



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report No.: 50-416/91-22

Licensee: Entergy Operations, Inc.
Jackson, MS 39205

Docket No.: 50-416

License No.: NPF-29

Facility Name: Grand Gulf

Inspection Conducted: December 16-20, 1991

Inspector: *N. Merrinweather for* 1-30-92
P. J. Fillion Date Signed

N. Merrinweather for 1-30-92
L. R. Moore Date Signed

Accompanying Personnel: S. Rudisall

Approved by: *N. Merrinweather for* 1-30-92
M. B. Shymlock, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This special, announced inspection was conducted in the areas of design of electrical systems and related engineering activities. NRC Temporary Instruction 2515/111, Electrical Distribution System Followup Inspection (EDSFI), issued May 31, 1991, provided guidance for the inspection.

Results:

In the areas inspected, violations or deviations were not identified. The licensee has made good progress in resolving the findings of the EDSFI inspection. However, substantial work still remains.

REPORT DETAILS

1. Persons Contacted

Licensee Employee:

- *T. Barnett, Electrical Engineer, Nuclear Plant Engineering
- F. Bryan, System Engineer
- *W. T. Cottle, Vice President of Operations, Grand Gulf Nuclear Station
- *R. Dubey, Principal Mechanical Engineer, Nuclear Plant Engineering
- R. Green, System Engineering Supervisor
- *C. C. Hayes, Manager, Quality Systems
- *H. D. Haddon, Electrical Engineer, Nuclear Plant Engineering
- D. Hunt, Supervisor, Quality Programs
- *A. Khanifar, Principal Electrical Engineer, Nuclear Plant Engineering
- *H. E. Kock, Senior Engineer, Nuclear Safety and Regulatory Affairs
- *D. L. Pace, Director, Design Engineering
- C. Quick, Supervisor, Performance and System Engineering
- *J. C. Roberts, Manager, Plant Maintenance
- R. P. Rose, System Engineer
- R. West, Assistant Manager, Performance and System Engineering
- R. J. Wright, Mechanical Engineer, Nuclear Plant Engineering

Other licensee employees contacted during this inspection included engineers, and administrative personnel.

NRC Resident Inspectors

- *C. A. Hughey
- J. Mathis, Senior Resident Inspector

*Attended exit interview

2. Electrical Distribution System Followup (TI 2515/111)

For each of the weaknesses identified by the EDSFI team in December, 1990, the licensee agreed to take specific corrective actions which were either described in the report (90-24) or in their response to the notice of violation. The focus of this inspection was to follow up on these findings. Where possible the licensee's work, in calculation, procedure change etc., was inspected to determine whether or not the original issue was resolved. Each of the weakness is summarized in this section and the inspection activity described, and a conclusion (ie closed or remains open) stated. At the end is an overall summary and conclusions statement. Since significant portions of the work are not yet complete, the NRC intends to perform another followup inspection. No new findings were identified during this inspection. However, in one case, based on the (item L) licensee's preliminary work, the original issue is more sharply defined.

a: 50-416/90-24-01 Design Change Package (DCP) 87/0034
(EDSFI report para. 5.3)

Design Change Package 87/0034 called for the installation of fuses in the safety-related Divisions I and II 125 VDC distribution system. It was implemented during the year 1990. One fuse was installed in the battery 1DA3 (1DB3) to bus 11DA (11DB) connection, and one fuse was installed in the bus 11DA (11DB) to distribution panel 1DA2 (1DB2) connection. The purpose of the fuses was to provide overcurrent protection redundant to the existing power circuit breakers in these connections. The fuses were installed in series with the circuit breakers. The installation of these fuses resulted in miscoordination between the battery fuse (a KTU-1200) and battery charger feeder breakers 72-11A02 and 72-11A03 (600 A molded-case breakers) for Division I. A similar situation existed for Division II.

The inspector confirmed that the corrective actions stated in the licensee's response to the violation were implemented. Corrective actions stated in the response were:

1. Perform a design review of DCP-87/0034, and make any necessary hardware changes to provide proper protection and coordination.
2. Issue an instructive memorandum to Design Engineering personnel involved in the application and coordination of protective devices to make them aware of the violation.

The response also states that full compliance will be achieved prior to restart following Refueling Outage No. 5 in spring, 1992.

In relation to corrective action No. 1, the licensee performed an engineering calculation (EC) and prepared a design change package. The titles and numbers of these documents were:

EC-Q1L21-88003, Rev. 2, Sizing of Fuses for 125 VDC Feeders 72-11A01, 11A05, 11B01 and 11B05.

