



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

Report Nos.: 50-259/91-17, 50-260/91-17, and 50-296/91-17

Licensee: Tennessee Valley Authority  
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Docket Nos.: 50-259, 50-260, and 50-296

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

Facility Name: Browns Ferry Units 1, 2, and 3

Inspection at Browns Ferry Site near Decatur, Alabama

Inspection Conducted: April 29, - May 10, 1991

Inspector: *C. A. Patterson*  
C. A. Patterson, Senior Resident Inspector

6/6/91  
Date Signed

Accompanied by: E. Christnot, Resident Inspector  
T. Cooper, Resident Inspector

Approved by: *Paul Kellogg*  
Paul Kellogg, Section Chief,  
Inspection Programs,  
TVA Projects Division

6/10/91  
Date Signed

SUMMARY

Scope:

This special announced inspection of the unit separation program was conducted to verify that Unit 2 startup and operation would not be impacted by the planned modifications for Unit 3. This included a review of the operational interface control, personnel access control, design and modifications, secondary containment, fire protection, training, and division of responsibilities.

Results:

The unit separation program has been adequately implemented to support Unit 2 restart. The operational interface controls and personnel access control have been established. Mechanical, and electrical systems in Units 1 and 3 needed to support Unit 2 have been uniquely identified. Boundary isolation valves



have been chained and locked closed. Plant personnel have received training on the separation program with additional training for plant operators. The delineation of responsibilities and lines of communication between the operating unit and construction unit have been established.

One violation was identified for failure to follow the hold order procedure, paragraph 3. The separation hold order tags were being hung without first establishing the clearance boundary and independently verifying the boundary. This is in the reverse order of the procedure requirements. Implementation of hold orders is a weakness in the operations area. There is a lack of understanding of the purpose of a clearance boundary. Personnel sign onto a hold order without reviewing the specifics of the boundary against the work to be performed. In this case the boundary was not ever established.

During the inspection, it was identified that sealing of conduit and junction box in Units 1 and 3 around equipment needed for Unit 2 operation had not been considered, paragraph 3. This was a problem in Unit 2 when spurious actuation of open head fire spray nozzles wet equipment in the reactor building. Most of the open head nozzles were replaced in Unit 2 and components sealed because of this concern or the environmental qualification of equipment program. The licensee sealed an additional 216 items in Units 1 and 3 to resolve this concern.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees:

- \*J. Bynum, Vice President, Nuclear Operations
- O. Zeringue, Vice President, Browns Ferry Operations
- \*L. Myers, Plant Manager
- \*M. Herrell, Operations Manager.
- J. Rupert, Project Engineer
- \*M. Bajestani, Technical Support Manager
- R. Jones, Operations Superintendent
- A. Sorrell, Maintenance Manager
- G. Turner, Site Quality Assurance Manager
- \*P. Carier, Site Licensing Manager
- \*P. Salas, Compliance Supervisor
- \*J. Corey, Site Radiological Control Manager
- R. Tuttle, Site Security Manager

Other licensee employees or contractors contacted included licensed reactor operators, auxiliary operators, craftsmen, technicians, public safety officers, quality assurance, design, and engineering personnel.

#### NRC Personnel

- \*C. Patterson, Senior Resident Inspector
- E. Christnot, Resident Inspector
- \*W. Bearden, Resident Inspector
- \*K. Ivey, Resident Inspector
- \*G. Humphrey, Resident Inspector

\*Attended exit interview

Acronyms and Initialisms used throughout this report are listed in the last paragraph.

### 2. Program Description

Browns Ferry Unit 2 is being returned to service after a six year shutdown following extensive modification work. Similar modifications are planned for Unit 3 and eventually Unit 1. Since all three units are physically adjacent and operationally interdependent, the licensee established a Unit Separation Program. This program established the controls necessary to operate Unit 2 while working on Unit 3 with Unit 1 in layup. The program is defined in procedure SSP-12.50, Unit Separation for Recovery Activities. This procedure contains the personnel access control and system operation interface control. The personnel access control consist

of physical and administrative measures to restrict Unit 2 operating spaces from Unit 3 recovery personnel. This consists of barriers, unique badging and posting of signs. The System Operational Interface Control consists of color coded interface drawings, colored tape, signs and tags, and hold orders.

