UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30303-8931

June 30, 2000

Duke Energy Corporation
ATTN: Mr. W. R. McCollum
Vice President
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION - NRC SUPPLEMENTAL INSPECTION 50-270/00-10

Dear Mr. McCollum:

On June 5 through 26, 2000, the NRC completed a supplemental inspection at your Oconee Nuclear Station. The enclosed report presents the results of this inspection. The results of this inspection were discussed on June 27, 2000, with Mr. M. Nazar and other members of your staff.

This was a supplemental inspection of four Unit 2 reactor trips which resulted in a "white" performance indicator (PI) due to exceeding the PI threshold value of more than 3 unplanned scrams per 7,000 critical hours. Performance of this inspection was in accordance with the guidance contained in NRC Inspection Manual 2515 Appendix B, Supplemental Inspection Program.

Based on the results of this inspection, we have concluded that the causes of the Unit 2 reactor trips were well understood by your staff and immediate corrective actions were appropriate. Longer-term corrective actions for the June 19, 1999, December 21, 1999, and December 24, 1999, reactor trips were found to be appropriate and were meeting licensee schedules for completion. Similarly, the longer-term corrective actions for the February 28, 1999, reactor trip were also found to be appropriate; however, corrective actions to perform thermo-graphic inspections on various electrical switchgear had not been scheduled at the time of this inspection.

As indicated in the report, no findings were identified during this inspection.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available **electronically** for public inspection in the NRC Public Document

Room **<u>or</u>** from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Charles R. Ogle, Chief
Reactor Projects Branch 1
Division of Reactor Projects

Docket No: 50-270
License No: DRP-47

Enclosure: NRC Supplemental Inspection Report w/Attached NRC's Revised Reactor Oversight Process

cc w\encl:
Compliance Manager (ONS)
Duke Energy Corporation
Electronic Mail Distribution

Lisa Vaughn
Legal Department (PB05E)
Duke Energy Corporation
422 South Church Street
Charlotte, NC 28242

Rick N. Edwards
Framatome Technologies
Electronic Mail Distribution

Anne Cottingham
Winston and Strawn
Electronic Mail Distribution

Mel Fry, Director
Division of Radiation Protection
N. C. Department of Environmental Health & Natural Resources
Electronic Mail Distribution

Virgil R. Autry, Director
Div. of Radioactive Waste Mgmt.
S. C. Department of Health and Environmental Control
Electronic Mail Distribution

R. Mike Gandy
Division of Radioactive Waste Mgmt.
S. C. Department of Health and Environmental Control
Electronic Mail Distribution

County Supervisor of Oconee County
415 S. Pine Street
Walhalla, SC 29691-2145

Lyle Graber, LIS
NUS Corporation
Electronic Mail Distribution

L. A. Keller, Manager
Nuclear Regulatory Licensing
Duke Energy Corporation
526 S. Church Street
Charlotte, NC 28201-0006

Peggy Force
Assistant Attorney General
N. C. Department of Justice
Electronic Mail Distribution

Distribution w/encl:
D. LaBarge, NRR
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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No:	50-270
License No:	DPR-47
Report No:	50-270/00-10
Licensee:	Duke Energy Corporation
Facility:	Oconee Nuclear Station, Units 2
Location:	7812 Rochester Highway Seneca, SC 29672
Dates:	June 5 - 26, 2000
Inspectors:	M. Shannon, Senior Resident Inspector, Oconee Nuclear Station D. Starkey, Resident Inspector, Sequoyah Nuclear Plant
Approved by:	C. Ogle, Chief Reactor Projects Branch 1 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

Adams Template:

NRC Inspection Report 50-270/00-08, Duke Energy Corporation, Oconee Nuclear Station, Unit 2, conducted between June 5 - 26, 2000. This Supplemental Inspection reviewed the four Unit 2 reactor trips, which occurred on February 28, 1999, June 19, 1999, December 21, 1999, and December 24, 1999. The inspection, which was conducted by resident inspectors, did not identify any safety significant issues. The significance of issues is indicated by their color (green, white, yellow, red), as determined by the NRC's Significance Determination Process (Inspection Manual Chapter 0609), as discussed in the attached summary of the NRC's Revised Reactor Oversight Process.

Cornerstone: Initiating Events

- There were no safety significant findings during this inspection.

Report Details

01 Inspection Scope

This supplemental inspection was performed in accordance with Inspection Procedure 95001, Inspection For One Or Two White Inputs In A Strategic Performance Area, to assess the licensee's evaluations associated with the four Unit 2 reactor trips which occurred during the four quarter period from January 1, 1999, through December 31, 1999. The four trips exceeded the performance indicator (PI) threshold value of more than 3 unplanned scrams per 7,000 critical hours and resulted in the PI being characterized as "white." This PI is related to the initiating events cornerstone in the reactor safety strategic performance area.

