



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

December 21, 2015

Mr. David A. Heacock  
President and Chief Nuclear Officer  
Virginia Electric and Power Company  
North Anna Power Station, Units 1 & 2  
Innsbrook Technical Center  
5000 Dominion Boulevard  
Glen Allen, VA 23060-6711

**SUBJECT: NORTH ANNA POWER STATION – NRC TRIENNIAL FIRE PROTECTION  
INSPECTION REPORT NOS. 05000338/2015008 AND 05000339/2015008**

Dear Mr. Heacock:

On November 6, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your North Anna Power Station, Units 1 and 2. The enclosed inspection report documents the inspection results, which were discussed with Mr. M. Becker and other members of your staff on December 16, 2015.

During this inspection, the NRC staff examined activities conducted under your license as they relate to public health and safety to confirm compliance with the Commission's rules and regulations, and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, the NRC has identified two findings that were evaluated under the risk significance determination process as having very low safety significance (Green). These findings involved violations of NRC requirements. The NRC is treating these as non-cited violations (NCV) consistent with Section 2.3.2 of the Enforcement Policy. These NCVs are described in the subject inspection report. If you contest the violations, or the significance of these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis of your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at North Anna Power Station.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of the

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Sincerely,

*/RA/*

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

Docket Nos.: 50-338, 50-339  
License Nos.: NPF-4, NPF-7

Enclosure:  
Inspection Report 05000338/2015008 and 05000339/2015008  
w/Attachment: Supplementary Information

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Letter to David A. Heacock from Scott M. Shaeffer dated December 21, 2015.

SUBJECT: NORTH ANNA POWER STATION – NRC TRIENNIAL FIRE PROTECTION  
INSPECTION REPORT NOS. 05000338/2015008 AND 05000339/2015008

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**U. S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket Nos: 50-338, 50-339

License Nos: NPF-4, NPF-7

Report No: 05000338/2015008 AND 05000339/2015008

Licensee: Virginia Electric and Power Company (VEPCO)

Facility: North Anna Power Station, Units 1 & 2

Location: Mineral, Virginia 23117

Dates: October 19 – October 23, 2015  
November 02 – November 06, 2015

Inspectors: D. Jones, Senior Reactor Inspector (Lead Inspector)  
J. Dymek, Reactor Inspector  
W. Monk, Reactor Inspector  
M. Thomas, Senior Reactor Inspector

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

Enclosure

## SUMMARY OF FINDINGS

IR 05000338/2015008, 05000339/2015008; October 19 – October 23 and November 02 – November 06, 2015; North Anna Power Station, Units 1 & 2; Triennial Fire Protection Inspection

This report covers an announced two-week triennial fire protection inspection by a team of four Region II inspectors. Inspectors identified two non-cited violations (NCVs) of very low safety significance. The significance of inspection findings are indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red) and determined using IMC 0609, "Significance Determination Process", dated 04/29/2015. Cross-cutting aspects are determined using IMC 0310, "Components within the Cross Cutting Areas", dated 12/04/2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy, dated 02/04/2015. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 5.

### Cornerstone: Mitigating Systems

- **Green:** The inspectors identified a Green non-cited violation (NCV) of Technical Specification 5.4.1.a, for the licensee's failure to provide adequate procedural guidance for implementation of the alternative shutdown capability in the event of a fire in the quench spray pump house. In particular, the fire safe shutdown procedure did not include actions to locally fail open the Unit 2 turbine-driven auxiliary feedwater (TDAFW) pump steam admission valves to allow operation of the TDAFW pump in the event the motor driven auxiliary feedwater pumps (MDAFW) were adversely affected by fire damage. The licensee entered this issue in their corrective action program as CR 1017083 and established compensatory actions until the Unit 1 and 2 procedures were revised.

The site's failure to maintain adequate procedural guidance to operate the Unit 2 TDAFW pump for a fire in the quench spray pump house was determined to be a performance deficiency. This performance deficiency was more than minor because it was associated with the procedure quality attribute of the reactor safety mitigating systems cornerstone and it affected the cornerstone objective of protection against external events (i.e., fire). The inadequate procedural guidance affected the fire protection defense-in-depth element involving safe shutdown of the reactor. Using IMC 0609, Appendix F, Attachment 1, "Fire Protection Significance Determination Process Worksheet," the inspectors determined that the finding was of very low safety significance (Green) at Task 1.3.1, Question A, based upon observations that there were no credible fire scenarios which would likely result in simultaneous fire damage to the cables for the Unit 2 TDAFW pump and both Unit 2 MDAFW pumps. No cross-cutting aspect was identified because the issue was determined to not reflect current licensee performance. [1R.05.05.b]

- **Green:** The inspectors identified a Green non-cited violation (NCV) of North Anna Power Station, Units No.1 and No. 2, Renewed Facility Operating License, Conditions 2.D, "Fire Protection," for the licensee's failure to ensure that the turbine-driven auxiliary feed water (AFW) pump had the capability to provide sufficient flow such that residual heat removal (RHR) entry conditions could be achieved during fire events. The licensee entered this issue in their corrective action program as CR 1017291 with an action to re-evaluate the capability of the TDAFW pumps to achieve RHR entry conditions.

The site's failure to provide reasonable assurance that the turbine-driven AFW pump had the capability to provide sufficient flow such that RHR entry conditions could be met was a performance deficiency. This performance deficiency was more than minor because it was associated with the design control attribute of the reactor safety mitigating systems cornerstone and it affected the cornerstone objective of protection against external events (i.e., fire). The performance deficiency adversely affected the site's capability to achieve cold shutdown conditions in 72 hours for a fire event. Using IMC 0609, Appendix F, Attachment 1, "Fire Protection Significance Determination Process Worksheet," the inspectors determined that the finding was of very low safety significance (Green) at Task 1.3.1, Question A because the issue was associated with achieving cold shutdown conditions. The inspectors determined that the performance deficiency had a cross-cutting aspect of Teamwork in the Human Performance area (H.4). [1R.05.09]

## REPORT DETAILS

### REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

#### 1R05 Fire Protection (Triennial)

This report documents the results of a triennial fire protection inspection of the North Anna Power Station, Units 1 and 2. The inspection was conducted in accordance with the guidance provided in NRC Inspection Procedure (IP) 71111.05T, "Fire Protection (Triennial)," dated January 31, 2013. Section 71111.05-02 of the IP specifies a minimum sample size of four FAs and one B.5.b mitigating strategy for addressing large fires and explosions. This inspection fulfilled the requirements of the procedure by selecting a sample of four fire areas (FA) and 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.