### 3. Operation Interface Control

#### a. Boundary Establishment

The inspector reviewed the system interface boundaries to verify the boundaries were adequately established.

The licensee established the separation boundary by using as the bases the Unit 2 safe shutdown analysis boundary surrounded by additional operational boundaries. The safe shutdown boundary review was performed with Bechtel assistance and included a review of the essential calculation for those applicable systems. Some of this review was previously addressed in IR 91-06. Additional items reviewed were FSAR Chapter 14, Appendix R Shutdown Analysis and Unit 2 Dependency Matrix. No additional items were identified by the FSAR Chapter 14 or Dependency Matrix. The Appendix R review revealed that the Unit 3 DGs were needed for safe shutdown if a fire occurred in the Unit 1 and 2 DG building. However, the Unit 3 DGs are required by TS to support common equipment.

The inspector cross-referenced the list of safe shutdown systems to the list of systems needed to support Unit 2 operation listed in SSP-12.50. The Fire Protection system was not listed in SSP-12.50. The licensee stated this system is already red color coded and required by existing TS. The inspector agreed there was ample justification for removing this from the list. The inspector questioned if the electrical components in Units 1 and 3 were adequately sealed from spurious actuation of the fire protection system. A previous violation for this concern, 87-33-01, was identified. Unit 2 fire protection systems were upgraded and most open head spray nozzles replaced or removed. The same upgrades were not performed in Units 1 and 3. The licensee reviewed the separation drawings and issued FDCN to DCN H0397 on May 10, 1991, to seal an additional 216 items. This sealing would be completed before restart of Unit 2.

The inspector noted that FSAR Appendix F, "Interfacing Systems" had not been reviewed. The licensee reviewed the Appendix and identified no additional items that were not previously addressed.

The inspector concluded the boundaries were adequately established and concerns resolved.



b. Clearance Boundary

The inspector reviewed the following hold orders for separation:

3-91-95	Unit 2/Unit 3 Electrical Interface Separation - 1352 Tags
3-91-96	Unit 2/Unit 3 Mechanical Interface Separation - 714 Tags
1-91-66	Unit 1/Unit 2 Mechanical Interface Separation - 444 Tags
1-91-67	Unit 1/Unit 2 Electrical Interface Separation - 1223 Tags

The hold orders were denoted as 90 to 95% complete on the plan of the day. The inspector questioned why the hold orders were not 100% completed. The clearance sheet, form SDSP-216, was reviewed and the signatures for clearance boundary established and independent verification were not signed. The personnel preparing the hold order were questioned. There was some confusion whether the hold order had been issued or released. However, the hold order tags were being placed on equipment in the plant.

This is a violation TS Section 6.8.1 concerning procedures. SDSP-14.9, Equipment Clearances, Section 6.3, requires a clearance boundary be established and independently verified before the hanging of hold order tags. This violation is identified as VIO 259,260, 296/91-17-01, Failure to Follow Hold Order Procedure. The licensee issued PRD to correct this problem.

Additionally the inspector reviewed hold order 0-91-160. This was for Unit 1 loads not required for Unit 2 Cycle 5 operation. A hold order 0-91-161 was in place because of ampacity and separation concerns related to other plant equipment. The concerns would be resolved by modification once the respective unit was returned to service.

The common accident signal was disabled by a DCN. This would prevent Unit 1 or Unit 3 LOCA signals from actuating Unit 2 equipment. This was previously reviewed in IR 90-23.

The inspector questioned the operational scheme for tagging boundary breakers and valves. For valves the boundary valves had both a hold order tag and orange and black tag. The valves were tagged closed to prevent fluid flow. Electrical breakers remain closed allowing current flow but, were labeled with an orange and black tag. The licensee stated this method was explained in the separation procedure. The inspector concluded although this was inconsistent the procedure explanation was adequate.

c. Tapes and Labeling

During the drawing walkdowns, the use of the orange colored tape and labeling of electrical panels was inspected. In general, the use of tape or labels was found to adequately denote systems required for

Unit 2 operation which were not physically located in Unit 2. The following minor items were identified:

1. Tape was found on the Unit 3 DG exhaust lines which was a possible fire hazard. The licensee removed the tape on May 1, 1991.
2. Tape was found on a Unit 3 control bay chiller but the chiller was abandoned equipment. The licensee removed the tape on May 1, 1991.
3. In Unit 2 on the 4160 shutdown board C, there were labels for the breaker control power on the boards. The inspector questioned why the labeling was in Unit 2. The licensee removed the labels on May 1, 1991.

