



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

September 26, 2016

EA 16-0189

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

**SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 – NRC TRIENNIAL
FIRE PROTECTION INSPECTION REPORT 05000259/2016011,
05000260/2016011, 05000296/2016011 AND NOTICE OF ENFORCEMENT
DISCRETION**

Dear Mr. Shea:

On August 12, 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. Kevin Bronson, Sr. Vice President, and other members of your staff. Inspectors documented the results of this inspection in the enclosed inspection report.

NRC inspectors documented two findings of very low safety significance (Green) in this report. These findings involved violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy. If you contest the violation or significance of these NCVs, 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 20555-001; 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.

The enclosed report also documents noncompliances for which the NRC is exercising enforcement discretion in accordance with Section 9.1 of the NRC Enforcement Policy, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)." The noncompliances are associated with your implementation of the requirements and standards of 10 CFR 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979." The inspectors have screened the violation and determined that it warrants enforcement discretion per the Interim Enforcement Policy Regarding Enforcement Discretion for Certain Fire Protection Issues, and Section 11.05.b of IMC 0305.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 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 Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Scott M. Shaeffer, Chief
Engineering Branch 2
Division of Reactor Safety

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

Enclosure:
Inspection Reports 05000259/2016011, 05000260/2016011, 05000296/2016011
w/Attachment: Supplemental Information

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DATE	9/14/2016	9/15/2016	9/ 16 /2016	9/21/2016	9/15/2016		
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Letter to Joseph W. Shea from Scott M. Shaeffer dated September 26, 2016.

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 – NRC TRIENNIAL
FIRE PROTECTION INSPECTION REPORT 05000259/2016011,
05000260/2016011, 05000296/2016011 AND NOTICE OF ENFORCEMENT
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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.: 05000259/2016011, 05000260/2016011, 05000296/2016011

Licensee: Tennessee Valley Authority (TVA)

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

Location: Corner of Shaw and Nuclear Plant Road
Athens, AL 35611

Dates: July 25-29, 2016 (Week 1)
August 8-12, 2016 (Week 2)

Inspectors: J. Dymek, Reactor Inspector
D. Jones, Senior Reactor Inspector
J. Montgomery, Senior Reactor Inspector (Lead Inspector)
J. Patel, Reactor Inspector
M. Singletary, Reactor Inspector

Approved by: Scott M. Shaeffer, Chief
Engineering Branch 2
Division of Reactor Safety

Enclosure

SUMMARY

IR 05000259/2016011, 05000260/2016011, 05000296/2016011; 07/25/2016 – 07/29/2016 and 08/08/2016 – 08/12/2016; Browns Ferry Nuclear Plant Units 1, 2, and 3; Fire Protection - NFPA 805 (Triennial)

This report covers an announced two-week triennial fire protection inspection by a team of five regional inspectors. Two Green non-cited violations (NCVs) were identified. The significance of inspection findings are indicated by their color (i.e., greater than Green, Green, White, Yellow, Red) and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP) dated April 29, 2015. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy dated August 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6.

Cornerstone: Mitigating Systems

- Green. The NRC identified a violation of 10 CFR 50.48(c) for the licensee's failure to address in the Fire Probabilistic Risk Assessment (Fire PRA) the risk contribution associated with all potentially risk significant fire scenarios for a given fire compartment/fire area. The licensee did not identify and evaluate all targets that were within the zone of influence (ZOI) of ignition sources for selected fire scenarios that could potentially contribute to the risk for the fire scenarios. The licensee entered the issue in the corrective action program (CAP) as Condition Reports (CRs) 1195603 and 1197392. The affected area was already covered by an hourly roving fire watch as a compensatory measure.

The licensee's failure to address the risk contribution associated with all potentially risk-significant fire scenarios, as required by section 2.4.3.2 of NFPA 805, was a performance deficiency. For each example, the performance deficiency was determined to be more than minor because it was associated with the reactor safety mitigating systems cornerstone attribute of protection against external factors (i.e., fire) and it adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee failed to analyze the full risk impact of the selected fire scenarios, and the missed targets in the ZOI for the selected fire scenarios had the potential to impact the ability to achieve safe and stable conditions. Using IMC 0609, Appendix F, Attachment 1, "Fire Protection Significance Determination Process Worksheet," the finding was screened as Green in step 1.6.1 "Screen by Licensee PRA-Based Safety Evaluation." There was no cross cutting aspect assigned to this finding because it was not indicative of current licensee performance since the original ignition source and target walkdowns were performed more than 3 years ago. (Section 1R05.06)

- Green. The NRC identified a violation of 10 CFR 50.48(c) for the licensee's failure to properly identify circuits required for the nuclear safety function. Specifically, the licensee's Nuclear Safety Capability Assessment (NSCA) failed to identify that fire-induced failure of cables associated with the undervoltage trip function of the 4KV Shutdown Board could cause the shutdown board to not shed loads upon an undervoltage condition. This could lead to overloading the emergency diesel generator (EDG) credited for powering the shutdown board. This item was entered into the CAP as CR 1199002. The affected area was already covered by an hourly roving fire watch as a compensatory measure.

Additionally, the licensee submitted EN 52150 to the NRC, documenting this as an unanalyzed condition.

The licensee's failure to identify circuits required for the nuclear safety function, as required by Section 2.4.2.2.1 of NFPA 805 was a PD. The PD was determined to be more than minor because it was associated with the reactor safety mitigating systems cornerstone attribute of protection against external factors (i.e., fire) and it adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee's failure to analyze the effects of fire damage on the 4kV shutdown bus undervoltage circuitry could result in overloading the emergency diesel generator (EDG) credited for powering the shutdown board. Using the guidance of IMC 0609, App. F, the finding was screened as Green because the risk increase associated with the finding was an increase of core damage frequency of $<1E-6$ /year. There was no cross cutting aspect assigned to this finding because it was not indicative of current licensee performance since the original ignition source and target walkdowns were performed more than 3 years ago. (Section 1R05.06)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R05 Fire Protection

This report documents the results of a Triennial Fire Protection Inspection (TFPI) at the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3. The inspection was conducted in accordance with NRC Inspection Procedure (IP) 71111.05XT, "Fire Protection - NFPA 805 (Triennial)," issued January 31, 2013. The objective of the inspection was to evaluate the design, operational status, and material condition of the licensee's Fire Protection Program (FPP). An additional objective was to review site specific implementation of one mitigating strategy from Section B.5.b of NRC Order EA-02-026, "Order for Interim Safeguards and Security Compensatory Measures" (commonly referred to as B.5.b); as well as the storage, maintenance, and testing of B.5.b mitigating equipment. Section 71111.05-05 of the IP specifies a minimum sample size of two fire areas (FAs) and one B.5.b mitigating strategy for addressing large fires and explosions. The team selected three FAs based on available risk information as analyzed onsite by a senior reactor analyst from Region II, data obtained from in-plant walkdowns regarding potential ignition sources, location and characteristics of combustibles, and location of equipment needed to achieve and maintain the reactor in a safe and stable condition. Other considerations for selecting the FAs were the relative complexity of the post-fire safe shutdown (SSD) procedures, information contained in FPP documents, and results of prior NRC TFPIs. In selecting the B.5.b mitigating strategy sample, the team reviewed licensee submittal letters, safety evaluation reports (SERs), licensee commitments, B.5.b implementing procedures, and previous NRC inspection reports. This inspection fulfilled the requirements of the procedure by selecting a sample of three FAs and one B.5.b mitigating strategy.