02 Evaluation of Inspection Requirements

02.1 Reactor Trip Number 1

The inspector reviewed Licensee Event Report (LER) 50-270/99-01 and Problem Investigation Process report (PIP) O-99-00771 associated with the February 28, 1999, Unit 2 reactor trip that was caused by the failure of an overload protection fuse in the main turbine electro hydraulic control (EHC) system.

02.1.1 Problem Identification

a. Determine that the evaluation identifies who (i.e., licensee, self-revealing, or NRC), and under what conditions the issue was identified.

   The cause of this event was equipment failure. The failure of the 60 amp overload protection fuse in the EHC system and the subsequent reactor trip were self-revealing.

b. Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.

   In 1995 a spare breaker, in which the fuse was located, was moved to the breaker cubicle location where the fuse failure occurred. The analysis of the failed fuse revealed that the fuse failed due to long-term exposure to elevated temperatures, which could have been caused by a loose fuse clip, loose connection to the fuse holder, or a poor solder joint.

c. Determine that the evaluation documents the plant specific risk consequences (as applicable) and compliance concerns associated with the issue.

   The licensee's evaluation determined that the event was of no significance with respect to the health and safety of the public. The inspectors concluded that the licensee's determination was reasonable.

02.1.2 Root Cause and Extent of Condition Evaluation

a. Determine that the problem was evaluated using a systematic method(s) to identify root cause(s) and contributing cause(s).

A detailed failure analysis on the failed fuse was performed by the fuse manufacturer (Cooper Industries, Bussman Division) and by Spectrum Technologies.

b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

The licensee's root cause evaluation process (evaluation of the failed fuse by the manufacturer and an independent laboratory) was commensurate with the significance of the problem.

c. Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee's evaluation included a review of operating experience within the past two years, which determined that there had not been any reactor trips associated with equipment failures of this type.

d. Determine that the root cause evaluation included consideration of potential common cause(s) and extent of condition of the problem.

The licensee's evaluation included a review of the preventive maintenance program to determine appropriate changes to prevent recurrence. However, as of the date of this inspection, the licensee had not completed an extent of condition review to determine if other panelboards, similar to the one which contained the failed fuse, have hot spots which could result in fuse failures. The licensee has initiated a preventive maintenance (PM) action form to perform infared scans, on a three-year basis, of panelboards to identify hot spots. To date, none of the infared scans have been conducted.

02.1.3 Corrective Actions

a. Determine that appropriate corrective action(s) are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.

The licensee took immediate corrective actions to replace the failed fuse and to check the EHC circuitry for problems. A detailed failure analysis was performed on the failed fuse and the PM program was evaluated to determine appropriate changes to prevent recurrence.

b. Determine that the corrective actions have been prioritized with consideration of the risk significance and regulatory compliance.

The licensee's immediate corrective actions restored the EHC to operability. However, the licensee has not yet finalized a work schedule to perform infared scans on other panelboards.

c. Determine that a schedule has been established for implementing and completing the corrective actions.

The licensee has not established a schedule for implementing the infared scans on panelboards. The PM action request form, which is a step in the process for establishing a maintenance schedule for infared scanning, was signed by the system engineer on June 3, 2000.

d. Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.

The licensee's procedure IP/0/A/3011/012, Electrical Preventive Maintenance Procedure For Motor Control Centers and Power Panelboards, directs that detected hot spots be documented in the procedure and that technical support and/or engineering be notified.

02.2 Reactor Trip Number 2

The inspector reviewed LER 50-270/99-02 and PIP O-99-02540 associated with the June 19, 1999, Unit 2 reactor trip that was caused by two concurrent electrical ground faults in the moisture separator reheater (MSR) high level switches. The licensee's evaluation determined that one ground was caused by a manufacturing deficiency that allowed a wire to chafe against a sharp edge. The second ground was due to missing adhesive that allowed a mercury switch vial to move in its retaining bracket until a conductor contacted the metal bracket. The two simultaneous electrical grounds in the MSR high level trip circuits resulted in a main turbine trip.

02.2.1 Problem Identification

a. Determine that the evaluation identifies who (i.e., licensee, self-revealing, or NRC), and under what conditions the issue was identified.

The evaluation determined that one of the electrical grounds was attributed to a manufacturing deficiency. The licensee could not determine whether the second ground was due to a manufacturing deficiency or to maintenance activities. The conditions for both grounds were self-revealing.

b. Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.

The evaluation discussed that one or both of the grounds was caused by a manufacturing deficiency, but did not discuss how long the deficient conditions may have existed.

c. Determine that the evaluation documents the plant specific risk consequences (as applicable) and compliance concerns associated with the issue.

