



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

October 7, 2010

10 CFR 2.201

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2 and 3  
Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Updated Reply to Notice of Violation; EA-09-307**

- References:
1. Letter from NRC to TVA, "Final Significance Determination of Yellow and White Findings and Notice of Violation (NRC Inspection Report Nos. 05000259/2010007, 05000260/2010007 and 05000296/2010007), Browns Ferry Nuclear Plant," dated April 19, 2010
  2. Letter from TVA to NRC, "Reply to Notice of Violation; EA-09-307," dated May 18, 2010
  3. Letter from NRC to TVA, "Reply to Tennessee Valley Authority Letter Dated May 18, 2010, Regarding Inspection Report No. 05000259/2010007, 05000260/2010007, and 05000296/2010007, Browns Ferry Nuclear Plant," dated June 17, 2010

In response to the Reference 1 letter, the Tennessee Valley Authority (TVA) provided the reply to the Notice of Violation EA-09-307 on May 18, 2010 (Reference 2). As a result of updating the associated root cause analysis report, TVA has determined that certain updates to the reply to the Notice of Violation provided in the Reference 2 letter are warranted. As a result, an updated version of our reply to the Notice of Violation is provided in Enclosure 1. This version of our reply to the Notice of Violation supersedes our previous reply (Reference 2).

Consistent with the NRC understanding stated in the Reference 3 letter, TVA acknowledges that the license amendment request to adopt NFPA-805 as the licensing basis for the Browns Ferry Nuclear Plant fire protection program is anticipated to be submitted by March 4, 2012.

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U.S. Nuclear Regulatory Commission  
Page 2  
October 7, 2010

There is one regulatory commitment contained in this letter as identified in Enclosure 2. There are no new regulatory commitments as a result of the update of the reply to the Notice of Violation. Should you have any questions concerning this submittal, please contact James Emens at (256) 729-2636.

Respectfully,



K. J. Polson  
Vice President

Enclosures: 1. NRC Inspection Report Nos. 05000259/2010007, 05000260/2010007,  
05000296/2010007 Reply to Notice of Violation, Update  
2. Regulatory Commitment

cc (Enclosures):  
NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

**ENCLOSURE 1**

**TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3**

**NRC INSPECTION REPORT NOS. 05000259/2010007, 05000260/2010007, 05000296/2010007  
REPLY TO NOTICE OF VIOLATION, UPDATE**

### **Restatement of Violation 1**

Title 10 of the Code of Federal Regulations (10 CFR), Part 50.48(b)(1) requires that all nuclear power plants licensed to operate prior to January 1, 1979, must satisfy the applicable requirements of 10 CFR Part 50, Appendix R, Sections III.G, III.J, and III.O.

Section III.G requires fire protection of safe shutdown capability.

Section III.G.1 requires fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage, such that one train of systems necessary for achieving and maintaining hot shutdown conditions is free of fire damage.

Section III.G.2 requires, in part, that where cables and equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located in the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

- a. separation of cables and equipment by a fire barrier having a 3-hour rating; or
- b. separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. Fire detection and automatic fire suppression shall be installed in the fire area; or
- c. enclosure of cables and equipment of one redundant train in a fire barrier having a 1-hour fire rating. Fire detection and automatic suppression shall be installed in the fire area.

Contrary to the above, since the restart of each unit (Unit 2-1991, Unit 3-1995, Unit 1-2007) and as of January 20, 2010, the date of the inspection report, the licensee had not met nor has met, as of the date of this NOV, the requirements of 10 CFR Part 50, Appendix R, Section III.G, in that:

(i) fire protection features capable of limiting fire damage were not provided for structures, systems, and components important for safe shutdown. Specifically, the Tennessee Valley Authority (licensee) failed to provide fire protection features capable of limiting the fire damage such that one train of systems necessary to achieve and maintain hot shutdown conditions was free from fire damage in Fire Area 8 along with 19 other fire areas designated in the Browns Ferry Fire Protection Report, as required by 10 CFR Part 50, Appendix R, Section III.G.1.

