



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
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Report Nos.: 50-269/94-26, 50-270/94-26 and 50-287/94-26

Licensee: Duke Power Company
 422 South Church Street
 Charlotte, NC 28242

Docket Nos.: 50-269, 50-270, and 50-287

License Nos.: DPR-38, DPR-47, and DPR-55

Facility Name: Oconee Nuclear Station Units 1, 2 and 3

Inspection Conducted: August 29 - September 2, and
 September 12 - 16, 1994

Inspector: S. Rudisail 10/7/94
Date Signed

Approved by: M. Shymlock 10/12/94
Date Signed
 M. Shymlock, Chief
 Plant Systems Section
 Engineering Branch
 Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was conducted to review and assess the adequacy of corrective actions for a violation, deviations and findings identified during the Electrical Distribution System Functional Inspection (EDSFI) of NRC Inspection Report 50-269/93-02, 50-270/93-02, and 50-287/93-02. Temporary Instruction 2515/111, Electrical Distribution Follow-up Inspection was used for guidance during this inspection.

Results:

In the areas inspected a violation was identified. In response to Deviation 93-02-01, the licensee issued a procedure to semiannually verify the corrective action of locking valves open on Keowee cooler heat exchangers. The licensee had failed to perform this verification. This was identified as violation 94-26-01 (paragraph 3.4). Violation 93-02-01, Failure to Classify Feeder Circuit Breakers as Safety Related was closed. Corrective actions were

Enclosure

determined to be adequate. Deviation 93-02-02 was not closed. Corrective actions identified by the licensee had not been completed. Inspection of cable identified in the corrective action was not scheduled for completion until October 31, 1995. A modification to separate cables for 2LP-19 and 2LP-20 was scheduled for the Unit 2 refueling outage EOC14. The findings of the EDSFI were collectively identified as IFI 93-02-03. The response to these findings and the applicable corrective action was reviewed. Most calculations required to be revised in response to the findings were not complete and therefore not reviewed. Other corrective actions were also incomplete. Overall, the inspector considered the progress of the corrective actions to be slow. These items were addressed in a management meeting between Duke Power and the NRC on September 29, 1994. At that meeting Duke Power identified a completion date of November 1995 for the outstanding items associated with the EDSFI. The inspector closed IFI 93-02-03 to document the items completed in response to EDSFI findings. IFI 94-26-02 was opened for further review of incomplete finding responses.

IFI 93-02-04, Items Identified for Further NRC Review was closed.

Additionally, IFI 93-20-04, Alarm Circuit/Control Circuit Interface was reviewed and closed. Corrective actions for this item were reviewed and determined to be satisfactory.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *M. Abercrombie, Keowee Operations
- *M. Bailey, Regulatory Compliance
- *S. Burton, Keowee Operations
- *J. Davis, Engineering Manager
- *B. Dolan, Safety Assurance Manager
- *T. Grant, Electrical Engineering
- *T. Ledford, Supervisor, Electrical Engineering
- T. Lee, Operations Support
- *C. Little, Supervisor, Electrical Engineering
- M. Miller, Electrical Engineering
- *G. Rothenberger, Operations Superintendent
- *R. Severance, Mechanical Engineering
- *S. Townsend, Keowee Operations

Other licensee employee contacted during this inspection included craftsmen, engineers, technicians, and administrative personnel.

NRC Employees

- P. Harmon, Senior Resident Inspector
- *L. Keller, Resident Inspector
- *K. Poertner, Resident Inspector

*Attended exit interview

Acronyms and abbreviations used throughout this report are identified in the last paragraph.

2. Background

During January 25 through March 5, 1993, the NRC conducted the Electrical System Distribution Functional Inspection (EDSFI). The purpose of this inspection was to assess the capability of the Oconee Electrical Distribution System to perform its functions during operating and accident conditions. The conclusion of the EDSFI team was that the electrical distribution system would perform its intended function pending further analysis and testing by the licensee. During the EDSFI inspection a violation and several deviations were identified. Additionally, findings identified during the EDSFI were collectively identified as IFI 93-02-03.

3. Review of Corrective Action for Violation and Deviations (TI 2515/111)

The inspector reviewed a violation and three deviations identified at Oconee during the EDSFI. These items are discussed in the following paragraph.

- 3.1 (Closed) Violation 93-02-01, Failure to Classify Feeder Circuit Breakers as Safety Related, was issued for failure to classify feeder circuit breakers from the startup transformers to the Reactor Coolant Pump busses or the 4.16 kV load shed circuit breakers feeding non-safety related loads as safety related. Duke Power responded to this violation and denied the examples cited were a violation of NRC requirements. However, Duke Power agreed to enhance the maintenance and testing of the subject circuit breakers commensurate with the requirements for safety related circuit breakers. The NRC responded that the enhancement of the circuit breaker testing and maintenance would place the licensee in compliance with the NRC requirements.

