UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30303-1257

February 28, 2012

EA-11-018
EA-11-252

Mr. Joseph W. Shea
Manager of Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT – NRC INSPECTION PROCEDURE 95003 SUPPLEMENTAL INSPECTION REPORT 05000259/2011012, 05000260/2011012, AND 05000296/2011012 (PART 2)

Dear Mr. Shea:

On February 10, 2012, the United States Nuclear Regulatory Commission (NRC) completed Part 2 of a supplemental inspection pursuant to Inspection Procedure 95003, "Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Yellow Inputs or One Red Input," at your Browns Ferry Nuclear Station, Unit 1. The enclosed inspection report documents the inspection results, which were discussed at the exit meeting on January 26, 2012, with Mr. Preston Swafford, Mr. Tim Cleary, Mr. Keith Polson and other members of the TVA staff. The NRC's Reactor Oversight Process (ROP) collects information to enable the agency to arrive at objective conclusions about a licensee's safety performance. The assessment information is used to determine the appropriate agency response. The NRC's Action Matrix, found in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program," delineates expected NRC and licensee actions based on the inputs to the assessment process. Agency action beyond the baseline inspection program will normally occur only if assessment input thresholds are exceeded. The Action Matrix identifies the range of NRC and licensee actions and the appropriate level of communication for varying levels of licensee performance. The Action Matrix describes a graded approach in addressing performance issues.

As required by the NRC Oversight Process Action Matrix, this supplemental inspection was performed because one finding of red safety significance was identified which placed Browns Ferry Unit 1 in the Multiple/Repetitive Degraded Cornerstone Column in the fourth quarter of 2010. The issue, which degraded the Mitigating Systems Cornerstone, was a Red finding for the Residual Heat Removal Subsystem being inoperable for greater than the Technical Specification allowed outage time. The issue was documented in NRC Inspection Report 05000259/2011008, dated May 9, 2011 (ML111290482). The objectives for this inspection were to provide the NRC with information regarding the Browns Ferry maintenance program. The Part 2 inspection investigated whether maintenance activities for structures, systems, and components (SSCs) were being conducted in a manner that resulted in the reliable and safe operation of the plant. This inspection assessed the effect of the maintenance practices on equipment reliability and will be used as input to planning the inspection scope of Part 3 of

the 95003 inspection. The inspection consisted of examination of activities conducted under your license as they related to safety, compliance with the Commission's rules and regulations, and the conditions of your operating license.

Based on the results of this inspection, one NRC-identified finding of very low safety significance was identified. No immediate safety concerns were identified during this inspection. The finding involved a violation of NRC requirements. However, because of its very low safety significance and it was entered into your corrective action program, the NRC is treating the issue as a non-cited violation (NCV) in accordance with the NRC Enforcement Policy. If you contest the subject or severity of this NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, U.S. Nuclear Regulatory Commission - Region II; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the Resident Inspector Office at the Browns Ferry Nuclear Plant. In addition, if you disagree with the cross-cutting aspect assigned to the finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region II, and the NRC Resident Inspector at the Browns Ferry Nuclear Station.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

/RA/

Richard P. Croteau
Division Director
Division of Reactor Projects

Docket Nos.: 50-259, 50-260, 50-296
License Nos.: DPR-33, DPR-52, DPR-68

Enclosure: Inspection Report 05000259/2011012, 05000260/2011012,
and 05000296/2011012 w/Attachment: Supplemental Information

cc w/encl: (See next page)

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ADAMS: X Yes ACCESSION NUMBER: **ML12059A314** X SUNSI REVIEW COMPLETE ☐
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Letter to Joseph W. Shea from Richard P. Croteau dated February 28, 2012

SUBJECT: BROWNS FERRY NUCLEAR PLANT – NRC INSPECTION PROCEDURE 95003 SUPPLEMENTAL INSPECTION REPORT 05000259/2011012, 05000260/2011012, AND 05000296/2011012 (PART 2)

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U.S. Nuclear Regulatory Commission
Region II

Docket No.:	50-259, 50-260, and 50-296
License No.:	DPR-33, DPR-52, DPR-68
Report No.:	05000259/2011012, 05000260/2011012, 05000296/2011012
Licensee:	Tennessee Valley Authority
Facility:	Browns Ferry Nuclear Plant Units 1, 2, and 3
Location:	Athens, AL 35611
Dates:	October 1, 2011 - December 31, 2011
Inspectors:	J. Jandovitz, Project Engineer, Team Leader Z. Falevits, Senior Engineering Inspector E. Michel, Senior Construction Inspector T. Morrissey, Senior Resident Inspector, Crystal River S. Sandal, Senior Engineerng Inspector
Approved by:	Richard P. Croteau Division Director Division of Reactor Projects

Enclosure

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SUMMARY OF FINDINGS

IR 05000259/2011012, 05000260/2011012, 05000296/2011012; Browns Ferry Nuclear Plant, Units 1, 2, and 3; 10/1/2011 – 12/31/2011; Supplemental Inspection – Inspection Procedure (IP) 95003.

This report covers a 3-week period of on-site inspection and in-office reviews through December 31, 2011. This supplemental inspection was conducted by a Project Engineer, two Senior Engineering Inspectors, a Senior Construction Inspector, and a Senior Resident Inspector. One finding was identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process." The NRC staff performed Part 2 of this supplemental inspection in accordance with IP 95003, "Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Yellow Inputs or One Red Input," to evaluate the Browns Ferry Nuclear Plant (BFN) maintenance and testing programs. The results of this inspection, when combined with the results from Parts 1 and 3 of the Browns Ferry IP 95003 inspection, will allow the NRC to determine the breadth and depth of safety, organizational, and programmatic issues at Browns Ferry. This Part 2 inspection enabled the NRC to assess the effect of maintenance practices and their impact on equipment reliability.

A. NRC-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

- Green. The team identified a finding of very low safety significance (Green) and associated Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action, for the failure to promptly identify and correct a condition adverse to quality related to the electrolytic capacitors on the battery charger for main battery number 3. Specifically, the licensee failed to identify and correct results from ripple tests conducted on August 8, 2010, that showed degradation until questioned by the team on November 20, 2011. When the capacitors were retested in December 2011, similar results were obtained and the battery charger was determined to be degraded and was removed from service. The licensee entered this finding into their Corrective Action Program, removed the affected battery charger from service, initiated actions to expedite replacement of the electrolytic capacitors, and improved the capacitor testing procedure.

  The performance deficiency was determined to be more than minor because it was associated with the Mitigating Systems Cornerstone attribute of Equipment Performance, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failing to identify the test results that indicated the electrolytic capacitors were degraded and take corrective actions could have resulted in the failure of the battery chargers to perform their safety function and respond

to initiating events. The safety significance of the finding was characterized using Inspection Manual Chapter (IMC) 0609, Significance Determination Process (SDP), Appendix A, and determined to be of very low safety significance because the finding was not a design.deficiency confirmed not to result in a loss of safety function of a system or a train. The cause of this finding was directly related to the cross-cutting aspect of maintenance in the Resources component of the Human Performance area, because the licensee did not ensure that personnel, equipment, procedures, and other resources are available and adequate to assure nuclear safety. Specifically, the licensee did not have complete, accurate, up-to-date procedures and work orders for periodic testing and replacement of the electrolytic capacitors in the battery chargers. [H.2(c)] (4OA4.02.02.b)

Licensee-Identified Violations

No findings were identified.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA4 Supplemental Inspection (95003)

.01 Inspection Scope

This inspection was conducted in accordance with Inspection Procedure (IP) 95003, "Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Degraded Cornerstones, Multiple Yellow Inputs, or One Red Input," to assess the licensee's evaluation of one Red Finding. The inspection objectives were to provide the NRC with information regarding the Browns Ferry maintenance program, and specifically how the program implementation may have affected equipment reliability (ER). The team evaluated the conduct of maintenance activities for structures, systems, and components (SSCs) and support for reliable and safe operation of the plant.

Browns Ferry Nuclear Plant entered the Multiple/Repetitive Degraded column of NRC's Action Matrix in the fourth quarter of 2010. The issue, which degraded the Mitigating Systems Cornerstone, was a finding of high safety significance (Red), for the Residual Heat Removal Subsystem being inoperable for greater than the Technical Specification allowed outage time. This issue was documented in NRC Inspection Report 05000259/2011008, dated May 9, 2011 (ML111290482).

NRC Inspection Procedures IP 62700, "Maintenance Implementation," IP 62706, "Maintenance Rule," IP 71111.12, "Maintenance Effectiveness," and IP 88103, "Maintenance Observations," were used as guidance for conduct of this inspection. The inspection was intended to not only identify findings and violations of NRC requirements but to also document the team's observations and conclusions. All observations and conclusions in this report were evaluated in accordance with Inspection Manual Chapter 0612, Appendix B, "Issue Screening" and were determined not to be findings or violations.

.02 Inspection Areas

Inspections were performed on maintenance activities related to various elements of maintenance programs at the station as follows:

1. Identify historical equipment maintenance issues and evaluate the licensee's identification and resolution of these issues. Perform field observations on samples of scheduled corrective and preventive maintenance activities.
2. Review the facility's corrective maintenance program.
3. Verify post-maintenance testing activities on samples selected for inspection such that SSCs returned to service after the performance of all maintenance were capable of performing their intended function.

4. Review licensee procedures and processes to ensure work was scheduled and performed that supported equipment reliability.

.02.01 Identify historical equipment maintenance issues and evaluate licensee's identification and resolution of these issues

a. Inspection Scope

The team interviewed Browns Ferry personnel and reviewed licensee procedures related to identification of system and component issues indicative of repetitive maintenance.

The team reviewed historical Problem Evaluation Reports (PERs) and work orders (WOs) to independently assess the existence of repetitive or issues needing to be worked multiple times (rework) that were not identified by the licensee. Known repetitive issues associated with Residual Heat Removal (RHR) Room Coolers and Emergency Diesel Generator (EDG) Coolers were reviewed.

