UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-259/93-35, 50-260/93-35, and 50-296/93-35

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-259, 50-260 and 50-296

License Nos.: DPR-33, DPR-52, and DPR-68

Facility Name: Browns Ferry 1, 2, and 3

Inspection Conducted: September 20 - 24, 1993

Inspectors: S. B. Rudisail — 10/19/93 Date Signed
S. Rudisail

S. B. Rudisail for — 10/19/93 Date Signed
N. Salgado

Approved by: Caudle Julian — 10/22/93 Date Signed
M. Shymlock, Chief
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of electrical maintenance and design calculations.

Results:

In the areas inspected, violations or deviations were not identified.

Deficiencies 93-201-04 and 93-201-05 of NRC Inspection Report Number 50-296/93-201 were closed.

The electrical maintenance which was reviewed was adequate and in accordance with licensee requirements.

[illegible]

REPORT DETAILS

1. Persons Contacted

Licensee Employees

T. Ballew, Customer Group Support Supervisor
*M. Bajestanti, Technical Support Manager
D. Bradley, Electrical Engineer
D. Burrell, Supervisor, Electrical Engineer
R. Goodwin, Electrical Foreman
J. Gomez, Lead Electrical Engineer
H. Hudson, Electrical Engineer
*J. Johnson, QA Manager
T. Knuettel, Nuclear Engineer, Licensing
*G. Little, Operations
*J. Maddox, Engineering Manager
A. McDonald, System Engineer
J. Nawitt, Electrical Manager
*G. Nelson, General Electric
R. Rogers, Maintenance Supervisor
*J. Rupert, E & M Manager
*J. Sabados, Chemistry Manager
*P. Salas, Licensing Manager
*J. Schessel, Maintenance
*R. Soals, General Electric
J. Trainer, Project Manager
*J. Valente, Nuclear Engineering
B. Weaver, Electrical Engineer, I & C
*R. Wells, Compliance Licensing Manager
C. Woods, Unit 3 Engineering
*R. Wright, Supervisory Engineer

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, and technicians.

NRC Employees

*R. Musser, Resident Inspector
*C. Patterson, Senior Resident Inspector
*G. Schnebli, Resident Inspector

*Attended Exit Interview

Acronyms and abbreviations are listed in paragraph 7.0.

2. Follow-up on Deficiencies of Design Change Inspection

During a previous design change inspection conducted by the Special Inspection Branch, weaknesses were identified in mechanical and electrical calculations. Five deficiencies were identified in the Inspection Report Number 50-296/93-201. During this inspection, the licensee's corrective actions for deficiencies 93-201-04 and 93-201-05 were reviewed to ensure that they had been satisfactorily completed.

2.1 Deficiency 93-201-04, Document Discrepancies and Unsubstantiated Assumptions in Calculations

2.1.1 Calculation Deficiencies

Several unsubstantiated assumptions and discrepancies were noted in Calculation EEB/ED-Q3999-920106, Revision 0, Control Circuit Voltage Drop for Unit 3 Circuits. These weaknesses are described below.

Calculation EEB/ED-Q3999-920106, Revision 0, "Input Data," Sheet 3: The reference to the maximum voltage on all the boards was not clear. The maximum value was stated as two possible values of 270 V and 280 V. The licensee had agreed to revise the calculation.

Calculation EEB/ED-Q3999-920106, Revision 0, "Input Data," Sheet 4: There was no basis for assuming a maximum of 10 contacts in a circuit. The team found that the scheme shown in Figure 2 of attachment 1.1 of the same calculation displayed 11 contacts in series. The licensee agreed to add detailed wiring/block diagrams in the next revision of the calculation so that the number of contacts in a particular path could be identified.

Calculation EEB/ED-Q3999-920106, Revision 0, "Input Data," Sheet 4: There was no basis for assuming 0.1 ohm resistance for each contact. The team found that this value was not supported by vendor documents. The licensee agreed to obtain the correct resistance value and revise the calculations.

The inspector reviewed the calculation to ensure that the agreed upon corrections had been incorporated into the latest revision. The calculation had been revised to include a single value for assumed maximum voltage of 279.6 V. This value was based on the maximum terminal value of the battery and was a conservative value. The calculation had been revised to include the wiring/block diagrams so that the number of contacts would be available. The calculation also considered the actual number of contacts in the circuit when that number exceeds 10 contacts. Additionally, documentation was added to the calculation to support the assumption of 0.1 ohm for contact resistance.

Several unsubstantiated assumptions and discrepancies were noted in Calculation ED-Q3057-920329, Revision 0, 480 VAC Short Circuit Calculation. These weaknesses are described below.

