



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION II**

245 PEACHTREE CENTER AVENUE NE, SUITE 1200  
ATLANTA, GEORGIA 30303-1257

May 25, 2016

Mr. Joseph W. Shea  
Vice President, Nuclear Licensing  
Tennessee Valley Authority  
1101 Market Street, LP 3D-C  
Chattanooga, TN 37402-2801

**SUBJECT: BROWNS FERRY NUCLEAR PLANT - NRC DESIGN BASES (PROGRAMS)  
INSPECTION REPORT 05000259/2016010, 05000260/2016010, AND  
05000296/2016010**

Dear Mr. Shea:

On April 15, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Browns Ferry Nuclear Plant, Units 1, 2, and 3 and discussed the results of this inspection with Mr. Bono and other members of your staff. Inspectors documented the results of this inspection in the enclosed inspection report.

The inspection examined Environmental Qualification (EQ) activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

NRC inspectors documented one finding of very low safety significance (Green) in this report. The finding involved a violation of NRC requirements. The NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violation or significance of the 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 copies to the Regional Administrator, Region II; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC resident inspector at the Browns Ferry Nuclear Plant.

In accordance with Title 10 of the Code of Federal Regulations 2.390, "Public Inspections, Exemptions, Requests for Withholding," 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 (PARS) component of NRC's Agencywide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

***/RA: Theodore Fanelli for/***

Jonathan H. Bartley, Chief  
Engineering Branch 1  
Division of Reactor Safety

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

Enclosure:  
Inspection Report 05000259/2016010,  
05000260/2016010 and 05000296/2016010  
w/Attachment: Supplementary Information

cc: Distribution via Listserv

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PUBLICLY AVAILABLE       NON-PUBLICLY AVAILABLE       SENSITIVE       NON-SENSITIVE

ADAMS:  Yes      ACCESSION NUMBER: \_\_\_\_\_       SUNSI REVIEW COMPLETE       FORM 665 ATTACHED

OFFICE	RII:DRS	RII:DRP	RII:DRS	RII:DRS	RII:DRP		
SIGNATURE	<b>GKO VIA EMAIL</b>	<b>TXS2</b>	<b>MAR1 VIA EMAIL</b>	<b>TNF1 FOR JHB1</b>	<b>AJB3</b>		
NAME	G. Ottenberg	T. Su	M. Riley	J. Bartley	A. Blamey		
DATE	5/ 20 /2016	5/25/2016	5/24/2016	5/25/2016	5/25 /2016		
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES	YES NO

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

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

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

Report Nos.: 05000259/2016010, 05000260/2016010 and 05000296/2016010

Licensee: Tennessee Valley Authority

Facility: Browns Ferry Nuclear Plant, Units 1, 2, and 3

Location: 10833 Shaw Road SE  
Athens, AL 35611

Dates: April 11–15, 2016

Inspectors: Teh-Chiun Su, Reactor Inspector (Lead)  
Geoffrey K. Ottenberg, Senior Reactor Inspector  
Marcus A. Riley, Reactor Inspector

Approved by: Jonathan H. Bartley, Chief  
Engineering Branch 1  
Division of Reactor Safety

Enclosure

## SUMMARY

IR 05000259/2016010, 0500260/2016010, 05000296/2016010; 04/11/2016 – 04/15/2016; Browns Ferry Nuclear Plant, Units 1, 2, and 3; NRC Inspection Procedure 71111.21N, “Design Bases Inspection (Programs).”

This inspection was conducted by three Nuclear Regulatory Commission (NRC) inspectors from Region II. One Green non-cited violation (NCV) was identified. The significance of inspection findings is indicated by their color (Green, White, Yellow, Red) using the NRC Inspection Manual Chapter (IMC) 0609, “Significance Determination Process,” dated April 29, 2015. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, “Reactor Oversight Process,” Revision 5, dated February 2014.