DCP 91/0072, Rev. 0, Modification of Protective Devices to 125 VDC Distribution Centers 11DA and 11DB.

DCP 91/0072 calls for the following changes and modifications:

1. Create administrative controls to replace the bus 11DA (11DB) to distribution panel 1DA2 (1DB2) connection fuse any time the in-series circuit breaker trips. The need for this control was discussed in the EDSFI report.

Disable the auto trip feature of circuit breakers 72-11A01, 72-11A05, 72-11B01 and 72-11B05.

Replace the KTU-1200 fuses with Limitron Low-Peak Time Delay KRP-C-2000 fuses.

Change the setpoint of circuit breaker 72-11A04 and 72-11B04 to 1200A.

In relation to corrective action No. 2, the licensee issued a memorandum on the subject on March 19, 1991, to Design Engineering Personnel.

The inspector reviewed the above mentioned documents. In addition the manufacturer's published time-current curves for the fuses and circuit breakers were reviewed. The work request for actually implementing the modifications and changes had not yet been prepared as there was still sufficient time until the refueling outage to accomplish this work. The inspector confirmed that these items were on the outage schedule. Violation 90-24-01 is closed.

b: (EDSFI report para. 8.0)

The calibration procedures for both the degraded grid voltage bistables (Divisions I and II) and the undervoltage relays (Division III) did not require the set point be reset to the desired value if found at another value. The team was concerned that this practice could result in the devices' set points exceeding the Technical Specification allowed tolerance limits due to instrument error and drift which could occur between calibrations. The licensee stated they would revise the appropriate procedures to address this issue.

The licensee resolved this issue by establishing a desired value band for these set points rather than a specific set point value and requiring the device to be reset to within the band if the as found value was outside of this band. The band parameters incorporate trended instrument error and drift to ensure set points would not exceed Technical Specification allowable tolerances between calibrations. The following procedures were revised to implement this corrective action:

06-EL-1R21-M-001, revision 24, 4.16 Kv Degraded Voltage Functional Test and Calibration, dated July 22, 1991; and

06-EL-1P81-R-0001, revision 23, ESF Div 3 Bus Undervoltage and Time Delay Relay Calibration (temporary change notice dated December 11, 1991.)

Licensee corrective actions on this issue were adequate and this issue is closed.

c. 125 VDC (EDSFI report para. 10.2)

Material Non-Conformance Report (MNCR) 0251-90, initiated on November 15, 1990, identified that the safety-related 125 VDC breaker coils receive less than manufacturer recommended voltage for operation. The licensee

had verified by testing that the breakers would operate at the lowest calculated voltage. Further corrective action required the breakers to be retested periodically to identify degradation which could result in inoperability of the breakers due to the lower than recommended voltage. The licensee had not entered this test requirement into the Repetitive Task Program.

The inspector reviewed the licensee's Repetitive Task Program schedule and verified the incorporation of this task. The first performance of this 18-month repetitive maintenance task was scheduled for March 1, 1992. The performance procedure had not yet been approved.

The adequacy of these actions is still under review by the NRC staff, so this item remains open.

d. (EDSFI report para. 7.4)

This issue addressed a team concern with plant procedures which were ambiguous with respect to the terms "racked out" and "disconnect". Synonymous use of these terms was inappropriate and could result in a lack of physical restraint on a breaker when bus disconnection was the intent. This could permit movement and possible damage to operating equipment during a seismic event.

The licensee had completed corrective action on this issue. The following procedures were revised to define the term "disconnect" and indicate appropriate action:

01-S-06-1, revision 26, Protective Tagging, revised February 20, 1991

04-S-04-02, revision 17, Operation of Electric Circuit Breakers, revised July 9, 1991

07-S-12-42, revision 4, Inspection and Testing of 11E 5 Kv Power Circuit Breakers, revised January 30, 1991.

Licensee corrective actions on this issue were adequate and the issue is closed.

e. (EDSFI report para. 8.0)

This issue addressed an EDSFI team concern regarding the integrity of the switchgear bus bar connection. The switchgear general maintenance procedure did not require verification of appropriate switchgear nut and bolt connection tightness to the bus. The licensee stated they would revise the appropriate procedure to address this issue.

The inspector verified procedure 07-S-12-120, revision 2, Inspection and Cleaning of 4160 volt and 6900 volt Switchgear, was revised to address this issue. The procedure was revised on October 28, 1991.