The team inspected four risk-significant FAs to evaluate implementation of the fire protection program (FPP) as described in North Anna's Updated Final Safety Analysis Report (UFSAR) and the Appendix R Report. The sample FAs were chosen based on:

- a review of available risk information as analyzed by a senior reactor analyst (SRA) from Region II
- a review of previous inspection results
- plant walk-downs of FAs
- consideration of relational characteristics of combustible material to targets
- the location of equipment needed to achieve and maintain safe shutdown (SSD) of the reactor.

For each of the selected FAs, the inspectors evaluated the licensee's FPP against the applicable design bases documents and NRC requirements. Design bases documents reviewed by the team are listed in the Attachment of this report. The FAs chosen were identified as follows:

- Fire Area 6-2, Emergency Switchgear Room (Unit 2)
- Fire Area 14A-2, Turbine-Driven Auxiliary Feedwater Pump (Unit 2)
- Fire Area 14B-2, Motor-Driven Auxiliary Feedwater Pump (Unit 2)
- Fire Area 15-2, Quench Spray Room Pump House and Safeguard Area (Unit 2)

In selecting a B.5.b mitigating strategy sample, the inspectors reviewed licensee submittal letters, safety evaluation reports (SERs), licensee commitments, B.5.b implementing procedures, and previous NRC inspection reports (IRs). The B.5.b mitigating strategy that was chosen was to manually depressurize steam generators and use of the portable pump.



## .01 Protection of Safe Shutdown Capabilities

### a. Inspection Scope

The inspectors reviewed applicable portions of the site's post-fire safe shutdown analysis that was described in the "North Anna Power Station Appendix R Report." The inspectors also reviewed Fire Contingency Action (FCA) fire response procedures, fire annunciator response procedures, abnormal procedures (APs), and general operating procedures (GOPs), piping and instrumentation drawings (P&IDs), electrical one-line drawings, component cable routing information, the UFSAR, and other supporting documents that were referenced by the "Appendix R Report." The team's objective was to verify that post-fire SSD could be achieved and maintained from the main control room (MCR) for a postulated fire in the selected fire areas. The inspection activities focused on ensuring the adequacy of systems selected for reactivity control, reactor coolant makeup, reactor heat removal, process monitoring instrumentation, and support system functions.

For the selected FAs, the inspectors performed physical walk-downs to observe: (1) the material condition of fire protection systems and equipment; (2) the storage of permanent and transient combustibles; (3) the proximity of fire hazards to cables relied on, and (4) the licensee's implementation of procedures and processes for limiting fire hazards, housekeeping practices, and compensatory measures for inoperable or degraded fire protection systems and credited fire barriers.

### Methodology

Cable routing information by FA was reviewed for a selected sample of SSD components to verify that the associated cables would not be damaged by a fire in the selected fire areas, or that the licensee's analysis determined that the fire damage would not prohibit safe plant shutdown. The inspectors reviewed North Anna's "Appendix R Report" for the selected FAs and compared it to the FCA procedures, emergency procedures, and abnormal procedures to verify that cables and equipment credited for post-fire SSD in the FPR and applicable procedures were adequately protected from fire damage in accordance with the applicable requirements of 10 CFR 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability." In cases where local operator manual actions (OMAs) were credited in lieu of cable protection of SSD equipment, the inspectors reviewed the OMAs to verify that the OMAs were feasible utilizing the guidance of NRC IP 71111.05T, paragraph 02.02.j.2. A list of SSD components examined for cable routing are included in the Attachment to this report.

### Operational Implementation

The inspectors reviewed applicable sections of FCA procedures, emergency procedures, and abnormal procedures to verify that the shutdown methodology properly identified the systems and components necessary to achieve and maintain SSD conditions. The inspectors performed a walk-through of the FCA procedure steps to ensure the implementation and human factors adequacy of the procedures. The inspectors verified that licensee personnel credited for procedure implementation had procedures available, were trained on implementation, and were available in the event a fire occurred. The inspectors also reviewed selected operator actions to verify that the operators could

reasonably be expected to perform the specific actions within the time required to maintain plant parameters within specified limits.

b. Findings

See Section 1R05.05.b of this report.

.02 Passive Fire Protection

a. Inspection Scope

For the selected FAs, the inspectors evaluated the adequacy of fire barrier walls, ceilings, floors, mechanical and electrical penetration seals, cable tray fire stops, fire doors, and fire dampers. The inspectors walked down accessible portions of the selected FAs to observe material condition of the passive barriers and to identify any potential degradation or non-conformance. The inspectors reviewed design documents for a sample of walls, floors, ceilings, fire doors, and fire dampers to confirm that appropriate materials and construction methods were used to ensure that the fire barriers met their intended design function. In addition, the inspectors compared the installed configurations to the approved construction details and supporting fire endurance test data to ensure that the respective fire barriers met applicable license requirements in Appendix A to BTP APCSB 9.5-1. A sample of completed surveillance and maintenance procedures for selected fire doors, fire dampers, and penetration seals were reviewed to ensure that these passive fire barriers were being properly inspected and maintained. Additionally, the inspectors visually observed a sample of the barriers to verify the as-built configuration was adequately maintained. The fire protection features included in the review are listed in the Attachment to this report.

b. Findings

No findings were identified.

.03 Active Fire Protection

a. Inspection Scope

Using valve alignment procedures, fire pre-plans and engineering drawings, the inspectors observed the material condition and operational lineup of the fire water storage basins, diesel and motor-driven fire pump, and pressure maintenance devices to confirm that the underground fire main system was adequately maintained. The observations included assessing the material condition, accessibility and operational line-ups of the above ground water supply distribution piping to include sprinkler / water spray systems, standpipe systems and hose stations. The inspectors reviewed periodic surveillance and operability flow test data for the fire pumps and fire main loop to verify that the licensee's test program was adequate to ensure that the fire protection water supply system was being maintained in accordance with design and license requirements. Additionally, the inspectors verified that fire-induced failures of electrical power supplies or control circuits for the fire pumps would not render the system inoperable during a fire event.

The inspectors reviewed vendor equipment specifications and drawings, and engineering calculations to verify that the smoke detection capability was appropriate for the expected fire hazards in the selected FAs. The inspectors reviewed the design and installation of fire suppression systems in the selected FAs to verify that the systems met the required code and license requirements. This assessment was accomplished through the review of system vendor drawings, calculations, and code requirements. The inspectors assessed the manually actuated Halon system and associated smoke detection systems for FA-6-2. The inspectors reviewed the testing and maintenance requirements of the FPP and Technical Requirements Manual (TRM); completed periodic surveillance testing; and maintenance program procedures for the fire detection, suppression, standpipe, and fire hoses to verify that the test program was adequate for maintaining applicable design requirements.

The inspectors performed walk-downs of the selected fire areas to verify that the hose stations were adequately located, that the hoses were of the appropriate length, and that the hose stations were not obstructed. The team verified that the installed locations of the hose stations and extinguishers were consistent with the locations that were depicted in the site's fire-fighting plans and drawings.

