



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

Report Nos.: 50-259/95-45, 50-260/95-45, and 50-296/95-45

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 Nuclear Power Station Units 1, 2, and 3

Inspection Conducted: August 7 - 11, 1995 and August 29 - September 1, 1995

Inspector: S. Rudisail 9/27/95  
 S. Rudisail Date Signed

Approved by: M. B. Shymlock 9-29-95  
 M. B. Shymlock, Chief Date Signed  
 Plant Systems Section  
 Engineering Branch  
 Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of fuse control and review of concerns identified as Corrective Action Tracking Documents (CATDs).

In the area of fuse control the inspector reviewed the licensee's response to a concern identified in Nuclear Regulatory Commission (NRC) Inspection Report 50-259, 260, 296/95-02. The report documented a concern that fuse walkdown data was taken from fuse label information instead of verification of actual fuse installation during the Unit 3 fuse walkdowns.

Results:

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

The inspector reviewed the licensee documentation addressing the concern that walkdown data for fuses was taken from label information. The inspector

Enclosure

determined that the licensee had not used label information to determine fuse installation configuration but had verified the actual fuse installed. The inspector performed a walkdown to substantiate this conclusion.

During the fuse walkdowns a discrepancy was identified where the fuse installation and the fuse label and drawing were inconsistent. This was determined to be a drawing error. The fuse label and drawing were corrected prior to the conclusion of this inspection.

CATDs associated with electrical issues were reviewed to determine if corrective actions for resolution of the concerns were adequate. CATD 23801-BFN-01, 24102-BFN-01, 24200-BFN-02, 23801-BFN-02, 23900-BFN-06, 30403-BFN-02, 30403-BFN-03 and 24200-BFN-04 were reviewed and the corrective actions completed or planned for completion prior to Unit 3 restart were found to be adequate.

The corrective actions for violation 50-269, 270, 296/94-35-01 were reviewed. This violation was closed.

Enclosure

## REPORT DETAILS

### 1. Persons Contacted

#D. Burrell, Lead Electrical Engineer  
L. Chandler, Electrical Engineer  
\*J. Glass, Site Engineering  
P. Hollingworth, Electrical Engineer  
\*J. Johnson, Site Quality Manager  
\*R. Machon, Site Vice-president  
#J. Maddox, Maintenance and Modifications Manager  
\*J. McCarthy, Site Engineering  
\*D. Porter, General Electric Engineering Manager  
\*#G. Preston, Plant Manager  
\*S. Rudge, Site Support Manager  
\*#P. Salas, Licensing Manager  
\*J. Shaw, Technical Support  
\*J. Valente, Site Engineering  
\*C. Wages, Program Coordinator, Maintenance and Modifications  
\*#S. Wetzel, Acting Compliance Manager  
\*H. Williams, Engineering and Materials Manager  
\*J. Wright, Electrical Engineering Supervisor

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

#### NRC Employees

\*R. Musser, Resident Inspector  
\*#L. Wert, Senior Resident Inspector  
#J. Munday, Resident Inspector

\*Denotes those individuals that attended the exit meeting on August 11, 1995.

#Denotes those individuals that attended the exit meeting on September 1, 1995.

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

### 2. Review of Fuse Control Issues (IP 92701)

During an inspection documented in NRC IR 50-269, 270, 296/95-02, the inspector expressed a concern that verification of actual fuse installations for Unit 3 were determined by fuse label information instead of verification of actual fuse installation. In response to this concern, the licensee committed to provide objective evidence that fuse control walkdowns were based on installed fuse configuration versus fuse label information. The inspector reviewed the licensee response to this concern.

The sample of fuses selected by the inspection documented in NRC IR 50-269, 270, 296/95-02, was the 4 kV Shutdown Board 3EA, cubicles 1, 3, 5,

6, 7, 8, 9, 10, and 12. During that inspection, the inspector noted that information recorded by the licensee during walkdowns for Unit 3 restart indicated that fuse verification for several fuses was recorded from inspection of the fuse label as opposed to actual information on the installed fuse. After this concern was identified, the licensee responded by assembling the previous walkdown information of these switchboards from the Unit 2 restart effort. Because the 3EA Shutdown Board was required to be energized for the Unit 2 restart, these fuses were verified during previous Unit 2 walkdowns. Because the boards were energized during the Unit 3 walkdowns, those fuses which were inaccessible were not verified by licensee personnel.