Licensee corrective actions on this issue were adequate and the issue is closed.

f. EMERGENCY DIESEL GENERATOR (EDG)
(EDSFI report para 6.1.3)

The team noted the EDG fuel oil in-line duplex strainers between the day tank and the EDG fuel injection line were aligned for parallel flow through both strainer elements. General industry practice is to align flow through one strainer with the second strainer in standby to permit switching strainers for maintenance without impacting engine operating capability. The licensee stated during the EDSFI they would revise the system operating procedure to require verification of a single strainer flow path.

The inspector verified the appropriate system operating procedure for the Divisions I and II EDGs were revised to include this verification. In addition a walkdown was performed to verify that the duplex strainers on Divisions I, II, and III EDGs were aligned for flow through one strainer element only. The inspector noted that, while this issue applied to all three EDGs and all EDGs were appropriately aligned, the procedure for the Division III EDG was not revised to include this verification. The licensee stated the EDSFI team identified this issue in relation to the Division I and II EDGs only, but the licensee indicated that the corresponding Division III procedure should have also been changed.

Licensee corrective actions on this issue were adequate and the issue is closed.

g. EDG (EDSFI report para. 6.1.2)

This issue addressed the potential for undetected degradation of the Y-strainer between the EDG fuel oil storage tanks and the day tanks. The team was concerned that a clogged Y-strainer could decrease or block flow to the day tank thereby impacting the EDG safety function. There was no pressure differential indication or alarm to detect this condition. The licensee stated they would revise the operator low day tank level alarm response procedure to include a flush of the Y-strainer.

The inspectors reviewed the applicable alarm response manual procedures and performed a plant walkdown to verify appropriate procedure revision and component identification. The following procedures were reviewed:

04-1-02-1H22-P400-1A-C4, revision 19, Low Level Fuel Day Tank

04-1-02-1H13-P870-5A-E1, revision 33, DG 13 Fuel Oil Stor/Day Tank
Lvl Hi/Lo

Licensee corrective actions on this issue were adequate and the issue is closed.

h. (EDSFI report para. 7.3)

The EDSFI team noted that the fuse replacement program was not a controlled program. The electrical maintenance department had placed a fuse list in each electrical panel identifying each fuse, fuse size, fuse number and associated drawing. The list did not specify fuse type. This was considered a program weakness.

The inspector reviewed the licensee progress on development and implementation of a controlled fuse replacement program. The licensee was in the process of developing a data base for use in the fuse control program. Once the data base is complete a verification of data will be performed. The licensee had not decided how the data base will be incorporated into the fuse replacement program. The licensee is considering issue of a procedure to implement a fuse control program utilizing the fuse data base. Another possibility for use of the data base being considered by the licensee is replacement of the fuse list in electrical panels with a list from the fuse data base. The licensee did not provide a date when action on this issue would be complete.

Thus this issue is still being worked.

i. UFSAR (EDSFI report para. 3.2, 6.15, 8.0)

The EDSFI team identified four instances where the Updated Final Safety Analysis Report (UFSAR) should be revised to more accurately describe the system. Affected sections of the UFSAR and subject matter requiring revision are summarized below.

<u>UFSAR Section</u>	<u>Subject area of revision</u>
8.2.3	Transmission system (115 kV) capacities
9.5.4.1.1.d	Design criteria for diesel generator fuel oil storage tanks ventilation lines
8.3.2.1.6	Battery chargers ability to operate isolated from battery
8.3.2.1.6.2	The need for placing equalizing charges on the battery

On each of these subjects, the licensee presented UFSAR change request including safety evaluations which had been prepared and approved by Nuclear Plant Engineering. The inspector reviewed these documents and found the proposed changes to be acceptable. The proposed changes had been forwarded to Nuclear Licensing for eventual submittal to the NRC.

Licensee corrective actions on this issue were adequate and this item is closed.

j. (EDSFI report para. 6.1.4)

Prior to the NRC EDSFI inspection, the licensee calculated new, higher diesel fuel oil storage minimum volume values. These values had not been incorporated into plant procedures, design and licensing documents. The EDSFI team recommended that these documents be updated.

The inspectors verified that applicable surveillance and operating procedures had been updated to reflect the higher storage values and associated tank levels. The inspector reviewed Technical Specification and UFSAR change request including safety evaluations which had been prepared and approved by the Nuclear Plant Engineer (NPE) to reconcile the inconsistencies.

Licensee corrective actions to resolve this issue were adequate and the issue is closed.

k. NPE (EDSFI report para. 10.2.a)

The EDSFI team was concerned with the lack of specific guidance (i.e., procedures) for NPE to perform root cause analyses. Root cause activity at Grand Gulf was the responsibility of the plant staff engineering organization, Performance and System Engineering (P&SE). NPE, which was the corporate design engineering organization, was involved in providing design technical support for root cause activity associated with plant problem identification processes to the P&SE. The licensee stated that they would develop and issue an NPE root cause procedure.