Calculation ED-Q3057-920329, Revision 0, Attachment A, Section 5: There was no verification of the assumed impedance of 8% for the new transformers. A small variation in the impedance could affect the short circuit rating of the equipment. In response to the team's comment, the licensee provided adequate supporting information for the assumed impedance value and agreed to revise the calculation to incorporate the justification for the assumption.

During the review of Calculation ED-Q3057-920329 the team noted a lack of sufficient short circuit margin in an associated Calculation ED-Q3057-910237, 480 VAC Short Circuit Calculation. This lack of sufficient margin results when using the maximum system voltage of 508 V in the calculation. The licensee indicated that the problem would be resolved by relocating the power supply to a 150 HP chiller motor to another bus.

Calculation ED-Q3057-920329, Attachment A, Section 2.0: There was no documentation to support the assumption that a static load of 200 KVA was conservative. In response to the team's question, TVA prepared a calculation to verify the assumption and agreed to revise the calculation to incorporate the supporting document.

The inspector reviewed the revised calculation. The assumed impedance value of 8 percent had been reviewed and a justification for this impedance value was included in the calculation. The actual value of impedance was greater than 8 percent and thus the calculation results were conservative. The power supply for the 150 HP chiller motor had been relocated and this had resulted in sufficient short circuit margin in Calculation ED-Q3057-910237. Calculation ED-Q3057-920329, 480 VAC Short Circuit Calculation never indicated insufficient short circuit margin. Also, supporting documentation had been added to justify the conservatism of the 200 KVA static load.

Several unsubstantiated assumptions and discrepancies were noted in Calculation ED-Q3057-920035, Revision 0, Diesel load Study. These weaknesses are described below.

Calculation ED-Q3057-920035, Section 2.0: The licensee did not have documentation to justify the elimination of the small transformer and the cable losses from the assumed loading conditions. In response to the team's questions, the licensee prepared a detailed evaluation to support the assumption. The team found this adequate. The licensee agreed to revise the calculation to incorporate the supporting document.

Calculation ED-Q3057-920035, Section 4.0: There was no documentation to support the statement that "service factors were conservatively considered equal to one." In response to the team's question, the licensee prepared a detailed evaluation of the actual motor loads and concluded that motor horsepower ratings would not be exceeded. The licensee agreed to revise the calculation to incorporate the supporting document.

The inspector reviewed calculation ED-Q3057-920035 to ensure the agreed upon corrective actions had been completed. The calculation had been revised to include support for the statement that a service factor equal to one resulted in conservative results in the calculation. Justification for the elimination of the small transformers and cable losses had been included in the calculation.

2.2 Deficiency 93-201-05, Inadequate Justification for the Basis for Approval and Inadequate Design Verification of FDCN's

The design change inspection team identified several Design Change Notices which had been subsequently revised without adequate justification for the basis of approval. Also, a Field Design Change Notice (FDCN) was identified in which the design verification had been signed without a design verification being performed.

DCN W17724B had been issued with a requirement to perform a core megger test on the unit substation transformer. In a subsequent FDCN this test requirement was deleted without justification.

DCN W17667A was modified by FDCN 19576A which defeated the emergency run back relay for the load tap changer (LTC) operation. No justification was provided for this change.

In both of these examples, the licensee provided information to the design change inspection team which resulted in adequate justification for the basis of approval for these changes.

The inspector reviewed revisions to the FDCN which included justifications in the basis for approval for the deletion of the core megger test and for the LTC emergency runback operation.

Another example reviewed by the design change inspection team was an FDCN that was issued without the appropriate design verification. A repair was performed by a GE Field Design Deviation Request with a design verification being performed by GE. In order to incorporate the GE document into the Browns Ferry system a FDCN was issued. The FDCN was issued with a design verification signature. The engineer who signed it considered this signature as accepting the GE package not a design verification. This was not allowed by the procedures.

The inspector reviewed the licensee response to this issue. A memorandum had been issued to the engineering staff involved in design verification of DCNs. This memorandum restated the requirements for the design verification signature and the significance of the design verification signature. The inspector considered this corrective action adequate.

3.0 Review of Integrated Computer System Modification

The inspector reviewed the Unit 2 Integrated Computer System (ICS) modification completed during the last refueling outage. The inspector reviewed selective calculations supporting the design of the ICS power supply. Cable sizing calculations were reviewed to ensure that the cable supplying the ICS were adequately sized. The inspector noted that all cables were appropriately sized and derated in accordance with TVA standards. Additionally, the sizing calculations for non-linear loads such as the UPS supplying the ICS had appropriately considered the neutral conductor as a current carrying conductor. This was in

accordance with the recommendations of the National Electric Code for the sizing of cable supplying loads such as computers which could potentially produce harmonic currents that could be carried by the neutral conductor. The inspector considered these calculations satisfactory.