CAQR BFP 910129 was issued prior to the beginning of the inspection stating that the tape used for marking the interfaces was not procured under required specifications. Per the specifications the allowed halogens is 1000 ppm for use on corrosion resistant metals, while the tape used contains about 85,000 ppm. The specifications requires that all tape be removed before returning a system to operation, contrary to the intended purpose of the tape. The licensee is removing the tape from the stainless steel piping, cleaning and testing the piping, and then will sleeve the pipe and retape the sleeve. This will resolve the problems with the halogen content of the tape and the removal requirements, since the tape will be on the sleeve, not on the piping itself.

d. Separation Drawings

The inspector reviewed and walked down the following drawings:

45E614-11	120V AC/250V DC Valves and Misc.
10-45E614-5	Wiring Diagram 120V AC/250V DC Valves and Misc.
1-45E1647-1	Wiring Diagram Unit Control Board Panel 9-9, Cabinet 1,
1-45E614-9	Wiring Diagram 120V AC/250V DC Valves and Misc.
1-45E701-3	Wiring Diagram BD1 RPS PWR Single Line
0-15E500-2.	Key Diagram of Standby Systems
3-15E500-3	Key Diagram of Normal and Standby Auxiliary Power System





0-45E710-4	Key Diagram Instrumentation and Controls, DC and AC Power System
3-45E3647-1	Wiring Diagram, Unit Control Board, Panel 9-9, Cabinet 1
1-47E814-1	Flow Diagram Core Spray System
3-45E779-20	Wiring Diagram 480V Shutdown Auxiliary Power Schematic Diagram
2-45E779-18	Wiring Diagram 480V Shutdown Auxiliary Power Schematic diagram
1-47E1847-1	Mechanical I&C Flow Diagram Control Air System
3-47E861-1	Flow & Control Diagram Diesel Starting Air System Diesel Generator 3A
1-47E813-1	Flow Diagram Reactor Core Insolation Cooling System
2-47E811-1	Flow Diagram Residual Heat Removal System
1-47E858-1	Flow Diagram RHR Service Water System
3-47E850-1	Flow Diagram Fire Protection and Raw Service Water
3-47E858-1	Flow Diagram RHR Service Water System
3-47E844-3	Flow Diagram Raw Cooling Water

The inspector walked selected systems down to assure the proper isolation of boundary valves on interfacing systems. Valves identified on drawings as boundary isolation valves were inspected. All of the identified valves had a hold tag hung on them, they had been chained in the required position, and they had the required orange and black sign hung on the valve, per procedure SSP 12.50, identifying the valve as necessary for Unit 2 operation. The boundary system piping was properly marked with orange tape, as required by the procedure.

The inspector reviewed SSP 12.50 and the list of designated drawing locations did not contain the centralized EOF or CECC. The licensee placed a set of critical drawings in CECC. An inspector verified the drawings were in place on May 10, 1991.

#### 4. Personnel Access Control

##### a. Physical Barriers

The inspector examined the physical barrier program being implemented to separate Unit 3 activities from Unit 2. At the time of the inspection, the barriers had been fabricated, and were being installed.

Hard hats were being issued to Unit 3 workers that are dissimilar to any other hardhats in use at the site. A light blue hard hat signifies that the worker is assigned to Unit 3 and is not exempt from the Unit 2 access control restrictions. The licensee procedure, SSP 12.50, requires that a list of exempt personnel who are allowed to freely travel between Unit 3 and Unit 2 be developed.

Non-exempt personnel will be required to obtain an orange and black access badge prior to entering Unit 2 from Unit 3. Before these badges can be issued, the person must be qualified through experience or training to perform the required work on Unit 2. The licensee procedure requires that Unit 3 work control and the job supervisor are responsible for assuring that each individual required to enter Unit 2 is qualified.

Access to the Unit 3 reactor building will be through the same airlock being used for access to the Unit 2 reactor building, until the secondary containment isolation separation is completed. At that time barriers will be placed to prevent access to unit 3 through the airlock. The equipment airlock will be used for Unit 3 access after the separation.