Because the 3EA Shutdown Board was required to be energized for the Unit 2 restart, the fuse verification walkdowns for Unit 2 included the fuses for this board. The Unit 3 walkdowns indicated that the fuses were not verified because the boards were energized. The licensee provided records from the Unit 2 walkdowns which indicated that prior to the energization of these boards for Unit 2 restart, the installed fuses were verified. These records demonstrated that the installed configuration had been verified. This verification had occurred during Unit 2 restart activities instead of Unit 3 walkdowns. The inspector reviewed these records and considered them adequate to resolve the concern for fuse installation verification.

As an additional measure of the adequacy of the licensee's fuse control program, the inspector performed a walkdown of selected fuses for Unit 3. The inspection sample was selected from those systems identified in the Browns Ferry Multi-Unit PRA Main Report as important systems. The following fuses were inspected:

System 23 - Residual Heat Residual Service Water, 3-FU1-023-0036A, 3-FU2-023-0040A, 3-FU2-023-0040B, 3-FU2-023-0040C, 3-FU1-023-0043A, 3-FU2-023-0046A, 3-FU2-023-0046B, 3-FU1-023-0048A, 3-FU2-023-0052A, 3-FU2-023-0052B,

System 67 - Emergency Equipment Cooling Water System, 3-FU2-067-0025A, 3-FU2-067-0025B, 3-FU2-067-0025C, 3-FU2-067-0026B, 3-FU2-067-0026C, 3-FU2-067-0074AC, 3-FU2-067-0074CC, 3-FU2-067-0075AA, 3-FU2-067-0075CA, 3-FU2-067-0077CA,

System 73 - High Pressure Coolant Injection System, 3-FU2-073-002B, 3-FU1-073-002D, 3-FU1-073-002E, 3-FU2-073-003B, 3-FU2-073-002D, 3-FU2-073-0010C, 3-FU2-073-0018A, 3-FU1-073-0019A, 3-FU2-073-0026B, 3-FU1-073-0026D, 3-FU1-073-0026E,

System 74 - Residual Heat Removal System, 3-FU2-074-0012B, 3-FU2-074-0012C, 3-FU2-074-0012B, 3-FU2-074-0012C, 3-FU2-074-0039C, 3-FU2-074-0039D, 3-FU2-074-0052B, 3-FU2-074-0052C, 3-FU2-074-0058A, 3-FU2-074-0058B, 3-FU1-074-0067D, 3-FU1-074-0067E,

System 82 - Standby Diesel System, 3-FU1-082-0003BA, 3-FU1-082-0003BD, 3-FU1-082-0003CF, 3-FU1-082-0003CG, 3-FU1-082-0003CK, 3-FU1-082-0003CL,

3-FU2-082-0230B, 3-FU2-082-0231A, 3-FU1-082-25-047BB,  
3-FU1-082-25-0047BC,

System 248 - 250 VDC Power System, 3-FU2-248-000BA, 3-FU2-248-000BB,  
3-FU2-248-000BC, 3-FU2-248-000BD, 3-FU2-248-000EBE, 3-FU2-248-000EBF,  
3-FU2-248-0100AA/1, 3-FU2-248-0100AA/2, 3-FU2-248-0100BA/1, and  
3-FU2-248-0100BA/2.

These fuses were verified by walkdown inspection. Verification was accomplished by comparing the installed fuse with the fuse labels, the fuse tabulation drawings and the Equipment Management System (EMS) database.

The actual fuses installed were found to be in agreement with the fuse tabulation drawings and the EMS. One exception to this finding was identified. During the walkdowns, fuses 3-FU1-073-0019A and 3-FU1-073-0019B were identified as ATM-4 ampere fuses. The fuse label identified the fuses as ATM-10 type fuses. These are the fuses for the HPCI Turbine Speed Control Circuit. On fuse tab drawing 3-45B721-85-6 the fuses were indicated as 10 ampere fuses. The EMS data base identified these fuses as four ampere fuses. The inspector questioned this discrepancy. Site Standard Practice (SSP) 12.56, Fuse Control Program, requires the verification of the fuse size on the fuse tabulation drawing prior to replacement for safety-related fuses. A Problem Evaluation Report (PER) BFPER951011 was generated by the licensee in response to this fuse discrepancy.