- Fire Compartment 16-K - Auxiliary Instrument Room No. 1 (Part of FA 16--Control Building)
- FA 09 – Electrical Board Room 2A & 250V Battery Room, El. 621
- FA SWTICH – Switchyard, including Main Transformers
- B.5.b Strategy - Injecting Water to the Drywell

For each of the selected FAs, the team evaluated the licensee's FPP against applicable NRC requirements and licensee design basis documents (DBDs). Documents reviewed by the team are listed in the Attachment.

.01 Protection of Safe Shutdown Capabilities

a. Inspection Scope

The team examined BFN fire safe shutdown procedures (FSS) and compared them to the NFPA 805 NSCA and Fire Risk Evaluation (FRE), system flow diagrams, and other DBDs to determine if equipment required to achieve post-fire safe and stable plant conditions was properly identified and adequately protected from fire damage in

accordance with the requirements of 10 CFR 50.48(c) and the BFN approved FPP. Cable routing information was reviewed for a selected sample of SSD components to verify that either the associated cables would not be damaged for the selected FA's fire scenarios or the licensee's analysis determined that the fire damage would not prohibit achieving safe and stable plant conditions. A list of SSD components examined for cable routing is included in the Attachment. The specific fire response FSSs reviewed are listed in the Attachment.

The team reviewed applicable sections of the site's emergency operating procedures, as well as FSSs for the selected FAs and fire scenarios to verify that the shutdown methodology properly identified the components and systems necessary to achieve and maintain safe and stable plant conditions. The team performed in-plant walk-throughs of procedure steps to ensure the implementation and human factors adequacy of the procedures. The team verified the licensee personnel credited for procedure implementation had procedures available, were trained on implementation, and were available in the event a fire occurred. Additionally, selected defense-in-depth actions were assessed to verify that the operators could reasonably perform the specified actions.

b. Findings

No findings were identified.

.02 Passive Fire Protection

a. Inspection Scope

The team conducted walkdown inspections and examined the material condition and as-built configuration of accessible passive barriers both surrounding and within the FAs selected for review, to evaluate the adequacy of their fire resistance in accordance with NFPA 805 calculations. Fire barriers inspected included reinforced concrete ceilings, floors and walls, installed mechanical and electrical penetration seals, fire doors, and fire dampers. The team compared the as-built installed barrier configurations to the approved construction details and supporting fire endurance test data, which established the rating of the fire barriers. Fire doors and dampers were examined for attributes such as their material condition, clearances, and proper operation, Underwriters Laboratory (UL) labels on the door and frame, and the method of attachment to the rated barrier. Doors were examined to verify that no modifications had been performed which would void their UL listing, or that such modifications had been previously evaluated and approved. The team reviewed licensing bases documentation such as 10 CFR 50.48(a), 10 CFR 50.48(c) and the NRC NFPA 805 SER to verify that passive fire protection features met current licensing commitments. In addition, a sample of completed surveillances and maintenance procedures for selected fire doors, fire dampers and penetration seals were reviewed to ensure that these passive barriers were being properly inspected and maintained.

b. Findings

No findings were identified.

.03 Active Fire Protection

a. Inspection Scope

The team reviewed the licensee's incipient and ionization-type fire detection systems, manual and automatic water-based fire suppression systems, total flooding CO² systems and firefighting standpipe and hose systems protecting the selected FAs. Fire brigade pre-plans, training documents and fire response procedures for these areas were also reviewed. The team reviewed the adequacy of the design, installation and operation of the fire detection and alarm systems to promptly detect fires in the selected fire areas, and to annunciate in the control room. The review included walkdowns of as-built configurations, and an examination of the type of detectors, detector spacing, detector location relative to ignition sources, room geometry, fixed obstructions, and ventilation airflow, to assess whether the areas were protected in accordance with code of record requirements. The team also reviewed the licensee's fire alarm response procedures, fire protection DBD, NFPA 805 License Amendment Request (LAR) submittals and associated SER to verify that the fire detection and alarm systems for the selected FAs were installed in accordance with the design and licensing bases for the plant.

The team inspected the material condition, operational configuration and testing of the CO² system in Aux Instrument Room No. 1 (Fire Compartment 16-K); and deluge water spray systems protecting switchyard transformers (FA SWITCH). The team also reviewed code compliance evaluations to determine if there were any outstanding code deviations for these systems.

The team reviewed the firefighting pre-plans and fire response procedures for the selected FAs to determine if appropriate information was provided to fire brigade members to facilitate suppression activities. These plans were reviewed and confirmed by field walkdowns to verify that they accurately reflected current plant configurations and firefighting equipment locations. These walkdowns also confirmed that fire hose and extinguisher access was properly maintained throughout the plant. The team evaluated whether the fire response procedures and pre-plans could be implemented as intended, and that they addressed equipment important to safety, ventilation of heat and smoke from a fire, and drainage/runoff from installed fixed fire suppression systems and manual hose streams. Additionally, fire brigade drill records for recently run drills in each area were reviewed to confirm drill scenarios addressed specific hazards to likely be encountered in the areas and to verify actual fire brigade response times supported the fire brigade response time performance basis criteria. A walkdown of staged fire brigade personal protective equipment (PPE) was performed, with gear selected to ascertain its physical condition. An operating shift fire brigade was randomly selected to confirm that all members were currently qualified with regard to their medical and fire brigade training records. Current mutual aid agreements with local outside fire departments response to the plant in a fire emergency were reviewed as well as drill records for outside department participation for a postulated fire event.

b. Findings

No findings were identified.

.04 Protection from Damage from Fire Suppression Activities

a. Inspection Scope

The team inspected the selected FAs to evaluate whether the ability to achieve the nuclear safety performance criteria could be adversely affected due to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems. The team addressed the possibility that a fire in one FA could lead to the migration of smoke or hot gasses to other plant areas. The team also evaluated whether the manual firefighting activities could adversely affect the credited nuclear safety equipment, and/or adversely affect local operator recovery actions for the selected fire areas. Additionally, the team checked that the firefighting water would either be contained in the fire-affected area, or be safely drained off through floor drains or stairwells. A review of potential flooding through unsealed floor cracks and absorption of water through penetration seals to areas beneath the selected FAs was conducted. This portion of the inspection was carried out through a combination of walkdowns, and reviews of drawings, calculations and installation records. Documents reviewed by the team are listed in the Attachment.

b. Findings

No findings were identified.

.05 Shutdown from a Primary Control Station

a. Inspection Scope

For postulated fire scenarios in FA 16, which may impair main control room (MCR) functions, the licensee credited shutdown from a primary control station to achieve hot standby conditions. For the limiting fire, this would involve transfer of plant control from the MCR to the remote shutdown panel (RSP).

