted areas. Hampton acknowledged the occurrences and stated that one door lock was being modified to prevent a recurrence. He stated that, in the future, guards would be stationed at any point at which access was necessary. Murphy stated that the Regulatory letter would address the need for tighter security.

8. Jape stated that he had reviewed a draft of the initial fuel loading procedure with Stergakos. From this review, it appears that Regulatory comments will be resolved satisfactorily. (See Section III, paragraph 3)

9. Jape stated that he had reviewed the drawing control procedure and that the control measures had not been fully implemented. When a drawing is removed from a controlled distribution file, no record is maintained. Thus, it was stated, the drawings are no longer under control as required by DPC's Administrative Procedure No. 1. This item had been discussed with Summerlin on April 19, 1972. Summerlin indicated that a checkout signature will be required when a drawing is removed from the files to correct this weakness in drawing control. (See Section III, paragraph 4)

10. Potapovs noted that his review of the steam generator repair operation had identified several potential problems but, in all cases, satisfactory resolutions were made and no outstanding items remain on this phase of the inspection. One of the problems identified during the inspection was related to inconsistencies between field construction procedures and manner of work performance. Another concerned inadequately-defined dye penetrant testing procedure, acceptance criteria and procedure qualification. The

inspector also noted that the DPC site QC was apparently not committed to take any part in the repair operation and that the QC surveillance of the B&W effort was being performed by the DPC Charlotte office on the basis of periodic site visits. The inspector advised that the adequacy of this type of QC coverage would be reviewed during subsequent visits.

Hampton stated that DPC Engineering department QA Supervisor, would perform audits of B&W's QA program for the repairs to the reactor coolant system to assure its adequacy. J. M. Curtis has been assigned this responsibility.

SECTION II

Prepared By: C. E. Murphy, Reactor Inspector (Testing and Startup Unit)

ADDITIONAL SUBJECTS INSPECTED, NOT IDENTIFIED IN SECTION I, WHERE NO DEFICIENCIES OR UNRESOLVED ITEMS WERE FOUND

1. Unit Schedules

Smith advised the inspector that DPC had not determined the extent of the delay to any of the units as a result of the Unit 1 vibration problem.

2. Concrete - Unit 2

During the placement of the eight-inch-thick concrete cap on the containment dome liner, the batch plant broke down for three hours. No concrete was placed for two hours. The breakdown occurred at about 10:00 p.m. As soon as the plant was restarted, a six-inch-deep pass of concrete was placed over the entire joint. The remainder of the cap was placed without incident. Visual inspection of the concrete after it had set indicated no cracking at the joint. To avoid the possibility of a recurrence during the placement of the remainder of the dome concrete, the batch plant at Jocassee Dam will be stocked with material to take over in the event of failure of the Seneca plant.

DETAILS OF SUBJECTS DISCUSSED IN SECTION I

3. Electrical Cable Installation - Unit 2

The Unit 2 cable tray supports in the cable spreading room and the electrical equipment room had been modified by welding on extensions. The inspector observed that the welds were of poor appearance. Upon closer examination, the inspector found that the welds did nc penetrate the metal and were of doubtful quality. Freeze could not verify that the welds had been made in accordance with approved procedures or that any type of NDT had been performed on them. He agreed that the supports were required to withstand seismic forces and that qualified welding procedures should have been used in attaching the extensions. He agreed to have the welds repaired by qualified weldors in accordance with approved procedures. This item was discussed in the management interview.

4. Control Air System

During a tour of the Unit 2 area of the auxiliary building, the inspector observed that an air receiver for the control air system was located in an alcove of the Unit 2 battery room. The only protection afforded the battery from the receiver was an eight-inch concrete block wall. The air line (2½ inches) to the receiver was routed through the wall and through the battery room. Since, during a L-DPC meeting, DPC had agreed to move the air line out of the Unit 1 battery room,[1/] the inspector called the DPC design department to discuss these items. Hall advised the inspector that DPC was aware of the agreement with L but had not been able to determine a suitable alternate design. He asked the inspector if the installation of a four-inch guard pipe around the air piping and the addition of redundant relief valves on the air receiver would be an acceptable alternate. The inspector told Hall that since this involved a L commitment, the inspector would have to contact L as to the acceptability of the proposed installation. In discussions with Hampton concerning the installation, the inspector asked about the testing frequency for the relief valves. Hampton advised the inspector that DPC would not make a commitment to test the valves unless it were required by L. These items were discussed at the exit interview and during a telecon with Smith on May 1, 1972. Smith was advised that the problem would be included on the inspector's outstanding items list, and would require resolution prior to fuel loading.

