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

Report Nos.: 50-259/93-12, 50-260/93-12, and 50-296/93-12

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: March 20 - April 16, 1993

Inspector: C. A. Patterson, Senior Resident Inspector — 4/28/93 Date Signed

Accompanied by: J. Munday, Resident Inspector
R. Musser, Resident Inspector
G. Schnebli, Resident Inspector
T. Liu, Intern

Approved by: Paul J. Kellogg, Chief, Reactor Projects, Section 4A, Division of Reactor Projects — 4/28/93 Date Signed

SUMMARY

Scope: This routine resident inspection included surveillance observation, maintenance observation, operational safety verification, modifications, and Unit 3 restart activities.

One hour of backshift coverage was routinely worked during the work week. Deep backshift inspections were conducted on March 21 and April 11, 1993.

Results: Unit 2 was in day 78 of a 100 day refueling outage at the end of the report period, paragraph four. The outage activities were progressing with active involvement of the system engineers in

system testing. Test directors were established and pre-job briefings for complicated testing were conducted. This was a strength of the technical support staff.

One violation, with two examples, was identified for failure to follow the equipment clearance procedure, paragraph five. The first example was that five active hold order tags with the fuse blanks attached were found lying in the back of a control room panel with personnel working in the panels. The second example was that component's position/condition was not adequately specific on the clearance sheet. The sheet specified "PLACED" although two PK block covers were removed and laying on the floor with the tags attached. The licensee changed the procedure to specify tag placement over the block cover opening.

REPORT DETAILS

1. Persons Contacted

Licensee Employees:

*O. Zeringue, Vice President
*J. Scalice, Plant Manager
*J. Rupert, Engineering and Modifications Manager
R. Baron, Site Quality and Licensing Manager
D. Nye, Recovery Manager
*M. Herrell, Operations Manager
J. Maddox, Engineering Manager
*M. Bajestani, Technical Support Manager
A. Sorrell, Special Programs Manager
*C. Crane, Maintenance Manager
*G. Pierce, Acting Licensing Manager
*J. Corey, Site Radiological Control Manager

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

NRC Personnel:

P. Kellogg, Section Chief
*C. Patterson, Senior Resident Inspector
*J. Munday, Resident Inspector
*R. Musser, Resident Inspector
*G. Schnebli, Resident Inspector
*T. Liu, Intern

*Attended exit interview

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

2. Surveillance Observation (61726)

The inspectors observed and/or reviewed the performance of required SIs. The inspections included reviews of the SIs for technical adequacy and conformance to TS, verification of test instrument calibration, observations of the conduct of testing, confirmation of proper removal from service and return to service of systems, and reviews of test data. The inspectors also verified that LCOs were met, testing was accomplished by qualified personnel, and the SIs were completed within the required frequency. The following SIs were reviewed during this reporting period:

a. 0-SI-4.8.F.1, Spent Resin Dewatering Process Control Verification

The inspector reviewed 0-SI-4.8.F.1, Spent Resin Dewatering Process Control Verification, completed on March 23, 1993. This SI fulfills the requirements of TS 3.8.F.1 that requires the solid radwaste system be operated in accordance with a process control program for the solidification and packaging of wet radioactive wastes to ensure meeting the requirements of 10 CFR 20 and 10 CFR 71 and burial ground requirements prior to shipment of radioactive wastes from the site. The inspector checked the dewatering times and volume of water for compliance with the procedure acceptance criteria. The criteria applied was for dewatering a CNSI (Chem-Nuclear Systems, Inc.), 24 inch diameter carbon steel and fiberglass reinforced plastic pressure vessel. No discrepancies were noted.