The team reviewed the licensee's FPP, system flow drawings, electrical drawings, electrical schematics, and other supporting documents to verify that control circuits and power for the credited equipment controlled from the RSP would be free of fire damage when isolated by disconnect switches. The team reviewed the RSP transfer switches' testing methodology and completed surveillances to assess the capability and functionality of the isolation. The reviews ensured that the required functions to achieve post-fire safe and stable conditions were included in the fire response procedures. The review included assessing the adequacy of procedural guidance for establishing and maintaining hot standby conditions from the RSP.

b. Findings

No findings were identified.

.06 Circuit Analysis

a. Inspection Scope

The inspectors reviewed the licensee's UFSAR, NSCA, licensee circuit analysis documents, post-fire procedures, electrical schematics and system flow diagrams to gain an understanding of the licensee's SSD strategy in order to verify that the licensee had properly identified required and associated circuits that could impact the ability to achieve and maintain safe and stable conditions for the selected FAs. The inspectors assessed whether the licensee's identified structures, systems and components (SSCs) important to meeting the 10 CFR 50.48 requirements were consistent with the established licensing basis. The team performed walk-downs of the selected FAs to independently verify the assumptions and results of the licensee's fire scenario development analysis. The team verified, on a sample basis, that the licensee properly identified cables and equipment required to achieve and maintain safe and stable conditions for the selected fire scenarios in the selected FAs. The inspectors also reviewed cable routing drawings, electrical one-line diagrams, component block diagrams, penetration and conduit plan drawings, and electrical control wiring diagrams for the selected SSD components to determine if these cables had either been adequately protected from the potential adverse effects of fire damage or analyzed to show that fire induced faults (single and/or multiple) would not prevent shutdown to safe and stable conditions.

The team also reviewed, on a sample basis, breaker/fuse coordination study documents and several EC packages to ensure proper coordination existed between load and incoming supply breakers. The inspectors reviewed the licensee's diesel loading calculations to determine if the diesel could power the required SSD equipment given a fire that could potentially damage off-site power. The specific components and references reviewed are listed in the Attachment.

b. Findings

.1 Failure to Identify and Evaluate All Targets Within the Zone of Influence of Ignition Sources

Introduction: The NRC identified a violation of Browns Ferry Nuclear Plant's Renewed Facility Operating License Condition 2.C(13), 2.C(14), and 2.C(7) for Units 1, 2 and 3 respectively, for the licensee's failure to address in the Fire Probabilistic Risk Assessment (Fire PRA) the risk contribution associated with all potentially risk significant fire scenarios for a given fire compartment/fire area. Specifically, the licensee did not identify and evaluate all targets that were within the zone of influence (ZOI) of ignition sources for selected fire scenarios that could potentially contribute to the risk for the fire scenarios.

Description: Walkdowns of FA 9 during this TFPI inspection resulted in the identification of numerous missed targets within the ZOI of ignition sources that were not evaluated for their risk contribution to the selected risk significant fire scenarios. The targets were missed when the original ignition source walkdowns were performed during the licensee's initial fire scenario development to support the BFN Fire PRA. Specifically, the licensee did not identify and evaluate the effects of fire on several conduits and an ignition source that were within the ZOI of ignition sources which could potentially

contribute to a risk increase for the selected fire scenarios. In one example, it was identified that 1 equipment target and 12 conduit targets were omitted from fire scenario 09.016-CAB, 250V DC RMOV Board 2A. The licensee evaluated the risk contributions of the missed targets, which resulted in a delta core damage frequency (CDF) of 2.62E-8/year for Unit 1, 2.74E-8/year for Unit 2, and 1.1E-8/year for Unit 3. In another example, it was identified that 4 conduit targets were omitted from fire scenario 09.5002-0-BDAA-211-000C, 4kV Shutdown Board C. The licensee evaluated the risk contributions of the missed targets, which resulted in a delta core damage frequency (CDF) below truncation (essentially zero) for all 3 units. The licensee documented this issue in the corrective action program (CAP) in condition reports (CRs) 1195603 and 1197392. The affected area was already covered by an hourly roving fire watch as a compensatory measure.

Analysis: The licensee's failure to address the risk contribution associated with all potentially risk-significant fire scenarios, as required by section 2.4.3.2 of NFPA 805, was a performance deficiency. For each example, the performance deficiency was determined to be more than minor because it was associated with the reactor safety mitigating systems cornerstone attribute of protection against external factors (i.e., fire) and it adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee failed to analyze the full risk impact of the selected fire scenarios, and the missed targets in the ZOI for the selected fire scenarios had the potential to impact the ability to achieve safe and stable conditions.

The finding was screened in accordance with NRC IMC 0609, "Significance Determination Process", Attachment 4, "Initial Characterization of Findings," dated June 19, 2012, which determined that, an IMC 0609, Appendix F, "Fire Protection Significance Determination Process," dated September 20, 2013, review was required because it potentially affected the ability to reach and maintain safe and stable conditions in case of a fire. Using IMC 0609, Appendix F, Attachment 1, "Fire Protection Significance Determination Process Worksheet," dated September 20, 2013, the finding was screened as Green in step 1.6.1 "Screen by Licensee PRA-Based Safety Evaluation." The licensee's risk evaluation of this finding was reviewed by an NRC regional senior reactor analyst (SRA).

No cross cutting aspect was assigned to this finding because it was not indicative of current licensee performance since the original ignition source and target walkdowns were performed more than 3 years ago.

Enforcement: Browns Ferry Nuclear Plant's Renewed Facility Operating License Condition 2.C(13), 2.C(14), and 2.C(7) for Units 1, 2 and 3 respectively, required the licensee to implement and maintain in effect all provisions of the approved FPP that complied with 10 CFR 50.48(c), "National Fire Protection Association Standard NFPA 805," as specified in the NRC safety evaluation report (SER) dated October 28, 2015. NFPA 805 Section 2.4.3.2 stated that the PSA evaluation [BFN Fire PRA] shall address the risk contribution associated with all potentially risk-significant fire scenarios.

Contrary to the above, since March 2013, the licensee failed to address the risk contribution of all targets within the ZOI of ignition sources associated with all potentially risk significant fire scenarios for selected fire compartments resulting in potentially underestimating the post-fire SSD risk. The licensee entered the issue in the CAP as

CRs 1195603 and 1197392 and took credit for an existing hourly roving fire watch as a compensatory measure. This violation is being treated as an NCV consistent with Section 2.3.2 of the Enforcement Policy. (NCV 05000259, 260, 296/2016011-01, Failure to Identify and Evaluate All Targets Within the Zone of Influence of Ignition Sources)

.2 Failure to Adequately Identify and Evaluate All Circuit Failures for NSCA Credited Equipment

Introduction: The NRC identified a violation of 10 CFR 50.48(c) and NFPA 805, Section 2.4.2.2.1 for the licensee's failure to properly identify circuits required for the nuclear safety function. Specifically, the licensee's NSCA failed to identify that fire-induced failure of cables associated with the undervoltage trip function of the 4KV Shutdown Board could cause the shutdown board to not shed loads upon an undervoltage condition.