During the licensee investigation of this fuse problem, the fuse installed was confirmed to be the correct size. However, it was discovered that sheet 5 of the fuse tab drawing had been revised to indicate the correct ATM-4 type fuse. Sheet 6 incorrectly indicated an ATM-10 type fuse for the discrepant circuit. Prior to the conclusion of this inspection, the drawings were corrected to resolve this drawing discrepancy. The fuse label was also corrected. Through discussions with Operations personnel responsible for labeling, it was demonstrated that the labeling group was aware of the incorrect fuse label and it was planned for replacement. Although the in-place process at the time of the discrepant fuse work was informal and relied on the diligence of the responsible personnel, the process had been recently revised to formalize the procedure for label replacements. SSP 9.3, Plant Modifications and Design Change Control, had recently been revised to require changes to the fuse control program. When a fuse is changed, this procedure requires completion of the fuse installation/replacement form. This requires verification of the correct fuse size and type by the craftsman with second party Quality Control verification. Operations personnel are required to locate, pull and discard the original fuse. The old label is then removed and a new label or temporary label is installed. The temporary label process will notify responsible personnel for the implementation of the permanent label. Operations then replaces the fuse. Operations requires first and second party verification for all required steps. The inspector considered these actions and procedures adequate to control the replacement and



control of fuses and fuse labels. Had this process existed at the time of the fuse replacement and been followed, the problem could have been prevented.

### 3. Review of CATDs (IP 92701)

The inspector reviewed CATDs associated with electrical issues to ensure corrective action for the CATDs were adequate for resolution of the concern prior to Unit 3 restart. The following CATDs were reviewed:

#### 3.1 Review of CATD 24102-BFN-01

The inspector reviewed CATD 24102-BFN-01. This CATD documented a concern that pre-insulated diamond grip (PIDG) lugs had been inappropriately applied to solid conductor cable. The licensee identified corrective action for this concern was to perform walkdowns to determine if any such PIDG lug misapplication existed at Browns Ferry. The use of PIDG terminal lugs had been identified in solid conductor cables, Foxboro instruments, and Arc suppression networks. At Browns Ferry, the only use of solid conductor cable was coaxial cable. This type of cable does not lend itself to use of PIDG lugs. Foxboro instrument devices have been identified in control room panels 9-52 and 9-7. A walkdown was performed on these panels for Unit 3 and no terminations were identified with PIDG terminals. A walkdown inspection was performed on Arc suppression network circuits with no use of PIDG terminal lugs found. The inspector reviewed the results of these walkdowns and determined that no misapplication of PIDG lugs had been identified at Browns Ferry for Unit 3. This corrective action was determined to be adequate for resolution of the concern identified.

#### 3.2 Review of CATD 30403-BFN-02

CATD 30403-BFN-02 documented a concern that cables routed in manholes were not installed in trays properly. Specifically, the CATD identified that several dozen cables had been routed outside the cable trays in manhole T and there was not enough slack in the cables to place the cables in the trays. In manhole E, some of the 4 kV bus tie cables follow the top edge of the cable tray. The drawings for manholes F, G, H, and J show a metal barrier and cover in the trays to separate 4 kV cables from 480 V cables. These barriers are not installed in the trays.

The corrective action for this CATD had been completed. A walkdown was performed by the licensee and a work request (WR) C105832 initiated to perform the following:

- (1) All spared or abandoned cables hanging loose, or hanging coiled shall be reworked into the trays and tied down.
- (2) All cables routed outside the trays shall be reworked into the trays and tied down.

(3) All cables that cannot be reworked into the trays shall be neatly bundled and tied to the nearest tray rung support steel.

(4) All loose cables routed to wall sleeves shall be neatly bundled and tie-wrapped together.

The 4 kV bus tie cables were determined to have been abandoned. As such, no additional corrective action was required for placement of metal barriers between the 480 V and 4kV cables or routing of the cables which followed the top edge of the trays. The corrective action prescribed by the WR C105832 had been completed. Engineering and Quality Control follow-up inspections had been performed to verify the adequacy of the corrective actions.