The inspector reviewed the licensee implementation of the maintenance and testing of the circuit breakers as safety related. Nuclear Station Directive NSD B.1 307, QA Condition Structures, Systems and Components was revised to require 6.9 kV Switchgear TA and TB to be maintained and tested as QA-1. The NSD was also revised to require 4.16 kV switchgear TC, TD, and TE as QA-1. Procedure IP/O/A/2001/003A, Inspection and Maintenance of 4.16kV and 6.9kV ACB's was also reviewed. This procedure had been revised to require Quality Control requirements and inspection of maintenance activities as required for QA-1 components.

Additionally, work orders were reviewed for performance of maintenance on circuit breakers. Work order 93082223 was issued for maintenance on circuit breaker 1TE-06. This work order required the replacement of the puffer tubes on the circuit breaker. The inspector verified that this work order accomplished the work as required for QA-1 work activities and the replacement of parts met the requirements for QA-1 work activities. Violation 93-02-01 was closed.

- 3.2 (Open) Deviation 93-02-02, Item 1, Deviation from FSAR Color Coding Requirements for Cables was one of three examples of a deviation identified during the EDSFI. The first example was identified as power cables 1XS2 and 1XS48 not being correctly color coded. These cables run from the motor control centers 1XS1 and 1XS2 to transformer CT4 cooling fans. Final Safety Analysis Report (FSAR) section 8.3.1.3 states that motor control center (MCC) 1XS1 power and control system cable are color coded gray and that MCC 1XS2 cables are color coded yellow. Contrary to this requirement, both cables were color coded black.

The licensee responded to this deviation and agreed that it was a deviation from the requirements of the FSAR and an oversight during initial installation. The licensee considered the color coding was intended to ensure separation during installation. The separation requirements are for mutually redundant cables to be run in separate trays. The cables are routed in different cable trays until they reach the block house of the CT4 transformer. The cable is interlocked armor type cable. The licensee determined the impact of failure of both cables and concluded that should they fail the transformer would continue to operate as designed with only a small impact on transformer life. Alarms are available to indicate loss of power to the fans and high oil and winding temperature in the transformer. Operator action

would be required upon receipt of alarms. The licensee concluded that the impact on safety due to the cable being color coded black was insignificant. The inspector agreed with this conclusion. The licensee proposed additional corrective action to perform an inspection of all plant, switchyard, and Keowee cables fed from safety related busses not previously identified as having mutually redundant safety related functions. These cables will be inspected to ensure that they are not routed in the same tray with other cables with redundant functions. This action is scheduled to be completed by October 31, 1995. This deviation remains open.

- 3.3 (Open) Deviation 93-02-02, Item 2, identified mutually redundant cables for Unit 2 emergency core cooling isolation valves 2LP-19 and 2LP-20 as being routed in the same cable tray. This was contrary to the requirements of FSAR section 8.3.1.4.6.2. The licensee agreed that this was a deviation.

The corrective action for this deviation was to perform a modification to separate the cables. Minor modification OE-5990 was prepared to separate the cables. This modification was scheduled to be performed during Unit 2 refueling outage (RFO) (EOC14) scheduled for the fall of 1994. The inspector reviewed this modification and the scope of work to be accomplished during its performance. This modification will accomplish the required corrective action. Inspection of Unit 1 and Unit 3 cable for valves LP-19 and LP-20 were performed and the separation problem did not exist. The licensee proposed additional corrective action to perform an inspection of all plant, switchyard, and Keowee cables fed from safety related busses not previously identified as having mutually redundant safety related functions. These cables will be inspected to ensure that they are not routed in the same tray with other cables with redundant functions. This action was scheduled to be completed by October 31, 1995. This deviation will remain open pending completion of the modification and inspection.

- 3.4 (Closed) Deviation, 93-02-02, Item 3, identified examples of heat exchanger cooler piping that did not have a provision for relief of overpressure. United States of America Standards (USAS) B31.1, section 101.4.2 requires either design of the piping to withstand overpressure conditions or a means of pressure relief be provided. FSAR section 3.2.2.2 established the design criteria for Keowee system cooler piping as USAS B 31.1.0 section 101.4.2. The Keowee turbine guide bearing oil cooler, generator thrust bearing cooler, and generator air coolers were not designed with the ability to withstand increased pressure in an isolated mode. The licensee agreed that this was a deviation.