Description: During circuit analysis review of the licensee's SSD strategy for FA 9, it was determined that the SSD analysis did not consider the potential for fire-induced failure of the credited 4kV Shutdown Board under-voltage trip function for emergency diesel generator (EDG) power supply alignments. When relying on an EDG for SSD, the licensee's SSD strategy credits load shedding of the associated shutdown board, such that only essential loads will be loaded to the EDG. This is to prevent overloading the EDG. Fire-induced failure of the board under-voltage 27S relay function could result in the credited shutdown board's loads not shedding upon a shutdown board undervoltage condition (via a LOOP). If the nonessential loads are not automatically removed from the credited shutdown board, operators would need to perform additional actions to trip board loads. These actions are currently not included in the FSS procedures. The licensee documented this issue in the CAP in CR 1199002. The affected area was already covered by an hourly roving fire watch as a compensatory measure. Additionally, the licensee submitted Event Notification (EN) 52150 to the NRC, documenting this as an unanalyzed condition.

Analysis: The licensee's failure to identify circuits required for the nuclear safety function, as required by Section 2.4.2.2.1 of NFPA 805 was a PD. The PD was determined to be more than minor because it was associated with the reactor safety mitigating systems cornerstone attribute of protection against external factors (i.e., fire) and it adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee's failure to analyze the effects of fire damage on the 4kV shutdown bus undervoltage circuitry could result in overloading the emergency diesel generator (EDG) credited for powering the shutdown board.

The finding was screened in accordance with NRC IMC 0609, "Significance Determination Process", Attachment 4, "Initial Characterization of Findings," dated June 19, 2012, which determined that, an IMC 0609, Appendix F, "Fire Protection Significance Determination Process," dated September 20, 2013, review was required because it potentially affected the ability to reach and maintain safe and stable conditions in case of a fire.

The team evaluated the finding using the guidance in IMC 0609, Appendix F. Using the Phase 1 screening, inspectors determined that a Phase 2 quantitative assessment was required for Units 1 & 2, based on the initial quantitative screening resulting in an

increase of core damage frequency of $>1E-6$ /year (Step 1.5). Affected FAs on Unit 3 were screened out, because the shutdown boards that are susceptible to this condition were not credited in the licensee's SSD strategy for those areas.

The Phase 2 evaluation estimated the fire risk of Unit 1 & Unit 2 in 4 separate fire areas. Each fire area contained one credible ignition source that could damage the credited 4kV Shutdown Board under-voltage trip function. These ignition sources were modeled as single cabinet fires of 200kW and 650kW heat release rate intensity. The major analysis assumptions included: target cables were assumed to follow thermoplastic cable damage criteria; a one year exposure period was assumed; thermal fire ignition frequencies were obtained from NRC IMC 0609 Appendix F Attachment 1; no credit was given for suppression of the fire, as the areas did not have fixed suppression systems; and the conditional core damage probability data for the fire damage scenarios was obtained using the latest NRC Browns Ferry SPAR model. The dominant sequence was a challenging fire in the 4kV SD Board A Logic Relay Panel 25-45A which would result in a reactor trip, and a loss of high pressure coolant injection (HPCI), and reactor core isolation cooling (RCIC). The individual fire scenarios in the respective FAs would not result in loss of offsite power, which enabled the credited low pressure coolant injection pump to remain available. The Phase 2 SDP analysis determined that the risk increase associated with the finding was an increase of core damage frequency of $<1E-6$ /year, a finding of very low safety significance (Green). The phase 2 analysis was reviewed by a regional SRA.

No cross cutting aspect was assigned to this finding because it was not indicative of current licensee performance since the original ignition source and target walkdowns were performed more than 3 years ago.

Enforcement: Browns Ferry Nuclear Plant's Renewed Facility Operating License Condition 2.C(13), 2.C(14), and 2.C(7) for Units 1, 2 and 3 respectively, required the licensee to implement and maintain in effect all provisions of the approved FPP that complied with 10 CFR 50.48 (c), "National Fire Protection Association Standard NFPA 805," as specified in the NRC safety evaluation report (SER) dated October 28, 2015. NFPA 805 Section 2.4.2.2.1 stated, in part, that circuits required for the nuclear safety functions shall be identified. This includes circuits that are required for operation, that could prevent the operation, or that result in the maloperation of the equipment identified in [NFPA 805 section] 2.4.2.1 (i.e, the NSCA). This evaluation shall consider fire-induced failure modes such as hot shorts (external and internal), open circuits, and shorts to ground, to identify circuits that are required to support the proper operation of components required to achieve the nuclear safety performance criteria, including spurious operation and signals.

Contrary to the above, since March 2013, the licensee failed to adequately identify and evaluate circuits that are required for operation, that could prevent the operation, or that result in the maloperation of the equipment identified in NSCA. This item was entered into the CAP as CR 1199002, and the licensee implemented compensatory measures in the form of hourly fire watches. Additionally, the licensee submitted EN 52150 to the NRC, documenting this as an unanalyzed condition. This violation is being treated as an NCV consistent with Section 2.3.2 of the Enforcement Policy. (NCV 05000259, 260, 296/2016011-02, Failure to Adequately Identify and Evaluate All Circuit Failures for NSCA Credited Equipment)

.07 Communications

a. Inspection Scope

The inspectors reviewed plant communication capabilities to evaluate the performance of the telephone/page and portable radio system to support plant personnel in the performance of recovery actions to achieve and maintain SSD, as credited in the licensee's feasibility analysis for performance of recovery actions. The team performed interviews and plant walk-downs with the licensee's operations staff to assess the credited method of communications used to complete recovery actions as specified in post-fire SSD procedures for the selected FAs. The team reviewed the adequacy of the communication systems to support plant personnel in the performance of fire brigade and B.5.b. duties. This was accomplished by inspectors observing the testing of communication systems during walkdowns, to identify areas of high noise or low signal strength that could hinder effective communication of fire event notification and fire brigade firefighting activities at these locations. Additionally, a walk-down of the Fire Brigade Storage Room was conducted to verify the material condition status of the Fire Brigade's and SSD team's communication equipment. The inspectors reviewed preventive maintenance and surveillance test records to verify that the communication equipment was being properly maintained and tested. The team also verified that the design and location of communications equipment would not cause a loss of communications during a fire. Specific documents reviewed by the team are listed in the Attachment.

b. Findings

No findings were identified.

.08 Emergency Lighting

a. Inspection Scope

The inspectors verified the adequacy of the plant's emergency lighting systems through review of design and maintenance aspects and inspection walk-downs of the fixed 8-hour battery pack emergency lighting units (ELUs), MCR Emergency Lighting, and credited hard hat lighting. Specifically, the team reviewed the adequacy of the ELUs used to support plant personnel during post-fire safe shutdown for the selected FZs. The team performed plant walk-downs and observed the placement and coverage area of fixed 8-hour battery pack emergency lights credited for SSD, to evaluate their adequacy for illuminating access and egress pathways and any equipment requiring local operation and/or instrumentation monitoring for post-fire SSD. The inspectors reviewed the vendor manual to ensure that the hard light lighting were being maintained consistent with the manufacturer's recommendations, and verified the battery storage conditions and maintenance practices were also being followed in accordance with the vendor guidance. Specific documents reviewed by the team are listed in the Attachment.

b. Findings

No findings were identified.