b. 0-SI-4.8.A.1-1, Release Procedure - Liquid Effluents

On March 29, 1993, the inspector observed the performance of a liquid release from the Floor Drain Sample Tank to the Tennessee River. The controlling procedure was SI-4.8.A.1-1, Release Procedure - Liquid Effluents. The inspector observed chemistry technicians draw and analyze samples from the tank and verify the tank contents were suitable for release. The inspector also observed the system alignment needed to support this release. Normally, liquid radioactive releases are diluted with CCW because of the system's extremely high flow rate, approximately 400,000 gpm. This reduces the concentration of the release. However, when this tank was released, CCW was secured to facilitate piping repair. The RCW system was aligned to provide sufficient flow rates for diluting the contents of the tank to ensure TS limits would not be exceeded. The inspector reviewed the Safety Analysis and Evaluation that was performed to verify that radioactive liquid releases via this method was acceptable. No discrepancies were noted. In addition, Operations issued Standing Order OS-0058, which outlined the additional precautions and prerequisites required while releasing effluents using this method. The inspector verified the prerequisites were satisfied. Due to this configuration, an electrical jumper had to be installed inside a control room panel to bypass features that were not required. The inspector noted that the jumper used alligator clips to attach it to the screw head in the circuit. The connection did not appear very secure due to the amount of area and shape of the screw to which it was attached. The inspector discussed the possibility of jumpers with alligator clip connectors falling off with the maintenance manager. He was aware of this possibility and has installed banana jack connectors where possible to prevent this from occurring. Following completion of the release, the inspector reviewed the completed procedure and the post-release calculations and found no discrepancies.

c. O-SI-4.9.A.1.a(D), Diesel Generator D Monthly Operability Test

On April 13, 1993, the inspector witnessed a portion of the performance of the DG Monthly Operability Test. The surveillance satisfies the requirements of TS 4.9.A.1.a and 4.6.G.1 as it pertains to the fuel oil and starting air system ASME Section XI testing. The surveillance was completed satisfactorily with one discrepancy noted by the inspector. A fuel oil transfer pump vibration calculation was performed incorrectly. Vibration data is taken on the fuel oil transfer pump with the pump running and with it off. The two readings are subtracted to obtain true pump vibration. The true vibration is determined this way because the transfer pump is located on the same skid as the DG and vibration of the DG is induced in the pump. The completed surveillance containing the error had not yet been reviewed by either the ASME Inservice Test Group or the cognizant engineer. The inspector informed the cognizant engineer of the error who stated that it would be corrected. No other discrepancies were noted.

d. Main Steam Safety Relief Valve Testing

The thirteen main steam SRV pilot cartridges were tested by Wyle Laboratories to obtain the as-found relief setpoints as required by TS 4.6.D. The results are as follows:

VALVE ID	SET PRESSURE	AS FOUND	PERCENT DELTA
1-80	1125 psig	1185 psig	5.3%
1-4	1125 psig	1172 psig	4.2%
1-31*	1105 psig	1082 psig	2.1%
1-5*	1115 psig	did not lift at 1250 psig	>12.1%
1-179	1125 psig	1136 psig	0.98%
1-30*	1115 psig	1194 psig	7.1%
1-42	1125 psig	1148 psig	2.0%
1-34*,#	1105 psig	1250 psig	13.1%
1-22*	1115 psig	1108 psig	0.6%
1-18	1115 psig	1176 psig	5.5%
1-19*	1105 psig	did not lift at 1250 psig	>13.1%
1-41	1125 psig	1180 psig	4.9%
1-23	1105 psig	1168 psig	5.7%

* These SRVs are also ADS.
# SRV had severe leak.

Technical Specification 2.2.A allows a tolerance of ± 11 psi which correlates to 1%. Nine SRVs did not lift within this tolerance and two did not lift when the pressure was increased to 1250 psig, (this is the highest pressure the valves are subjected to for this test). Due to the significant deviation between the as-found relief setpoints and those assumed in the licensing analysis for

BFN Cycle 6, TVA Nuclear Fuel Division performed an analysis to verify the integrity of the reactor coolant boundary would not have been challenged if the most limiting over-pressure event had occurred. The results of the analysis verified that adequate margin existed to preclude challenging the reactor coolant boundary.