(ii) where cables and equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located in the same fire area, the licensee did not ensure that one of the redundant trains was free of fire damage by providing one of the following means: (a) a 3-hour rated fire barrier; (b) 20 feet of spatial separation (free of intervening combustibles and fire hazards) with detection and suppression installed in the fire area; or (c) a 1-hour rated fire barrier with detection and suppression installed in the fire area. Specifically, cables associated with the RHRSW Pump A1, RHR Pump 1A, and LPCI injection valve 1-FCV-74-53 in Fire Area 1/Fire Zone 1-4 are some of the many examples in which the licensee failed to ensure that one train of cables of redundant systems or equipment necessary to achieve and maintain hot shutdown conditions, located in the same fire area, outside of primary containment was free of fire damage by one of the means described in 10 CFR Part 50, Appendix R, Section III.G.2.

This violation of 10 CFR Part 50, Appendix R, Section III.G is associated with a Yellow significance determination process finding for Units 1, 2, and 3 in the Mitigating Systems cornerstone.

## **Reply to Violation 1**

**The reason for the violation, or, if contested, the basis for disputing the violation or severity level,**

The root causes for this violation include:

1. Inadequate management and oversight of the Browns Ferry Nuclear Plant (BFN) Appendix R program resulted in noncompliance with NRC requirements.
  - The Tennessee Valley Authority (TVA) failed to critically review the overall 10CFR50, Appendix R, compliance strategy in light of the changing Appendix R generic communications and enforcement guidance and the impacts of Unit 1 restart. TVA Management maintained an entrenched Appendix R compliance position and failed to recognize that BFN's compliance methodology put them in the position of being an industry outlier and out of alignment with the direction taken by the regulator. This failure resulted in unacceptable regulatory risk by continuing to use outdated strategy.
  - Inadequate corporate governance and oversight by the Licensing and Engineering organizations with regard to compliance with Fire Protection regulations existed. Corporate governance and oversight failed to effect changes to mitigate problems with the strategy to address Fire Protection/Appendix R issues and the implementation of that strategy.
2. Ineffective use of the Corrective Action Program to identify, evaluate, and appropriately resolve Fire Protection/Appendix R compliance issues resulted in TVA's failure to systematically review and analyze NRC regulatory documents, correspondence, and generic communications related to Fire Protection/Appendix R, and to assess the adequacy of the existing compliance strategy in light of the evolving regulatory expectations. TVA senior management failed to monitor progress towards achieving compliance with 10CFR50, Appendix R, requirements or to intervene when the plan did not meet milestones.
  - Identification - TVA failed to systematically review and analyze NRC regulatory documents and correspondence related to Appendix R to identify issues requiring corrective actions. Additionally, some Fire Protection/Appendix R related issues identified during external and internal assessments were not entered into the corrective action program.
  - Evaluation - Review and evaluation of issues did not always identify the significance of the issue. For example, non-conformances with NRC regulations identified in 2006 were not screened as non-conforming conditions.
  - Untimely Resolution - In April 2006, NRC notified BFN that non-risk-significant OMAs would be given enforcement discretion for three years starting March 6, 2006. This issue was entered into the corrective action program. However, BFN failed to implement actions to correct known deficiencies within three years.

The initial implementation of the Appendix R Fire Protection Program requirements at BFN in the 1980s included extensive use of Operator Manual Actions (OMAs). The TVA failed to re-evaluate Appendix R compliance as NRC requirements evolved and were clarified over a period of years.

When the NRC Safety Evaluation (SE) for the BFN Appendix R safe shutdown system analysis was issued on December 8, 1988, licensees were not required to formally apply for OMA exemptions. At that time, the NRC approved OMAs through a variety of means. The 1988 SE

approved the OMAs covered by the SE. Several subsequent SEs issued from 1989 through BFN, Unit 1, restart in 2007 also addressed OMAs without explicitly approving exemptions.

In 2000, the NRC implemented the Reactor Oversight Process that included inspection of safe shutdown capability. Training materials provided to NRC inspectors in 2001 stated that the NRC did not consider OMAs to be approved unless they were formally exempted in accordance with 10 CFR 50.12, even if they had been previously addressed by NRC-issued SEs. The Nuclear Energy Institute (NEI) took issue with that position, and responded, in early 2002, with a basis for the acceptability of using OMAs to meet Appendix R requirements. The NEI position reinforced the mindset that OMAs, as used at BFN, were an acceptable Appendix R strategy.