.09 Cold Shutdown Repairs

a. Inspection Scope

The licensee does not require transitioning to cold shutdown to achieve the safe and stable condition, and therefore does not require cold shutdown repairs to be implemented.

b. Findings

No findings were identified.

.10 Compensatory Measures

a. Inspection Scope

The team reviewed the Fire Protection Impairment Log, which included out-of-service, degraded, and/or inoperable fire protection features (e.g., detection and suppression systems and passive fire barriers); and NFPA 805 implementation deficiencies. The Fire Protection Impairment Log was also assessed to determine the adequacy of the assigned compensatory measures. Additionally, the team verified that the risk associated with removing the fire protection feature from service was properly assessed and the compensatory measures were implemented in accordance with the approved FPP. The team reviewed impairment and compensatory measures forms for fire watch tours for selected FAs and confirmed by direct observation that fire watch rounds were conducted in the required plant areas at their scheduled intervals. Hourly and roving watch personnel were interviewed to ascertain that their duties and responsibilities were properly understood.

b. Findings

No findings were identified.

.11 Radiological Release

a. Inspection Scope

The team reviewed possible radiological release paths to any unrestricted area due to the direct effects of fire suppression activities for each of the selected FAs. Fire pre-plans addressed ventilation paths and specified monitoring of contamination levels of smoke. Fire brigade training and pre-plans were reviewed to verify the performance requirements of NFPA 805 for radioactive release were being met. FAs 16 and FA SWITCH were outside the Radiological Control Area and were concluded to not have any possible release path. FA 09 is inside the Radiological Control Area, and inspectors concluded that the licensee's fire pre-plan adequately addressed the possibility of radiation release to any unrestricted area due to the direct effects of fire suppression activities.

b. Findings

No findings were identified.

.12 Non Power Operations

a. Inspection Scope

The team reviewed the site's recently issued NPO procedure to verify that the associated license requirements had been adequately implemented. The review included interviews and the evaluation of supporting calculations that formed the bases of the licensee's NPO program. The team verified that the licensee had identified key safety functions for maintaining the plant in a safe and stable condition during NPO modes. Unit 1 entered an unplanned outage during the inspection due to the HPCI system being declared inoperable. The site did not enter any high risk evolutions such as mid-loop operations and maintained adequate FPP controls during the time period that the team was on-site.

b. Findings

No findings were identified.

.13 Monitoring Program

a. Inspection Scope

The team reviewed procedure NPG-SPP-09.27, "NFPA 805 Monitoring Program", as well as procedure 0-TPP-FPP-006, "Implementation of the NFPA 805 Fire Protection Monitoring Program," to verify that a monitoring program was established to ensure that the availability and reliability of the fire protection systems and features credited in the performance-based analyses are maintained and to assess the performance of the FPP in meeting the performance criteria in accordance with NFPA 805. The licensee established performance monitoring groups that provide a link between components and functions that are monitored together. The items in scope were being monitored for performance based on the established criteria as part of the normal engineering health reporting process. The team also verified that the monitoring program instituted appropriate corrective actions to return availability, reliability, and performance of systems that fall outside of established levels.

b. Findings

No findings were identified.

.14 Plant Change Evaluation

a. Inspection Scope

During the transition period in which Browns ferry is not in full compliance with 10 CFR 50.48(c), the acceptance criteria for risk-informed changes must not exceed the acceptance criteria in the NFPA 805 License Condition.

The team reviewed NPG-SPP-03.6, Fire Protection Program Change Regulatory Reviews, Rev 6, along with other documents to verify that the licensee had a program to determine if a change to the approved FPP could be made without prior NRC approval. The team also interviewed the licensee personnel responsible for evaluating the risk associated with fire protection program changes to verify that their process is followed. The team reviewed a sample of engineering changes to verify the adequacy of the Fire Protection Program Change Evaluation forms.

b. Findings

No findings were identified.

.15 Control of Combustibles and Ignition Sources

a. Inspection Scope

The team reviewed the administrative control of combustible materials and ignition sources to verify that the FPP performance requirements of NFPA 805 Chapter 3 were satisfied. Plant administrative procedures were reviewed to determine if adequate controls were in place to control the potential ignition sources of welding and grinding and the handling of transient combustibles in the plant. The team walked down numerous areas in the plant, including the selected FAs, for control of combustible materials, storage of in-plant materials, transient combustibles, and general housekeeping. The team verified that containers with combustibles were UL or Factory Mutual listed. Hot Work activity (WO 114785358) in the Unit 2 Reactor Building EI. 593' was specifically observed for conformance with all plant administrative controls and fire watch training requirements.

b. Findings

No findings were identified.

.16 B.5.b Mitigating Strategy

a. Inspection Scope

The team reviewed the licensee's preparedness to handle large fires or explosions by reviewing the mitigating strategy of injecting water to the drywell. To verify that the licensee continued to meet the requirements of their B.5.b related license conditions and 10 CFR 50.54 (hh)(2), the team reviewed procedures to ensure that they were being maintained and were adequate; and performed walkdowns with licensee staff to ensure that the actions were feasible. Inspectors also verified that the required equipment was properly staged and maintained, and that the staff was properly trained.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA2 Problem Identification and Resolution

a. Inspection Scope

The team reviewed a sample of recent independent licensee audits, CRs, self-assessments, and system/program health reports for thoroughness, completeness and conformance to FPP requirements. Guidance for the independent audits are contained in Regulatory Guide 1.189, "Fire Protection for Operating Nuclear Power Plants," and Generic Letter 82-21, "Technical Specifications for Fire Protection Audits."

The team also reviewed other CAP documents, including completed corrective actions documented in selected CRs and operating experience program documents, to ascertain whether industry identified fire protection issues (actual or potential) affecting BFN were appropriately entered into the CAP for resolution. Items included in the operating experience program effectiveness review were NRC information notices, regulatory guides, regulatory issues summary, industry or vendor generated reports of defects and non-compliances submitted pursuant to 10 CFR Part 21, and vendor information letters. The team evaluated the effectiveness of the corrective actions for the identified issues. The documents reviewed are listed in the Attachment.

b. Findings

No findings were identified.

4OA3 Followup of Events

.01 (Closed) Licensee Event Report (LER) 05000259, 260, 296/2013-008-00: Fire Damage to Cables in Fire Areas Could Cause Residual Heat Removal Pumps to Spuriously Start

a. Inspection Scope

On February 14, 2014, the licensee submitted an LER documenting the discovery of a condition of non-compliance with the site's fire protection program (FPP). These conditions could prevent operators from achieving and maintaining safe shutdown (SSD) of the plant, in the case of a postulated fire.