The inspector reviewed the NPE root cause analysis procedure, NPEAP-809, revision 0, dated July 8, 1991. The inspectors additionally reviewed the root cause training provided to NPE and a small sample of their involvement in root cause activity. The inspectors concluded the procedure provided adequate guidance for NPE root cause activity, training was adequate, and adequate support of P&SE root cause activity was demonstrated by the examples reviewed.

Licensee corrective actions on this issue were adequate and this item is closed.

e. (EDSFI report para 3.2)

The licensee agreed to compare the Branch Technical Position PSB-1 voltage verification test (performed during initial plant start-up) with the new DAPPER program results, and take any necessary actions based on this comparison.

Progress made on this work was the modelling of PSB-1 test configuration and loads using DAPPER, running the calculation and preparing a summary of results. For each of the nine cases studied, three voltages are tabulated at various buses - the measured voltage, the calculated voltage using VOLTAN (the original program) and the calculated voltage using DAPPER (new

program). This work is contained in calculation EC-Q1111-91002, Emergency Core Cooling System Pre-Operational Test Voltage Correlation Using Personal Computer Based DAPPER Program. The calculation was in draft form in that it had not been signed by the preparer nor checked.

The nine cases comprised pre-LOCA, LOCA and post-LOCA loads for three different power source paths. Two originate at the 500 kV bus and one originates at the 115 kV bus. VOLTAN and DAPPER results agree well within one percent difference for all nine cases. In the 500 kV source cases the DAPPER results are all slightly lower values (ie. within three percent difference at most and often within one percent) than the measured values. However, in the 115 kV source LOCA and post-LOCA cases the DAPPER results give higher values than the measured. The results still match closely (largest difference being about one percent) but the 115 kV cases results are opposite to the 500 kV cases results.

This comparison of measured values to calculated values could indicate one or both of the following:

There is an error with modeling of the 115 kV source which results in overly optimistic results for the voltage calculation.

Some adjustment to the degraded grid voltage relays may be needed, especially with respect to the re-set point.

The licensee was continuing to analyze the situation and moving towards completing the calculation.

This issue is not yet resolved and will be the subject of future NRC inspections.

(EDSFI report para 3.1)

During the EDSFI the team reviewed the licensee's short-circuit calculations. These calculations were performed in accordance with industry standards. The licensee utilized a computer program titled A-FAULT to perform the short-circuit calculations. Design control procedures require a verification and validation of software used for calculations. The licensee performed the verification and validation of the A-FAULT but omitted the sub-program for the low-voltage calculations. The licensee agreed to perform this verification and validation for the low-voltage calculations.

The inspector reviewed the progress of the verification and validation effort. This effort was on-going. The licensee provided a draft copy of the verification and validation calculation, for review. These calculations are consistent with accepted practice for validation of software programs used for short-circuit calculations.

Licensee corrective actions on this issue were adequate and this item is closed.

n. (EDSFI report para. 3.1 and 3.2)

As part of a calculation enhancement program the licensee was upgrading the basic calculations for voltage and short-circuit on the ac distribution system including control voltages. This work was in progress, and was not reviewed by the inspectors during this inspection.

o. 480 VAC (EDSFI report para. 5.2)

The design calculation for Class 1E Continuous Duty Thermal Overload (TOL) Settings, EC-Q1111-90001, recommended overcurrent protection settings on 480 VAC Motor Control Center (MCC) which varied from existing MCC breaker protection settings. During the EDSFI the licensee stated they would evaluate the variations and revise actual set points as necessary.

The inspector reviewed the licensee progress in accomplishing the above actions and determined their actions on this issue were ongoing but incomplete. Prior to changing any protection set points the licensee determined it was necessary to verify the set point values in the TOL calculation. They were in the process of verifying the TOL set point calculation referenced above. A related calculation, EC-Q-90028, AC Power System Calculation, which determined the lowest voltage available to the MCCs, was required to provide input to determine the TOL settings. Due to this calculation being incomplete during the development of the TOL calculation, input values were assumed which incorporated excess conservatism into the TOL set points. This work is still in progress.

p. 4160 V (EDSFI report para. 5.1c)

When the team reviewed the bus overcurrent protective relay calculation (PR 29) for the Division II 4160 V bus they identified two discrepancies. These were: first, the design input stated that the residual heat removal pump motor was the largest starting load on the bus when in fact the standby service water pump motor was largest; second, the maximum running load on the bus was determined by the inspector to be greater than that stated in the calculation.