##### b. Access Control

The inspector interviewed security management concerning the measures being taken to implement the access control program for Unit 3 and Unit 2. The security force has been prepared for the implementation of the separation program. They have received the same general employee training as the plant personnel and are familiar with requirements for the unit separation.

Unit 3 recovery personnel must meet the vital area access requirements before being issued a badge, but their badges will be distinctively marked, with either a blue dot or a blue stripe, to differentiate them from the unit 2 work force. For Unit 3 personnel found in Unit 2 without the proper authorization, security plans to consider the incident as a security violation, to be dealt with as such.



## 5. Design and Modifications (Electrical)

The inspector reviewed and observed the licensee's design and modification activities involved with the unit separation program. This consisted of a review of drawings, DCN, associated FDCNs, and the Support to Frontline Dependency Matrix. The observations consisted of completed work and work activities in the field.

### a. Dependency Matrix

The inspector reviewed the dependency matrix in relationship to the scope of the electrical system separation boundary. The inspector noted the matrix did not list any Unit 3 RMOV Board 480V AC or 250V DC; listed Unit RMOV 480V AC Boards 1A, B, C, and E; listed all 4 KV shutdown boards; listed all, except 3D, 4KV Unit Boards; did not list the Unit 3, 4KV Tie Board; and listed various other electrical boards. The inspector observed the electrical system boundary identification tags on various electrical boards such as 4160 volt unit, common, bus tie and shutdown boards, 480 volt common and shutdown boards, 480 volt and 250 volt DC RMOV Boards, and 120/208 volt I and C panels.

The inspector concluded from the review, walkdown, and followup of the dependency matrix versus the electrical unit separation boundary that no electrical board listed on the matrix is outside the electrical unit separation boundary.

The inspector noted that the dependency matrix was an operator aid in the control room. The matrix references numerous notes but the notes were not available to the operators. The licensee made the notes available to the control room operators on May 1, 1991.

### b. Design and Modifications

The inspector reviewed, observed, and followed up the licensee activities involving modifications for Unit Separation. The DCNs reviewed were W16408, Physical Modification to penetrations, W16441, Seal Unit 3 Stairwells to Refuel Floor, W15432, Emergency Lighting for Unit 3 Equipment Airlock; W16576, Add a Card Reader to Door 25A, Airlock from Turbine Building to Unit 3 Reactor Building, and W16567, Install New Emergency Stairwell. The inspector reviewed the various DCAs associated with the DCNs. The inspector noted that DCN W16440, Masonry Block Walls and Other Components of the Unit 3 Elevator Shaft, and DCN W16532, Seismic Qualification of Unit 3 Refuel Flow Exhaust Ducts, were not issued at the close of the inspection.

The inspector observed in progress field activities included in DCNs W16567 and W16576. These activities involved WPs 2069-91, 0074-91, and 0076-91. The inspector reviewed the field work completed for DCN W16567 which involved WP 2069-91.

The inspector concluded from the reviews and the observations of the work activities that the modifications were being installed in accordance with the DCAs and WPs.

c. Temporary Alterations

The inspector reviewed two TAs. One TA, involving the connections to the SGBT system from the Unit 3 containment, containment purging system and the HPCI system, had not been approved for installation. The other TA, designated TACF 3-91-002-040, involved the installation of an expandable plug between the Unit 2 and Unit 3 turbine building station drain sumps. The inspector observed that this TA was installed and adequately identified.

The inspector concluded that the BFN separation program as it applied to the areas reviewed was being conducted in a controlled manner in accordance with procedures.

6. Secondary Containment

The inspector reviewed the separation plans associated with secondary containment. Presently four zones, the three reactor buildings and refuel floor, are treated as a common secondary containment. This will remain in place when Unit 2 is started. Several months after restart Unit 3 reactor zone will be separated from the other three zones. Several modifications are being prepared to permit isolation of Unit 3. Some of the modifications necessary are as follows:

- Rubber boots on piping penetrations
- Reinforce concrete blocks on top of elevator shaft
- Seal up elevator cables and ventilation
- Modification to reactor cavity HVAC

A TS change is also required for Unit 3. TS 3.7.c.2.6. requires shutting down all three units if reactor zone containment is lost in any reactor zone. These activities will be followed during the routine inspection program after Unit 2 restart.