The inspectors performed a detailed review of the information related to these LERs. Inspectors reviewed documents, and discussed the events with plant personnel to gain an understanding of the events. The inspectors assessed the licensee's compensatory measures and corrective actions to determine if they were adequate.

b. Findings

Introduction: A licensee-identified non-compliance with 10 CFR Part 50, Appendix R, Section III.G.2, was identified for the licensee's failure to protect one of the redundant

trains of equipment needed to achieve post-fire SSD from fire damage. Specifically, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage.

Description: On February 14, 2014, the licensee submitted LER 2013-008-00, which documented discovery of a condition where a postulated fire could result in the spurious start of a Residual Heat Removal (RHR) pump. This condition was identified during the licensee's transition to NFPA 805. On December 16, 2013, an extent of condition review related to an Appendix R operator manual action deficiency identified that fire damage to a non-isolated 250 VDC control cable could cause RHR pump 2C to spuriously start when it's associated 4kV Shutdown Board is credited by the Appendix R analysis. This undesired start could overload the credited EDG, or take away the necessary load capacity to allow operation of other Appendix R fire safe shutdown credited loads. The licensee determined that a similar condition exists for RHR pumps 1A, 1B, 1D, 2A, 2B, 3A, and 3C.

The licensee determined that the deficiencies existed because of legacy human performance errors that occurred during the resolution of Appendix R cable routing failures. This LER was applicable to Units 1, 2 and Unit 3. Upon discovery, the licensee entered this issue into their CAP as PER 822895, and implemented compensatory actions in the form of fire watches for the affected FAs, as well as an operator work around to remove the affected RHR pump breaker close circuit control power fuses during performance of the affected safe shutdown instructions.

Analysis. Failure to protect one train of cables and equipment necessary to achieve post-fire SSD from fire damage for fire areas designated in the Fire Protection Report (FPR) as meeting Appendix R, Section III.G.2, was a performance deficiency. This finding was more than minor because it was associated with the reactor safety mitigating system cornerstone attribute of protection against external events (i.e., fire). Specifically, failure to protect safe shutdown cables and equipment from fire damage negatively affected the reactor safety mitigating systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Because this issue relates to fire protection and this non-compliance was identified as a part of the site's transition to NFPA 805, this issue is being dispositioned in accordance with Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" of the NRC Enforcement Policy.

In order to verify that this non-compliance was not associated with a finding of high safety significance (Red), inspectors reviewed qualitative and quantitative risk analyses performed by the licensee. These risk evaluations took ignition source and target information from the BFN fire PRA to demonstrate that the significance of the non-compliances were less-than-Red (i.e. Δ CDF less than $1E-4$ /year). The inspectors also performed walkdowns to verify key assumptions were applicable. Based on the ignition frequency of fire sources in the affected areas, inspectors determined that the significance of this non-compliance was less-than-Red. The inspectors also noted that the values in the licensee's quantitative analysis were conservative, in that they used screening values instead of more detailed values. This provided additional confidence that this non-compliance was not associated with a finding of high safety significance (Red). A bounding risk assessment performed by a regional SRA reviewed the licensee

and inspector risk evaluations and confirmed the Δ CDF risk increase due to this condition was less than 1E-4, and therefore less than Red.

The inspectors determined that no cross cutting aspect was applicable to this performance deficiency because this finding was not indicative of current licensee performance.

Enforcement. 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, Section III.G. 10 CFR 50, Appendix R, Section III.G.2, states, in part, that where cables or equipment, that could prevent operation or cause mal-operation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within 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, (b) separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire detectors and an automatic fire suppression system in the fire area, or (c) enclosure of cables and equipment in a fire barrier having a 1-hour rating and with fire detectors and an automatic fire suppression system in the fire area.

Contrary to the above, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage. Specifically, on December 16, 2013, the licensee identified the failure to protect equipment that was required to mitigate fire events. The licensee determined that fire damage could cause mal-operation of RHR pumps, potentially leading to the overloading of the EDG credited for SSD. This condition has existed since initial plant startup for Units 1, 2 and 3. The licensee entered this issue into the CAP (PER 822895) and implemented compensatory actions in the form of fire watches for the affected FZs, and an operator workaround.

Because the licensee committed to adopt NFPA 805 and change their fire protection licensing bases to comply with 10 CFR 50.48(c), the NRC is exercising enforcement and reactor oversight process (ROP) discretion for this issue in accordance with the NRC Enforcement Policy, Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" and Inspection Manual Chapter 0305. Specifically, this issue was identified and addressed during the licensee's transition to NFPA 805, it was entered into the licensee's CAP, immediate corrective action and compensatory measures were taken, it was not likely to have been previously identified by routine licensee efforts, it was not willful, and it was not associated with a finding of high safety significance (Red). The licensee identified and addressed the issues prior to NRC's issuance of Browns Ferry's NFPA 805 amendment.

.02 (Closed) Licensee Event Report (LER) 05000259, 260, 296/2014-002-00: Fire Damage to Cables During An Appendix R Fire Event Could Cause Loss of Control Power to 480 VAC Shutdown Boards

b. Inspection Scope

On May 23, 2014, the licensee submitted an LER documenting the discovery of a condition of non-compliance with the site's fire protection program (FPP). These conditions could prevent operators from achieving and maintaining safe shutdown (SSD) of the plant, in the case of a postulated fire.

The inspectors performed a detailed review of the information related to these LERs. Inspectors reviewed documents, and discussed the events with plant personnel to gain an understanding of the events. The inspectors assessed the licensee's compensatory measures and corrective actions to determine if they were adequate.

b. Findings

Introduction: A licensee-identified non-compliance with 10 CFR Part 50, Appendix R, Section III.G.2, was identified for the licensee's failure to protect one of the redundant trains of equipment needed to achieve post-fire SSD from fire damage. Specifically, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage.

Description: On May 23, 2014, the licensee submitted LER 2014-002-00, which documented discovery of a condition where a postulated fire could result in the spurious transfer of the 480 VAC Shutdown Board control power during an Appendix R safe shutdown event. This condition was identified during the licensee's transition to NFPA 805. On March 24, 2014, an extent of condition review related to an Appendix R operator manual action deficiency identified that cables associated with 480V Shutdown Boards 3A and 3B were routed in areas of Fire Area 3-3 (U3 Reactor Bldg 593' elevation). These cables are for the DC control power transfer switches associated with the respective shutdown boards. Failure of these cables could cause the 480V shutdown board DC control power to spuriously transfer to the alternate DC control power source and fluctuate between alternate and normal. If alternate power fails due to fire damage, all DC control power to the U3 480V shutdown boards would be lost.

The licensee determined that the deficiencies existed because of human performance errors that occurred during the resolution of Appendix R cable routing failures. This LER was applicable to Units 1, 2 and Unit 3. Upon discovery, the licensee entered this issue into their CAP as PERs 862842 and 864156, and implemented compensatory actions in the form of fire watches for the affected FAs.