The licensee believes the failures are due to corrosion bonding of the pilot valve seat and disc. This is evidenced by a decreasing lift pressure with each subsequent lift. Similar failures of two-stage Target Rock SRVs have occurred at other utilities as noted in Information Notice 88-30, Target Rock Two-Stage SRV Setpoint Drift Update. The licensee plans to install pilot assemblies removed from Unit 3 into Unit 2 for Cycle 7, and to disassemble the Unit 2 pilot assemblies at some later date. The BWROG, which TVA is a member of, is working to resolve this problem with the Target Rock SRVs. The licensee plans to take no further action on this matter until the BWROG determines the best course of action. The inspector witnessed a portion of the testing at Wyle Labs, reviewed the licensee's analysis, and other industry information. The inspector concluded that the licensee's assessment and actions are consistent with the industry approach to the problem.

No violations or deviations were identified in the Surveillance Observation area.

3. Maintenance Observation (62703)

Plant maintenance activities were observed and/or reviewed for selected safety-related systems and components to ascertain that they were conducted in accordance with requirements. The following items were considered during these reviews: LCOs maintained, use of approved procedures, functional testing and/or calibrations were performed prior to returning components or systems to service, QC records maintained, activities accomplished by qualified personnel, use of properly certified parts and materials, proper use of clearance procedures, and implementation of radiological controls as required.

Work documentation (MR, WR, and WO) were reviewed to determine the status of outstanding jobs and to assure that priority was assigned to safety-related equipment maintenance which might affect plant safety. The inspectors observed the following maintenance activities during this reporting period:

a. Control Rod Drive Disassembly

Four of the control rod drives removed from Unit 2 this outage were disassembled and inspected. The inner cylinder of two drives had minor pitting, otherwise the inspection was satisfactory. Based on the results of this inspection the licensee will determine whether or not it is feasible to reuse the control rods in Unit 3. The inspector attended the pre-job briefing conducted

on March 24, 1992. The participants discussed the process of disassembling the drive with particular attention paid to the expected dose rates for specific steps to be performed. The participants then determined methods to reduce the dose for these steps. The meeting was thorough, going into explicit detail for every aspect of the job. The inspector noted no discrepancies with this activity.

b. Condenser Circulating Water Tunnel Inspection

On March 22, 1993, the inspector conducted an inspection of the CCW tunnel to perform followup on an underground leak identified in IR 93-07. An underground leak had developed at the north side of the RHRSW building on February 28, 1993. The CCW tunnel was entered and the leak was observed. Initially, a tower crane was located at the northwest side of the intake structure and was assumed to be the cause of the leak. The licensee determined that the leak resulted from the normal degradation of the contraction/expansion joint of the CCW intake conduit. The licensee also concluded that parking the tower crane in the area would not damage the CCW conduit given that the weight of the crane was within the design limits of the conduit. Repairs were made to the Unit 2 CCW intake conduit per Work Order 93-03676-00. The inspector concluded no damage to underground safety-related piping had occurred.

c. Failed MSIV Limit Switch

On March 31, 1993 the inspector accompanied maintenance personnel to inspect the internals of a failed limit switch on the D outboard MSIV. The limit switch failed its functional test on November 28, 1992, and was suspected to have failed due to moisture intrusion from a steam leak in the area. This was documented as IFI 92-41-01. The initial inspection revealed no evidence of moisture intrusion. Maintenance personnel exercised the tripper arm several times. If the arm was moved slowly it would occasionally stick and the switch would not change state. If the arm was moved rapidly the switch operated satisfactorily. The licensee intends to remove the limit switch and further disassemble it in an effort to determine the reason for the sticking tripper arm. The inspector will continue to monitor this item.

No violations or deviations were identified in the Maintenance Observation area.