The inspectors assessed the condition of fire-fighting and smoke control equipment that was located at fire brigade staging and dress out areas. The inspectors reviewed documentation for selected members of the fire brigade to verify conformance with medical and training requirements. The inspectors reviewed the fire brigade's drill planning schedule which included drill critique records for announced, unannounced, and off-site fire department drills for the past two years to verify adequacy of fire brigade training. Additionally, mutual aid agreements with local outside fire departments were also reviewed to verify that they were being maintained. Specific documents reviewed by the inspectors are listed in the Attachment to this report.

b. Findings

No findings were identified.

.04 Protection from Damage from Fire Suppression Activities

a. Inspection Scope

The inspectors reviewed heating, ventilation, and air conditioning (HVAC) system drawings; fire contingency action procedures; and configuration drawings of electrical raceways and SSD components to verify that the effects of water, drainage, heat, hot gasses, and inter-area migration of smoke would not inhibit credited SSD operator actions. The documents reviewed are listed in the Attachment to this report.

b. Findings

No findings were identified.

.05 Alternative Shutdown Capabilities

a. Inspection Scope

Methodology

The inspectors reviewed the licensee's FPP as described in UFSAR Section 9.5.1, the safe shutdown analysis (SSA), FCAs, P&IDs, electrical drawings, and other supporting documents for postulated fires in FAs 6-2, 14B-2, and 15-2. The reviews focused on ensuring that the required functions for post-fire SSD and the corresponding equipment necessary to perform those functions were included in the procedures. The review included assessing whether shutdown from the MCR could be implemented, and transfer of control from the MCR to the alternative shutdown control stations could be accomplished. This review also included verification that shutdown be performed both with and without the availability of offsite power.

Plant walk-downs were performed to verify that the plant configuration was consistent with that described in the SSA. These inspection activities focused on ensuring the adequacy of systems selected for reactivity control, reactor coolant makeup, reactor heat removal, process monitoring instrumentation, and support systems functions. The inspectors reviewed the systems and components credited for use during this shutdown method to verify that they would remain free from fire damage.

Implementation

The team reviewed the training lesson plans for licensed and non-licensed operators to verify that the training reinforced the shutdown methodology in the SSA and FCAs for the selected FAs. The team also reviewed shift turnover logs and shift manning to verify that personnel required for SSD using the alternative shutdown systems and procedures were available on-site, and were exclusive of those assigned as fire brigade members.

The team reviewed the adequacy of procedures utilized for post-fire SSD and performed a walk-through of procedure steps to ensure the implementation and human factors adequacy of the procedures. The team also reviewed selected operator actions to verify that the operators could reasonably be expected to perform the specific actions within the time required to maintain plant parameters within specified limits.

The team reviewed and walked down applicable sections of the following fire response procedures:

- 0-FCA-0, Fire Protection – Operations Response
- 2-FCA-2, Emergency Switchgear Room Fire
- 2-FCA-6, Motor Driven Auxiliary Feedwater Pump Room Fire
- 2-FCA-11, Safeguards/Quench Spray Pump House/MSVH Fire

The team also reviewed the periodic test procedures and test records of the alternative shutdown transfer capability which included instrumentation and control functions to ensure the tests were adequate to verify the functionality of the alternative shutdown capability. Electrical schematics were reviewed to verify that circuits for SSD equipment, which could be damaged due to fire, were isolated by disconnect switches. In addition, the team reviewed wiring diagrams for instrumentation located on the auxiliary shutdown

panels to verify that necessary process monitoring was available as required by the NAPS UFSAR and "Appendix R Report."

b. Findings

Introduction: The inspectors identified a Green non-cited violation (NCV) of Technical Specification 5.4.1.a, for the licensee's failure to provide adequate procedural guidance for implementation of the alternative shutdown capability in the event of a fire in the quench spray pump house. In particular, the fire safe shutdown procedure did not include actions to locally fail open the Unit 2 turbine-driven auxiliary feedwater (TDAFW) pump steam admission valves to allow operation of the TDAFW pump in the event the motor driven auxiliary feedwater pumps (MDAFW) were adversely affected by fire damage.

Description: The "NAPS Appendix R Report" stated that alternative shutdown capability would be utilized to achieve post-fire SSD in the event of a fire in Unit 2, Fire Area 15-2, "Quench Spray Pump House and Safeguards Area." The Appendix R Report also stated that a fire in FA 15-2 could cause a loss of power and control cables to the Unit 2 MDAFW pumps 2-FW-P-3A and 2-FW-P-3B. The Unit 2 TDAFW pump (2-FW-P-2) was credited in the "Appendix R Report" as being available to perform the decay heat removal function if the two MDAFW pumps were not available due to fire damage. Unit 2 Procedure, 2-FCA-11, "Safeguards/Quench Spray Pump House/MSVH Fire," provided guidance for achieving post-fire SSD in the event of a fire in FA 15-2. The inspectors noted, during the review and in-plant walk-down of Procedure 2-FCA-11, that Attachment 2 of the procedure identified that the Unit 2 TDAFW pump steam admission valves (2-MS-TV-211A and 2-MS-TV-211B) could also be potentially affected by a fire in FA 15-2. This was confirmed by the inspectors through review of licensee cable routing and electrical circuit information which showed that solenoid operated valves (SOVs) 2-MS-SOV-211A and 2-MS-SOV-211B for the Unit 2 TDAFW pump steam admission valves were located in FA 15-2 and were subject to fire damage. Fire damage to these SOVs could prevent the Unit 2 TDAFW pump steam admission valves from being opened from the MCR for operation of the TDAFW pump. The inspectors determined that Procedure 2-FCA-11 was inadequate to implement the alternative shutdown capability because the procedure did not include actions to locally fail open the Unit 2 TDAFW pump steam admission valves. The valves were located in the Main Steam Valve House.

The licensee determined that this issue was also applicable to Unit 1. The licensee entered this issue in their corrective action program as condition report (CR) 1017083 and established compensatory actions until the Unit 1 and 2 procedures were revised.

Analysis: The site's failure to maintain adequate procedural guidance to operate the Unit 2 TDAFW pump for a fire in FA 15-2 was determined to be a performance deficiency. This performance deficiency was more than minor because it was associated with the procedure quality attribute of the reactor safety mitigating systems cornerstone and it affected the cornerstone objective of protection against external events (i.e., fire). The inadequate procedural guidance affected the fire protection defense-in-depth element involving safe shutdown of the reactor. The finding was screened in accordance with NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," Attachment 4, "Initial Characterization of Findings," which determined that an IMC 0609, Appendix F, "Fire Protection Significance Determination

Process,” review was required as the finding involved post-fire safe shutdown. The finding category of “Post-Fire Safe Shutdown” was assigned, based upon that element of the FPP being impacted. Using IMC 0609, Appendix F, Attachment 1, “Fire Protection Significance Determination Process Worksheet,” the inspectors determined that the finding was of very low safety significance (Green) at Task 1.3.1, Question A, based upon observations that there were no credible fire scenarios which would likely result in simultaneous fire damage to the cables for the Unit 2 TDAFW pump SOV’s and both Unit 2 MDAFW pumps. No cross-cutting aspect was identified because the issue was determined to not reflect current licensee performance.