After dialog with the industry, the NRC published a draft rulemaking in 2005 to define requirements for using OMAs to comply with requirements of Appendix R, paragraph III.G.2. The proposed rulemaking was withdrawn on March 6, 2006. The NRC reiterated in the same March 6, 2006, Federal Register notice that OMAs cannot be relied upon in lieu of compliance with Appendix R, III.G.2 requirements. In the same year as the draft rulemaking, the NRC issued Regulatory Issue Summary RIS 2005-30, "Clarification of Post-Fire Safe-Shutdown Circuit Regulatory Requirements," dated December 20, 2005. This RIS clarified:

- Requirements to analyze post-fire spurious actuations that could impact safe shutdown,
- Use of operator manual actions with respect to protection of associated circuits, and
- Use of emergency control stations in accordance with Appendix R, Section III.G.1.a.

TVA missed the opportunity to identify that BFN site use of emergency control stations differed significantly from NRC guidance contained in the RIS. This issue ultimately led to TVA's misclassification of III.G.1 areas.

TVA met with the NRC in a public meeting on April 5, 2006, to discuss Appendix R requirements for Unit 1 restart. The NRC stated that:

- TVA must be in compliance with Appendix R,
- All OMAs determined to be risk-significant must be corrected, and
- Non-risk-significant OMAs would be given enforcement discretion for three years starting March 6, 2006.

TVA initiated a Corrective Action Program (CAP) Problem Evaluation Report (PER) to address the issues identified in the meeting and referred to guidance associated with manual actions stated in the March 6, 2006, Federal Register notice. This PER was subsequently revised to expand the scope to include the need for OMA exemption requests or plant modifications to reduce OMAs for all three units. PER actions were deferred multiple times, until an exemption request was submitted to the NRC by letter dated January 27, 2009, 37 days before the end of the enforcement discretion period.

TVA took no action between 2006 and 2009 to comply with Appendix R requirements by modifying the plant based on the assumption that TVA would be automatically granted OMA exemptions upon request.

The following contributing cause has also been identified for this violation:

- Lack of effective turnover from the BFN, Unit 1, restart team to other BFN personnel.

NRC interpretation and enforcement of Appendix R requirements evolved substantially between 2005 and the NRC Triennial Fire Protection/Appendix R Inspection of BFN in the fall of 2009. Numerous BFN organizational changes took place in key positions (licensing, engineering, site and corporate management) between 2005 and the investigation of the root cause of this event. The timing of many of these changes exacerbated the situation.

The infrastructure (procedures, processes, and communications) to ensure that supervisors, managers, and executives were equipped with the necessary knowledge and information was not adequate for site and corporate leadership to stay current with Appendix R requirements. One of the deficiencies was the lack of effective corporate governance and oversight to 1) verify that TVA was cognizant of evolving Appendix R requirements and interpretations, and 2) provide appropriate advice to BFN and corporate decision-makers in an effective manner.

Between March and May 2007, the BFN, Unit 1, restart licensing staff was disbanded and left BFN. No formal mechanisms were in place to ensure that open fire protection issues from Unit 1 restart were turned over to other BFN personnel and subsequently tracked to completion.

Prior to 2008, TVA nuclear plants operated as nearly autonomous entities, with the corporate office providing support and advice as requested. The relationship between the NRC and the sites was managed at the sites, as were individual projects like Appendix R. At the same time, the corporate Fire Protection/Appendix R Manager managed the interface with the industry, participated in NEI workshops and task forces, and monitored the evolution of Appendix R requirements.

Personnel from BFN did not participate in industry Appendix R activities and depended upon corporate input to remain current with the nuclear industry. The BFN and corporate fire protection/Appendix R organizations were ineffective in developing and implementing a clear plan to achieve compliance with Appendix R requirements. There was disagreement over the different alternatives between early 2006 and early 2008. During this time (pre-2008), communications between BFN personnel and corporate personnel were ineffective in resolving these differences and no one was held accountable to ensure a timely resolution of the issue.

TVA missed several opportunities to formally identify, document, analyze, and resolve issues associated with Appendix R. In 2005, the NRC published draft rulemaking to provide a method to request exemptions to Appendix R for using OMAs in lieu of meeting Appendix R paragraph III.G.2 requirements. Also in 2005, the NRC issued RIS 2005-30, "Clarification of Post-Fire Safe-Shutdown Circuit Regulatory Requirements." TVA did not identify possible impacts for BFN from this RIS or initiate and track actions to ensure compliance.