5. Welding Deficiencies

Murphy was given a copy of the report prepared by SwRI relating to their audit of the Oconee welding program. SwRI's conclusions and recommendations are summarized as follows:

a. Weld procedures should be revised to control and document repairs.

b. Positive control of filler materials should be instituted including receipt onsite through the issue and use for joints to be welded.

1/ RO Report No. 50-269/71-2

c. Document control procedures should be revised to include control of welding isometric pipe sketches.

d. The governing procedures for Form QC-36, "Field Weld Checkoff List," should be revised to make strict field compliance mandatory.

e. Record inaccuracies and/or inadequacies should be corrected to the extent possible by record supplementation and/or explanation and signed by a DPC representative with commensurate authority.

f. The Oconee site is not in full compliance with the requirements of the FSAR, Appendix B to 10 CFR 50, USAS B31.7, 1968 Edition and site quality assurance procedures E-1 and G-1. DPC should amend the FSAR and other governing documents to permit the use of USAS B31.7, 1969 Edition.

g. A form of serialized notation should be developed for indicating where surporting statements and/or documentation of correction can be found when the records indicate discrepancies in Class I and Class II piping.

h. DPC should survey stainless steel pipe welds made with type 316 and type 308 filler materials for delta ferrite contents of less than 3% and retain a metallurgical consultant to advise them concerning the possible microfissuring problems.

i. A sufficient number of the records audited exhibited inaccuracies and omissions to indicate that DPC's quality assurance/quality control of the site pipe erection was not considered to be adequate.

j. DPC should have a reaudit of the pipe erection records by a third party when a review of the existing records has been completed.

In discussions with Beam and Freeze, the inspector stated that the SwRI audit appeared to substantiate the previous findings of the Regulatory Inspectors.[1/] He told Beam that Regulatory would expect

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1/ RO Report No. 50-269/71-11

DPC to take positive steps to verify that the deficiencies in the welding program did not have an adverse effect on the quality of the safety-related and safety-feature systems. Beam stated that DPC had retained an outside consultant, Helmut Thielsch, to review the effects of the deficiencies. Murphy asked if DPC had considered such steps as taking boat samples and analyzing them for ferrite content. Beam replied that DPC planned only to make up specimens using low ferrite rod and making the analysis on these specimens. The inspector stated that he would want to review any steps taken by the licensee to verify the weld quality.

The welding problem was reviewed in the management interview and the inspector advised Freeze that this would be an unresolved item and urged that DPC complete their work on this item as soon as possible to avoid the danger of a delay in licensing.

6. Shift Supervisor's Log

The inspector reviewed the shift supervisor's log for the period of March 1, 1972, to April 18, 1972. The following deficiencies were noted.

a. For several of the shifts, the shift supervisor was not identified.

b. Changes and deletions were made and the responsible persons were not identified.

c. Time of events was not recorded.

d. Information relating to tests being conducted was insufficent to identify the particular tests and the test status.

e. Plant status at shift change not given.

f. There was very little or no discussion in the log regarding problems.

g. The log was inconsistent, e.g., an entry made during one shift would state that a test had been completed, whereas later entries would refer to the test as being in progress.

h. Plant history could not be reconstructed from the log and its references.

Murphy discussed these items with Smith who promised to review the log requirements. At the management interview, Hampton agreed that the log needed strengthening but stated that he would need to discuss the matter with Smith. On April 24, 1972, during a telecon with the inspector, Hampton agreed to the following specific changes:

a. The log will identify the shift supervisor for each shift.

b. For applicable items, the time of occurrences will be logged.

c. Plant problems will be entered as well as other events significant to safe operation of the plant. This may be by reference to another document.

d. Details will be expanded so that a complete picture is presented of tests in progress, e.g., test steps will be identified and basic results given.

e. A summary of plant status and tests in progress will be given at the end of each shift sufficient to permit an orderly turnover of the plant.

f. Scope of log will be expanded to include significant events. Log entries will be complete and factual.

Hampton stated that changes and deletions presently require initialling by the person making the change. The inspector plans to review the log during the next inspection.

SECTION III

Prepared By: F. Jape, Reactor Inspector (Testing and Startup Unit)

ADDITIONAL SUBJECTS INSPECTED, NOT IDENTIFIED IN SECTION I, WHERE NO DEFICIENCIES OR UNRESOLVED ITEMS WERE FOUND

1. Preoperational Test Program Status

Summerlin, DPC Staff Engineer, provided data for the following summary of the preoperational and startup test programs as of April 21, 1972:

	Total Number	Approved Procedures	Tests Completed	Results Approved or Tests Signed Off
Tests before hot functional	380	380 (100%)	380 (100%)	380 (100%)
Tests during hot functional	161	158 (98%)	95 (49%)	65 (40%)
Tests prior to core loading	144	101 (71%)	61 (43%)	52 (36%)
Total preoperational Tests	685	639 (93%)	536 (77%)	497 (73%)

2. Evaluation of Test Results

The licensee's evaluation of eleven completed tests was reviewed. The test results appear to satisfy the acceptance criteria of the tests.