The team reviewed licensee equipment reliability indicators intended to provide site awareness and alignment to improve equipment reliability to evaluate trends and accuracy of the indicators. Specifically, the licensee equipment reliability index (ERI), and ER program performance measurement bubble charts, were reviewed for the last 3 years.

b. Observations

The team determined that the licensee used three main procedures to address equipment maintenance and performance issues at the station. These were management tools used to monitor and improve ER performance as necessary and not required by regulation or NRC commitments. As such, concerns and observations of the team were not performance deficiencies resulting in findings or violations. Most issues had been previously identified by BFN staff or were entered into the BFN corrective actions program (CAP) as a result of this inspection.

- NEPD-12, Equipment Failure Trending
- MMDP-14, NPG Rework Reduction Program, and
- NPG-SPP-02.10, Equipment Reliability Performance Indicators

The team observed the implementation of these procedures:

- NEPD-12, "Equipment Failure Trending"

The purpose of this program was to support equipment reliability through trending and initiating corrective actions for critical component failures. This was performed by periodic review of PERs by system engineers and the ER Manager. The team requested the most recent Critical Component Failure Trend Evaluation Report. NEDP-12 specified this report be issued every 18 months at a minimum.

The team found that the latest report issued was dated October 27, 2009, covering the period from March 1, 2008, through September 30, 2009, which was outside the procedurally specified periodicity. The team questioned the licensee's ability to meet the ER goals of this program, specifically that the licensee may not identify trends and actions necessary to ensure critical component reliability and communicate these to the organization. The licensee agreed with the team's observations and entered the issue into the corrective action program (CAP).

- MMDP-14, "NPG Rework Reduction Program"

The rework program establishes the guidance and programmatic requirements for identifying, documenting, trending, analyzing, and assessing maintenance rework activities. The goals of the licensee's rework reduction program were to improve overall plant and equipment reliability by reducing the likelihood of rework and unexpected corrective maintenance, accomplish all maintenance actions correctly the first time as scheduled, and provide necessary feedback to personnel to eliminate adverse trends. Deficiencies in the rework program were recognized by the licensee during Fleet Maintenance Assessment QA-BF-11-015, dated August 18, 2011. The deficiencies included: 1) rework data not including one work item, 2) planners not doing an adequate job of screening work history to identify rework, 3) rework coordinator not performing periodic trending and reporting, and 4) the rework coordinator not reporting station rework trending analysis to the appropriate personnel. The licensee initiated corrective actions for the deficiencies identified by this assessment.

The team conducted interviews of staff members responsible for the implementation of the rework program. The discussion revealed that the position of Station Rework Reduction Program Coordinator was not staffed full-time from approximately July 2010 through October 2011. The interviews also revealed rework issues were not consistently identified for investigation, cause coding, and reporting as specified by MMDP-14. The team determined this resulted in the rework performance indicator being "under reported."

A new full-time rework coordinator was assigned in October 2011. Additional discussions with this coordinator revealed that his initial review of PERs identified several rework issues that were previously unidentified in October 2011 and a potential 20 additional issues for November. The average number of rework issues identified during the previous 10 months was about 3 per month. Also, the rework program procedure was reissued as a plant level procedure to remedy a perception at the site that the rework program was a "maintenance department" program and therefore issues coming from the program were issues that the "maintenance department" should resolve.

The team independently identified possible equipment maintenance rework issues during review of historical documents including PERs, WOs, system health reports, and maintenance rule reports. In particular, the team wanted to determine whether components or systems that had a history of recurring problems, resulted in a safety

system actuation or plant shutdown, or whose failure resulted in reduced system capability, were being identified for evaluation as possible rework so the licensee could determine why they needed to be worked repeatedly. The team identified twenty-two historical PERs that potentially met the criteria for rework. These PERS were then re-evaluated by the rework coordinator against the procedure requirements. The coordinator determined that 11 of the issues should have received a rework evaluation and of those, 8 should have been considered rework. The team agreed with the rework coordinator's results. As a result the licensee determined that design and equipment obsolescence issues had not been previously identified for consideration of rework and should have been had the procedure been followed.

The team had increased confidence that program requirements for rework were addressed by the recently appointed rework coordinator and the other actions taken by the licensee from their assessment. However, the team found that there was a long-term failure of the site regarding implementation and adherence to this program procedure. The licensee agreed with the team's observations.

- NPG-SPP-02.10, "Equipment Reliability Performance Indicators"

The team reviewed the Equipment Reliability Index (ERI), composed of 19 leading and lagging performance indicators (PIs) used by management to assess past and future performance in ER. Each indicator is scored based on data obtained from predetermined criteria, usually from industry guidelines. The licensee also used a bubble chart, which is a one-page colored graphic of the ER performance objectives and associated criteria. This program evaluated each bubble and assigned a rating (color) by its owner based on qualitative criteria and judgment of the owner. After review of the historical and current ER PIs and bubble charts, the following observations were made by the team:

1. The October 2011 bubble chart aligned with the team's overall assessment of the ER processes at the time of this inspection. The team determined that implementation of this program warranted improvement. However, the team found that the ERI data represented a different representation than the ER performance assessment in that it represented more positive results. During review of the September and October information, the team noted the following:

   (a.) The work management ERI data resulted in a satisfactory rating but the assessment of the management objective and most of the associated work management criteria indicated significant improvement was needed.

   (b.) The system health ERI received 12 out of 14 points, leading to the conclusion that system health was satisfactory to excellent, while the rating of the bubble chart objectives of Equipment Performance, Prevention of Equipment Performance, and Long Term Equipment Reliability received the worst rating. This represented a contradiction in performance for the same index.

(c.) A comparison of ER Bubble Chart Assessments from September 2009 to September 2011 showed only minor improvement. Of the seven major objectives: Equipment Performance, Prevention of Equipment Failures, and Long Term Equipment Reliability received the worst rating in 2009 and remained the same through 2011; Conduct of Maintenance and Work Management objectives improved from the worst rating to the second worst; and the Conduct of Engineering, and Chemistry Controls and Asset Preservation objectives remained the same during the period. During this same period, the ERI improved from an average of 55 to 75 points (of 100 possible). This represented a contradiction in performance of the same objective.

(d.) There was no specific corrective action plan to improve the overall ER program adequacy as represented by the ER Bubble Chart Assessment; specifically those bubbles rated the worst.

2. Some issues were identified that questioned the accuracy of several licensee performance metrics:

(a.) The deficient WO backlog metric was red (the worst) in the Key Performance Indicator (KPI) report but green (the best) in the ER PI report. According to the licensee, the green was incorrect because the target value was wrong. The team found this had not been corrected by the licensee.

(b.) When reviewing the metric data for each unit, the team noted that the ER PI data for the deficient critical work backlog was 218 for each of the three units. This number represented the per-unit value (average of all 3 units) rather than the actual value of the unit. Using the average value rather than the actual unit value skewed the metric color for a particular unit.

The team determined that there are a significant amount of licensee performance metric discrepancies and apparent conflicting conclusions drawn by the licensee from this information that may prevent recognition and implementation of necessary actions to improve equipment reliability.

c. Conclusions

No findings were identified.

The licensee agreed with the team's observations and ensured these issued were entered into the CAP.

1. The team noted that the licensee had procedures in place to identify, trend, and correct repetitive and rework issues.

2. The licensee did not meet the ER goals established in the ER procedures, and consequently, ER was adversely affected.

3. The Site demonstrated low standards for procedure implementation and adherence.

4. Various issues associated with ER indicators that were not being addressed to ensure corrective actions were successful in improving ER.

5. Management did not reinforce standards for addressing ER improvement.

.02.02 Perform field observations on a sample of scheduled corrective and preventive maintenance activities, preferably those that are related to problem components or systems.

a. Inspection Scope

The team selected a sample of scheduled corrective and preventive maintenance activities for inspection. The activities were selected based on their importance to safety, complexity or a one-of-a-kind activity; involved different craft expertise; or had experienced previous maintenance issues. These activities were evaluated through in-depth inspection of areas such as maintenance personnel comprehension and involvement; supervisory oversight; failures addressed by appropriate corrective actions, measures to prevent recurrence; personnel following up-to-date procedures; documentation; scheduling and work management; and support organization involvement in the activity, such as health physics and engineering. This inspection was performed through direct field observations, documentation reviews; and discussions with personnel involved in the maintenance activities.

The team was on-site three weeks, which were selected based on scheduled maintenance activities. The first week was October 3 through 7, 2011; the second week November 7 through 11; and the third week November 28 through December 2.

The following activities were selected for review or observation:

- WO 111436612; Replace HS 2-HS-071-17A
- WO 111241696; Rewire Unit 2 RCIC Governor valve
- WO 112426667; Unit 2 RCIC EGM replacement
- WO 112752909; Unit 1 Replace RPS Circuit Protection 1A1 Undervoltage Relay (Emergent Work; considered “high risk”)
- WO 112409165; replacement of the 1A condenser circulating water (CCW) pump motor
- WO 112530635: EDG 3D Heat exchanger, Disassemble, Clean, Inspect and Plug Tubes as required
- WO 112784918: Install a Pipe Nipple and Pipe Cap on the Downstream Side of BFN-2-LOV-071-0037RCIC Valve Repair

- WO 09-715369-000; Troubleshoot the ICS Circuit Associated with BFN-2-MVOP-071-0034 In Accordance with MMDP-3
- WO 112092632; License Renewal one time inspection of RHR Pump seal heat exchanger
- WO 111453929; Clean RHR pump seal heat exchanger
- WO 111155064; Lubricate Drive Water pump 1A and associated components
- WO 111381632; Clean CRD pump oil cooler Seal Water strainers and small bore piping to pump bearings
- W0 110863036; Pipes rubbing together
- WO 111806510; Inspect, Clean, Lubricate and Adjust Dampers
- WO 111806454; Lubricate Bearing with GP-1 and Inspect Fan Drive Components
- WO 112080249; 0-SR-3.3.8.1.2 (0) 4Kv SD BD D Undervoltage and Time Delay Relay calibration
- WO 09-927705; load test and troubleshooting activities on 250V dc Battery Charger #6
- WO 111675813; Battery Board #3 Breaker Trip out or Ground

b. Findings

Degraded Electrolytic Capacitors Test Results Not Entered Into Corrective Action Program

Introduction: The team identified a finding of very low safety significance (Green) and associated Non-Cited Violation (NCV) of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action, for the failure to promptly identify and correct a condition adverse to quality related to the electrolytic capacitors installed in as the safety-related battery charger for main battery number 3 (MB3). Specifically, the licensee failed to identify and correct degraded test results from ripple tests conducted on August 8, 2010 until questioned by the team on November 20, 2011. When the capacitors were retested in December 2011, similar degraded test results were obtained and the battery charger was determined to be degraded and removed from service.