The proposed corrective action was to lock open the outlet valves in accordance with Operation Management Procedure (OMP) 1-17. This requires semi-annual verification that the valves are locked. To accomplish this verification, a new procedure was prepared and issued to provide for semiannual verification of the locked valves. Keowee procedure OP/A/2000/45, Lock Verification was issued to accomplish this action. During this inspection the inspector reviewed the results of

the semi-annual verification of lock position. The licensee had not performed the procedure since issuance on June 29, 1993, and had no record of its performance at the time of issuance. The procedure was performed September 1, 1994, following this determination. The inspector reviewed the results of the procedure and confirmed that the valves required to be locked open were in the appropriate locked position. This was identified as Violation 94-26-01, Failure to Accomplish Procedure for Corrective Action. This example of the deviation was closed.

4. Review of Inspector Follow-up Items (IP 37550)

The inspector reviewed the items identified at Oconee as Findings. These items are discussed in the following paragraphs.

- 4.1 (Closed) IFI 93-02-03, EDSFI findings consisted of six findings with several issues identified in each finding. Finding 1 of the IFI identified a lack of integrated testing for the Oconee emergency power system and a lack of testing to demonstrate the design capability of the power source. Several features of the emergency power source had not been tested. The overhead path from Keowee and the switchyard isolation relays of the Emergency Grid Protection system had not been tested. The Keowee Hydro Emergency Start test procedure PT/O/A/0620/16 was identified as not performing tests in accordance with FSAR section 8.3.1.1.1. Also, the composite of all Keowee testing was identified as not bounding the design requirements.

The licensee response to Finding 1 was reviewed by the inspector. Testing of the switchyard isolation relays has been accomplished. During the subsequent RFO for Unit 2, test procedure PT/O/A/0610/022 was performed on May 22, 1993. The NRC witnessed this testing as documented in NRC Inspection report 50-369, 270, 287/93-19. This was an integrated test of the overhead power path which included the isolation relays. The second channel of the switchyard isolation relays was tested during the RFO for Unit 1 on May 24, 1994. These test results were reviewed with no discrepancies identified.

FSAR section 8.3.1.1.1 states that each Keowee hydro unit generator is equipped with a volt-per-cycle limiting feature which permits it to accept full emergency power load as it accelerates from zero to full speed. The licensee addressed the NRC concern that this FSAR requirement was not being met by the present mode of testing. Procedure PT/O/A/0620/016 verifies that the Keowee unit will reach rated speed and voltage within the required 23 seconds as required by the FSAR. This test was performed annually. The ability to reject load and separate from the grid was demonstrated every RFO since January 1992, by PT/O/A/0610/01J. This test also demonstrates the ability to reconnect to the overhead power path and properly align the underground path. The results of PT/O/A/0610/01J prior to 1987 were provided to demonstrate the ability to accept loading and accelerate to full speed and voltage as required. PT/O/A/0610/022 was performed to demonstrate the ability to place loads on the generators which exceed the emergency loads. This

procedure loaded a Reactor Coolant Pump onto the Keowee unit. This load was measured as 9 MVA steady state and 47 MVA inrush.

The inspector concluded the testing described above satisfactorily demonstrated the ability of the Keowee units to meet their design requirements. Finding 1 of IFI 93-02-03 was closed.

4.1.1 Finding 2 was an identification of analyses, studies and calculations which were not complete or had not been performed. There were ten elements identified in this finding. Only one element will be closed.

Item 1 of this finding identified that calculation OSC-2059, 4160 Voltage Study, may not have bound the worst case. The revision to this calculation was not complete. This item will remain open.

Item 2 identified that no analysis or test was available to verify the rapid transfer timing was correct. An analysis was scheduled to document transfer adequacy. This analysis was not complete. Item 2 of this finding will remain open.

Item 3 identified that a transient voltage study for the 4kV safety loads when supplied by the Lee or Central substation was not available. The licensee responded that a calculation to demonstrate dynamic modeling of the Lee and Central power sources would be completed. During this inspection this item was not complete. This item will remain open.

Item 4 identified that a study to review control cable length and the size of fuses that protect them had not been conducted. The licensee responded that the load study calculation of OSC-2059 would address fuse adequacy. This item was not complete during the follow-up and this item will remain open.

Item 5 identified that the Keowee 600V Auxiliary Power System Voltage Analysis did not evaluate maximum and minimum expected voltages. The licensee planned calculation KC-UNIT-1-2-0095 to address voltage adequacy in the auxiliary power system. This item was not complete and will remain open.