The tests that were reviewed are listed below:

a. TP 1B 310 9 - Engineered Safeguards Two-Out-of-Three Logic Functional Test.

b. TP 1B 310 11A - Logic Subsystem I Module Interlock Test.

c. TP 1B 310 10B - Engineered Safeguard System Analog Channel 2 Module Interlock Test.

d. TP 1A 340 16 - Control Rod Drive System Position Indicator Dynamic Calibration.

e. TP 1A 240 4 - Component Cooling System Functional Test.

f. TP 1A 261 6 - CCW System Gravity and Recirculation Flow Test.

g. TP 1B 202 4 - HPI System Functional Test.

h. TP 1B 323 1 - Integrated Control System Reactor Demand.

i. TP 1B 321 4 - ICS/Unit Load Demand Change and Rate of Change Control, Instrument Calibration.

j. TP 1B 202 1 Q - HPI System Boron Dilute Permit Interlock Functional Test.

k. TP 1B 310 10A - Engineered Safeguard System Analog Channel I Module Interlock Test.

DETAILS OF SUBJECTS DISCUSSED IN SECTION I

3. Initial Fuel Loading Procedure

The initial fuel loading procedure is currently being rewritten to incorporate the RO comments discussed with DPC during the March 1972 inspection. (See RO Report No. 50-269/72-3) One comment remains unresolved. This item pertains to the location of readout equipment and type of signal provided by the temporary in-core flux monitor. A telephone discussion with Hampton on April 24, 1972, resulted in a commitment to considering to provide an audible and visible signal in both the control room and the reactor building.

All other comments appear to be satisfactorily resolved. The responsible engineer stated that an approved copy of the procedure will be sent to RO as soon as it becomes available.

4. Drawing Control

The drawing control system was reviewed to assure that only current drawings are used to test, operate, and maintain the plant. DPC issued a procedure for this purpose on February 22, 1972. The procedure was discussed with Miller and Summerlin.

A field check was made to determine if the system had been fully implemented. During this check, it was discovered that full control was not being maintained in that the location of many drawings could not be determined. When a drawing is removed from a controlled file, no record is maintained. Thus, when a revised drawing is issued, there is no way to retrive the old obsolete ones.

As a result, a new checkout system is being instituted. It is intended that the location of each drawing be known at all times. When revisions are issued, the old drawing will be either destroyed or stamped as being out-of-date.

SECTION IV

Prepared By: U. Potapovs, Reactor Inspector (Metallurgy)

ADDITIONAL SUBJECTS INSPECTED, NOT IDENTIFIED IN SECTION I, WHERE NO DEFICIENCIES OR UNRESOLVED ITEMS WERE FOUND

1. General

Announced inspection was made on April 19-21, 1972, at Oconee 1 to review the steam generator repair program.

DETAILS OF SUBJECTS IN SECTION I

2. Status of Repair

The "B" generator dome cladding had been cleaned up by localized grinding and fairing-in where necessary to remove disturbed metal. The cladding had been dye penetrant inspected and found acceptable. Eddy-current test was used to verify minimum cladding thickness in areas where repair grinding was necessary. The tube ends in the "B" generator were not as badly damaged as those in "A" unit and it was anticipated that manual grinding would be sufficient to remove disturbed metal and obtain PT clearance. The grinding was now in progress, and was carried out concurrently with penetrant examination and charting of the affected tubes for subsequent weld repair. It was anticipated that all tubes in the "B" generator could be repaired by manual localized TIG welding without having to remove the original factory fillet weld. At this time, it was estimated that at least 290 tubes will require weld repair. All tubes (approximately 15,000) will be dye penetrant examined before acceptance using the standard shop acceptance criteria.

Machining equipment had been installed inside the "A" generator dome and spot-facing of the damaged tube ends was in progress using two machines simultaneously. Approximately 300 tubes had been spot-faced. It was expected that approximately 1/8 inch will be removed from the tube sheet surface. The machining operation utilized 1 1/16 inch diameter, flat-bottomed end mills which are centered on the tube ends. The machines are supported on a drilling fixture which is aligned parallel with the tube sheet surface. Machining depth is controlled with dial indicators and positive stops are provided to prevent accidental depth over-

runs. The cladding thickness has been established at .410 to .420 by drilling two, 180° apart holes through the deposit and etching to determine the bond area. Original plans included the use of eddy-current techniques to establish the cladding thickness at several locations, but a satisfactory method could not be developed and these plans have been discarded.