Description: During review and observation of battery charger surveillance testing and maintenance activities, and interview of the DC (direct current) system engineer, the team requested the preventive maintenance (PM) program and ripple testing results for all the safety-related battery chargers electrolytic capacitors. The capacitors function to minimize AC (alternating current) ripple voltage when battery chargers supply loads without an attached battery. The capacitors performance affects the design function of the battery charger and the battery charger fails if a capacitor shorts.

The team noted that the BFN PM program had a scheduled replacement period for the capacitors set at 10 years of service, with an allowance for engineering judgment. The team was also provided corporate procedure MPG-E-002, “Maintenance and Good Practice – Maintenance and Replacement of Electrolytic

Capacitors" dated January 31, 1991. This specified, in attachment 2, periodic replacement of the electrolytic capacitors every 5, 7 or 10 years (the capacitors design service life). At the time of this inspection, the document could not be found in the procedure index and had not been revised since 1991. However, the replacement periods in that document closely align with the current BFN PM designated frequencies. The system engineer stated that a review of selected safety-related battery charger vendor manuals did not indicate recommendations for capacitor replacement.

MPG-E-002, stated in part, that the electrolytic capacitors were known to deteriorate over life due to a number of different factors. Failure mechanisms include thermal stress, continuous applications of deep discharging, corrosive attack of the dielectric foil and terminal tabs by halogenated hydrocarbon cleaning agents, and improper storage. Short circuits are the most frequent failure mode for electrolytic capacitors during their useful life period and are the result of random breakdown of the dielectric oxide film under normal stress. It further stated that age-related failures of electrolytic capacitors have already occurred at each TVA nuclear plant and predominately occurred in power battery chargers and inverters.

To supplement the PM replacement program, periodic ripple testing was conducted by the licensee to monitor the performance of the electrolytic capacitors. The system engineer trended the amount of AC ripple voltage at the charger DC output to help predict capacitor failure. However, the team reviewed a sample of the measured ripple voltage test data provided and could not conclude from the data provided (some measured ripple voltages were documented as 0 Vac (Volts alternative current)) that the capacitor's ripple voltage had not changed significantly from the last time it was measured and whether the electrolytic capacitors needed to be replaced. The team also noted that the licensee had not defined a criterion or a specific tolerance for the measured output ripple voltage value or trend at which the capacitors needed an evaluation and possible replacement. The team noted the ripple test result on July 2, 2008, for the capacitor on the MB3 charger was 0.0067 Vac and on August 8, 2010, was 3.2 Vac. This step increase indicated the capacitor was degraded and the team questioned the status of the operability of the MB3 charger. As a result, BFN retested the MB3 charger's capacitor (and all other battery charger capacitors) on December 2, 2011, under WO 112970629, and found the ripple voltage to be 0.81 Vac. The team was informed by the system engineer that the difference between the 2010 and 2011 results was due to inconsistent test conditions regarding the battery.

The EPRI Capacitor Application and Maintenance Guide, effective December 6, 2006, stated that "ripple testing should be typically less than 100 mV" (0.100 V). Current criteria provided by BFN stated, "IF the measurement is greater than 0.200 Vac (200 mvdc), THEN immediately order replacement capacitors for the entire DC filter capacitor bank. REPLACE the entire DC filter capacitor bank in the equipment as soon as the new capacitors arrive on site." Based on the 2010 results, the capacitors and associated charger should have been identified as degraded (a condition adverse to quality), entered into the corrective action system, and

corrective actions taken to replace the capacitors. Based on the 2011 tests, the MB3 charger and EDG charger 'A' were considered degraded, removed from service, and replaced with spare chargers. The licensee initiated PER 469567 and performed a functional evaluation and determined that all safety related battery chargers would have met all their design function requirements.

The licensee reviewed past work orders and PERs and did not identify past battery electrolytic capacitor failures. The team noted; however, that the BFN Nuclear Safety Review Board Action Item A271-4, Electrolytic Capacitor Plan," dated April 29, 1996, documented that a SCRAM of BFN Unit 2 occurred on August 19, 1995, due to a series of events traced to failure of an electrolytic capacitor in the power supply for the off-gas condenser level control and was attributed to age-related degradation of the electrolytic capacitors. It further stated that "System Engineering should be tasked with being the focal point for identifying critical electrolytic within their assigned equipment and initiate either a WO or a PM item to test/replace the electrolytic at appropriate intervals. Types of equipment including electrolytic for which PMs are prepared are inverters, chargers…"

The system engineer informed the team that in 2006 the required PM documents were generated for implementation of the periodic replacement of electrolytic capacitors that were installed in all 125 Vdc and 250 Vdc safety related battery chargers. The team noted that the required WOs were not initiated in 2006 to implement the issued PMs for replacement of these capacitors. Consequently, although the licensee was aware that all installed electrolytic capacitors exceeded the specified replacement periodicity and their service life when the PMs were initiated in 2006, capacitors were not replaced until some were replaced in 2011.

Based on information provided by the licensee, the team determined that BFN has 16 - 250 Vdc safety-related battery chargers (manufactured by General Electric and Power Conversion Products) and 16 safety-related 125 Vdc battery chargers (manufactured by La Marche Manufacturing Company). The team noted that the electrolytic capacitors have not been replaced in 8 of the 16 safety-related 250 Vdc battery chargers since about 1974. In addition, the electrolytic capacitors in all 16 - 125 Vdc safety-related battery chargers had not been replaced since initial installation until 2011, when the licensee replaced the electrolytic capacitors in 4 of the 16 - 125 Vdc battery chargers.

The periodicity for replacement was specified in corporate procedure MPG-E-002, every 5, 7 or 10 years (the capacitors design service life). This program weakness was considered to be a contributor to this issue because, had the capacitors been replaced, the degraded condition resulting from the ripple testing would not have occurred.

The licensee initiated Service Request (SR) 468603 on November 30, 2011, to document this issue and address the concerns noted above. The licensee informed the team that they planned to expedite replacement of the electrolytic capacitors in the safety-related battery chargers.

Analysis: The team determined that the failure to enter the degraded results obtained from the 2010 ripple testing of MB3 battery charger electrolytic capacitors into the corrective action program was a performance deficiency. The performance deficiency was determined to be more than minor in accordance with IMC 0612, "Power Reactors Inspection Reports," Appendix B, "Issue Screening," dated December 24, 2009, because it was associated with the Mitigating Systems Cornerstone attribute of Equipment Performance, and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failing to identify and take corrective actions based on test results indicating a degraded condition could result in the failure of the battery chargers to perform their safety function and respond to initiating events.

The finding was evaluated using the SDP in accordance with IMC 0609, "Significance Determination Process," Attachment 0609.04, "Phase I - Initial Screening and Characterization of Findings," Table 4a for the Mitigating System cornerstone, dated January 10, 2008. The finding screened as very low safety significance (Green) because the finding was not a design or qualification deficiency, did not represent a loss of system safety function, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. In addition, the licensee provided reasonable assurance based on past performance and surveillance test results that the battery chargers would remain capable of performing their safety-related function until replaced in the near future.
This finding had a cross-cutting aspect in the area of human performance, resources, because the licensee did not ensure that personnel, equipment, procedures, and other resources are available and adequate to assure nuclear safety. Specifically, having complete, accurate, up-to-date procedures and work orders for periodic testing and replacement of the electrolytic capacitors in the battery chargers were required to ensure safety. [H.2(c)]

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action, requires, in part, that measures be established that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective materials and equipment, and nonconformances are promptly identified and corrected.

Contrary to the above, as of August 8, 2010, the licensee failed to enter results of surveillance testing that showed degradation of the MB3 battery charger electrolytic capacitors as a condition adverse to quality and take corrective actions. Because this violation was of very low safety significance and it was entered into the licensee's corrective action program, as PER 469567, this violation is being treated as a Non-Cited Violation, consistent with Section 2.3.2 of the NRC Enforcement Policy (NCV 05000259/2011012-01; 05000260/2011012-01; 05000296/2011012-01, Degraded Electrolytic Capacitor Test Results Not Entered Into Corrective Action Program).

c. Observations

The team developed observations during the inspection of maintenance activities related to various aspects of the maintenance process. The observations involved aspects of maintenance in planning, execution, human performance tools, work management, support organizations, training, oversight, and plant observations. These aspects are discussed individually below:

1. Planning Observations

The team noted that as a result of poor planning, many of the WOs associated with activities reviewed contained inaccurate or were missing critical information. The team observed adverse consequences to the maintenance process, including errors by the craft, rework, use of unplanned resources, extended equipment unavailability, challenges to operability, and impacts to work schedule. The team observed that the station relied on the personnel performing the work to catch errors and that safety-related equipment was unavailable longer (although still within the regulatory requirements).

The team found that weakness in work order quality had been identified by the site for many years and was a well known issue; such that poor work order quality appeared to be accepted by the craft and supervision. The team noted that no formal training program existed for planners or was there guidance related to expectations for work order package quality. No improvements were observed during this inspection by the team. The licensee agreed with the team' observations and entered this issue into the CAP.

Examples of the more significant planning process deficiencies are detailed below:

- WO 112095809, 2-MVOP-71-0009, Cable Replacement, was removed from the schedule after it was determined that the work had already been completed during the previous Reactor Core Isolation Cooling (RCIC) outage under a different work order. Potentially unnecessary work would have been performed if the mistake was not identified by the craft.

- During a RCIC system maintenance activity, Operations determined that scaffolding was needed to establish a mechanical clearance to establish safe working conditions. The delays could have increased unavailability of the RCIC system or deferred the work.