In June, 2006, the NRC issued RIS 2006-10, "Regulatory Expectations With Appendix R Paragraph III.G.2 Operator Manual Actions," dated June 30, 2006. TVA failed to conduct a detailed review of each paragraph of the RIS and to thoroughly consider the actions needed to fully comply with that interpretation of Appendix R requirements.

The NRC presented TVA with another opportunity when it issued an SE for the restart of BFN, Unit 1 on April 25, 2007. In this SE, the NRC advised TVA of NRC positions regarding Appendix R, paragraphs III.G.1 and III.G.2. TVA failed to formally review this SE, or to document the commitments in the SE in the TVA CAP. Site licensing personnel later formally reviewed this SE in March/April 2009. This review was deficient. Contemporaneously with receipt of the SE, TVA Nuclear Assurance conducted a fire protection audit at BFN and recommended that BFN revisit the definition of III.G.1 versus III.G.2 fire areas. No evidence was found that TVA reacted to this recommendation.

**The corrective steps that have been taken and the results achieved,**

TVA implemented the following immediate actions in response to this violation:

1. Established compensatory fire watches on all three units to mitigate the possibility of an "Appendix R" fire developing from a smaller fire.

2. Evaluated the most critical operator manual actions and revised selected safe shutdown instructions to include the requirements for independent confirmation of operator manual actions in order to improve the likelihood of the success of these actions.

Additional corrective actions taken include the following:

1. Established corporate governance and oversight of BFN Licensing Activities. This action included the following.
  - a. Established and filled the position of a Corporate Vice President of Nuclear Licensing with governance authority and oversight over site licensing activities.
  - b. Established and filled the position of a Corporate Licensing Manager for BFN.
  - c. Established corporate licensing review and approval of site licensing submittals.
  - d. Assigned authority to approve NRC submittals to the Site Vice President or Corporate Vice President of Nuclear Licensing.
  - e. Established daily fleet licensing telephone calls to report regulatory issues and challenge responses.
  - f. Revised a business practice to strengthen the guidance for effective governance and oversight by corporate functional area managers.
2. Re-established formal review of incoming regulatory correspondence including independent review and tracking.
3. Established and filled position for Corporate Fire Protection Program Manager with authority and oversight over site Fire Protection Programs.

Improvements to the CAP initiated in response to two previous PERs (Nos. 131878 and 136489) addressed the CAP weaknesses observed for this violation. Additionally a root cause analysis and development of the corrective action plan for PER 223536 has been initiated and is ongoing to address the recently NRC identified substantive crosscutting theme in the area of Problem Identification and Resolution.

Interim guidance to require fire protection program changes go through additional challenge prior to approval and require time line analyses of changes to Safe Shutdown Instruction (SSI) entry conditions and OMAs was issued.

At this time, TVA considers it too early to assess the results achieved since these corrective actions have only recently been implemented. TVA will conduct an effectiveness review of these corrective actions.

#### **The corrective steps that will be taken.**

The following corrective actions are planned:

Prepare and conduct a lessons learned presentation on regulatory compliance using the lessons learned from this event for Senior Nuclear Power Group Management, Senior Site Management, Plant Operations Review Committee and Corrective Action Review Board members, Project Managers, Program Engineers, Licensing personnel, Fire Protection personnel, affected Corporate Licensing and Corporate Fire Protection personnel.

Transition to the National Fire Protection Association (NFPA) 805 as the basis for compliance with Appendix R and include appropriate documentation of the licensing basis of the BFN NFPA-805 program in appropriate licensing basis documents.

Establish review process criteria, identify, and re-review significant incoming regulatory correspondence (e.g., License Amendment SEs, Inspection Reports, and Regulatory Issue Summaries) received between January 2005 and December 2008 against those criteria and enter implementation deficiencies in the Corrective Action Program.

**The date when full compliance will be achieved.**

Full compliance for this violation will be achieved upon completing the implementation of the transition to the NFPA 805 basis for compliance with fire protection regulations. Full implementation of NFPA 805 compliance approach will not be completed until at least 2014.