### A. NRC-Identified and Self-Revealing Findings

#### Cornerstone: Mitigating Systems

Green. An NRC-identified non-cited violation (NCV) of Title 10, Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” for the licensee’s failure to include vendor requirements for maintaining the environmental qualification of the main steam isolation valve (MSIV) limit switches in maintenance procedures. Specifically, not maintaining the MSIV limit switches in their qualified condition impacts their reliability. The licensee entered this issue into the corrective action program as CR 1160702. The licensee evaluated the impact of the incorrect guidance, and determined that all three units were affected, and that the MSIV limit switches remained operable, although they were in an unqualified condition. The licensee plans to correct the affected procedures.

This performance deficiency was more than minor 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, not maintaining the MSIV limit switches in their qualified condition impacted their reliability. The team used IMC 0609, Att. 4, “Initial Characterization of Findings,” issued June 19, 2012, for Mitigating Systems, and IMC 0609, App. A, “The Significance Determination Process (SDP) for Findings At-Power,” issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality. The team determined that no cross-cutting aspect was applicable because the finding was not indicative of current licensee performance. (Section 1R21.2)

## REPORT DETAILS

### 1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

#### 1R21 Design Bases Inspection (Programs) (71111.21N)

##### .1 Inspection Sample Selection Process

The team selected risk-significant components based on Fussell-Vesely risk importance values, different plant systems including post-accident monitoring system components, variety of equipment types and feasibility of plant walkdowns to access the effectiveness of the licensee's EQ program.

Based on the requirements of the inspection procedure, eight (8) components were selected which were representative of multiple EQ files, different plant systems, equipment types and whether the component is located inside or outside the containment. The focus was that the components would be subject to the effects of pipe breaks, radiation, high temperature and other harsh environments and were required to mitigate the consequences of design basis accidents. Inputs from Senior Resident Inspectors were taken into considered as well.

##### .2 Component Reviews

###### a. Inspection Scope

###### SSCs

- BFN-2-MVOP-071-0017, Reactor Core Isolation Cooling Suppression Pool Inboard Suction Valve Operator
- BFN-1-ZS-001-0026/LS1, Main Steam Isolation Inboard Isolation Valve Limit Switch
- BFN-1-FSV-085-39A/1427, Unit 1 Scram Solenoid Pilot Valve
- BFN-2-LS-073-0057A, Suppression Chamber Level Switch
- BFN 2-TS-073-0002A, HPCI Steam Line Leak Detection Temperature Switch
- BFN-3-MTR-074-0028, Residual Heat Removal Pump 3B Motor
- BFN-2-TB-073-0111JJ, Terminal Block
- BFN-\$ES-001-0138B, Raychem Splice

The inspection team performed a pilot inspection conducted as outlined in NRC Inspection Procedure (IP) 71111.21N, Attachment 1, and "Environmental Qualification under 10 CFR 50.49 Programs, Processes, and Procedures." The team assessed

Browns Ferry's implementation of the environmental qualification program as required by 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants." The team evaluated whether Browns Ferry staff properly maintained the environmental qualification of electrical equipment important to safety throughout plant life, established and maintained required environmental qualification documentation records, and implemented an effective corrective action program to identify and correct environmental qualification related deficiencies.

The inspection included review of environmental qualification program procedures, component environmental qualification files, environmental qualification test records, equipment maintenance and operating history, maintenance and operating procedures, vendor documents, design documents, and calculations. The team interviewed program owners, engineers, maintenance staff, and warehouse staff. The team performed in-plant walkdowns (where accessible) to verify equipment was installed as described in Browns Ferry's environmental qualification component documentation files; and that the components were installed in their tested configuration. Additionally, the team performed in-plant walkdowns to determine whether equipment surrounding the environmental qualification component could fail in a manner that could prevent the safety function of the components, and to verify that components located in areas susceptible to a high energy line break were properly evaluated for operation in a harsh environment. The team reviewed and inspected the storage of replacement parts and associated records to verify environmental qualification parts approved for installation in the plant were properly identified and controlled, and that storage and environmental conditions did not adversely affect the components' qualified lives. Documents reviewed for this inspection are listed in the Attachment.

b. Findings

Failure to Include Required Gasket Replacement in Limit Switch Maintenance Procedure

Introduction: The NRC identified a Green non-cited violation (NCV) of 10 Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," for the licensee's failure to include vendor requirements for maintaining the environmental qualification of the main steam isolation valve (MSIV) limit switches in maintenance procedures.