Enforcement: NAPS Technical Specification 5.4.1.a. requires that written procedures shall be established, implemented, and maintained covering the activities recommended in Regulatory Guide 1.33, Appendix A, Rev. 2, dated February 1978. Regulatory Guide 1.33, Appendix A, Section 6.v., required procedures for combating emergencies such as plant fires.

Contrary to the above, the licensee did not meet the requirements of NAPS Technical Specification 5.4.1.a. The inspectors identified on November 4, 2015, that the licensee did not provide adequate guidance in Unit 2 Procedure 2-FCA-11 for implementation of the alternative shutdown capability for a fire in the quench spray pump house. Specifically, the procedure did not include actions to locally fail open the TDAFW pump steam admission valves to allow operation of the pump. The licensee initiated CR 1017083 and established compensatory actions until the procedures were revised. This condition has existed since at least 2006 when Rev. 3 of procedure 2-FCA-11 was issued. Because the finding was of very low safety significance and it was entered in the licensee’s corrective action program as CR 1017083, this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. The violation is identified as NCV 05000338 & 05000339/2015008-01, Inadequate Procedural Guidance for Implementing Alternative Shutdown for a Fire in the Unit 2 Quench Spray Pump House.

.06 Circuit Analyses

a. Inspection Scope

The inspectors reviewed the licensee’s UFSAR, applicable portions of the SSA described in the NAPS “Appendix R Fire Protection Report”, post-fire procedures, and system flow diagram drawings to gain an understanding of the licensee’s SSD strategy in order to verify that the licensee had identified required and associated circuits that may impact post-fire SSD for the selected FAs. This review included accessing the potential for flow diversion paths, loss of function, or other scenarios that would adversely impact the plant’s ability to achieve and maintain SSD conditions. Specifically, the team reviewed credited components specified in the NAPS Appendix R Report for meeting the SSD function and reviewed cable routing information for these credited components to determine if they would be impacted by a fire within the chosen FAs. Additionally, the team reviewed the licensee’s post-fire SSD procedures and compared them with the post-fire SSD analysis and component separation analysis for the selected FAs.

The team reviewed a representative sample of the credited SSD components in the selected FAs to verify that the components specified in the post-fire SSD procedures were available for a postulated fire and met their SSD function. The inspectors also reviewed cable routing drawings, electrical one-line diagrams, Appendix R Block diagrams, penetration and conduit plan drawings, and electrical control wiring diagrams for these selected SSD components to determine if these cables had either been adequately protected from the potentially adverse effects of fire damage or analyzed to show that fire induced faults would not prevent post-fire SSD. Specifically, this review analyzed whether identified combinations of individual circuit conductors, which if shorted together due to fire damage, could cause spurious operation or non-operation. The inspectors conducted walk-downs of the chosen FAs to help determine if the credited components relied upon for SSD would still be available given a fire in the chosen FAs. For instances where cables traversed through the selected FAs, the inspectors performed more detailed circuit analysis to verify fire-induced damage would not adversely impact the credited SSD methodology.

Additionally, a review was conducted of cable routing information for credited active fire protection and SSD components to determine if a fire in the selected FAs would impact the credited defense-in-depth systems. The team reviewed the licensee's evaluations for spurious circuit failure scenarios (single and/or multiple) specified in the circuit analysis to determine if the sample list of components challenged the assumptions made in the SSD analysis ("Appendix R Report"). The inspectors reviewed the licensee's electrical breaker coordination study calculations to determine if power supplies were susceptible to fire damage, which would potentially affect the credited components for the FAs chosen for review. The specific components and references reviewed are listed in the Attachment.

b. Findings

No findings were identified.

.07 Communications

a. Inspection Scope

The team reviewed the plant communications systems that would be relied upon to support safe shutdown, fire event notification, and fire brigade fire-fighting activities. The team reviewed communication system drawings and performed walk-downs to ensure the system would remain operable during a fire event. The team also verified the alternate power source would be capable of maintaining the communication system in the event of a loss of offsite power. Portable radio vendor documentation was reviewed to verify that battery endurance was sufficient to combat a plant fire. The team inspected the contents of designated emergency storage lockers and reviewed the FCA procedure to verify that portable radio communications and fixed emergency communications systems were available, operable, and adequate for the performance of designated SSD activities. The team observed portable radio communication demonstrations between the MCR and selected FCA procedure local operator action locations to verify clear communications for the SSD action locations.

b. Findings

No findings were identified.

.08 Emergency Lighting

a. Inspection Scope

The team assessed the adequacy of emergency light units that were credited for the performance of post-fire safe shutdown operator manual actions in the selected fire areas. The team performed plant walk-downs and observed the placement and coverage area of fixed 8-hour battery pack emergency lights to evaluate their adequacy for illuminating access and egress pathways; and for illuminating SSD equipment or instrumentation. The team observed installed lights to verify they were aimed as referenced in plant specific drawings.

b. Findings

No findings were identified.

.09 Cold Shutdown Repairs

a. Inspection Scope

The team reviewed the "Appendix R Report" and FCA procedures to verify that the licensee identified repairs needed to reach and maintain cold shutdown and had dedicated repair procedures, equipment, and materials to accomplish these repairs after a fire event assuming offsite power was not available. Electrical maintenance repair Procedure 0-ECM-0204-01, "Installation of Temporary Residual Heat Removal Motor Feeder Cables," described methods for repairing equipment needed to bring the unit from hot standby to cold shutdown following a fire event. The team inspected the fire damage repair kits and inventoried their contents in accordance with station procedure 0-EPM-2304-02, "RHR Appendix R Equipment Inspection," to verify that repair kits necessary to restore the RHR Pumps were adequately maintained. The team reviewed these procedures to verify that the fire damage repair procedures were current and adequate. The team inspected the NAPS Warehouse Appendix R Storage area to examine the material condition of the tools and equipment in the designated storage area. The team reviewed licensee inventory records to verify that repair parts and equipment were maintained in accordance with the applicable attachments in the electrical maintenance procedures and to verify that all required replacement parts and equipment were being accounted for and were available for use.

b. Findings

Introduction: The inspectors identified a Green non-cited violation (NCV) of North Anna Power Station, Units No.1 and No. 2, Renewed Facility Operating License, Conditions 2.D, "Fire Protection," for the failure to ensure that the turbine-driven auxiliary feed water pump had the capability to provide sufficient flow such that residual heat removal entry conditions could be achieved during fire events.