Item 6, concerned the lack of an analysis to support that the Keowee auxiliaries would not be damaged by overvoltage or overfrequency when supplied by one Keowee unit. The inspector reviewed the actions completed for this finding. One calculation had been completed. The calculation to demonstrate the effect of overvoltages and overfrequencies on the Keowee auxiliaries was complete. The calculation OSC-5701, Oconee Keowee Overhead Path Analysis identified weaknesses that limit the percent power the Keowee units can generate to the grid and the alignment of the Keowee units. These concerns are being addressed in modification NSM 52966 currently being reviewed by NRC. This item will remain open.

Item 7 identified the need for the full scope and completion of component calculations for Keowee. Calculations to resolve this item were not complete. This item will remain open.

Item 8 identified the lack of an analysis to support the assumption that Oconee safety loads could properly perform during an overfrequency transient lasting 40-50 seconds. The licensee plans to complete an analysis to support this assumption. This item is not complete and will remain open.

Item 9 of this finding identified that calculations for the Safe Shutdown Facility are not complete. These calculations are scheduled for completion by December 1994. This item will remain open.

Item 10 identified the need for more rigorous testing of the minimum required pickup voltage for components of the Switchyard 125 VDC system to support calculations. Calculations had demonstrated acceptable voltage levels at each component with the exception of one case. This case was the pickup voltage to the Cutler Hammer Type M relay. The licensee now purchases the type M relays from a third party supplier. Test results are provided which document ability of the relays to operate within the range of voltage determined from the Oconee calculation. The inspector reviewed this documentation. This item was closed.

Other calculations and studies required for completion of the actions addressing this finding were in various stages of development. The inspector did not review draft calculations. These items are all scheduled for completion by November 1995 and will be reviewed after that date. These incomplete actions addressing this finding are identified as Inspector Follow-up Item, IFI 94-26-02, EDSFI Finding Items Not Closed During Follow-up Inspection.

4.1.2

Finding 3 identified examples of inadequate control of drawings and setpoint documents. Inaccuracies were identified in Keowee mechanical support system flow diagrams and drawings of Keowee air systems were not available.

The inspector reviewed the corrective actions for the drawing deficiencies. The following drawings were reviewed: KFD-105A-1.1, Unit 1 Flow Diagram of Governor Oil System, KFD-105A-2.1, Unit 2 Flow Diagram of Governor Oil System, KFD-101A-1.1, Unit 1 Flow Diagram of the Turbine Guide Bearing Oil System, KFD-101A-2.1, Unit 2 Flow Diagram of the Turbine Guide Bearing Oil System, KFD-103A-1.1, Unit 1 Flow Diagram of High Pressure Oil System, KFD-103A-2.1, Unit 2 Flow Diagram of High Pressure Oil System, KFD-100A1.1, Unit 1 Flow Diagram of Turbine Generator Cooling System, and KFD-100A1.1, Unit 1 Flow Diagram of Turbine Generator

Cooling System. All drawings had been revised to correct the deficiencies identified during the EDSFI inspection. Finding 3, item 1 was closed.

Item 2 of this finding noted that bulletins, information notices and generic letters had not been reviewed for applicability to Keowee. The licensee initiated a comprehensive review of operating experience documents for applicability to Keowee. This review was completed and actions items have been identified for any missed items discovered during the review. This item was scheduled for completion by November 1995 and will remain open.

Item 3 identified that there was not a controlled setpoint document available at Keowee except for electrical relay settings. Corrective actions for this item are not complete. This portion of the finding will remain open.

- 4.1.3 Finding 4 identified areas where additional licensee actions were warranted to complete corrective actions. Item 1 of this finding was that the response to the Keowee governor system to postulated failures was not fully analyzed. Item 2 of this finding identified that implementation of a setpoint revision to the Loss of Field relay at Keowee had not been completed.

The inspector reviewed minor modification OE-6215 which implemented a setpoint change for the Loss of Field relay in accordance with the results of design calculation, OSC 4300. Item 2 of Finding 4 was closed.

The licensee responded to the concern that postulated failures of the Keowee governor had not been analyzed. The Keowee governor system single failure analysis had been completed. An enhancement to the governor's availability was still under review. A modification to add a DC powered governor oil pump was being planned. Item 1 of Finding 4 will remain open.

- 4.1.4 Finding 5 identified Keowee engineering analyses which were not sufficiently comprehensive and specific values had not been established that would bound design criteria. All credible failure modes for the Keowee governor control system and the voltage regulator had not been considered. The basis for bypassing trip functions during emergency start of the Keowee unit was not fully analyzed or documented. The effect of frequency of the electric power supplied by Keowee to ECCS pump motors had not been fully evaluated and acceptable voltage and frequency limitations for Keowee electrical auxiliaries and the emergency power system should be defined.