The inspector concluded that the corrective action for this CATD was adequate to address the identified concern.

### 3.3 Review of CATD 30403-BFN-03

The inspector reviewed CATD 30403-BFN-03. This CATD was also associated with manhole issues. The concern identified that a terminal strip in junction box 7118 in manhole T was severely corroded. The need for a sump pump in the manhole was also identified.

Corrective action identified for this CATD was installation of a permanent sump pump in manhole T and replacement of the terminal strip with a water proof splice. The permanent sump pump, discharge piping and electrical 120 V power receptacle were installed by DCN W17326A. This installation was complete. The corroded terminal strip in JB 7118 was determined to not need additional corrective action. Security upgrade project of DCN W17011 was removing all loads from this JB. The inspector considered the corrective action adequate for resolution of the identified concerns.

### 3.4 Review of CATD 23900-BFN-06

CATD 23900-BFN-06 documented a concern that current programs identified for resolving raceway fill tracking had been initiated but no evidence could be found that conduit overfills were being addressed. Additionally, no program had been identified for tracking of raceway fill for future installations. The inspector reviewed the corrective action identified by the licensee for resolution of this concern. Walkdowns have been performed to determine raceway fill and conduit fill conditions for Unit 3. Cable data is controlled at Browns Ferry using the SETROUTE Program. Conduit fill and raceway fill have been addressed through calculations to resolve other cable installations concerns such as ampacity and tray support concerns. These required the extent of

raceway and conduit fill to be determined as part of the calculation process. These calculations have been reviewed and documented in NRC IR 50-259, 260, 296/94-35. Design Standard DS-E13.1.4 and Design Criteria BFN-50-758 identify the requirements for raceway and conduit fill requirements. The inspector considered the corrective actions adequate for resolution of the concern.

### 3.5 Review of CATD 24200-BFN-04

The inspector reviewed CATD 24200-BFN-04. This CATD documented a problem that the implementation of ECNs P0753 and P0822 to satisfy a previous NRC violation was not being tracked as a long term commitment. An analysis to justify the change of a conduit from non-Class 1E to a division II was not performed. A review had not been performed to determine if additional re-classifications of conduit without justification had occurred.

The corrective action for this CATD was to review all "M" conduit to determine if Class 1E cables had been installed within "M" conduits and provide justification as needed. "M" is a designation for miscellaneous conduits which are not designated as divisional. Additionally, justification was to be provided for the re-classification of the M80 conduit to a 3ES division II conduit.

The corrective actions for the classification of conduits has been completed. The "M" conduits have been reviewed and no additional examples were identified. The M80 conduit which had been re-classified as 3ES3069 division II conduit was reviewed and determined to be seismically qualified based on inspection and engineering evaluation against established structural engineering design benchmarks. This seismic qualification was documented per the Conduit Evaluation Program Report.

The tracking of the implementation of ECNs P0753 and P0822 was being documented by CATD SWEC-BFN-05-03 and SWEC-BFN-05-04. These CATDs have been previously reviewed and documented in NRC IR 50-259, 260, 296/95-20 and the corrective actions were determined to be adequate.

### 3.6 Review of CATD 24200-BFN-02

CATD 24200-BFN-02 documented the following observations identified during walkdowns. Switches of redundant divisions such as HS-64-36, HS-76-19, HS-13A-S24, HS-76-24, HS-64-31, and HS-43-14A in Panel 9-3 were not separated as required by design criteria. Internal wiring of the above redundant switches were not properly separated with six inches of flexible conduit. In panel 9-3, Unit 2 cable 2PC-469-I was routed with division II cables without physical separation and terminated at "VV" terminal block.



The inspector reviewed the corrective actions identified for this concern. The Unit 3 controls panels had been analyzed and documented in calculation ED-Q3999-930120, Unit 3 Internal Panel Separation/Functional Redundancy Evaluation. This calculation evaluated the Unit 3 panels and the Unit 1 and Unit 2 panels where cross divisional cables were present. The evaluation assures that either divisional separation or functional redundancy are available to meet single failure criteria. The results of the calculation documented a determination that the Unit 3 internal wiring configurations complied with the design criteria. Engineering walkdowns of these panels identified a need for modifications to provide design changes to the Unit 3 control panels and their internal wiring to assure compliance with the electrical separation criteria. DCN No. T35738A had been issued to accomplish these modifications. The inspector determined that planned and completed corrective actions were adequate for resolution of the concern.