Analysis. Failure to protect one train of cables and equipment necessary to achieve post-fire SSD from fire damage for fire areas designated in the Fire Protection Report (FPR) as meeting Appendix R, Section III.G.2, was a performance deficiency. This finding was more than minor because it was associated with the reactor safety mitigating system cornerstone attribute of protection against external events (i.e., fire). Specifically, failure to protect safe shutdown cables and equipment from fire damage negatively affected the reactor safety mitigating systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Because this issue relates to fire protection and this non-compliance was identified as a part of the site's transition to NFPA 805, this issue is being dispositioned in accordance with Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" of the NRC Enforcement Policy.

In order to verify that this non-compliance was not associated with a finding of high safety significance (Red), inspectors reviewed qualitative and quantitative risk analyses performed by the licensee. These risk evaluations took ignition source and target information from the BFN fire PRA to demonstrate that the significance of the non-compliances were less-than-Red (i.e. Δ CDF less than $1E-4$ /year). The inspectors also performed walkdowns to verify key assumptions were applicable. Based on the ignition frequency of fire sources in the affected areas, inspectors determined that the significance of this non-compliance was less-than-Red. The inspectors also noted that the values in the licensee's quantitative analysis were conservative, in that they used screening values instead of more detailed values. This provided additional confidence that this non-compliance was not associated with a finding of high safety significance (Red). A bounding risk assessment performed by a regional SRA reviewed the licensee and inspector risk evaluations and confirmed the Δ CDF risk increase due to this condition was less than $1E-4$, and therefore less than RED.

The inspectors determined that no cross cutting aspect was applicable to this performance deficiency because this finding was not indicative of current licensee performance.

Enforcement. 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, Section III.G. 10 CFR 50, Appendix R, Section III.G.2, states, in part, that where cables or equipment, that could prevent operation or cause mal-operation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within 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, (b) separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire detectors and an automatic fire suppression system in the fire area, or (c) enclosure of cables and equipment in a fire barrier having a 1-hour rating and with fire detectors and an automatic fire suppression system in the fire area.

Contrary to the above, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage. Specifically, on December 16, 2013, the licensee identified the failure to protect equipment that was required to mitigate fire events. The licensee determined that fire damage could cause mal-operation of RHR pumps, potentially leading to the overloading of the EDG credited for SSD. This condition has existed since initial plant startup for Units 1, 2 and 3. The licensee entered this issue into the CAP (PERs 862842 and 864156) and implemented compensatory actions in the form of fire watches for the affected FZs.

Because the licensee committed to adopt NFPA 805 and change their fire protection licensing bases to comply with 10 CFR 50.48(c), the NRC is exercising enforcement and reactor oversight process (ROP) discretion for this issue in accordance with the NRC Enforcement Policy, Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" and Inspection Manual Chapter 0305. Specifically, this issue

was identified and addressed during the licensee's transition to NFPA 805, it was entered into the licensee's CAP, immediate corrective action and compensatory measures were taken, it was not likely to have been previously identified by routine licensee efforts, it was not willful, and it was not associated with a finding of high safety significance (Red). The licensee identified and addressed the issues prior to NRC's issuance of Browns Ferry's NFPA 805 amendment.

.03 (Closed) Licensee Event Report (LER) 05000259/2014-001-00: Fire Damage to Cables in a Fire Area Could Cause Improper Operation of 4kV Shutdown Board Crosstie Breaker

a. Inspection Scope

On May 1, 2014, the licensee submitted an LER documenting the discovery of a condition of non-compliance with the site's fire protection program (FPP). These conditions could prevent operators from achieving and maintaining safe shutdown (SSD) of the plant, in the case of a postulated fire.

The inspectors performed a detailed review of the information related to these LERs. Inspectors reviewed documents, and discussed the events with plant personnel to gain an understanding of the events. The inspectors assessed the licensee's compensatory measures and corrective actions to determine if they were adequate.

b. Findings

Introduction: A licensee-identified non-compliance with 10 CFR Part 50, Appendix R, Section III.G.2, was identified for the licensee's failure to protect one of the redundant trains of equipment needed to achieve post-fire SSD from fire damage. Specifically, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage.

Description: On May 1, 2014, the licensee submitted LER 2014-001-00, which documented discovery of a condition where a postulated fire could result in loss of power to credited safe shutdown equipment used for Unit 1. This condition was identified during the licensee's transition to NFPA 805. On March 2, 2014, an extent of condition review related to an Appendix R operator manual action deficiency identified that fire damage to breaker control cable PP679-1A in Fire Area 2-3, could cause spurious opening of breaker 1824, a 4kV Shutdown Board (SDBD) crosstie breaker. The crosstie breaker is required to be closed during an Appendix R safe shutdown event in Fire Area 2-3. In addition to causing the breaker to spuriously open, fire damage to the cables can also prevent breaker closure. Inability to control breaker 1824 due to fire damage could prevent Units 2 & 3, Division II of the Residual Heat Removal Low Pressure Coolant Injection inboard valves from opening, which would challenge the ability to provide adequate core cooling for Unit 1, in the event of a fire safe shutdown event.

The licensee determined that the deficiencies existed because of legacy human performance errors that occurred during the resolution of Appendix R cable routing failures. This LER was applicable to Unit 1. Upon discovery, the licensee entered this issue into their CAP as PER 853503 and implemented compensatory actions in the form

of an operator workaround to prevent spurious breaker opening and a roving fire watch for the affected FA.

Analysis. Failure to protect one train of cables and equipment necessary to achieve post-fire SSD from fire damage for fire areas designated in the Fire Protection Report (FPR) as meeting Appendix R, Section III.G.2, was a performance deficiency. This finding was more than minor because it was associated with the reactor safety mitigating system cornerstone attribute of protection against external events (i.e., fire). Specifically, failure to protect safe shutdown cables and equipment from fire damage negatively affected the reactor safety mitigating systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Because this issue relates to fire protection and this non-compliance was identified as a part of the site's transition to NFPA 805, this issue is being dispositioned in accordance with Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" of the NRC Enforcement Policy.

In order to verify that this non-compliance was not associated with a finding of high safety significance (Red), inspectors reviewed qualitative and quantitative risk analyses performed by the licensee. These risk evaluations took ignition source and target information from the BFN fire PRA to demonstrate that the significance of the non-compliances were less-than-Red (i.e. Δ CDF less than $1E-4$ /year). The inspectors also performed walkdowns to verify key assumptions were applicable. Based on the ignition frequency of fire sources in the affected areas, inspectors determined that the significance of this non-compliance was less-than-Red. The inspectors also noted that the values in the licensee's quantitative analysis were conservative, in that they used screening values instead of more detailed values. This provided additional confidence that this non-compliance was not associated with a finding of high safety significance (Red). A bounding risk assessment performed by a regional SRA reviewed the licensee and inspector risk evaluations and confirmed the Δ CDF risk increase due to this condition was less than $1E-4$, and therefore less than RED.

The inspectors determined that no cross cutting aspect was applicable to this performance deficiency because this finding was not indicative of current licensee performance.