7. Fire Protection

The inspector reviewed the Fire Protection pre-fire plans and verified that the interfaces between Units 2 and 3 had been accounted for in the latest revision. All interfacing access areas between the two units had been accounted for in the revision. The access areas from Unit 3 into Unit 2 Reactor Building were still listed as alternate access/egress points, with a note stating that Security would be required to unlock the doors between the two units. The interfacing doors were only listed as an alternative, if the others could not be used.

## 8. Training

The inspector observed the training for unit separation for the general employees and the licensed operators. The general employee training consisted of a video tape which stressed the procedure requirements of licensee procedure SSP 12.50, Unit Separation for Recovery Activities.

Licensed personnel received live training at the beginning of a shift. The inspector observed the training of one of the operating shifts. The training consisted of watching the general employee training tape and then having the instructor discuss the procedure SSP 12.50 with the personnel.

The training of the operating personnel did not include any information not provided in the procedure, such as the areas where barriers would be erected, an explanation of the systems and components chosen as boundary components, or any basis for the decisions. The operators were told that the Unit 3 recovery personnel would be wearing "unique" badges, but the badges themselves were not described to the personnel. Questions to the instructor were usually requesting more detail, such as access requirements to the Unit 3 and Unit 2 reactor buildings and whether the orange tape being used to mark the boundary system piping was acceptable due to chloride leaching.

The operators were required to successfully complete a test following the training session. The test consisted of 10 multiple choice questions and two short informational questions. The operators were allowed to use the procedure while taking the test. Of the four shifts that had completed the training, one person had failed the test. This person will be required to repeat the training.

The inspector concluded that the training was adequate to explain the separation program. The inspector commented to operations management that operations personnel may need more detail in their training.

## 9. Division of Responsibilities

On April 18, 1991, the licensee issued a memorandum to delineate responsibilities and lines of communications between BFN Operations (Unit 2) and BFN Restart Organizations (Unit 3). BFN Operations is responsible for all operations and programs at BFN which affect the licensing, operations, and maintenance of the units. BFN Restart provides service to BFN Operations for implementing modifications to BFN Units 1 and 3 based on NRC commitments and established criteria using acceptable BFN procedures. The inspector concluded that the memorandum, which would be placed in a separation procedure, clearly defined responsibilities and communication channels.

The inspector noted one comment during the review of the hold order violation discussed in this report. Initially the Unit 2 operations staff stated that the hold order work was being performed by Unit 3 people who





felt the method was acceptable. The inspector emphasized that according to the memorandum that Unit 2 operations was clearly responsible.

#### 10. Exit Interview (30703)

The inspection scope and findings were summarized on May 10, 1991 with those persons indicated in paragraph 1 above. The inspectors described the areas inspected and discussed in detail the inspection findings listed below. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection. There were no dissenting comments by the licensee.

<u>Item Number</u>	<u>Description and Reference</u>
259, 260, 296/91-17-01	VIO, Failure to Follow Hold Order Procedure, paragraph 3.

#### 11. Acronyms and Initialisms

AC	Alternating Current
BFN	Browns Ferry Nuclear Plant
BFP	Browns Ferry Plant
CAQR	Condition Adverse to Quality Report
CECC	Centralized Emergency Control Center
CFR	Code of Federal Regulations
DCA	Design Change Authorization
DC	Direct Current
DCN	Design Change Notice
DG	Diesel Generator
EOF	Emergency Operating Facility
FDCN	Field Design Change Notice
FSAR	Final Safety Analysis
HPCI	High Pressure Coolant Injection
HVAC	Heating, Ventilation, and Air Conditioning
IC	Instrument and Control
IR	Inspection Report
KV	Kilovolt
LOCA	Loss of Coolant Accident
NRC	Nuclear Regulatory Commission
PPM	Parts Per Million
PRD	Problem Reporting Document
RMOV	Reactor Motor Operated Valve
RPS	Reactor Protection System
SBGT	Standby Gas Treatment
SDSP	Site Directors Standard Practice
SSP	Site Standard Practice
TA	Temporary Alteration
TACF	Temporary Alteration Control Form
TS	Technical Specification
VIO	Violation
WP	Work Plan