- WO 112409165, 1A CCW Pump Motor Replacement, had several work planning issues:

  (1) The vendor manual stated that the pump-to-motor case bolting should not be torqued prior to adjusting the rotor nut. However, the team found that procedure ECI-0-027-MOT001, Removal and Installation of Condenser

Circulating Water (CCW) Pump Motor, required torquing the pump-to-motor case bolting prior to adjusting the rotor nut.

(2) Work was delayed due to a lack of information regarding the weight of the original 1A CCW motor, needed to perform the lift. It was also noted that the new motor was missing its name plate with this information.

(3) Lessons learned during previous motor replacement work had not been incorporated into the work planning. Specifically, it was previously recommended that the mechanical maintenance craft perform a check of motor-to-pump shaft alignment prior to reconnecting and testing the motor electrically. However, procedure ECI-0-027-MOT001 called for the motor-to-pump alignment following reinstallation of flex conduit and multiple cable tests. Additionally, it was a recommended practice that the mechanical craft clean and prepare the mating surface at the bottom of the motor casing prior to connecting the motor to the pump; however; this step was not included in the procedure.

(4) The work order contained steps to align the motor and pump shafts, but no acceptance criteria were provided for the degree of misalignment. Supervision worked with engineering to develop the criteria, delaying the work. The team noted the activity has been performed previously and the information should have been already developed and documented.

- Emergency Diesel Generator (EDG) heat exchanger (Hx) cleaning was initiated as emergent work based on reduced flow measurements taken the previous week. The work order was planned for both sides of the Hx, the Emergency Cooling Water (ECW) side and the EDG jacket water side, but only the ECW side required cleaning. The WO was sent back to planning to revise the scope, which increased the unavailability of the EDG.

- A work order for instrument troubleshooting contained out-of-date clearance orders. It was sent back to planning for Operations to develop new clearance orders.

- During a RCIC valve modification, maintenance personnel found the work package specified the incorrect weld size and the work package was returned to planning for correction.

- During the pre-job brief associated with WO 111453929, Open and Inspect the RHR Pump Seal Heat Exchanger, mechanical craft determined that incorrect o-rings were assigned to the work order. This had been identified previously for the same work activity. A service request was initiated to document that this was a repeat issue. The skill of the craft prevented possible gasket issues with this heat exchanger.

- A seismic review of the 1D RHR pump with its seal heat exchanger removed had not been completed. Although the pump was determined to be operable, this was an oversight during the planning stages.

- WO 09-727705 specified the torque value on battery charger number 6 output terminals as 480 inch pounds vice 192 inch pounds maximum, and resulted in breaking the stud.

- WO 11143599 replaced a switch on RHR Hx 2C RHESW outlet valve. However, the maintenance walkdown found the wrong switch was specified in the WO. A new switch had to be ordered and the activity was postponed and the reliability of the valve was not improved.

- Troubleshooting was conducted for battery charger number 6. However, the WO did not contain a troubleshooting plan that would have provided a more organized approach including input from system engineering, electrical maintenance, vendor information, and operating experience.

3. Execution

The team determined that work activities were generally completed in accordance with the associated WO instructions and procedures. However, the team observed errors were made during work activities due to time pressure or short preparations. In one case, the work order was not followed because the craft stated “that was the way it was always done.”

The following are examples of issue identified during execution. All of the examples were noted during the maintenance process and were either fixed or did not affect the safety function of the component, therefore no performance deficiencies existed.

- During work associated with the RCIC valve modification, a problem with the quality peer check resulted in the weld being ground off and redone. Also, the welder’s ground cable was moved during welding which melted the wire on an adjacent valve’s metal identification label, causing it to fall off. This work order required numerous changes and additional preparation time such that the craft personnel were then under pressure to get the job done. The workers only had a short time to review the final work order and prepare appropriately for the work.

- During troubleshooting of battery charger number 6, the technician attempted to perform current limit adjustments using potentiometers on the printed cards mounted inside the BC. They could not adjust the current down to 310 amps as specified in the WO. The system engineer (SE) was present to assist the technicians in the troubleshooting activities. However, after the technicians appeared frustrated, the SE performed the adjustment successfully. This did not meet engineering and maintenance department requirements and expectations.

- During a heat exchanger leak test, the mechanics did not use a bleed valve to reduce pressure on the test rig as required by the work instructions. Instead, the mechanics loosened a fitting to relieve pressure and when asked stated "that was the way it was always done".

- Due to plant operating experience with past failures of the Fuel Pool Cooling (FPC) pump discharge check valve springs, which do not have a safety related function, the valve reassembly instructions contained in MCI-0-000-CKV006, "Generic Maintenance Instructions for Wafer Check Valves," was changed to contact system engineering to evaluate and change the rotation orientation of the check valve if damage was identified during visual inspection. Because the check valves are vertically located in close proximity to a piping elbow, a rotational change in valve orientation prevents disc "chatter" against the valve stop which can result in spring failure. The team noted that the procedure steps for rotating the orientation of the check valve were marked as not applicable in WO 110882939. However, the engineering report for the as-found condition of the check valve stated that the valve orientation had been changed during valve reassembly. The team challenged the licensee regarding the apparent discrepancy between the completed work order and the engineering report. The team concluded that the orientation of the 1B FPC discharge pump check valve had been modified and the required evaluation and authorization of the modification by engineering had not been documented on the work order.

The pre-job briefs observed were adequate, with all craft and supervision attending and participating. Attendees discussed procedures, operating experience, safety, and contingencies.

Generally, the team observed good field practices for use of foreign material exclusion, industrial safety, procedure place-keeping, and good unit, equipment, and component identification practices.

3. Human Performance Tools

The team noted that in each of the three on-site weeks there were issues with performance of concurrent verification (CV) or independent verification (IV). These verifications are very important to ensure plant and personnel safety during performance of critical steps in procedures. The issues were identified by licensee observations, however, in most cases, an inspector was also present. The issues involved maintenance, operations, and power services personnel. The team found a significant, widespread acceptance of low standards for use and enforcement of these particular tools. In all cases, the verification errors were found and corrected prior to completion of the work activity such that there was no resultant performance deficiency. Examples observed include:

- For WO 111241696, the supervisor had to counsel the workers to ensure the independent verifier remained independent. One of the workers involved with

completing the work discussed the job with the independent verifier as he was performing his verification. Had the supervisor not been present, the independent verification would not have been independent.

- WO 12752909 required an as-found CV. One electrician read the work instructions and recorded data while the other determined the number of leads on each relay terminal. Both signed for the as-found data even though the reader could not see all the terminal points he was to concurrently verify. A supervisor counseled the workers and the CV was re-performed correctly.

- During an inspector observation of relay calibration activities, the individual conducting the required IV conferred with one of the individuals conducting the calibration and was no longer independent. After that, the individual performing the IV verified the step and signed it. In this case, other personnel were present ensuring the correct action had been taken.

- In preparation for work on a battery charger, operations completed a clearance using CV. However, prior to the work being performed, the electricians found breaker 201 for BC number 6 in the wrong position, still energized, indicating the CV was ineffective. In this case the team identified a performance deficiency that was licensee identified and since it was corrected before work was performed, it was determined by the team to be of minor significance.

4. Work Management

The team attended a number of work management meetings, including the Plan of the Day (POD); the schedule review meeting; a T+1 meeting; and a T-1 schedule meeting. Initially, the team observed widespread acceptance of individuals providing minimal information and status during the meetings. For instance, during a POD meeting, no one at the meeting could give the shift manager an update on the status of the ongoing RCIC outage. It was not clear to the team how work management and site management understood the work week status without more specific information.

Subsequently, the team observed attempts to enforce higher reporting standards and expectations for meeting participants. Status reports were then expected to provide the current status of the work, if it was on schedule, and if not, and what the new completion time was. It was evident that this was a new standard for most participants. Follow-up discussion with Browns Ferry management indicated this expectation existed for over a year, but was not enforced.

Many plant personnel also indicated the plant was attempting to implement a strategy to schedule work for improved efficiency. Work Management defined functional equipment groups (FEGs) and then scheduled work by FEG to capture all work associated with similar requirements, such as operational impacts, clearances, limiting conditions for operation (LCOs), etc. This process was not yet fully functional

at the close of this inspection due to issues with planning and parts. The team noted that this work management practice had been implemented in the nuclear industry many years ago. Further discussion with Browns Ferry management indicated this process has been in place for some time, but was not enforced.

5. Support Organizations

The team observed that, in general, other site organizations provided adequate support to maintenance activities. However, there were several observations involving engineering support.

- WO 111241696, Rewire Unit 2 RCIC Governor Valve, implemented a design change to rewire the governor valve's position indication circuitry so that a mid-position of the valve would be indicated by closed and open lights both being lit. The post-maintenance test for this work item revealed that the engineering design change was incorrect. The design change was revised and satisfactory implemented.

- During the 1A CCW pump motor replacement, the pump component engineer referred to EPRI TR-112449, Shaft Alignment Guide, dated September 1999, to determine the allowable values of shaft misalignment (as discussed earlier in this report). This document provided a table with values of pump speed in revolutions per minute (rpm) correlated to allowable pump/motor shaft offset misalignment. The lowest pump speed for which an alignment value is provided is 600 rpm. However, the CCW pump speed was 250 rpm. Engineering provided alignment criteria using engineering judgment with no qualitative basis to extrapolate the existing EPRI data. Additionally, the Shaft Alignment Guide provided shaft offset values for pumps intended to vibrate (such as ball mills and shaker screens), and another value for all other pumps. The range of CCW pump/motor shaft misalignment provided by engineering included values only intended for vibrating pumps. Also, there was no attempt to contact the pump vendor to obtain additional guidance on shaft misalignment. Since the CCW pumps are not safety-related, no performance deficiencies were identified, but the lack of engineering rigor was noted.

- Work associated with WO 110882939, to inspect and replace the 1B FPC pump discharge check valve, had been removed from the work schedule because engineering input had not been received. This was the second time this work was deferred for the same reason. The results of radiographic testing (RT) performed in September 2010 were not evaluated by engineering and communicated to maintenance planning so that the valves could be inspected and repaired as needed. This deferral did not affect the safety-related function of the valve.