4. Operational Safety Verification (71707)

The NRC inspectors followed the overall plant status and any significant safety matters related to plant operations. Daily discussions were held with plant management and various members of the plant operating staff. The inspectors made routine visits to the control rooms. Inspection

observations included instrument readings, setpoints and recordings, status of operating systems, status and alignments of emergency standby systems, verification of onsite and offsite power supplies, emergency power sources available for automatic operation, the purpose of temporary tags on equipment controls and switches, annunciator alarm status, adherence to procedures, adherence to LCOs, nuclear instruments operability, temporary alterations in effect, daily journals and logs, stack monitor recorder traces, and control room manning. This inspection activity also included numerous informal discussions with operators and supervisors.

General plant tours were conducted. Portions of the turbine buildings, each reactor building, and general plant areas were visited. Observations included valve position and system alignment, snubber and hanger conditions, containment isolation alignments, instrument readings, housekeeping, power supply and breaker alignments, radiation and contaminated area controls, tag controls on equipment, work activities in progress, and radiological protection controls. Informal discussions were held with selected plant personnel in their functional areas during these tours.

a. Unit Status

Unit 2 was in day 78 of a 100 day refueling outage at the end of the report period. Preparations were being made for the establishment of secondary containment followed by fuel reload.

b. Diesel Generator Cooling Water Sampling

While reviewing the chemistry sampling logs, the inspector noted that the DG cooling water corrosion inhibitor sample was consistently high out of the administrative limit. The administrative limit stated in SSP-13.1, Chemistry Program, is 2.2 - 3.0 ounces/gallon. Sampling indicated the coolant corrosion inhibitor concentration was consistently greater than 4.0 ounces/gallon. The chemistry technician stated that the upper limit was not applicable and that the procedure would be revised to only indicate a lower limit. The inspector verified this to be true through discussions with the system engineer and a review of the vendor manual. The inspector noted no further discrepancies in this area.

c. Water Intrusion into the Control Air System

On March 30, 1993, the licensee discovered an intrusion of water into the control air system when an operator on rounds noted water coming from instrumentation racks in the Unit 2 turbine building. The water was limited to the Unit 2 turbine building portion of the control air system as this portion of the system was isolated from the remainder of the system. The source of water was Unit 2 condenser circulating water system instrument lines associated with the condenser tube cleaning amertap system. The instrument

lines sense differential pressure across the amertap ball collecting baffles. Should the amertap balls become lodged in the collecting baffle, a high d/p would be sensed and the baffle would open and release the balls to the CCW discharge. The d/p cells/gauges are mounted on CCW instrument racks 2-25-250A, B, C located in the condenser bay. An air-CCW interface exists at this rack so that when both the CCW and control air systems are operational (pressurized), an equilibrium exists such that neither water enters the air system nor air enters the CCW system. In this case, since the control air system was isolated, the lack of air pressure allowed the intrusion of water into the air system.

The licensee analyzed the conductivity of water which entered the air system and found that it would not be detrimental to the copper and stainless steel air lines. The air lines are being flushed with control air. Instruments affected by the water intrusion are being disassembled, dried via a baking process, inspected, re-calibrated and returned to service. This process is still on going and will be monitored by the inspector.

To prevent a future intrusion of water into the control air system, the licensee is evaluating the installation of check valves at the CCW discharge strainer racks. Such devices will be installed prior to Unit 2 completing the cycle 6 refueling outage. A similar condition exists on Units 1 and 3 and will be addressed by the licensee prior to these Units returning to an operational status.

d. HPCI System Walkdown

The NRC is developing risk-based inspection guides to be published as NUREG reports to provide guidance for NRC inspections. A draft NUREG (NUREG/CR-6022, BNL-NUREG-52370) has been developed for the HPCI system at Browns Ferry. On March 23, 1993, a walkdown of the Unit 2 HPCI system was performed to assist with the development of this Risked-Based Inspection Guide. The inspection walkdown was performed by the licensee's system engineer, a NRC contractor, a member of the NRC's Probabilistic Safety Assessment Branch, the NRR Project Manager, and the resident inspector. A majority of the HPCI piping, associated electrical boards and the control room panels were examined during the walkdown. At the time of the walkdown Unit 2 was defueled for its cycle 6 refueling outage and therefore the system was inoperable. In addition, maintenance was in progress and this somewhat prevented the inspectors from assessing the adequacy and operational readiness of the HPCI system. Following the walkdown, the draft copy of the Browns Ferry HPCI NUREG was discussed with the licensee. The licensee plans to review the document and provide any applicable comments to the NRC. Additionally, examples of past operational problems associated with the HPCI system were discussed with the licensee to ensure a thorough understanding of these problems and how these matters could aid in the development of the NUREG. Once comments