Description: North Anna's fire protection license required that cold shutdown conditions be achieved within 72 hours during fire events. Fire safe shutdown procedures (FSSD) direct operators to place the residual heat removal (RHR) system in service when the reactor coolant system (RCS) is less than 350 degrees F. An RCS temperature of 350 degrees F equates to an approximate saturated steam pressure of 120 PSIG in the steam generators (SG). The FSSD procedures directed operators to perform a RCS cooldown using the steam generator(s) and the auxiliary feedwater (AFW) system. In most fire areas that utilized an alternate safe shutdown strategy, the turbine-driven AFW pump was the only credited means for replenishing SG inventory. In these areas, the site's "Appendix R Report" stated that both motor-driven AFW pumps would be adversely affected by the fire event. The site's "Appendix R Report," Section 3.4.5 "Auxiliary Feedwater System," stated that "the TDAFW pump was capable of operating down to the steam pressure that corresponds to the RCS pressure and temperature at which the residual heat removal (RHR) system may be placed in service." The Unit 1 and 2 fire areas that credited the TDAFW pump as the only means of achieving RHR entry conditions were: Main Control Room; Emergency Switchgear Room; Cable Vault and Tunnel; Auxiliary, Fuel, and Decontamination Buildings; Quench Spray Room Pump House and Safeguards Area.

The inspectors identified the following deficiencies when assessing the capability of the TDAFW pump to provide required flows at low steam pressures.

Calculation ME-0968, "Evaluation of the TDAFW Pump Performance at Low Steam Pressures (dated 08/15/2013)," was performed to assess the capability of the turbine-driven AFW pump to provide the required flow when supplied with reduced steam pressure (125, 300, and 600 PSIG). The calculation stated that the pump was designed to operate with 1,100 PSIG inlet steam pressure (with a minimum of 800 PSIG) at a speed of 4,200 RPM. Vendor information, included in the calculation, stated that the pump was susceptible to excessive vibration and inadequate lubrication if operated below 2,000 RPM. The calculation determined that at 125 PSIG the pump would not provide the required flow of 300 GPM with a minimum pump speed of 2000 RPM. The inspectors determined that the results of this calculation were not translated into the fire protection program - the inspectors were informed that this calculation was performed to meet FLEX requirements.

Calculation ME-0572, "TDAFW Pump at the Point of the RHR System is Placed in Service (dated 10/07/1999)," determined that the TDAFW was capable of providing a minimum flow rate of 300 GPM when supplied with a SG outlet pressure of 120 PSIG. The inspectors determined that the licensee failed to account for steam supply piping friction losses, and failed to account for pump efficiency losses in the brake horsepower calculation.

Based on this information, the inspectors determined that the licensee failed to demonstrate that the Unit 1 and 2 TDAFW pumps had the capability to provide the required flow to achieve RHR entry conditions; and that the licensee failed to ensure that the TDAFW pumps would be operated above the minimum required pump speed. As a result, the site would not be able to reach cold shutdown conditions within 72 hours as required. The licensee entered this issue in their corrective action program as CR 1017291 with an action to re-evaluate the capability of the TDAFW pumps to achieve RHR entry conditions.

The inspectors identified Teamwork (H.4) as the cross-cutting aspect in the area of Human Performance because the results of Calculation ME-0968, completed in 2013, were not communicated across organizational boundaries to ensure that nuclear safety was maintained. Specifically, the site failed to effectively communicate between the FLEX and fire protection groups to establish the criteria for assessing the turbine-driven AFW pumps or to translate the results of calculation such that the deficiency could be identified and corrected.

Analysis: The site's failure to provide reasonable assurance that the turbine-driven AFW pump had the capability to provide sufficient flow such that RHR entry conditions could be met was a performance deficiency. This performance deficiency was more than minor because it was associated with the design control attribute of the reactor safety mitigating systems cornerstone and it affected the cornerstone objective of protection against external events (i.e., fire). The performance deficiency adversely affected the site's capability to achieve cold shutdown conditions in 72 hours for a fire event. The finding was screened in accordance with NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," Attachment 4, "Initial Characterization of Findings," which determined that an IMC 0609, Appendix F, "Fire Protection Significance Determination Process," review was required as the finding involved post-fire safe shutdown. The finding category of "Post-Fire Safe Shutdown" was assigned, based upon that element of the FPP being impacted. Using IMC 0609, Appendix F, Attachment 1, "Fire Protection Significance Determination Process Worksheet," the inspectors determined that the finding was of very low safety significance (Green) at Task 1.3.1, Question A, because the performance deficiency did not adversely affect the capability to reach and maintain hot safe shutdown conditions. The inspectors identified the performance deficiency had a cross-cutting aspect of Teamwork in the Human Performance area (H.4).

Enforcement: North Anna Power Station, Units No.1 and No. 2, Renewed Facility Operating License, Conditions 2.D, "Fire Protection," stated, in part, that VEPCO shall implement and maintain in effect all provisions of the approved fire protection program as described in the Updated Final Safety Analysis Report for the facility and as approved in the SER dated February 1979.

FSAR, Section 9.5.1, "Fire Protection," stated, in part, that the station's fire protection program satisfied the regulatory criteria set forth in 10 CFR 50, Appendix R, Section III.G. Section III.G.3 stated, in part, that an alternative or dedicated shutdown capability was required when the protection requirements of Section III.G.2 could not be met. Appendix R, Section III.L provided alternative shutdown requirements.

10 CFR 50, Appendix R, Section III.L.(d) and (e), stated, in part, an alternative or dedicated shutdown capability shall be able to achieve cold shutdown conditions within 72 hours; and maintain cold shutdown conditions thereafter.

Contrary to the above, since August, 2013, the licensee failed to provide an alternative shutdown strategy with the capability to achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter. Specifically, the licensee failed to provide reasonable assurance that turbine-driven AFW pumps had the capability to provide sufficient steam generator make-up inventory during a reactor plant cooldown such that RHR entry conditions could be met. The RHR system must be operated to achieve cold shutdown conditions. Because the finding was of very low safety

significance and it was entered in the licensee's corrective action program as CR 1017291, this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. The violation is identified as NCV 05000338 & 05000339/2015008-03, Failure to Ensure that the Turbine-driven Auxiliary Feed Water Pump had the Capability to Provide Sufficient Flow Such that Residual Heat Removal Entry Conditions Could Be Achieved during Fire Events.

.10 Compensatory Measures

a. Inspection Scope

(1) Compensatory Measures for Degraded Fire Protection Components

The team reviewed administrative controls for out-of-service, degraded and/or inoperable fire protection features (e.g. detection and suppression systems and passive fire barriers) to verify the adequacy of FPP interim compensatory measures.