The size and loading of the transformers supplying the battery chargers for the ICS were also reviewed. The inspectors noted that the loading of the transformers was approximately 50 percent of the rated capacity. Additionally, the battery charger sizing calculation was reviewed. This calculation assumed the inverter was fully loaded. The inverter was conservatively sized at approximately twice the required rating. This provides additional margin to the transformer loading as the loading on the charger is conservative. The inspector considered the transformer and battery charger sizing to be adequate.

4.0 Methodology for Cable Lengths in Calculations

The inspector reviewed the design methodology for determining cable length in calculations. In all calculations walkdown data or cable pull length was used when available. When this data is not available the engineering length is used with a margin added to ensure conservatism. For instance, in voltage drop calculations a margin of up to 40 percent is added to the engineering length. In calculations where it was determined that voltage drop margin was tight, a maximum length is specified with instructions for this length not to be exceeded without engineering approval.

In short circuit calculations cable impedance was not always included in calculations. This added conservatism to the calculations. When short circuit margin was tight, cable impedance was added to the calculation. In this case either the walkdown data was used to calculate cable impedance or 80 percent of the engineering length was used.

The inspector reviewed examples of both short circuit and voltage drop calculations. The inspector found these calculations were conservative and that the cable length determinations were consistent with the methodology described above.

5.0 Electrical Maintenance

5.1. Manholes

The inspectors conducted a review of the method in which the licensee performs operability checks on plant sump pumps in yard manholes. The licensee conducts periodic bi-annual operability checks of plant sumps in various manholes onsite using a PM procedure. All manholes are non-safety related, and contain only non-Class 1E equipment. The licensee inspects the immediate surrounding area, manholes and pits, internal and general exterior, for visual clutter, debris or signs of deterioration. The licensee verifies that the sump pumps operate. Work requests are

generated when repairs are required on individual pumps. The inspectors reviewed the latest completed results from the PM procedure dated September 15, 1993. No problems were identified.

The inspectors conducted a limited walkdown inspection of Manhole B, switchyard cable tunnel F11. The switchyard manholes are sloped so that accumulated water will drain to the sump pump area. No problems with cables being submerged in water in Manhole B, were noted by the inspectors.

5.2. Fuse Control Program

The inspectors reviewed the fuse control program at BFNP.

The inspectors reviewed Site Standard Practice, SSP-12.56, Fuse Control Program, Revision 2. Incorporated in the operations section of SSP-12.56 as a requirement to conduct an audit semi-annually by Operations, and results were to be documented on 0-GOI-300-1, to verify compliance with SSP-12-56. The inspectors reviewed the last two completed audits. The audits had been performed in a timely manner and no problems were identified.

A generic concern was raised by another TVA plant concerning inadequately marked reversible fuse blocks (RFB) in which a pump was rendered inoperable due to an incorrectly installed RFB. BFNP initiated PIR BFNEEB 8809 R0 to review a potential generic concern involving reversible fuse blocks being marked inadequately. The PIR results concluded that the BFNP had clear and permanent markings on the 4.16 kV and 480 V shutdown boards RFBs. The 4.16 kV RFB have highlighted white on/off markings. The 480 V RFB have a manufactured on/off markings on a center notch which only displays one condition at a time. The PIR provided guidance that if unmarked RFBs were identified in the field Electrical Design Standard DS-E1.2.2, Master Fuse List and Fuse Labeling and SDSP 16.8, Fuse Control were to be followed to correct the situation. These standards require marking the blocks that are not clearly or permanently marked to minimize possible confusion as to whether the fuse block is inserted in the ON or OFF position. The inspectors conducted a walkdown inspection of the 4.0 kV switchgear and 480 V shutdown boards to assess material condition, configuration control, and the corrective action of PIR BFNEEB 8809 R0. The inspectors verified the markings on the RFBs installed in various 4.0 kV switchgear, and 480 V shutdown boards. While, the RFBs markings on the 4.0 kV switchgear are clear, the markings on the 480 V shutdown boards required more attention to the detail of the RFB. The inspectors assessed the material condition, configuration control, and corrective action to PIR BFNEEB 8809 R0 as adequate.

6.0 Exit Meeting

The inspection scope and results were summarized on September 24, 1993, with those person indicated in paragraph 1. The inspectors described those areas inspected. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

7.0 Acronyms and Abbreviations

BFNP	Browns Ferry Nuclear Plant
DCN	Design Change Notice
FDCN	Field Design Change Notice
GE	General Electric
HP	Horsepower
ICS	Integrated Computer System
LTC	Load Tap Changer
kV	kilovolts
KVA	Kilovolt Amperes
NRC	Nuclear Regulatory Commission
PIR	Problem Identification Report
PM	Preventive Maintenance
RFB	Reversible Fuse Blocks
TVA	Tennessee Valley Authority
UPS	Uninterruptible Power Supply
V	Volts
VAC	Volts Alternating Current