and suggestions have been provided, the final version of the NUREG will be forwarded to the NRC for approval.

No violations or deviations were identified in the Operational Safety Verification area.

5. Modifications (37700, 37828)

The inspectors maintained cognizance of modification activities to support the restart of Unit 2. This included reviews of scheduling and work control, routine meetings, and observations of field activities. Throughout the observation of modifications being performed in the field QC inspectors were observed monitoring and documented verification at work activities.

a. CREV PMT

On April 11, 1993, the inspector observed post modification testing of the CREV system. This was the first day of several days of testing for the units. This testing was for DCN W17527. This DCN provides for additional CREV capacity by installing redundant 3000 cfm units. The inspector observed correct fan and damper position indication in the control room for the "A" CREV unit while operating. However, the inspector questioned why the amber lights for AUTO/MANUAL INIT indication were lit for both the A and B trains. This was discussed with the test director. After several possible explanations it was concluded that several additional SIs would test the logic and any deficiencies would be identified for disposition.

The inspector will continue to inspect testing of the CREV units and resolution of any test deficiencies. Also, the inspector noted there was not any of the licensee inspectors from the quality organization observing the testing. This was discussed with the Site Quality and Licensing Manager. The licensee plans to provide periodic monitoring of the CREVs testing. Additionally, the inspector noted the continued active involvement of the system engineers in testing and directing tests. This was identified as a strength of the technical support organization.

b. CRDR Modifications and Hold Order Problems

On March 30, 1993, the inspector observed outage activities associated with Unit 2 CRDR. While walking down the control room back panels, the inspector noted that five clearance tags were not attached to their assigned components laying inside panel 2-PNL-9-3. One hold tag was found by itself on top of the cables, another was found underneath the cables, and three more were found stacked together on top of cables. The inspector reviewed the applicable clearance sheets and discovered the hold orders were still in active status. The five examples of the hold order tags not in place with active clearances are identified as follows:

Clearance No.	Tag No.	Component Description
2-93-0388	9	2-FU1-75-26A Fuse Clip Installed
2-93-0154	12	2-FU1-73-50A Fuse Clip Installed
2-93-0154	13	2-FU2-73-18A Fuse Clip Installed
2-93-0298	67	2-FU1-73-8A Fuse Clip Installed
2-93-0298	68	2-FU1-73-8B Fuse Clip Installed

The inspector notified the operations manager upon the discovery of the deficiency. The operations manager inspected panel 2-PNL-9-3 with the inspector and initiated corrective action to ensure that no additional hold order tags located in Unit 2 control room were unattached from their assigned components.

SSP 12.3, Equipment Clearance Procedure, 3.1.5 K requires that clearances involving control fuses located on multiple terminal boards which are required to be tagged shall have the control fuses removed, a hold notice tag attached to fuse blanks, and the blanks inserted into the fuse clips. Section 3.1.D.3. provides the requirements for unattached tags to be reported to the SOS. Furthermore, Browns Ferry Unit 2 cycle 6 refueling outage handbook, page 26, under the operational considerations section concerning clearances, states, "If a loose tag is discovered, do not restore it to the component. Immediately notify the SOS or the SOS representative at extension 2213, 2214." Failure to comply with equipment clearance procedure requirements is a violation of TS 6.8.1.1.a, which requires that written procedures should be established, implemented, and maintained covering the applicable procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978. Included in the appendix are Administrative Procedures covering equipment control (e.g. locking and tagging). This is the first example of VIO 259, 260, 296/93-12-01, Clearance Tags Not In Place.