(2) Operator Manual Actions as Compensatory Measures for Safe Shutdown

This portion of the inspection procedure was not applicable because the selected fire areas were licensed in accordance with Appendix R, Section III.G.3. Section 1R05.05 assessed alternative shutdown operator manual actions.

b. Findings

No findings were identified.

.11 Review and Documentation of Fire Protection Program Changes

a. Inspection scope

The inspectors reviewed a sample of FPP changes to determine if the changes to the FPP were in accordance with the fire protection license condition and had no adverse effect on the ability to achieve SSD. The following modifications were reviewed: replacement of the fuel oil pump house fire detection and extinguishing system; replacement of the 17 Ton CO2 tank 1-FP-TK-5; removal of automatic reset function to 2H Appendix R lockout relays; and the site's revision of Technical Requirements Manual, Section 7.5, "Appendix R Alternate Shutdown Equipment / Maintenance Rule (a)(4) Fire Risk Equipment." Design change documents reviewed by the inspectors are listed in the Attachment.

b. Findings

No findings were identified.

.12 Control of Transient Combustibles and Ignition Sources

a. Inspection Scope

The inspectors conducted tours of risk significant plant areas to assess the licensee's implementation of fire protection requirements as described in procedures CM-AA-FPA-100, "Fire Protection/Appendix R (Fire Safe Shutdown) Program," and CM-AA-FPA-101, "Control of Combustible and Flammable Materials." The inspectors verified that the licensee had adequately evaluated in-situ combustible fire loads, limited transient fire

hazards, controlled hot-work activities, and maintained general housekeeping consistent with administrative control procedures and the “Appendix R Report.” The inspectors evaluated generic fire protection training, fire event history, the potential for fires or explosions, the combustible fire load characteristics, and the potential fire severity exposure to verify that the site’s procedures were adequate to control transient combustibles and ignition sources as described in the site’s fire protection program. There were no hot work activities ongoing within the selected FAs during the inspection, therefore no observations were performed.

b. Findings

No findings were identified.

.13 B.5.b Inspection Activities

a. Inspection Scope

The inspectors reviewed the licensee’s mitigation strategy to “manually depressurize steam generators and use the portable pump” during large fires and explosions to verify that the measure was feasible, personnel were trained to implement the strategy, and equipment was properly staged and maintained. Through discussions with plant staff, review of documentation, and plant walk-downs, the inspectors assessed the capability of the equipment to provide the makeup capacity required by this strategy. This review included an assessment of the water source and the minimum fuel supply required by the portable pump. The inspectors verified, by review of records and physical inspection, that B.5.b equipment was currently being properly stored, maintained, and tested in accordance with the licensee’s B.5.b program procedures.

b. Findings

No findings were identified.

4OA2 Identification and Resolution of Problems

a. Inspection Scope

The inspectors verified that the licensee identified fire protection and post-fire SSD issues at an appropriate threshold and entered them into the corrective action program. The inspectors reviewed a sample of selected issues to verify that the licensee had taken or planned appropriate corrective actions. The CRs were reviewed with regard to the attributes of timeliness and apparent cause determination to ensure that proposed corrective actions addressed the apparent cause, reportability and operability determination. The inspectors also reviewed a sample of licensee independent audits, self-assessments, and system/program health report for thoroughness, completeness and conformance to FPP requirements. The documents reviewed are listed in the Attachment.

b. Findings

No findings were identified.

## 4OA5 Other Activities

.01 (Opened) Unresolved Item (URI) 05000338 & 05000339/2015008-02, Operator Manual Action that Ensured Auxiliary Feedwater Pumps Have Sufficient Make-up Inventory

Introduction: The inspectors identified an Unresolved Item (URI) associated with the emergency condensate storage tank (ECST) level indication/setpoints and associated operator actions that ensures the auxiliary feedwater (AFW) pumps have an adequate suction source.

Description: UFSAR, Section 7.4-2, states that the emergency condensate storage tank (ECST) was designed to supply the initial eight hours of water to the auxiliary feedwater (AFW) pumps during licensing bases events. The inspectors noted that the licensee utilized operator actions to reduce AFW flow during the initial stages of events which is typically accomplished in order to prevent over cooling of the primary RCS during events where maximum AFW is not required. For events where maximum AFW may be required, the licensee developed calculations to ensure that an adequate water supply was maintained. The licensee's Calculation ME-0584, "Maximum AFW Pump Flow and NPSH Analysis," (dated 11/04/1999) determined that AFW flow reduction was required within the initial 30 minutes of an event to ensure that the pumps had sufficient net positive suction head. The inspectors determined, in some cases, that operator actions would be required prior to the receipt of the ECST tank level alarm that was described UFSAR Section 10.4.3.3, which stated that the ECST had redundant ECST safety-level alarms (1/2-CN-LI-200A and -200B) to alert operators that sufficient inventory remained for 20 minutes of pump operation at the highest-volume flow rates. Additionally, the inspectors noted that a Virginia Electric Power Company letter, dated December 22, 1999, stated that "*Technical Specifications ensure that the level maintained in the ECST is adequate to mitigate the accident without operator action during a design basis accident. Therefore, the indication of ECST level is not required as a "Type A" variable. Indication of ECST level remains a Type D, Category 1 variable...*"

This issue is unresolved pending the NRC's review of applicable licensing requirements, calculations, and operating procedures to assess the adequacy of the ECST level indication/setpoints and associated operator actions to ensure that the AFW pumps have an adequate suction source as described by their licensing design basis. This issue is identified as URI 05000338 & 05000339/2015008-02, ECST Level Indication/Setpoints and Associated Operator Action that Ensures the Auxiliary Feedwater Pumps have an Adequate Suction Source.

## 4OA6 Meetings, Including Exit

On December 16, 2015, the lead inspector presented the inspection results to Mr. M. Becker, acting NAPS Plant Manager and other members of the licensee's staff. A preliminary exit was conducted on November 6, 2015, and additional inspection was performed in the RII office until December 10, 2015. The lead inspector confirmed that proprietary information was not reviewed during the inspection and that all security-related information had been returned to the site.