The licensee's evaluation stated that the MSR high level trip is a protective trip for economic reasons (turbine protection), that MSR high level does not affect nuclear safety, and that the health and safety of the public was not affected by the event. The

Magnetrol mercury contact level switches are only used in non-safety applications. The inspectors reviewed the licensee's conclusion and determined that it was reasonable.

02.2.2 Root Cause and Extent of Condition Evaluation

a. Determine that the problem was evaluated using a systematic method(s) to identify root cause(s) and contributing cause(s).

The licensee assigned an equipment Failure Investigation Process (FIP) team to investigate the electrical grounds. The team focused on potential causes for a spurious actuation of the MSR high level turbine trip. The primary method of analysis was a Failure Analysis Fault Tree.

b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

The licensee's root cause evaluation identified the root cause of the problem as manufacturing deficiencies and/or maintenance activities. The manufacturer of the MSR level switches was notified of the problems experienced with the presence of sharp edges in high vibration resistant level switch conduit and loss of mercury contact vial adhesive. The inspector determined that the extent of the licensee's root cause evaluation was appropriate to the significance of the problem.

c. Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee searched the operating experience database for events that involved glass mercury vial and the chaffing of wiring inside the housing of Magnetrol level switches. The search did not reveal any similar events from those causes. However, Oconee has experienced spurious actuations of MSR level switches in the past due to other reasons such as switches being hit or kicked, wiring being damaged by high temperature, and glass vials losing vacuum seal. Corrective actions were initiated for the previously identified failures.

d. Determine that the root cause evaluation included consideration of potential common cause(s) and extent of condition of the problem.

The licensee's evaluation considered the potential for common cause and extent of condition. Wiring in all the Oconee Unit 1,2, and 3 MSR and high pressure extraction heater level switches were inspected for nicks, wires replaced as necessary, and wiring slack added at the conduit entrances as necessary. High temperature adhesive was applied to secure the mercury contact vials in all units.

02.2.3 Corrective Actions

a. Determine that appropriate corrective action(s) are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.

The licensee took immediate corrective action to repair the damaged MSR level switch and to inspect similar switches on both units.

b. Determine that the corrective actions have been prioritized with consideration of the risk significance and regulatory compliance.

The licensee expeditiously performed inspections on the Unit 1 and Unit 2 Magnetrol level switches. Similar inspections in Unit 3 were performed at the next appropriate outage.

c. Determine that a schedule has been established for implementing and completing the corrective actions.

All corrective actions have been completed.

d. Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.

The licensee revised the calibration procedure which contained instructions for inspection, repair, and/or replacement of MSR level switches. The revised procedure provides instructions to inspect internal wiring, inspect the integrity of the mercury in the glass bulbs, inspect the material condition of the adhesive that is used to secure the mercury contact glass vials to their retaining clips, and document results of the inspection on appropriate procedure enclosures.

02.3 Reactor Trips Number 3 and 4

The inspector reviewed LER 50-270/99-05, PIP O-99-05251, and PIP O-99-05261, associated with the reactor trips which occurred on December 21 and 24, 1999. Both of these Unit 2 trips were caused by the spurious closure of the main turbine intercept valves. The root cause of the main turbine intercept valve closure was an intermittent short circuit cable fault due to rubbing of the cable against the sharp edge of the associated conduit entrance fitting where the normal insulation bushing was pushed out of its proper position.

02.3.1 Problem Identification

a. Determine that the evaluation identifies who (i.e., licensee, self-revealing, or NRC), and under what conditions the issue was identified.

The December 21, 1999, trip was self-revealing. The licensee’s evaluation stated that the root cause of this trip was unknown; however, two circuit cards in the EHC system were replaced to eliminate them as possibilities for having caused the trip.

The December 24, 1999, trip was also self-revealing. The licensee conducted fault insertion testing and cable inspection. That resulted in the discovery of cable insulation chafing that exposed bare conductors, which caused an electrical fault and the resultant closure of the turbine intercept valves. The licensee concluded that both the December 21 and 24, 1999, trips had the same root cause.

b. Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.

The licensee's evaluation did not state how long the condition existed.

c. Determine that the evaluation documents the plant specific risk consequences (as applicable) and compliance concerns associated with the issue.

The licensee's evaluation stated that the health and safety of the public were not compromised by these events. The inspectors determined that the licensee's conclusion was reasonable.

02.3.2 <u>Root Cause and Extent of Condition Evaluation</u>

a. Determine that the problem was evaluated using a systematic method(s) to identify root cause(s) and contributing cause(s).

The licensee established a FIP team to determine the root cause of the events. The team developed fault trees and failure scenarios to assist in troubleshooting and data analysis.

b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

Following the second trip, the licensee's root cause evaluation was thorough and identified the root cause of both events. The evaluation was conducted to a level of detail commensurate with the significance of the problem.

c. Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee's evaluation included a review to determine if similar problems had been identified at other utilities; however, no relevant information could be obtained relating to events caused by similar deficiencies.

d. Determine that the root cause evaluation included consideration of potential common cause(s) and extent of condition of the problem.