Description: The MSIV limit switches provide an open or closed signal to indication in the main control room, so that operators are aware of the MSIV position, and can make appropriate assessment of plant conditions. Since the MSIV limit switches are post-accident monitoring equipment and are located in a harsh environment after a postulated accident, they were included within the scope of Browns Ferry's environmental qualification (EQ) program and were subjected to its requirements. Administrative requirements of the EQ program were described in the licensee's procedure, NPG-SPP-09.2, "Equipment Environmental Qualification (EQ) Program," revision 06. This procedure stated, in section 3.2.5, "in addition to periodic performance of QMDS requirements and recommendations, controls are imposed upon maintenance activities to ensure qualification is maintained and not degraded." The Qualification Maintenance Data Sheets (QMDS) identify the required maintenance to keep the equipment in a qualified configuration. The team determined that, in 2005, the licensee incorrectly incorporated guidance from the MSIV limit switch vendor, NAMCO, into QMDS-IZS-004, "Browns Ferry Plant Qualification Maintenance Data Sheet" for the NAMCO limit

switches, and subsequently incorporated the incorrect guidance into the maintenance procedure for performing calibration of the switches.

The team noted that procedure 1-SR-3.3.1.1.13 (INBD), "Inboard MSIV Limit Switch Calibration and Slow Sped Adjustment," revision 9, directed the performer to remove the limit switch top cover, perform the calibration steps, and then, prior to re-installing the top cover, step 7.4[9.16] stated "(QMDS) IF the gasket is damaged, THEN REPLACE the gasket, otherwise, N/A this step." The team also noted that the last time the procedure was performed on October 10, 2014, using work order 114743008, the step was marked as not applicable (N/A), indicating the gasket was not replaced. Upon review, the team determined that the wording in step 7.4[9.16] was derived from the guidance in the QMDS, and that it was incorporated from a NAMCO vendor manual, VTD-N007-0280, "NAMCO Installation Instruction for EA740 Nuclear Switch and EA750 Rad Env. Switch," which was for initial installation of the gasket. The team determined the licensee should have used the guidance in VTD-N007-0620, "Maintenance and Surveillance Instructions for EA740 Series Limit Switches," which stated "in order to maintain the qualification and integrity of the limit switch seals, replace the top cover gasket and screw assemblies each time the top cover is removed for any reason," which did not have the allowance to inspect the gasket prior to replacing it. The team determined that the qualification test described in NAMCO test report No. QTR 180, "Generic Qualification of EA740-Series Limit Switches for Use in Nuclear Power Plant Class 1E Applications in Compliance With IEEE Standards 323-1974, 382-1972, and 344-1975," revision 1, required the gasket be replaced. The licensee entered this issue into the corrective action program as CR 1160702. The licensee evaluated the impact of the incorrect guidance, and determined that all three units were affected, and that the MSIV limit switches remained operable, although they were in an unqualified condition.

Analysis: The team determined that failure to include vendor requirements for maintaining the environmental qualification of the main steam isolation valve limit switches in maintenance procedures as required by NPG-SPP-09.2 was a performance deficiency and a failure to meet 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." This performance deficiency was more than minor 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. Not maintaining the MSIV limit switches in their qualified condition impacted their reliability. The team used IMC 0609, Att. 4, "Initial Characterization of Findings," issued June 19, 2012, for Mitigating Systems, and IMC 0609, App. A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality. The team determined that no cross-cutting aspect was applicable because the finding was not indicative of current licensee performance.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," required, in part, that "instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished." Data Sheet QMDS-IZS-004, "Browns Ferry Plant Qualification Maintenance Data Sheet," for the NAMCO limit switches provided acceptance criteria that ensured activities affecting the qualification of the MSIV