Enforcement. 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, Section III.G. 10 CFR 50, Appendix R, Section III.G.2, states, in part, that where cables or equipment, that could prevent operation or cause mal-operation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within 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,
- (b) separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire detectors and an automatic fire suppression system in the fire area, or
- (c) enclosure of cables and equipment in a fire barrier having a 1-hour rating and with fire detectors and an automatic fire suppression system in the fire area.

Contrary to the above, the licensee failed to use one of the means described in Appendix R, Section III.G.2.a, b, or c to ensure that one of the redundant trains of equipment necessary to achieve and maintain hot shutdown conditions was protected from fire damage. Specifically, on March 2, 2014, the licensee identified the failure to protect equipment that was required to mitigate fire events. The licensee determined that fire damage could cause improper operation of a crosstie breaker therefore resulting in a loss of power to credited safe shutdown equipment. This would challenge the ability to provide adequate core cooling during performance of the BFN Safe Shutdown Instructions. This condition has existed since initial plant startup for Unit 1. The licensee entered this issue into the CAP (PER 853503) and implemented compensatory actions in the form of an Operator Work Around to prevent spurious breaker opening and a roving fire watch for the affected FA.

Because the licensee committed to adopt NFPA 805 and change their fire protection licensing bases to comply with 10 CFR 50.48(c), the NRC is exercising enforcement and reactor oversight process (ROP) discretion for this issue in accordance with the NRC Enforcement Policy, Section 9.1, "Enforcement Discretion for Certain Fire Protection Issues (10 CFR 50.48)" and Inspection Manual Chapter 0305. Specifically, this issue was identified and addressed during the licensee's transition to NFPA 805, it was entered into the licensee's CAP, immediate corrective action and compensatory measures were taken, it was not likely to have been previously identified by routine licensee efforts, it was not willful, and it was not associated with a finding of high safety significance (Red). The licensee identified and addressed the issues prior to NRC's issuance of Browns Ferry's NFPA 805 amendment.

4OA6 Meetings, Including Exit

On August 12, 2016, the inspection team leader presented the preliminary inspection results to Mr. K. Bronson and other members of the licensee's staff. The licensee acknowledged the results. Following additional reviews in the Region II office, another exit meeting was held by telephone with Mr. M. Oliver on September 14, 2016, to provide an update on changes to the preliminary inspection findings. The licensee acknowledged the findings. Proprietary information is not included in this report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Barker, Operations Support Superintendent
R. Bates, Nuclear Licensing Engineer
H. Brown, Fire Protection Program Owner
K. Bronson, Senior Site Vice President
B. Calkin, Nuclear Licensing Engineer
P. Chadwell, Operations
V. Furr, BWR PRA Manager
P.S. Lovvorn, Electrical Design Engineer
J. Paul, Nuclear Site Licensing Manager
H. Smith, Fire Marshall
T. Stafford, NFPA 805 Supervisor

NRC Personnel

H. Barrett, Senior Fire Protection Engineer, Fire Protection Branch, NRR
D. Dumbacher, Senior Resident Inspector
A. Gody, Director, Division of Reactor Safety, Region II
P. Lain, Senior Fire Protection Engineer, Fire Protection Branch, NRR
S. Shaeffer, Chief, Engineering Branch 2, Division of Reactor Safety, Region II

LIST OF REPORT ITEMS

Opened and Closed

05000259, 260, 296/2016011-01	NCV	Failure to Identify and Evaluate All Targets Within the Zone of Influence of Ignition Sources (Section 1R05.06.01)
05000259, 260, 296/2016011-02	NCV	Failure to Adequately Identify and Evaluate All Circuit Failures for NSCA Credited Equipment (Section 1R05.06.02)

Closed

05000259, 260, 296/2014-002-00	LER	Fire Damage to Cables During An Appendix R Fire Event Could Cause Loss of Control Power to 480 VAC Shutdown Boards (Section 4OA3)
05000259, 260, 296/2014-002-00	LER	Fire Damage to Cables During An Appendix R Fire Event Could Cause Loss of Control Power to 480 VAC Shutdown Boards (Section 4OA3)
05000259/2014-001-00	LER	Fire Damage to Cables in a Fire Area Could Cause Improper Operation of 4kV Shutdown Board Crosstie Breaker (Section 4OA3)

SUPPLEMENTAL INFORMATION

Section 1R05.06: List of Safe Shutdown Components Inspected

Component Identification

2-FIC-71-36B

0-XSW-211-000D

FCV-74-60

FCV-74-57

SB-D 0-PNLA-248-000D

Breaker 1614

Backup Control Panel

Description

RCIC System Flow/Control

DC Control Power Xfer Switch

RHR SYS I Drywell Spray Outboard Valve
Control

RHR SYS I Supp Pool Spray/Test Isol VLV
Control

250 VDC Distribution Panel

4kV Shutdown Board A Normal Feeder

LIST OF DOCUMENTS REVIEWED

Calculations

BFN-50-799, Design Basis Document – Fire & Pressure Seals, Rev. 8
BFN-50-7026, Design Basis Document – High Pressure Fire Protection, Rev. 9
BFN-50-7039, Design Basis Document - CO2 Storage, Fire Protection & Purging Systems, Rev. 5
BFN-50-7308, Design Basis Document - Fire Alarm & Detection Systems, Rev. 9
EDQ099920110010, NFPA 805 Nuclear Safety Capability Assessment, Rev. 31
EDQ005720020069, Diesel Load Study for Units 1 and 2, Rev. 34
EDQ0009992011000004, NFPA 805: Associated Circuit Analysis – Common Power Supply/Common Enclosure, Rev. 3
EDQ0009992011000010, Appendix N-09, Rev 30
EDQ2000870550, Cable and Bus Protection/Breaker/Fuse Coordination for 250 V DC System, Rev 44
EDQ0211880138, Fuse Evaluation for 4kV Shutdown Boards A, B, C, D, 3EA, 3EB, 3EC, 3ED, Rev 33
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DWG 1-45E834-10, Conduit & Grounding Cable Trays Node Diagram Elevation 621-3 & 639-0, Rev. 6
DWG 1-45E834-8, Conduit & Grounding Cable Trays Node Diagram Plan Elevation 593-0, Rev. 7

LIST OF ACRONYMS AND ABBREVIATIONS

AV	Apparent Violation
CAP	Corrective Action Program
CFR	Code of Federal Regulations
DBD	Design Bases Document
DC	Direct Current
ELU	Emergency Lighting Unit
FA	Fire Area
FPP	Fire Protection Program
FZ	Fire Zone
IMC	Inspection Manual Chapter
IP	NRC Inspection Procedure
NCV	Non Cited Violation
NFPA	National Fire Protection Association
NRC	United States Nuclear Regulatory Commission
NSCA	Nuclear Safety Capability Assessment
NSD	Nuclear System Directive
OMA	Operator Manual Actions
ONS	Oconee Nuclear Station
P&IDs	Piping and Instrumentation Diagrams
PIP	Problem Investigation Program
Rev	Revision
SDP	Significance Determination Process
SER	Safety Evaluation Report
SLC	Selected Licensee Commitments
SSC	Systems, Structures and Components
SSD	Safe Shutdown
WO	Work Order