6. Training

The team observed mechanical maintenance training during the week of September 3, 2011. The training observed was effective in providing the mechanical maintenance personnel the knowledge, technical criteria, as well as performance requirements to successfully perform the maintenance tasks.

The team noted that there were 30 new mechanical maintenance personnel, all of them qualified journeymen or higher. Most of them had worked previously at BFN as contractors. Training weeks were set up with certain focus areas and the shop supervisors sent workers who needed that training. The Curriculum Review Committee was thorough, and training received a lot of feedback and requests from supervisors. Historical issues with work quality have involved documentation, not following WO instructions or maintenance procedures, and not completing documentation in real-time (or at all sometimes). In response, several years ago the site started training to WOs and procedures, i.e., simulating conditions the craft would face when doing work in the field, and stressed following procedures and documenting actions. This was effective during the training observed.

7. Oversight

The team observed that oversight, including supervisory participation, for maintenance activities was adequate. Supervisors were present for pre-job briefs, active in the field; and in several cases were conveying higher standards. As discussed in a previous section on human performance, the team noted two instances where management provided in-field coaching to ensure proper verifications were performed. In both cases, an observation was entered into the licensee's observation program. The team reviewed selected observations from the licensee's maintenance observation data base (October 1, 2010, to October 20, 2011) to determine whether the observation system was being used to capture issues outside the corrective action program. The team determined that the maintenance observation program was being used appropriately and observations that were adverse to quality were also documented in the corrective action program. On Tuesday of each week, the shops held an expanded brief to go over issues and messages. On November 29, 2011, an inspector attended the dayshift electrical maintenance shop briefing. The brief was run by the electrical superintendent and was extensive and covered a number of relevant topics, included errors noted in current work week activities. The superintendent's discussion on maintenance personnel behaviors and improvements required indicated that supervision in this case was actively pursuing site corrective actions for improving behaviors.

8. Plant Observations

During field observations, the team noted two deficient conditions. Browns Ferry personnel had many opportunities to identify these conditions and failed to do so.

(a.) During a walk-down of a scheduled maintenance activity in Unit 2, the team identified 100' of red rubber hose located in an area marked no combustible storage, contrary to the requirements NPG-SPP-18.4.7, Control of Transient Combustibles, Section 3.2.2.E. The licensee immediately removed the hose from the improper storage location and entered the issue into the CAP as SR458879. Finding number 05000259/2011004-01, Failure to Control Transient Combustible Materials in the Unit 1 Reactor Building, was issued in the recent quarterly NRC BFN inspection report, number 2011004 (ML113180503), which documented a similar condition. The licensee was implementing corrective actions from that finding.

(b.) During observation of the Standby Liquid Control (SLC) pump surveillance, the team noticed that two drains in the area of the SLC tank and pumps were covered with duct tape. The team questioned the purpose of the tape, how long it was there, and if this was evaluated as a temporary modification. The licensee could not answer the questions and therefore, addressed this condition as an undocumented temporary modification and performed the necessary actions, including placing the issue into the CAP. The team considered this a performance deficiency, but of minor significance.

d. Conclusions

1. Weakness of the maintenance planning process existed since deficiencies were identified in most of the work orders selected for inspection. The numerous issues observed impacted or could have impacted equipment reliability, rework, operability, or the efficiency of the work management process. This was a long-standing issue that had not shown improvement during the inspection.

2. Maintenance personnel were trained, well experienced, and generally exhibited good performance.

3. There were multiple instances noted associated with improper use of the CV and IV process tools by the organization. Continued poor performance could affect plant or personnel safety.

4. Deficient conditions were not identified by plant personnel, even though there were many opportunities to do so.

5. Weaknesses identified through observation of maintenance activities reflect poor accountability by site personnel to adhere to and enforce standards needed to improve equipment reliability.

.02.03 Review the facility's corrective maintenance (CM) program.

a. Inspection Scope

The team assessed the effectiveness of the corrective maintenance program by review of the corrective maintenance backlogs, defined as the accumulation of unperformed work activities identified by the licensee. The team reviewed backlogs pertaining to safety-related components determined to be inoperable or degraded. The team reviewed management performance indicators for applicable component backlogs, trends, and corrective actions for adverse performance indicators or trends. This data was provided as Key Performance Indicators (KPIs) in Management Review Meeting (MRM) reports. The team reviewed 3 years of data for all three units.

b. Observations

BFN has many categories and corresponding statistics for backlogs. The team evaluated the backlogs related to corrective maintenance, defined as components that are broken and cannot perform their design function or their failure is imminent.

The other category reviewed was deficient maintenance (DM), defined as component deficiencies that may still be relied upon for continued operation. Each of these categories is also divided into groups according to the components equipment reliability classification per the Industry Process, AP-913, "Equipment Reliability Process Description." These groups are critical components, non-critical components, components that run-to-failure or of very low consequence if not corrected. The team evaluated the trends associated with critical components.

Definitions and thresholds have been changing, mostly due to industry changes, making assessments more difficult. The CM backlog PI was rated as good in September 2009, but significantly exceeded licensee established thresholds throughout 2011. In October 2011, on a per unit basis, the CM backlog for critical components was 33 with a threshold of 7 and the DM backlog for critical components was 219 with a threshold of 90. The total CM backlog was 1156 (all groups) and the DM backlog was 4227 (all groups). Both were well above the threshold criteria for all of 2011 with no improving trend.

The team reviewed the action plans associated with the KPIs for the CM and DM backlogs. In September 2010, a CM KPI action plan was "Reduction of improperly classified CM was expected to reduce gap by 33 percent over next 3 years and result in improved work prioritization and effectiveness." The current action plan for the same KPI is "Maintenance reviewing open work orders to verify problem still exists and to eliminate duplicates." This appeared to be a similar administrative action and does not address the reduction of CM required to repair equipment that is not functioning or degraded. The fact that the CM and DM backlog KPIs have consistently remained significantly above the target thresholds led the team to conclude these corrective actions have been ineffective.

c. Conclusions

No findings were identified

1. The licensee's inability to reduce the CM and DM backlog adversely affected equipment reliability.

2. The team did not have confidence that the additional resources will improve the CM and DM backlogs without increased emphasis on corrective actions and improving weaknesses discussed in this report.

.02.04 Verify post-maintenance activities on samples selected for inspection such that SSCs returned to service after the performance of all maintenance are capable of performing their intended function.

a. Inspection Scope

The NRC found a KPI that monitored the post-maintenance testing (PMT) backlog which included safety related components. Performance of PMTs was then selected for this inspection to ensure the components were not returned to service prior to the PMT was completed satisfactorily. The team reviewed the licensee's PMT backlog database to determine whether PMTs for safety-related systems were appropriately completed prior to declaring the systems operable subsequent to maintenance being performed. The team discussed the backlog, changes to the process, accountability, and oversight for PMTs with the operations and maintenance superintendents.

b. Observations

The licensee recognized that they were an industry outlier for allowing a PMT backlog. As a result, the licensee reassigned accountability to the Operations Department to ensure PMTs were implemented correctly prior to returning the component to service. Scheduling of PMT activities was also changed so that each PMT was scheduled as a separate activity and, therefore, could not be closed until it was completed. The team verified that all PMT activities on safety-related equipment were performed. The team did note an increase in the PMT backlog since August. The increase was due to work on non-safety systems where the system had not yet been placed back in service.

c. Conclusions

No findings were identified

1. The licensee has taken adequate corrective actions to ensure that PMT performance, accountability, and oversight were improved such that SCCs were verified as capable of performing their safety function after maintenance.

2.05 Review licensee procedures and processes that ensure the maintenance is scheduled to support equipment reliability

a. Inspection Scope

The team reviewed a sample of system health reports and maintenance rule reports that indicated systems or components exhibited reliability issues. The system health reports contain information and evaluations from respective system engineers that provide information on reliability issues. Based on these issues, the system/component is assigned severity rating and the team sampled system health reports assigned the worst ratings and identified the systems/components issues that required corrective maintenance and the schedule for correcting the issues.

The team also reviewed procedures established to select, prioritize, and schedule what corrective maintenance is to be performed and then assessed if it corresponded with the system health reports. The team reviewed the following procedures related to the ER Program: Integrated Reliability Program, Equipment Reliability Classification, System Vulnerability Review Process, Equipment Reliability Program ER Strategy Development and Implementation Process, and Development of Life Cycle Management Plans.

The team interviewed the various management and engineering personnel involved in the above processes and reviewed the ER MRM package, dated August 18, 2011 .

b. Observations

Review of the licensee's system health reports found that of the 140 systems in all 3 units, 5 were categorized by the licensee as "intolerable- required excessive monitoring and resources to maintain," 10 were rated as "not acceptable" and 57 as "need improvement." Of the 11 component groups, 4 were rated "intolerable," 3 were rated as "not acceptable," and 3 were "needs improvement." Several of these systems and component groups rated the worst were selected for more in-depth review by the team, including discussion of the system/component status with the system engineers.

1. The system health report for check valves from October 1, 2010, through October 31, 2011, was reviewed. Some of the component specific indicators were worse because work was deferred. For instance, one indicator needed improvement due to six outage-required work activities removed from the outage and another indicator was defined by the licensee as 'intolerable' due to thirteen check valve PM tasks deferred from October 2010, to June 2011.

2. The team reviewed the high pressure coolant injection (HPCI) system health report and system vulnerability review. The team interviewed the back-up system engineer and previous system engineer for the HPCI system and concluded their participation during the ER strategy development for components associated with HPCI was adequate. The team also inquired about the plans to

improve the HPCI system health status (currently defined by the licensee as intolerable). The system engineers and health report identified six major areas intended to improve system health. These plans were adequate; however, improvements in some areas were delayed by a lack of parts. For example, the Unit 1 stop valve actuator cylinder was intended to be replaced, but was not be due to parts not being available. Additionally, internal inspections of HPCI main pump discharge check valve 1-FCV-073-0045 and steam admission valve 1-FCV-073-0016 maintenance were unable to be performed during an upcoming outage due to a lack of parts. The team also verified the recommendations provided by the HPCI System Vulnerability Review had been adequately dispositioned.