ATTACHMENT: SUPPLEMENTARY INFORMATION

## **SUPPLEMENTARY INFORMATION**

### **KEY POINTS OF CONTACT**

#### Licensee Personnel

B. Miller, Appendix R Coordinator  
D. Struckmeyer, Supervisor, Engineering Programs  
R. Page, Licensing Engineer  
J. Martin, Dominion - Fleet Appendix R Lead  
D. Spears, Operations

#### NRC Personnel

A. Gody, Division Director, Division of Reactor Safety, Region II  
G. Kolcum, Senior Resident Inspector, North Anna Power Station Units 1 & 2  
S. Shaeffer, Branch Chief, Division of Reactor Safety, Region II  
G. Skaggs Ryan, Resident Inspector, North Anna Power Station Units 1 & 2

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

|                           |     |   |
|---------------------------|-----|---|
| 05000338 & 339/2015008-02 | URI | ECST Level Indication/Setpoints and Associated Operator Action that Ensures the Auxiliary Feedwater Pumps have an Adequate Suction Source (4OA5.01) |
|---------------------------|-----|---|

### Opened and Closed

|                           |     |   |
|---------------------------|-----|---|
| 05000338 & 339/2015008-01 | NCV | Inadequate Procedural Guidance for Implementing Alternative Shutdown for a Fire in the Unit 2 Quench Spray Pump House (1R05.05.b.1) |
|---------------------------|-----|---|

|                           |     |  |
|---------------------------|-----|--|
| 05000338 & 339/2015008-03 | NCV | Failure to Ensure that the Turbine-driven Auxiliary Feed Water Pump had the Capability to Provide Sufficient Flow Such that Residual Heat Removal Entry Conditions Could Be Achieved during Fire Event (1R05.09) |
|---------------------------|-----|--|

### Discussed

None

## LIST OF COMPONENTS REVIEWED

### Valves

1-FP-246 – Power Block Fire Header / Warehouse Header Cross Connection Isolation Valve  
1-FP-298 – Cable Vault Tunnel Deluge Valve  
1-FP-299 – Cable Vault Tunnel Deluge Isolation Valve  
2-CH-LCV-2460A, Letdown Isolation Valve  
2-FW-MOV-200A, AFW Discharge to S/G “A” MOV  
2-FW-MOV-200B, AFW Discharge to S/G “B” MOV  
2-FW-MOV-200C, AFW Discharge to S/G “C” MOV  
2-FW-MOV-200D, TDAFW Discharge to S/G “A” MOV  
2-RC-PCV-2456, U2 PZR PORV  
2-RC-PCV-2455C, U2 PZR PORV

### Pump Motors

1-FP-P-1, Motor-Driven Fire Pump  
1-FP-P-2, Diesel-Driven Fire Pump  
1-FP-P-10, Warehouse Diesel-Driven Fire Pump  
1-FP-P-11, Warehouse Motor-Driven Fire Pump  
2-FW-P-2, U2 TDAFW Pump  
2-FW-P-3A, U2 MDAFW Pump “A”  
2-FW-P-3B, U2 MDAFW Pump “B”  
2-GN-P-1, U2 S/G Vacuum Pump

### Process Instruments

1-EI-CB-203, App. “R” Alternate Monitoring Panel  
1-EP-CB-002, U1 App. “R” Monitoring Panel  
1-FP-CP-100 , U1 ESGR Halon Control Panel  
2-EI-CB-202, 2H EDG Isolation Cabinet  
2-EP-CB-002 , U2 App. “R” Monitoring Panel  
2-EP-CB-46A, RWST Heat Trace Cabinet  
2-EP-CB-46A, Heat Tracing Annunciator Cabinet  
2-FW-LT-2477, S/G “A” WR Level Transmitter  
2-FW-LT-2487, S/G “B” WR Level Transmitter  
2-FW-LT-2497, S/G “C” WR Level Transmitter  
2-FW-LI-2477A, S/G “A” WR Local Level Indicator  
2-FW-LI-2487A, S/G “B” WR Local Level Indicator  
2-FW-LI-2497A, S/G “C” WR Local Level Indicator  
2-FP-CP-100, U2 ESGR Halon Control Panel  
2-MS-PT-2474, S/G “A” WR Pressure Transmitter  
2-MS-PT-2485, S/G “B” WR Pressure Transmitter  
2-MS-PT-2496, S/G “C” WR Pressure Transmitter  
2-NM-NFD-290, U2 Excore Gammametrics

### Fire Barriers

Rated Walls / Floor / Ceiling - Fire Area 6-2, Emergency Switchgear Room (U 2)  
Rated Walls / Floor / Ceiling - Fire Area 14A-2, Turbine-driven Auxiliary Feedwater Pump (U 2)  
Rated Walls / Floor / Ceiling - Fire Area 14B-2, Motor-Driven Auxiliary Feedwater Pump (U 2)  
Rated Walls / Floor / Ceiling - Fire Area 15-2, Quench Spray Room Pump House and Safeguards Area (U 2)



Fire Damper Identification

1041 Battery Room Ceiling to ESGR (Fire Area 7B-1 to Fire Area 6-2)  
1042 Battery Room Ceiling to ESGR (Fire Area 7B-1 to Fire Area 6-2)  
1043 Battery Room Ceiling to ESGR (Fire Area 7D-1 to Fire Area 6-2)  
1044 Battery Room Ceiling to ESGR (Fire Area 7D-1 to Fire Area 6-2)

Fire Door Identification

01-BLD-STR-54-8, Double Doors Between Unit 1/Unit 2 ESGR  
02-BLD-STR-54-11, Single Door Between U2 Turbine Building and Unit 2 ESGR  
02-BLD-STR-5412, Single Door Between Unit 2 ESGR and Battery Room 2-II  
02-BLD-STR-S54-13, Single Door Between Unit 2 Air Condition Chiller Room and Equipment Room

Fire Barrier Seal Identification

2CK0870B, QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2WL039N01, QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2CX053NA, QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2CX024NA, QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2CX053ND, QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2CX053NB - QSPH (FA 15-2) to Cable Vault (FA 3-2)  
2WX978N01, Turbine-driven Auxiliary Feed Pump Room (North Wall)  
2CKO870B, Quench Spray (FA15-2) to Cable Vault (FA3-2)  
2WLO39N01, Quench Spray (FA15-2) to Cable Vault (FA3-2)  
2CXO53NA, Quench Spray (FA15-2) to Cable Vault (FA3-2)  
2CXO53ND, Quench Spray (FA15-2) to Cable Vault (FA3-2)  
2CXO53NB, Quench Spray (FA15-2) to Cable Vault (FA3-2)

## LIST OF DOCUMENTS REVIEWED

### Audits & Self-Assessments

Fire Protection System Health Report, Q1-2015  
Fire Protection System Health Report, Q2-2015  
Nuclear Oversight Audit 15-4, Fire Protection Program, July 14, 2015  
2015 Triennial Fire Protection Preparation Assessment NAPS Report SAR 003051, 3/2015