Another instance concerning a clearance problem was identified by the inspector on April 12, 1993. Two clearance tags attached to PK block covers were found lying on the floor. Descriptions on the hold tags are listed as the following:

Clearance No.	Tag No.	Component Description
3-93-0045	2	TRANSF 3 FDR & GEN BACKUP AUX RLY PK BLOCK FOR 386TF RELAY ROOM
3-93-0045	3	TRANSF 3 FDR & GEN BACKUP AUX RLY PK BLOCK FOR 386TF RELAY ROOM

The inspector reviewed the clearance sheet and questioned the status of the hold clearance. The clearance sheet stated the normal position/condition for removal from service was "PLACED" and the normal position/condition for release of clearance was to "remove tag". SSP 12.3, Section 3.1.D requires for all hold notices that the component's position/condition shall be specified. The word "PLACED" did indicate that the block was removed but only appeared to be that the tag should be placed

where the block was removed. The inspector notified the operations manager upon discovery and verified the condition with the operations manager at the affected panel. After discussing with the operations manager, the as-found condition was determined to be deficient. The licensee initiated a procedure change on April 15, 1993, to specify in step 3.1.5.B. that when PK block covers are removed and for a component boundary, the stationary component where the cover was removed shall be tagged with a hold notice tag. Consequently, the hold tags were restored to their correct configurations with the tags attached to the panel and the PK test blocks removed. The significance of the hold order tags were to prevent the placement of PK block covers back on the panel, and this instruction was not followed as required by the clearance sheet.

Site Standard Practice 12.3, Equipment Clearance Procedure, 3.2.2, Establishing a Clearance, requires proper tag placement, component positioning and the system or component properly isolated. This is the second example of VIO 259, 260, 296/93-12-01, Clearance Tags Not In Place.

One violation was found in this area.

6. Unit 3 Restart Activities (30702)

The inspector reviewed and observed the licensee's activities involved with the Unit 3 restart. This included reviews of procedures, post-job activities, and completed field work; observation of pre-job field work, in-progress field work, and QA/QC activities; attendance at restart craft level, progress meetings, restart program meetings, and management meetings; and periodic discussions with both TVA and contractor personnel, skilled craftsmen, supervisors, managers and executives.

Limited activities on Unit 3. A major assessment of the schedule and minor system SPOC review were in progress.

7. Exit Interview (30703)

The inspection scope and findings were summarized on April 16, 1993, 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. Dissenting comments were not received from the licensee.

Item Number	Description and Reference
259, 260, 296/93-12-01	VIO, Clearance Tags Not in Place, paragraph five.

8. Acronyms and Initialisms

ADS	Automatic Depressurization System
ASME	American Society of Mechanical Engineers
BFNP	Browns Ferry Nuclear Power Plant
BWROG	Boiling Water Reactor Owners Group
CCW	Condenser Circulating Water
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CNSI	Chem-Nuclear Systems, Inc
CRDR	Control Room Design Review
CREVS	Control Room Emergency Ventilation System
DCN	Design Change Notice
DG	Diesel Generator
D/P	Differential Pressure
GPM	Gallons Per Minute
HPCI	High Pressure Coolant Injection
IFI	Inspector Followup Item
IR	Inspection Report
IVVI	In Vessel Visual Inspection
LCO	Limiting Condition for Operation
MR	Maintenance Request
MSIV	Main Steam Isolation Valve
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
PMT	Post Modification Test
PSIG	Pounds Per Square Inch Gauge
QA	Quality Assurance
QC	Quality Control
RCW	Raw Cooling Water
RHRSW	Residual Heat Removal Service Water
SI	Surveillance Instruction
SPOC	System Preoperability Checklist
SRV	Safety Relief Valve
SSP	Site Standard Practice
TS	Technical Specifications
VIO	Violation
WO	Work Order
WP	Work Plan
WR	Work Request