limit switches were satisfactorily accomplished. Contrary to the above, since 2005 when the QMDS was updated with incorrect information, the licensee failed to include appropriate quantitative or qualitative acceptance criteria in Instructions, Procedures, and Drawings for determining that important activities have been satisfactorily accomplished. Specifically, the licensee did not include the limit switch vendor's requirement to replace the top cover gasket each time the top cover was removed in order to keep the equipment in a qualified configuration. In response to this issue, the licensee evaluated the potential condition of the limit switches and determined they remained operable. The licensee plans to correct the affected procedures. This violation is being treated as an NCV consistent with section 2.3.2 of the Enforcement Policy. The violation was entered into the licensee's corrective action program as CR 1160702. (NCV 05000259/2016010-01, 05000260/2016010-01 and 05000296/2016010-01, "Failure to Include Required Gasket Replacement in Limit Switch Maintenance Procedure")

#### 4OA6 Meetings, Including Exit

##### Exit Meeting Summary

On April 15, 2016, the inspectors presented the final inspection results to S. Bono, Site Vice President, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

ATTACHMENT: SUPPLEMENTARY INFORMATION

## **SUPPLEMENTARY INFORMATION**

### **KEY POINTS OF CONTACT**

#### Licensee personnel:

B. Calkin, Licensing Engineer  
G. Harrison, EQ Program Manager  
J. Colvin, BFN Programs Engineering Manager  
V. Schiavone, Backup EQ Program manager  
K. Snoddy, EQ Coordinator  
E. Bradley, Corporate EQ Program Owner

#### NRC personnel:

J. Bartley, Chief, Engineering Branch 1, Division of Reactor Safety  
R. Bernhard, Senior Reactor Analyst, Division of Reactor Projects  
D. Dumbacher, Senior Resident Inspector  
T. Stephen, Resident Inspector  
A. Ruh, Resident Inspector

### **LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

#### Opened & Closed

05000359, 360, 396/2016010-01    NCV    Failure to Include Required Gasket Replacement in  
Limit Switch Surveillance Procedure (Section 1R21)

### **List of Documents Reviewed**

#### Procedures

NPG-SPP-09.2, Equipment Environmental Qualification (EQ) Program, Rev. 6

#### Completed Procedures

#### Modifications

DCN 69391, Replacement of 4kV motors, dated 6/6/08

#### Drawings

0-45B800-1000, Conduit and Grounding Junction Box Details, Rev. Rev. 004  
0-45B891-1, Conduit and Grounding Waterproofing & Sealing Details of Electrical Equipment,  
Rev. 004  
0-45B891-10, Conduit and Grounding Acceptable Weep Holes for Conax Seal Installation,  
Rev. 003  
0-45B891-2, Conduit and Grounding General Notes, Symbols & Details, Rev. 005  
0-45B891-22, Conduit and Grounding Waterproofing & Sealing Details of Electrical Equipment,  
Rev. 001  
0-45B891-25, Conduit and Grounding Cable Support Fire Seal, Rev. 000  
0-45B891-31, Conduit and Grounding Waterproofing & Sealing Electrical Enclosure List,  
Rev. 004  
0-45B891-4, Conduit and Grounding Cable-Conduit Seal Conax Corp Method, Rev. 001