The inspector reviewed calculation KC-Unit 1-2-0098, Keowee Governor Mechanical Single Failure Analysis. The analysis methodology did not differ from the original memorandum to file reviewed during the EDSFI that documented the results of the

single failure review of the governor. The licensee initiated a design study to further examine the bypassing of trip functions during an emergency start. This study was not complete at the conclusion of this inspection. Finding 5 will remain open.

- 4.1.5 Finding 6 identified design features and mechanical components at Keowee that were not being tested. Weaknesses were identified in the testing of lubricating oil systems at Keowee. Pressure switches in the carbon dioxide fire protection system were not being tested or calibrated. Valves which were required to change position for Keowee to provide emergency power were not included on the Keowee active valve list. These valves were 1 and 2 OG-7 which were the float valves for the governor oil tank and the check valves of the ACB air accumulators. Weaknesses were identified in the testing procedures associated with ACBs 1, 2, 3, and 4.

The inspector reviewed the corrective action for this finding. Procedure IP/1/A/0400/023, Unit No. 1 CO2 Fire Protection Pressure Switch Calibration and IP/2/A/0400/023, Unit No. 2 CO2 Fire Protection Pressure Switch Calibration were developed for the calibration of the pressure switches in the Keowee fire protection system. Procedure MP/O/A/2000/059, Periodic Test of the CO2 System Generator No. 1 and Procedure MP/O/A/2000/060, Periodic Test of the CO2 System Generator No. 1 were developed for testing of the Keowee fire protection system. These procedures are implemented and were reviewed and the inspector did not identify any concerns. Minor modifications OE-5586 and OE-5597 had been completed to install the necessary valves and test tee for testing of the fire protection system. These modifications were reviewed and no problems were identified.

The inspector also reviewed completed work orders for the testing of oil level switches in the Keowee system. These work orders had been completed to ensure that all oil level switches in oil systems effecting operability at Keowee were calibrated. The inspector found the calibrations satisfactory.

Procedure revisions to remove weaknesses from the procedure for testing the Keowee Air Circuit Breakers was not complete. The actions to determine which Keowee equipment will be added to the Inservice Testing (IST) program was still incomplete. These incomplete actions will be identified under IFI 94-26-02.

- 4.2 (Closed) IFI 50-269/93-20-04, Alarm Circuit/Control Circuit Interface (IP 92701)

The inspector reviewed IFI 93-20-04 which was opened after Unit 1 experienced a turbine driven emergency feedwater pump (TDEFWP) auxiliary oil status alarm in the control room. Investigation of the problem by Work Order 40704C revealed blown fuses in the TDEFWP auxiliary oil pump start circuit. The TDEFWP was declared inoperable because the automatic

start feature of the pump was defeated if the auxiliary oil pump is out of service. The cause of the blown fuses was identified as a shorted alarm relay AR-15. Problem Investigation Process (PIP) No. 1-093-0545 was opened to determine corrective action for this problem and track its resolution.

The inspector reviewed the corrective actions associated with the PIP. A modification to add parallel fuses across the existing fuses was completed on Unit 1 and 3 by minor modification OE-6080 and minor modification OE-6082 respectively. Minor modification OE-6081 was outstanding for Unit 2. The modification prevented a blown fuse in the indication portion of the circuit from disabling the pump start circuit. IFI 93-20-04 was closed.

7. Exit Meeting (IP 30703)

The inspection scope and results were summarized on September 16, 1994, with those individuals indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings. There was no dissenting comments received from the licensee. Proprietary information is not contained in this report.

- (Opened) Violation 50-269/94-26-01, Failure to Perform Procedure as Corrective Action
- (Opened) Inspector Follow-up Item, IFI 94-26-02, EDSFI Finding Items Not Closed During Follow-up Inspection
- (Closed) Inspector Follow-up Item, IFI 93-02-03, EDSFI Findings
- (Closed) Inspector Follow-up Item, IFI 93-02-04, EDSFI Items Identified for NRC Review
- (Closed) Inspector Follow-up Item, IFI 93-20-04, Alarm Circuit/Control Circuit Interface

8. Acronyms and Abbreviations

CO2	Carbon Dioxide
ECCS	Emergency Core Cooling System
EDSFI	Electrical Distribution System Functional Inspection
IST	Inservice Testing
IP	Inspection Procedure
KFD	Keowee Flow Diagram
kV	Kilovolts
MCC	Motor Control Center
MVA	Mega Volt Amperes
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
NSD	Nuclear Station Directive
QA	Quality Assurance
RFO	Refueling Outage
TDEFWP	Turbine Driven Emergency Feedwater Pump
VDC	Volts Direct Current