During the inspection a preliminary re-evaluation was made on the relay settings for the main breaker. The team considered the relay settings to be acceptable, and the licensee agreed to correct the design inputs to the calculation. Since that time, the licensee has superseded calculation PR 29 with calculation EC-Q1R21-91041, "Verification of Protective Coordination for 4.16 kV Division II, Bus 16AB". The inspector reviewed this new calculation, which indicated the same relay settings as the old, and concluded that it was accurate.

Licensee corrective actions on this issue were adequate and this item is closed.

q. (EDSFI report para. 3.4)

The team reviewed the adequacy of 4.16 kV and 480 V cable systems to operate under postulated normal and abnormal operating conditions. The team observed an error in calculation Minimum Cable Sizing Calculation No.-3Q. After the licensee revised the calculation the results still indicated lack of protection for No. 10 AWG wire in MCC. The licensee acknowledged the team's finding and agreed to prepare any necessary design procedures to ensure that future MCC loads would be properly protected by the MCC breaker and any newly installed wire would be sized to withstand the short-circuit fault level at the MCC.

The licensee had issued a new calculation EC-Q1111-91038 to supersede calculation number 3-Q. This calculation determines the acceptability of power distribution cables under short-circuit conditions. The licensee used the methodology of Publication P-32-382 of the Insulated Cable Engineers Association (ICEA). This calculation was reviewed by the inspector. The calculations demonstrated the acceptability of existing cables to meet calculated short-circuit current. The licensee has not issued any design procedure to ensure future MCC load cabling is properly protected. The licensee considers this an inherent part of any design change process.

Licensee corrective actions on this issue were adequate and this item is closed.

r. DC (EDSFI report para. 5.3)

The EDSFI team reviewed various 125 VDC 1E Distribution System calculations and observed some inconsistencies between calculations. The licensee agreed to revise the calculations as part of the ongoing program. The inspector reviewed the revised calculations. Inconsistencies previously noted during the EDSFI such as cable damage curves and available fault current between calculations PR 148 and PR 151 were corrected.

Licensee corrective action on this issue were adequate and this issue is closed.

s. HVAC ESF (EDSFI report para. 6.2)

The EDSFI team was concerned that the conclusions resulting from non-conservative assumptions in the HVAC calculations did not assure adequate ventilation design for these spaces. Adequate ventilation design is required to maintain space ambient conditions within the limits recommended by the electrical equipment manufacturer. The licensee stated they would review and revise this calculation.

The electrical equipment heat load calculation for the spaces had been completed. These results provide the input for the HVAC calculation and evaluation of HVAC design for this space. The licensee's anticipated completion of these activities was March 31, 1992.

Although the licensee had not completed their corrective actions the inspector concluded the progress was adequate.

SUMMARY AND CONCLUSIONS

Seven of the findings or issues deal with programmatic changes. Six of these are not simple procedure changes, but represent actual changes to the licensee's program where lineups are different than before or where testing and maintenance will be performed differently than they were before. With the exception of the fuse control program these changes were in place at the time of this inspection, and they should enhance the safety of the plant. The fuse control program is taking longer to implement because of the considerable effort involved in creating and validating a master fuse list.

Two of the findings deal with multiple examples of where design basis documents such as the UFSAR and Technical Specification were in error or not up to date in that they did not accurately describe the systems. The licensee was expeditious in preparing the necessary proposed changes.

Eight of the findings deal with calculations. Based on calculations reviewed during this inspection, four of the findings are considered closed. The most significant work that remains to be done is the 120 VAC system voltage calculations.

Findings from the EDSFI inspection that remain open items are:

- h. Lack of a comprehensive fuse control program.
 - l. Failure to compare voltage calculation results to measured values. Since the EDSFI, the calculation was performed to make that comparison, and results were basically acceptable. However, the licensee identified a significant discrepancy which they are working to resolve.
 - n. Completion of updated voltage and short-circuit calculations. This finding was actually identified by the licensee, but results must be reviewed by the NRC.
 - o. Thermal overload settings recommended in calculation varied from actual settings (EDSFI report para. 5.2)
 - s. Calculations to demonstrate adequate ventilation in the safeguards and ESF switchgear room contained non-conservative assumptions.
3. Exit Interview

The inspection scope and results were summarized on December 20, 1991, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results.

Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

<u>Item Number</u>	<u>Description and Reference</u>
416/90-24-01	(Closed) Violation - Inadequate Evaluation of DCP 87/0034, paragraph 2.0