3. The team reviewed the EDG system Health Report for June 1 through September 30, 2011, and then interviewed the EDG system engineer. This system was rated by the licensee as "intolerable" for the last four quarters. The team found that the licensee planned to return this system to "needs improvement" by early 2013 after all eight EDGs have twelve-year PM tasks completed, governors replaced, standby lube oil recirculation pump modification completed, and backlog work orders completed. The licensee plans on returning the system to 'excellent' by the end of 2013. The system engineer was very familiar with all the issues associated with the EDG system, and the priorities and schedules to correct them.

   The team found that the system engineers generally had a good understanding of work required to return their systems to an excellent status. Most of the procedures for the site to approve, prioritize and schedule the work identified were new or revised in the last quarter of 2010 or early 2011. The plans to restore these systems to an "excellent" rating appeared adequate, although they were still in draft.

   Senior Equipment Reliability Mangers were interviewed including, the Browns Ferry ER Manager, the TVA corporate General Manager for ER, Component Engineering Manager, and the Director of Project Management. The discussion indicated that prior to 2008 the licensee had maintained an ER program similar to that of the rest of the nuclear industry. The team determined that since that time the ER program condition had declined. In 2008 corporate oversight of TVA sites was increased and ER was made one of five cornerstone priorities. Additionally, over the last 3 years significant increases in ER funding were approved.

c. Conclusions

No findings were identified.

1. Processes and funding were available to support the equipment reliability goals defined in the system health reports, although some plans were still in draft form. The team observed that identified weaknesses in this report may be an obstacle to get work accomplished as planned.

2. In general, the systems engineers knew what improvements were needed to return their systems to an excellent rating. System health reports documented the corrective maintenance needed with scheduled target dates.

.02.06 Safety Culture

a. Inspection Scope

The 95003 inspection Safety Culture (SC) team lead continued to review actions the licensee is taking to assess the safety culture of Browns Ferry. This includes review of licensee's methods and efforts to conduct an independent safety culture survey. The results of the survey were not available at the close of the Part 2 inspection. In addition, the Part 2 inspection team observed behaviors associated with safety culture during interactions with plant staff. The observations of the team will be used by the NRC SC team lead to assess the Browns Ferry safety culture during the Part 3 inspection.

b. Observations

The inspection team identified three behaviors that affected the safety culture aspects of management reinforcement of safety standards and displays behaviors that reflect safety as an overriding priority, and the workforce demonstrates a proper safety focus and reinforces safety principles with their peers. The three behaviors are discussed below:

1. The team observed inconsistent use of the corrective actions program (CAP). In some cases, issues were not entered and evaluated in the CAP as expected. The team identified one condition adverse to quality, discussed earlier in this report that was not entered into the CAP. Examples related to this observation were:

   - Maintenance craft personnel identified many planning errors and issues and acknowledge that the work orders they received were often incorrect. The team observed that most of the issues were not entered into the CAP, unless the error resulted in a mistake in the field.

   - WO 112752909, Unit 1 Replace RPS Circuit Protection 1A1 Undervoltage Relay, was emergent work that was added to the weekly schedule. This relay was tested every 6 months. The relay setpoint was found to have drifted low out of calibration. The licensee determined that this setpoint had also drifted low during the previous two surveillances. The relay was replaced after operability could not be justified. Following discussions with the licensee, the team learned that the licensee had not always entered previous occurrences into the CAP when the relay was found out of calibration.

- The team noted a 2010 peer verification self-assessment identified that peer inspectors would not write a PER on a peer. None were written since the peer inspection program started, although previously Quality Control personnel entered many issues into the CAP when they performed the oversight.

- The team observed the installation of a new coupling on a gearbox-to-pump shaft. A heating bar was required to install the new coupling on the shaft. After the craft had left the work area, the inspector noted a strong acrid odor present in the general work area. A licensee individual found the still hot heating bar in a canvas bag. This should have been considered a near miss but personnel involved had not entered this issue into the CAP until questioned by the inspector.

- PER 217729 was entered into the CAP on February 21, 2010, to identify a rattling noise that appeared to be coming from both the 1A and 1 B FPC discharge check valves. WO 110882939 was initiated as corrective actions to inspect the internals of the valves if engineering evaluation of radiographic testing results indicated potential degradation. The function of these check valves is not safety-related. The team made the following observations of the CAP process regarding this one issue:

    - The original PER had been closed to action items that transferred the issue to other' traceable' programs (i.e. the work order process), but ultimately did not drive the issue to resolution and closure.

    - Radiographic testing was performed on September 9, 2010, and the reports indicated that the 1A check valve had a broken spring and the 1B check valve spring was missing. No PER was entered into the CAP to document and evaluate these deficiencies.

    - The team was informed on November 7, 2011, that WO 110882939 to inspect and replace the 1B FPC pump discharge check valve had been removed from the work schedule (for the second time) because input had not been received from engineering regarding the radiographic testing results of the check valve. The team found a PER had not been entered into the CAP to address the failure of engineering to meet work planning deadlines to support maintenance completion.

- SR 459730 was written to address reactor building floor drains found covered with duct tape. The PER was to address whether this was a possible undocumented temporary engineering modification/alteration. During the team's follow up of the PER, it was found that the PER was closed to actions taken to remove the tape, no evaluation of whether the drains had been inappropriately modified had been performed. In fact, the PER stated the tape was put on the drain as a "good practice" to prevent any spills from

going into the radwaste system. PER 468204 was then written to address the original issue.

- An issue related to an improperly performed independent verification was entered into the maintenance management observation program. Initially, it was not also entered into the CAP where similar site-wide issues could be trended and corrected.

2. The second observed behavior was related to adherence to procedures that the site uses to monitor program effectiveness and not within the NRC regulations. However, procedure compliance is still expected and an aspect of the site's safety culture. Section .02.01 of this report discussed two program procedures that were not implemented. This report also discussed instances where procedures involving concurrent verifications and independent verifications were not properly performed. These instances of noncompliance with procedures were identified as safety culture issues since there was a breakdown in individual accountability for procedural compliance and also lack of management oversight for not identifying and correcting the problem.

3. The third observed behavior was not demonstrating adequate standards or enforcing existing standards and expectations. Specifically, work management did not enforce the existing standards for reporting work status information or scheduling work by functional equipment groups. Additionally, this report discussed problems with some of the management performance indicators which the team attributed to not having adequate standards and expectations to ensure the indicators accomplished their purpose.

c. Conclusions

The team identified three adverse behaviors related to aspects of the site's safety culture in the following areas. These conclusions will be considered for further inspection during the 95-003 Part 3 inspection.

1. Procedure adherence and enforcement
2. Use of the corrective action system; and
3. Standards and expectations

4OA6 Meetings, Including Exit

On January 26, 2012, the inspection team presented the inspection results to Messrs. Preston Swafford, Tim Cleary, and Keith Paulson and other members of the licensee's staff.

On February 10, 2010, the BFN Senior Resident Inspector presented additional inspection results to Steve Bono. The team confirmed with the licensee that no proprietary information was retained by the team.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

B. Baker	BFN Operations Supervisor Support
S, Bono	Manager, Maintenance
S. Brown	Manager, Modifications
T. Cleary	Vice President
P. Donnahue,	BFN Assistant Engineering Director
C. J. Gannon,	BFN Plant Manager
L Hughes,	Manager, Operations
Q.Hughes,	Maintenance Specialist
E. Johnson,	EDG System Engineer
M. Oliver,	Licensing Engineer
K. Polson,	Site Vice President
P. Branton,	Maintenance Support Superintendent
R. Sanders,	Rework Program Manager
R. Stowe,	Manager, Equipment Reliability
C. Reischman	I&C System Engineer

NRC Personnel

E. Guthrie, Chief, Special Project Branch

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

05000259, 260, 296/2011012-01	NCV	Degraded Electrolytic Capacitor Test Results Not Entered into Corrective Action Program (Section 4OA4.02.02.b)

Closed

None

Opened

None

Attachment

LIST OF DOCUMENTS REVIEWED

Problem Evaluation Reports (PERs)	
Number	Title
961455	Track BFN Corrective Actions for SQPER 962179 on Inservice Life of Tantalum Capacitors (BFPER 961455)
470377	9500- SR469117did not have the total list of associated rework PERS
470377	PERS Left Off the List of Missing MMDP-14 Evaluation Forms
470273	NRC Identified Inadequate Response to the NRC on 2-65-3 Request Form
470273	NRC Identified Inadequate Response to the NRC on 2-65-3 Request Form
470094	NRC Identified 95-003 identified Steps Incorrectly NA's in WO110882939
470094	NRC Identified 95-003 Indentified Steps Incorrectly N/A'd in WO 110882939
469973	Bubble Chart-Long Term Equipment Reliability Bubble Red
469792	95003 Identified - Rework Evaluations Misplaced
469696	NRC Identified – Address Rework Issues that Involve Design Changes/Obselesence per MMDP-14
469567	PMs Initiated for 10-year Electrolytic Capacitor Replacement did not have an Initial Performance WO
469534	October 2011 NRSB Engineering Subcommittee Recommendation
469527	Need Minor Maintenance WO to verify MB3 Ripple Voltage for NRC 95003 Inspection
468880	Check Tech Observation – Vendor Used a Non-insulated Screwdriver Inside a Battery Charger Cabinet
468875	95-003 Identified; NRC Identified inaccurate Crit Code In Maximo for RHR Pump Handswitches
468819	NRC Identified 95-003; Identified NEDP-12 Requirement for Trend Report Not Met
468287	Could not Perform Predictive Maintenance WO
468257	NRC Identified 95-003; Engineer in the Field Adjusted Potentiometer During Troubleshooting
468204	PER 461460 Closed Without Addressing the Issue
468204	PER 461460 Closed Without Addressing the Entire Issue
467257	95-003 Consider Revising Work Order Templates to Align with NPG-SPP-10.3
465007	Recreate PER 462075
461645	95003 NRC Identified: Tools Left in Area of 1A CRD Pump (Housekeeping Issue)
461633	95-003 Identified Deferral of PM on Critical Component Was not Approved by Plant Manager
461627	95-003 Identified PM Basis Revision not Made While Revising PM Frequency