3. Project Organization

The repair work is being done by B&W construction company utilizing a special project team organized for this task. The site project engineer appointed for the repair (Walker) is manager of manufacturing for the Nuclear Equipment Division in the B&W corporate organization and therefore intimately familiar with the manufacturing process. A special QA manual has been prepared for the Oconee 1 repair operation and has been in effect since April 7, 1972. The manual has been approved by the DPC QA organization.

Arrangements have been made for the services of an authorized inspector (Hartford) to cover the repair operations. The code inspector has been provided with a copy of the QA manual.

From the licensee standpoint, the repair operation is being treated as an extension of the original shop fabrication. The DPC site QC is not involved in the surveillance of B&W activities. Inspection coverage is provided by the DPC Quality Assurance organization (Charlotte) in the form of periodic site visits.

4. Provisions for Controlled Repair Process

The system for process control is outlined in the QA manual and appears to be consistent with the ASME Code requirements for controlled fabrication. Field construction procedures are utilized as the basic fabrication tools. These are prepared by the field project engineer and concurred with by the field QC supervisor. The field construction procedures outline all fabrication and inspection operations, provide or reference sufficient detail to perform the described operation and require appropriate signoffs by the responsible construction or inspection personnel. Provisions are also made for treatment of deviations and non-conformances.

Review of the documentation and control system and its implementation resulted in several comments:

a. Work on the "B" generator had commenced prior to adoption of the field construction procedures outlined in the QA manual; hence, a somewhat different documentation system is on file for this work. The inspector noted that care should be exercised to assure that orderly transition has been made to the current manufacturing and documentation system and that the documentation is complete including the transition period.

b. It was difficult to relate the field construction procedures to the overall repair plan or general work outline since the sequence numbers were not correlated. Thompson noted that the same comment had been made during a DPC QA audit and that improvements were being considered in this area.

c. In some cases, the conduct of work did not appear in complete accord with the field construction procedures and operations were conducted out of sequence. On the "A" generator, for example, the construction procedure required that prior to machining, all tube ends be inspected and classified as (a) spot-faced for complete rewelding, (b) spot-faced for repair weld only and (c) designated for manual repair grinding and local repair.

The operation had been signed off with notation that all tubes are to be spot-faced without classifying whether the spot-facing was intended for complete reweld (machined 1/8 inch below clad surface) or for repair weld (only protruding tube end removed). Verbal discussions with Thompson indicated that all machining at this time was for complete rewelding, but the condition of peripheral tubes would be reevaluated at a later time for the possibility of saving several of the outer tube rows. He noted that the work instructions would be clarified in this area.

5. Nondestructive Examination

The basic NDT procedure used in the repair operation is dye penetrant. Review of the records showed that procedure 12-2-PT-1 had been specified and used on steam generator "B". Examination of this procedure and the QA manual resulted in several comments.

a. The QA manual was found to contain two PT procedures: 12-2PT-1 and 12-2PT-/C1. Both were nonwater washable procedures but utilized different penetrant types and had different acceptance criteria. It could not be determined from the manual which was preferred.

b. The acceptance criteria for procedure 12-2PT-1, which was specified for the "B" generator, was not consistent with the application requirements. Procedure 12-2PT-1 was apparently intended as a general weld inspection procedure since it permitted rounded indications up to 3/16 inch diameter. Attachment 1A had been added to the procedure restricting the acceptance criteria for tube end inspection. This attachment, however, was not referenced in the field construction procedures.

c. Procedure 12-2PT-1 permitted the use of two different families of penetrant groups. The field construction procedures did not designate a specific penetrant type, but referenced only the general procedures.

d. Procedure 12-2PT-/C1 utilized a special fast-drying penetrant. The acceptance criteria was equivalent to that contained in attachment 1A to procedure 12-2PT-1.

Thompson stated that procedure 12-2PT-/C1 would not be used and that this penetrant type would be removed from the jobsite. He also noted that future field construction procedures would reference the specific acceptance criteria and penetrant group intended for the application.

Implementation of these commitments was subsequently verified and the resolution is considered satisfactory. Qualifications of the B&W NDT personnel involved in the repair were reviewed and found to be consistent with the provisions of SNT-TC-1A.

6. Examination of Reactor Pressure Vessel

A brief inspection of the reactor vessel lower head was made to observe the in-core instrumentation tube failures. The fracture surfaces showed evidence that the failures were initiated by fatigue which propagated across varying distances of the tube diameters before the final phase of failure which appeared to be due to mechanical overload. Some tubes showed multiple fatigue initiation sites and varying rates of propagation. The failures did not appear to be associated with the vessel attachments welds.

Examination of the core structure supports near the vessel lower head showed slight evidence of fretting which could be associated with the vibration of the core support structure.