In the interim, TVA plans to initiate fire protection program improvements prior to completion of the transition to NFPA 805. Current program improvements that are planned include: analysis updates, actions to inhibit Common Accident Signal (CAS) logic, revised actions to bypass diesel generator logic in certain fire areas, improved component selection, ensuring the condensate storage tank suction path is available to high pressure makeup systems (High Pressure Coolant Injection/Reactor Core Isolation Cooling) in all fire areas where high pressure makeup is credited, and reducing the number of time critical and long term OMAs in the 39 fire areas. These improvements include implementation of interim revisions to the safe shutdown procedures resulting from the analysis updates. TVA plans to continue fire protection program improvements during the transition to NFPA 805 with implementation of identified program changes, where allowed, under the transition requirements with the focus on risk reduction and elimination of OMAs. TVA plans to prioritize these improvements based on those with greater impact on overall fire risk reduction.

## **Restatement of Violation 2**

Technical Specification 5.4.1.a requires that written procedures be established, implemented, and maintained covering the activities in NRC Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2, Appendix A, February 1978.

Regulatory Guide 1.33, Appendix A, Section 6.v, requires procedures for combating emergencies, such as plant fires. Embodied within these requirements is the requirement that the procedures are adequate.

Procedure 0-SSI-001, "Safe Shutdown Instructions," Revision 2, specified the licensee's fire emergency response for certain major plant fire events.

Contrary to the above, the licensee failed to establish, implement, and maintain an adequate procedure for combating a plant fire event. On December 23, 2008, the licensee revised the entry conditions of procedure 0-SSI-001, "Safe Shutdown Instructions," such that response to a major fire event would have been delayed or prevented. This revision resulted in the procedure being inadequate. Specifically, the licensee added a reactor vessel water level entry criterion which would have required operators to remain in the emergency operating instructions until reactor vessel water level decreased to less than +2 inches narrow range, thus delaying or preventing establishment of safe shutdown conditions during a postulated major fire event.

This violation is associated with a White significance determination process finding for Units 1, 2, and 3 in the Mitigating Systems cornerstone.

## **Reply to Violation 2**

### **The reason for the violation, or, if contested, the basis for disputing the violation or severity level.**

The root cause for this violation is that the preparer and reviewers of the entry condition change had inadequate knowledge of the impact of Safe Shutdown Instruction (SSI) entry conditions on the plant, and did not understand the limits of their technical knowledge. In addition, the original Safe Shutdown Analysis Report does not provide a clearly documented technical basis for the SSI Entry Conditions. No contributing causes for this violation have been identified.

### **The corrective steps that have been taken and the results achieved.**

In response to this violation, TVA restored the entry conditions to the BFN SSI to those previously in place prior to the change.

### **The corrective steps that will be taken.**

Perform an analysis of the Safe Shutdown Analysis and establish the basis for the current SSI Entry Conditions.

Implement training to address the root cause, based on a completed training needs analysis that identified the target population and the topics of the training.

Revise appropriate procedure(s) to require that Fire Protection Program changes, including proposed changes to procedures, go through additional challenge prior to approval and revise appropriate procedure(s) to require changes to SSI Entry Conditions to be analyzed against the established basis for the current SSI Entry Conditions.

Prepare and conduct a lessons learned presentation on regulatory compliance using the lessons learned from this event to Senior Nuclear Power Group Management, Senior Site Management, Plant Operations Review Committee and Corrective Action Review Board

members, Project Managers, Program Engineers, Licensing personnel, Fire Protection personnel, affected Corporate Licensing and Corporate Fire Protection personnel.

Transition to the NFPA 805 standard as the basis for compliance with Appendix R, and include appropriate documentation of the licensing basis of the BFN NFPA-805 Program in appropriate licensing basis documents.

**The date when full compliance will be achieved.**

Full compliance was achieved for this violation upon restoring the entry conditions to the BFN safe shutdown instructions to those previously in place prior to the change.

**ENCLOSURE 2**

**TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3**

**REPLY TO NOTICE OF VIOLATION, REVISION 1; EA-09-307**

**REGULATORY COMMITMENT**

Full compliance for this violation will be achieved upon completing implementation of the NFPA 805 approach to compliance with fire protection requirements. Full implementation of NFPA 805 will not be completed until at least 2014.