Problem Evaluation Reports (PERs)	
Number	Title
461616	95-003 identified No Risk Assessment for PM Deferral
461609	95-003 Identified: U1 Missing Level Stick During 1-SI-4.4.A.1 on 11/9/11
461585	95-003 NRC Identified – Procedure Reference is Incorrect
461460	95-003 Identified: Remove Red Tape from the Two Floor Drains on U1 El 639’
461426	95-003 Inspector Identified Heated Rod Left in Canvas Bag With Other Tools
460505	The 1A CRD Pump Motor to Speed Increaser Coupling is Stamped Incorrectly
460434	During Performance of WO 110882939 on 1-CKV-078-05010 , Valve Found Intact Despite Radiography Report
460384	Missed Opportunity for NRC to Witness Work Activity
460379	Step 1.8 in WO 111453929 Not Completed Per Step Text
460374	95-003 Identified Ineffective Corrective Action for RHR Seal Water Hx O-Ring
459844	1A CRD Hx
459841	NRC Identified Unclear Guidance in Work Order
459836	Independent Verification
459811	Document Problems with FPC Check Valve 1-CKV-078-0501 and 1-CKV-078-0502
459159	95003 Inspection Interference Between Insulation and Conduit
459159	95003 Inspection – Interference between insulation and conduit
459152	Wrong O-Ring Loaded to Work Order
459151	95-003 Identified Review of Potential Seismic Impacts not Documented in Work Order Prior to Performance of Work
459050	95-003 Identified Work Removed from Schedule at T-8 Due to Lack of Communication
450249	Control room receiving 2-XA-55-4C window 9
443861	95003 Item Engineering Provided CCW Pump Alignment Specifications Without Proper Reviews
443836	As Left Values in RPS Circuit Protector Calibrations Not Brought Within Required Values
443793	SR Not Tied to Failed AC Step in 1-SR 3.3.8.2.1(A) During 2/1/11 Performance
443781	NRC Identified WO Steps in Multiple Locations and Procedures
443752	95-003 NRC Identified Oil in the 2A CRD Pump Catch Basin
443725	3D Diesel Cooler Cleaning Package Returned to Planning During Execution (95003)
443429	NRC Identified Combustible Material Found Near Cutting and Grinding
443359	95003 Clarification is Needed on the Proper Orientation that Yo-Yo Lanyard can be Worn
443163	95-003 Late PMs on Critical Components

Problem Evaluation Reports (PERs)	
Number	Title
442914	Evaluation of Surveillance Data from Past Performances
442824	Scaffold not in Place to Support Clearance Order for RCIC Work (95003)
442801	95003 Initiated ECI-0-027-MT001 Procedure Change Recommended
442706	95-003 Documentation in WO Did Not Meet Expectations
442692	Appendix “M” for RCIC Addition not Completed Properly
442687	BFN-2-MVOP-071-0034 RCIC Pump Minimum Flow Valve 250 RMOV 2B/5D
442246	95-003 Item: Cold Quick Start Not Scheduled as Called Out in WO 112426667
442242	95-003 Item: WO 112095809 Canceled at T-0 , WO Should have Been Canceled Months Ago
442235	95-003 Identified: Toothpick Found in Reactor Building
442223	95003 NRC Identified: Rag Around Valve Body
442058	Could not Perform Required Surveillance Due to Schedule did not Reflect that Scaffold was Required
441622	Scope Stability Percentage Challenge WW1140
441486	Lost Traceability of CCW Motor
413140	1A RPS Relay Circuit Protector Undervoltage Trips
375732	IRM G erratic
372291	Regenerative heat exchanger 1B tube side relief valve leak
368164	Work order 111068664 BFN-2-LCV-006-0001
366361	Poor equipment design due to repeated failures at same time
363925	Equipment repeat maintenance on BFN-2-FR-077-0006
362896	Unit preferred MG set inboard flywheel bearing failed
358146	3-FCV-085-0011A and/or 3-FCV-085-0011B operate erratically during Unit shutdowns
356222	Low EECW flow 3EB DG <560 gpm >450 gpm
329007	2-SI-3.2.4 (RHR I) completed unsat
281536	2D RHR pump room cooler EECW leak
246741	RHR/Core Spray room coolers
244676	Perform EECW flush of the 1A/1C RHR room cooler
238314	1A/1C and 2B/2D RHR room coolers not meeting minimum flow during 1,2-SI-3.2.4 surveillance
238010	RHR cooler low EECW flow issue
235862	U3RWCU repeat check valve LLRT failures
232525	3A Control room chiller cooling water PCV failed PMT

Problem Evaluation Reports (PERs)	
Number	Title
227275	3B RHR pump seal heat exchanger out of service for almost 2 years
225257	Pipe Rub – pipes rubbing together – Near 1-RTV-73-229A
225166	Potential repeat maintenance exists for the U3 PCV-006-0025 which is the heater B-3 pressure control valve
225050	Repeat maintenance (09-726114-000/110714758)
219706	A Programmatic Breakdown of Preventive Maintenance (PM) Program
217729	Discharge check valves rattling when respective Fuel Pool Cooling Pump is in service
217729	Discharge check valves rattling when respective Fuel Pool Cooling pump is in service
175207	2B RHR room cooler discharge plenums damaged resulting in low air flow
175190	2B RHR room cooler
175085	2B RHR room cooler
172063	Inconsistent Maintenance Practices
168754	Incomplete data during 2A RHR room cooler PMT
152015	RHR room cooler 1C PMT
149530	Valve 0-SHV-023-0504 A1 and A2 crosstie valve
143310	RHRSW check valves
143190	RHRSW check valves
142591	2A RHR room cooler inoperable
128449	2A and 2C RHR room cooler low EECW flow
85316	Battery Cell Voltage Low
84025	Critical Component Trend Evaluation, dated October 27, 2009

Service Requests (SRs)	
Number	Title
4602050	MCI-0-000-FIT001 References Wrong Verification Procedure
469607	95003 – SR 469117 did not have the total list of associated rework PERS
469128	95003 Identified – Missed opportunities for rework evaluations
469117	95003 Identified – Rework evaluations misplaced
468835	NRC identified 95-003 identified steps incorrectly N/A'd in WO 110882939

Service Requests (SRs)	
Number	Title
468800	NRC Identified – Address rework issues that involve design changes/obsolescence per MMDP 14
468603	PMs Initiated for 10 Year Electrolytic Capacitor Replacement did not have an Initial Performance WO
468186	U1 FPC 1B Pump Discharge Check Valve 078-0501 is Chattering
466811	Breaker on Clearance Found in Wrong Position
459730	Remove Red Tape from the Two Floor Drains on U1 El 639
459341	Hot Rod Found in Tool Bag After Alignment of 1A CRD Pump WO 111155064
459341	95003 – Inspector identified heated rod left in canvas bag with other tools
459086	Missed Opportunity for NRC to Witness EECW Flow Test
459041	Unclear guidance in Work Order
459041	Unclear Steps in WO 111453929 (O-Ring Measurements)
459018	Coaching required to ensure independent verification
459012	Lack of Timeliness on Engineering Evaluation
459012	95-003 Identified lack of engineering timeliness on evaluating radiography results
458993	Method to reduce pressure not in accordance with work instructions
458879	“Red Zone” 565/U2 South Red Rubber Hoses Found in Zone
458879	95003 – Found bundle of red rubber hose staged inside a combustibles exclusion area
458404	Incorrect O-ring loaded into work order
458383	Document lack of civil input in WO prior to WO performance
458151	WO 11088239 Removed from Schedule at T-8 Due to Communication
458151	95-003 Work removed from schedule at T-8 due to lack of communication between engineering and scheduling

Service Requests (SRs)	
Number	Title
458057	Document problem with FPC check valves 1-CKV-078-0501 and 1-CKV-078-0502
443373	No SRs written for leaving RPS Relays 3B1 and 2C1 outside as-left criteria
443225	SRs not written for previous failures of acceptance criteria for RPS Relay 1A1
443203	NRC Identified Steps in MM WO for Uncouple Different Than Procedure
442845	There is no evidence that surveillance data associated with RPS Relay 1A1 was trended. Determine the appropriate method to trend this type of data and to document the applicable extent of this condition
442731	Scaffold not in place to support clearance order for RCIC work (95-003)
442230	TVA Identified Electrical Procedure Lessons Learned
442009	TVA Identified Documentation in WO
441958	TVA Identified SPP-7.1 Appendix M Paperwork not Completed Properly
441926	TVA Identified WO 09-715369 Clearance Issue
441561	95-003 Item WO 112095809 canceled at T-0 on 10-3-11. WO should have been canceled months ago
441496	TVA Identified Late PMs
441264	TVA Identified Scaffold Requirements for Ops Tagging not Provided
440304	TVA Identified Additional RCIC Work Added to T-1
233367	Line Verification Root Cause
152351	Incorrect material (O-ring)
67394	Repeat PMT failure of RHR seal heat exchangers
51672	Determine proper sized O-ring to be used in RHR seal heat exchanger

Drawings		
Number	Title	Rev
1-47E855-1	Flow Diagram Fuel Pool Cooling System	28
1-47E832-1	Flow Diagram Fuel Pool Filter/Demineralizer System	4