0-45B891-6, Conduit and Grounding Cable-Conduit Seal Rosemount Corp Method, Rev. 002  
 0-45B891-78, General Wiring Details Electric Door, Rev. 000  
 0-45B891-80, Conduit and Grounding Cable-Conduit Seal EGS QDC Method, Rev. 001  
 0-45B891-81, Conduit and Grounding Acceptable Weep Holes for EGC QDC Installation,  
 Rev. 001  
 0-45B891-82, Conduit and Grounding Trompeter Series RSS-6-154A Connector P/N 105-1009-  
 1, Rev. 001  
 0-45B891-9, Conduit and Grounding Cable-Conduit Seal Rosemount Corp Method, Rev. 002  
 0-45E684-1, Wiring Diagram Containment Atmosphere Dilution system Schematic Diagram,  
 Rev. 38  
 1-47E225-100, Harsh Environmental Data Drawing Series Index, Notes and References, Rev. 5  
 1-47E225-102, Harsh Environmental Data Elevation View, Rev. 1  
 1-47E225-110, Harsh Environmental Data EL 565.0, Rev. 2  
 2-45N2635-19, Local Instrument Panels Connection Diagram SH-19, Rev. 009  
 2-45B891-3, Conduit and Grounding Cable-Conduit Seal Misc. Matl. Method, Rev. 001  
 2-45B891-8, Conduit and Grounding Stainless Steel Flex Conduit, Rev. 000  
 2-47E225-100, Harsh Environmental Data Drawing Series Index, Notes and References, Rev. 8  
 2-47E225-103, Harsh Environmental Data EL 519.0, Rev. 43-47E225-100, Harsh  
 Environmental Data Drawing Series Index, Notes and References, Rev. 8  
 3-45N3631-6, 120V AC/250 V DC Valve & Misc. Connection Diagram SH-6, Rev. 006  
 3-45N803-17, Conduit & Grounding Drywell Details, Rev. 000  
 3-47E610-84-1, Mechanical Control Diagram Containment Atmosphere Dilution System,  
 Rev. 32  
 IOW290-2, Grading and Paving Plan Sheet 2, Rev. 3

#### Calculations

MDQ0020712013000140, MOV 2-FCV-71-17, Operator Requirements and Capabilities, Rev. 1  
 NDQ0999890001, Master Components Electrical List (MCEL) Design Basis, Rev. 13  
 NDQ0999960009, Determination of Maintenance / Surveillance Frequency for Limitorque  
 Actuators, Rev. 6

#### Design Basis Documents

BFN-50-715, Environmental Design, Rev. 11

#### Condition Reports (CRs)

752019  
 1112445  
 1112460  
 1112463

#### Work Orders

08-716990-000	114597007
03-023407-083	114743008
00-008659-000	115699245
113089094	115699253
113769242	115753595
114397475	

Miscellaneous Documents

BFN-VTD-A613-0070, U-1 Scram Solenoid Pilot Valve Precautions, Engineering and Maintenance, Rev. 0  
 BFN-VTD-L200-0260, Limitorque- SMB Series / SB Series Installation and Maintenance Manual, Rev. 8  
 BFN-VTD-N007-0620, Namco Maintenance and Surveillance Instructions for EA740-Series Limit Switches, Rev. 0  
 DS-M18.14.1, Design Standard for Environmental Qualification of Electrical Equipment in Harsh Environments, Rev. 3  
 IZS-004, NAMCO Limit Switch Model EA740 (QTR 180), Revs. 0 and 6  
 Letter from A. Giambusso, NRC, to J. Watson, TVA, dated 12/18/1972  
 NEMA Enclosure Types, Dated Nov. 2005  
 PEG Package No. BVG950R, BFN-2-ZS-001-0014/LS1 (Typical), Rev. 12  
 PEG Package No. CJN777K, Scram Pilot Solenoid Valve (Typical: BFN-1-FSV-085-39AB/3007), Rev. 3  
 SOL-011, Automatic Valve (AVCO) Scram Solenoid Pilot Valves, Rev. 5

EQ Binders

BFN0EQ-ILS-001, Magnetrol International Incorporated Level Switches 291 Series, Rev. 12  
 BFN0EQ-ITS-001, Fenwal Inc. Temperature Switches, Rev. 16  
 BFN0EQ-IZS-004, NAMCO Controls Limit Switch Model EA740 (QTR 180), Rev. 3  
 BFN0EQ-MOT-001, General Electric Company-4KV Residual Heat and Core Spray Pump Motors, Rev. 19  
 BFN0EQ-MOV-003, Limitorque DC Actuators Outside Containment, Rev. 26  
 BFN0EQ-SOL-011, Automatic Valve (AVCO) Scram Solenoid Pilot Valve, Rev. 4

CRs Written Due to this Inspection

CR 1160702, NRC Identified- NRC Pilot EQ Program Inspection- Namco limit switch gasket  
 CR 1160780, Level B Warehouse not Well-drained  
 CR 1162961, Incorrect version of PDO approved