### 3.7 Review of CATD 23801-BFN-02

CATD 23801-BFN-02 identified a concern that the corrective action for CAR-86-0078, CAR-86-0079, and CAR-86-0080 had not been implemented at Browns Ferry. These CARs identified that a computerized cable program had not been implemented at Browns Ferry. From previous inspection efforts of Unit 3 restart activities, the inspector was aware that computerized cable programs were in use at Browns Ferry. Computer data bases are utilized for routing, separation, cable weight, ampacity, and cable length information. Additionally, data bases exist which document cable specifications such as type, vendor, ampacity and other cable data. The inspector considered the corrective actions adequate for the resolution of the concern.

### 3.8 Review of CATD 23801-BFN-01

CATD 23801-BFN-01 was reviewed by the inspector. This CATD documented a concern that Quality Assurance records could not be identified which would indicate effective control of raceway fill or the present status of raceway fill. The corrective action for this issue was to perform a review of all practices and procedures utilized in routing, installing, and abandoning cables in raceways during BFN design, construction and modification phases. This review was completed to determine the root cause of any discrepancies in procedures and practices for maintaining raceway fill within limits. The inspector reviewed cable installation practices at Browns Ferry for Unit 3 restart modifications. All raceways had been analyzed to determine the extent of raceway fill. Practices and procedures for cable sizing and installation are being utilized to maintain raceway fill within acceptable parameters. The inspector considered these corrective actions adequate for the resolution of the concern.

#### 4. Review of Violation 94-35-01 (IP 92702)

The inspector reviewed the corrective action for Violation 50-269, 270, 296/94-35-01. This violation was identified after cables were identified in the Unit 3 cable spreading room bundled together on top of Flamemastic. The tray identified was tray FZ-II. Modification and Addition Instruction 3.2, Cable Pulling for Insulated Cables Rated up to 15,000 Volts requires cables installed on top of Flamemastic to be spaced and not tied together. This requirements allows adequate heat transfer for the cables installed within the Flamemastic to maintain the ampacity rating of the cable.

The inspector reviewed the corrective actions identified in the response to the violation in TVA letter dated April 13, 1995. The corrective action was to unbundle the cables in the identified tray, determine that personnel are knowledgeable of the installation requirements, and perform walkdowns to determine the extent of condition. The inspector determined from a walkdown observation that the cables in tray FZ-II had been unbundled and spaced properly. The inspector reviewed the results of the walkdowns that determined the extent of condition. The licensee determined the extent of condition by a review of modifications which routed cables in trays with Flamemastic for Unit 2 and Unit 3. Walkdowns were then performed for those trays to ensure proper cable installation. As a result of this modification review and walkdown effort by the licensee, additional examples of the violation were identified. These trays were then evaluated by engineering personnel to ensure that the installed configuration of the cables in the trays was acceptable. The cable trays identified as having incorrect cable installations were corrected or calculations for ampacity demonstrated that the cable trays were acceptable as found. The results of these evaluations and corrective actions were reviewed by the inspector and found to be acceptable. Violation 50-269, 270, 296/94-35-01 was closed.

#### 5. Exit Meeting

The inspection scope and results were summarized on August 11, 1995, and September 1, 1995, with those individuals indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings. There were no dissenting comments received from the licensee. Proprietary information is not contained in this report.

(Closed) Violation 50-269, 270, 296/94-35-01, Failure to Separate Cables Installed in Trays with Flamemastic

## 6. Acronyms and Abbreviations

CATD	Corrective Action Tracking Document
DCN	Design Change Notice
ECN	Engineering Change Notice
EMS	Equipment Management System
HPCI	High Pressure Coolant Injection
IP	Inspection Procedure
IR	Inspection Report
JB	Junction Box
kV	Kilovolts
NRC	Nuclear Regulatory Commission
PER	Problem Evaluation Report
PIDG	Pre-insulated Diamond Grip
PRA	Probabilistic Risk Assessment
SSP	Site Standard Practice
VDC	Volts-Direct Current
WR	Work Request