Drawings		
Number	Title	Rev
0-47W454-2	Mechanical Fuel Pool Cooling System	2

Work Orders		
Number	BFN ID	Title
112970629	BFN-3-CHGA-248-0003	Need Minor Maintenance WO to Verify MB3 Ripple Voltage for NRC 95003 Inspection
112784918	BFN-2-FCV-071-0037	Install a Pipe Nipple and Pipe Cap on the Downstream Side of BFN-2-LOV-071-0037
112752909	BFN-1-27-099-0001A1	Unit 1 Replace RPS Circuit Protection 1A1 Undervoltage Relay
112530635	BFN-3-HEX-062-000D1	EDG 3D Heat Exchanger, Disassemble, Clean, Inspect and Plug Tubes as Required
112426667	BFN-2-SI-071-0042A	Unit 2 RCIC EGM Replacement
112409165	BFN-1-MTR-027-0010	Replacement of Circulating Water (CCW) Pump Motor
112173041	BFN-2-FCV-071-0037	Remove Packing Leak-off Line/Valve, As Authorized by N1M-002 Generic Substitution Data Sheet #4012
112095809	BFN-2-MVOP-071-0009	Cable 2ES1361-1 For 2-MVOP-071-0009 Found Damaged
112092632	BFN-1-HEX-074-0039	License Renewal One Time Inspection of RHR Pump Seal Heat Exchanger
112080249	BFN-1-MISC-082	0-SR-3.3.8.1.2(D) 4 Kv SD BD D Undervoltage and Time Delay Relay
111806513	BFN-0-FCO-031-0075	PMT and Return-to-Service Per Requirements in MCI-0-000-DMP001, MCI-0-000-DMP001
111806510	BFN-0-FCO-031-0075	Inspect, Clean, Lubricate, and Adjust Damper
111806454	BFN-0-FAN-031-0075	Lubricate Bearings with GP-1 and Inspect Fan Drive Components
111675813	BFN-3-EA-057-0117	Battery Board #3 Breaker Trip Out or Ground
111633642		2D RHR pump room cooler has an EECW leak
111454053	BFN-1-ACC-063-0581	Replace 1B Accumulator Bladder
111453929	BFN-1-HEX-074-0039	Clean RHR Pump Seal Heat Exchanger
111436612	BFN-2-HS-071-0017A	Replace HS 2-HS-071-17A
111436599	BFN-2-HS-023-0040A	Replacement of Hand Switch 2-HS-023-0040A for RHR Hx 2C RHR SW Outlet Valve
111381632	BFN-1-PMP-085-0001	Clean CRD Pump Oil Cooler Seal Water Strainers

Work Orders		
Number	BFN ID	Title
		and Small Bore Piping to Pump Bearings
111241696	BFN-2-ZS-071-0010A	Rewire Unit 2 RCIC Governor valve
111155067	BFN-1-PMP-085-0001	Post Maintenance Test – Vibes
111155064	BFN-1-PMP-085-0001	Lubricate Drive Water Pump 1A and Associated Components
110882943	BFN-1-CKV-078-0501	Perform Radiography of the 1B FPC Pump Discharge Check Valve
110882939	BFN-1-CKV-078-0501	Contingency: Perform and Inspection of the1B Pump Discharge Check Valve
110882914	BFN-1-CKV-078-0502	Perform Radiography of the 1A FPC Pump Discharge Check Valve
110863036	BFN-1-SHV-024-0732	Pipes Rubbing Together
087210770	BFN-1-CLR-064-0070	Flush EECW lines of 1C RHR room cooler
087185081	BFN-1-CLR-064-0070	Perform a trisodium phosphate flush on 1-CLR-64-70
087155640	BFN-1-CKV-023-0550	Disassemble, clean, and refurbish the 1C RHRSW heat exchanger inlet check valve
077278130	BFN-2-FAN-064-0068	Lubricate fan bearings and inspect drive components
077258800	BFN-1-CLR-064-0070	Install replacement fixed pitch motor sheave
077220440	BFN-1-CLR-064-0070	Flush RHR room coolers A and C
09-715369-000	BFN-2-MVOP-071-0034	Troubleshoot ICS Circuit Associated with BFN-2-MVOP-071-0034 in Accordance with MMDP-3
09-727705-000	BFN-0-CHGA-248-0006	Load Test and Troubleshoot Activities on the 250 Vdc Battery Charger Number 6

Procedures		
Number	Title	Rev
0-SR-3.3.8.1.2 (D)	0-SR-3.3.8.1.2(D) 4Kv SD BD D Undervoltage and Time Delay Relay Calibration and FT	5
0-TI-106	General Leak Rate Test Procedure	14
0-TI-346	Maintenance Rule Performance Indicator Monitoring, Trending, and Reporting – 10 CFR 50.65	37
0-TI-559	Preventive Maintenance Program Process	2
1-SI-4.4.A.1	Standby Liquid Control Pump Functional Test	11
1-SR-3.3.8.2.1	A RPS Circuit Protector Calibration/Functional Test	6

Procedures		
Number	Title	Rev
	for 1A1 and 1A2	
2-SI-3.2.4 (RHR II)	EECW Check Valve Test on Residual Heat Removal System Division II	2
BFN-ODM-4-17	Check Operator Program	3
ECI-0-027-MOT001	Removal and Installation of Condenser Circulating Water Pump Motor	4
MCI-0-000-CKV001	Generic Maintenance Instructions for Swing Check Valves	31
MCI-0-000-CKV006	Generic Maintenance Instructions For Wafer Check Valves	2
MCI-0-000-FIT001	Maintenance of Flaired Fittings	1
MMDP-1	Maintenance Management System	22
MMDP-14	NPG Rework Reduction Program	1
MMDP-14	NPG Rework Reduction Program	
MPG-E-002	Maintenance and Good Practice-Maintenance and Replacement of Electrolytic Capacitors	January 31, 1991
MSI-0-000-LFT001	Lifting Instructions for the Control of Heavy Loads	56
NEDP-22	Operability Determinations and Functional Evaluations	11
NEPD-12	Equipment Failure Trending	12
NPG-SPP-02.10	Equipment Reliability Performance Indicators	0
NPG-SPP-03.1	Corrective Action Program	2
NPG-SPP-06.1	Work Order Process	0
NPG-SPP-06.6	“Inspection Program	1
NPG-SPP-06.9.1	Conduct of Testing	2
NPG-SPP-07.1	On-Line Work Management	4
NPG-SPP-09.16.1	System, Component and Program Health	1
NPG-SPP-09.16.3	Performance Monitoring Plan (PMP) Development Monitoring Process	0
NPG-SPP-09.18	Integrated Equipment Reliability Program	1
NPG-SPP-09.18.1	System Vulnerability Review	2
NPG-SPP-09.18.2	Equipment Reliability Classification	1
NPG-SPP-09.18.3	ER Program ER Strategy Development and Implementation Process	0
NPG-SPP-09.18.5	Development of Life Cycle Management Plans	0
NPG-SPP-09.18.7	Single Point Vulnerability Review Process	0
NPG-SPP-09.18.9	Long Term Major Maintenance Program	0
NPG-SPP-09.3	Plant Modifications and Engineering Change Control	4
NPG-SPP-10.3	Verification Program	0

Procedures		
Number	Title	Rev
NPG-SPP-18.2.1	Oversight of the Human Performance Program	0
NPG-SPP-18.4.7	Control of Transient Combustibles	
NPG-SPP-18.4.7	Control of Transient Combustibles	1
OP-DP-1	Conduct of Operations	20
PMT-0-000-MEC001	Leak Checks on Tube Fittings, Threaded, Flanged, Bolted or Welded Connections	7
WG-1.3-001B	Action Style	0

Miscellaneous		
Number	Title	Rev/ Date
AP-913	Equipment Reliability Process Description	3
	BFN Coach of the Day Template	
MDM-2.0	Check Technician Program Charter	2
EPRI TR-112449	Shaft Alignment Guide	September 2009
	BFN Rework Monthly KPI Data	April 2009 to September 2011
QA-BF-11-015	BFN - QA - Fleet Maintenance Assessment	July 07 –July 18, 2011
	EPRI Capacitor Application and Maintenance Guide	December 6, 2006
	Plant Health Committee Agenda	November 14, 2011
	ER Performance Objectives and Criteria Bubble Chart	September 26, 2011
	BFN Critical Component Failure Trend Evaluation	October 27, 2009
	Plan of the Day Agenda	November 10, 2011
	Work Week Schedules for Work Week 1148	November 28 – December 4, 2011
	Work Week Schedules for Work Week 1145	November 07 – November 13, 2011
	Work Week Schedules for Work Week 1140	October 03 – October 07, 2011
TVA-NQA-PLN89-A	Nuclear Quality Assurance Plan (NQAP)	25
1-CKV-078-0501	Computed Radiography Report	09/21/2010
1-CKV-078-0502	Computed Radiography Report	09/21/2010
454893	Rework Investigation	11/10/2011

Miscellaneous		
Number	Title	Rev/ Date
444029	Rework Investigation	11/23/2011
453210	Rework Investigation	11/23/2011

LIST OF ACRONYMS USED

AC	Alternating Current
ADAMS	Agencywide Document Access Management System
BC	Battery Charger
BFN	Browns Ferry Nuclear
CAP	Corrective Action Program
CCW	Condenser Circulating Water
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CV	Concurrent Verification
DC	Direct Current
DM	Deficient Maintenance
EC	Engineering Change
ECW	Emergency Cooling Water
EDG	Emergency Diesel Generator
ER	Equipment Reliability
ERI	Equipment Reliability Index
FEG	Functional Equipment Group
FPC	Fuel Pool Cooling
GE	General Electric
HPCI	High Pressure Coolant Injection
Hx	Heat Exchanger
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IR	Inspection Report
IV	Independent Verification
KPI	Key Performance Indicator
LCO	Limiting Condition of Operation
MRM	Management Review Meeting
NCV	Non-Cited Violation
NRC	U.S. Nuclear Regulatory Commission
NSRB	Nuclear Safety Review Board
PARS	Publicly Available Records System
PER	Problem Evaluation Report
PI	Performance Indicator
PM	Preventive Maintenance
PMT	Post Maintenance Test
POD	Plan of the Day
QA	Quality Assurance
RCIC	Reactor Core Isolation Cooling
RHR	Residual Hear Removal
RPM	Revolutions Per Minute
RT	Radiographic Testing
SC	Safety Culture
SE	System Engineer
SLC	Standby Liquid Control

SR	Service Request
SSC	Structure, System and Component
TS	Technical Specification
TSAC	Technical Specification Action Statement
URI	Unresolved Item
Vac	Volts Alternating Current
Vdc	Volts Direct Current
WO	Work Order