The licensee considered that the event and root cause had applicability to Units 1 and 3, as well as other controlling valves within the EHC system on Unit 2. Accordingly, they took appropriate action to inspect all three units for similar deficiencies.

02.3.3 Corrective Actions

a. Determine that appropriate corrective action(s) are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.

The licensee took immediate corrective actions to inspect other EHC valves on Unit 2 prior to start-up. Units 1 and 3 were also inspected for similar problems (i.e., missing or damaged plastic bushings on the conduit entrance fitting and chaffed wiring).

b. Determine that the corrective actions have been prioritized with consideration of the risk significance and regulatory compliance.

The licensee's immediate corrective actions on Unit 2 and subsequent inspections of Units 1 and 3 have been completed. Several other corrective actions to prevent recurrence are in progress, but due dates have not be established.

c. Determine that a schedule has been established for implementing and completing the corrective actions.

The licensee's corrective action plan has not established due dates for implementing and completing the remaining corrective actions.

d. Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.

The licensee's corrective action plan to prevent recurrence included activities to inspect the integrity of other junction boxes and to protect the cables and wires where they enter and exit the junction boxes, such as the use of non-metallic conduit fittings.

03 Management Meetings

The inspectors presented the inspection results to Mr. Nazar and other members of licensee management at the conclusion of the inspection on June 27, 2000. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any of the material examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Groves, Nuclear Production Engineer
M. Nazar, Engineering Manager
L. Nicholson, Regulatory Compliance Manager
J. Smith, Technical Specialist Compliance
J. Weist, Regulatory Compliance Engineer

ITEMS OPENED, CLOSED, AND DISCUSSED

Previous Items Discussed

50-270/99-01	LER	Equipment Failure Results in a Reactor Trip (Section 02.1)
50-270/99-02	LER	Reactor Trip due to Secondary System DC Grounds (Section 02.2)
50-270/99-05	LER	Spurious Closure of Main Turbine Valves Results in Two Reactor Trip (Section 02.3)

NRC's REVISED REACTOR OVERSIGHT PROCESS

The federal Nuclear Regulatory Commission (NRC) recently revamped its inspection, assessment, and enforcement programs for commercial nuclear power plants. The new process takes into account improvements in the performance of the nuclear industry over the past 25 years and improved approaches of inspecting and assessing safety performance at NRC licensed plants.

The new process monitors licensee performance in three broad areas (called strategic performance areas): reactor safety (avoiding accidents and reducing the consequences of accidents if they occur), radiation safety (protecting plant employees and the public during routine operations), and safeguards (protecting the plant against sabotage or other security threats). The process focuses on licensee performance within each of seven cornerstones of safety in the three areas:

Reactor Safety

- Initiating Events
- Mitigating Systems
- Barrier Integrity
- Emergency Preparedness

Radiation Safety

- Occupational
- Public

Safeguards

- Physical Protection

To monitor these seven cornerstones of safety, the NRC uses two processes that generate information about the safety significance of plant operations: inspections and performance indicators. Inspection findings will be evaluated according to their potential significance for safety, using the Significance Determination Process, and assigned colors of GREEN, WHITE, YELLOW or RED. GREEN findings are indicative of issues that, while they may not be desirable, represent very low safety significance. WHITE findings indicate issues that are of low to moderate safety significance. YELLOW findings are issues that are of substantial safety significance. RED findings represent issues that are of high safety significance with a significant reduction in safety margin.

Performance indicator data will be compared to established criteria for measuring licensee performance in terms of potential safety. Based on prescribed thresholds, the indicators will be classified by color representing varying levels of performance and incremental degradation in safety: GREEN, WHITE, YELLOW, and RED. GREEN indicators represent performance at a level requiring no additional NRC oversight beyond the baseline inspections. WHITE corresponds to performance that may result in increased NRC oversight. YELLOW represents performance that minimally reduces safety margin and requires even more NRC oversight. And RED indicates performance that represents a significant reduction in safety margin but still provides adequate protection to public health and safety.

The assessment process integrates performance indicators and inspection so the agency can reach objective conclusions regarding overall plant performance. The agency will use an Action Matrix to determine in a systematic, predictable manner which regulatory actions should be taken based on a licensee's performance. The NRC's actions in response to the significance (as represented by the color) of issues will be the same for performance indicators as for inspection findings. As a licensee's safety performance degrades, the NRC will take more and increasingly significant action, which can include shutting down a plant, as described in the Action Matrix.

More information can be found at: http://www.nrc.gov/NRR/OVERSIGHT/index.html.