### Calculations, Evaluations & Specifications

1619F101MAINA, Summary of Hydraulic Calculations for Unit One Main Transformer (s) A, B & C, 10/08/2004  
1619F201MAINA, Summary of Hydraulic Calculations for Unit Two Main Transformer (s) A, B & C, 10/08/2004  
DBD-NAPS-FP, System Design Basis Document for Fire Protection System, North Anna Power Station, Rev. 15  
EE-0395, Breaker Coordination Calculation, Attachment 2, MCC 1J1-2N-A2, Rev. 2  
EP-0015, Technical Report, Fire Protection Information Relating to Appendix A to BTP 9.5-1, 1979 SER and National Fire Protection Association (NFPA) Codes, Rev. 0  
EP-0017, Combustible Loading Analysis, Rev. 12  
ET-CEP-00-0006, Evaluation of the Potential for Flooding in the Emergency Switchgear Rooms, Rev. 1  
ET-CEP-00-0009, Evaluation of Smoke Detector Design Criteria-Emergency Switchgear Rooms, North Anna Power Station, Units 1 & 2, Rev. 0  
ME-0572, TDAFW Pump Operation at the Point RHR System is Placed in Service, Rev. 0  
ME-0584, Maximum AFW Pump Flow and NPSH Analysis, dated 11/04/1999  
ME-0593, ECST 20 Minute Remaining Low Level Alarm Set Point, dated 01/26/2000  
ME-0924, North Anna Power Station Unit 1 & 2 Hydraulic Model for Sprinkler Systems Installed in Safety-Related Areas, Rev. 0  
OE Evaluation Response, N-1998-4028-E1, IN 98-31, Fire Protection System Design Deficiencies and Common Mode Flooding of Emergency Core Cooling System Rooms at Washington Nuclear Project Unit 2, 8/26/1998  
OE Evaluation Response, N-1998-4403-E1, SER 3-98, Recurring Event, Flooding of ECCS Rooms Caused by Fire Protection System Water Hammer, 9/03/1998  
OEE 001737 Fire Main Internally Clogged, Ginna Unit 1, 12/09/2014  
SE-0008, Head Loss Calculation for the Main Fire Loop, Rev. 0  
SM-1769, Thermal-Hydraulic Analysis for North Anna Appendix R Fire in the Emergency Switchgear Room or Cable Vault-Tunnel Areas and the MDAFW Pump Room Area, Rev. 0  
X3C708, Fire Event Safe Shutdown Circuit Analysis, Version 27

### Codes and Standards

Fire Protection Handbook, 14th Edition  
Underwriters Laboratories, Fire Resistance Directory, 1/1998  
Underwriters Laboratory Standard 555, Standard for Fire Dampers and Ceiling Dampers, dated 05/14/1979  
National Fire Protection Association Code 20, Centrifugal Fire Pumps, 1972 Edition

### Completed Surveillance Procedures, Test Records, & Work Orders (WO)

0-GOP-17.0, Time Critical Action Validation and Verification, Completed 02/11/2013

0-GOP-17.0, Time Critical Action Validation and Verification, Completed 07/26/2015  
 1-PT-100.1.1, Motor Driven Fire Protection Pump 1-FP-P-1 Exercise, 7/13/2015  
 0-PT-100.1.2, Diesel Driven Fire Protection Pump 1-FP-P-1 Exercise, 7/30/2015  
 0-PT-100.2, Fire Protection Pumps Annual Test, 8/13/2015  
 0-PT-100.6, Fire Protection-Main Loop Flow Test, 7/31/2006  
 0-FPMP-5, Fire Brigade Staging, U1 Mezzanine Level Storage Lockers and TSC Emergency Response Cabinet Equipment Check, 6/25/2015  
 0-FPMP 10.0, Fire Drill Report, E Shift, SBO Diesel, (Unannounced Drill in Accordance with Generic Letter 82-21), 5/06/2015  
 0-FPMP 10.0, Fire Drill Report, A Shift, Main Steam Valve House, 1/25/2015  
 0-FPMP 10.0, Fire Drill Report, B Shift, Main Steam Valve House, 1/28/2015  
 0-FPMP 10.0, Fire Drill Report, C Shift, Main Steam Valve House, 2/04/2015  
 0-FPMP 10.0, Fire Drill Report, D Shift, Main Steam Valve House, 2/11/2015  
 0-FPMP 10.0, Fire Drill Report, E Shift, Turbine Deck, 2/19/2015  
 0-FPMP 10.0, Fire Drill Report, A Shift, SBO Diesel, 6/10/2015  
 0-FPMP 10.0, Fire Drill Report, B Shift, SBO Diesel, 5/13/2015  
 0-FPMP 10.0, Fire Drill Report, C Shift, SBO Diesel, 5/27/2015  
 0-FPMP 10.0, Fire Drill Report, D Shift, SBO Diesel, 5/27/2015  
 0-FPMP 10.0 Fire Drill Report, A Shift B.5.b RCS Cooldown, 9/21/2010  
 0-FPMP 10.0 Fire Drill Report, B Shift B.5.b RCS Cooldown, 9/12/2010  
 0-FPMP 10.0 Fire Drill Report, C Shift B.5.b RCS Cooldown, 9/16/2010  
 0-FPMP 10.0 Fire Drill Report, D Shift B.5.b RCS Cooldown, 9/12/2010  
 0-FPMP 10.0 Fire Drill Report, E Shift B.5.b RCS Cooldown, 8/19/2010  
 0-MPM 1205-4, Door and Closure Inspection Unit 2, Rev. 11, 8/31/2015  
 0-MPM 1205-5, Door and Closure Inspection Unit 2, Rev. 7, 7/23/2015  
 0-PT-103.3, Backup Repeater Testing For Radio Trunking, 11/13/2014  
 0-PT-103.3, Backup Repeater Testing For Radio Trunking, 05/18/2015  
 0-PT-107.7, Appendix "R" Locker Inspections, 8/25/2015  
 0-PT-107.7, Appendix "R" Locker Inspections, 9/17/2015  
 NQC 4002, Report of Calibration, September 30, 2015  
 WO 59102612860, Fire Door Inspection, 11/24/2014  
 WO 59102827154, Hose Station Inspection, 8/12/2015  
 WO 59102009421, Fire Protection-Hose Station Flow Test, 6/06/2013  
 WO 59102707807, Fire Protection-Simplex Fire Detectors-Outside Containment-Channel Operational Test, 4/09/2015  
 WO 59102827617, Fuel Oil Sampling-Service Water Reservoir and Warehouse, 8/08/2015  
 WO 59102854951, Fire Extinguisher Inspection-Control Room, Service Building and Misc., 10/08/2015  
 WO 59102691411, Fire Protection-Fire Damper Inspection, 7/20/2015  
 WO 59102319548, Fire Protection-Fire Damper Functional Operability Test, 6/22/2015  
 WO 59102666426, Fire Protection-Halon System Flow test Unit 2 Emergency Switchgear R Room, 4/21/2015  
 WO 59102675762, Emergency Switchgear Room Halon System Functional Test, 1/08/2015  
 WO 59102614738, Fire Hydrant Gate Valve Inspections, 11/05/2014  
 WO 59102313004, 1-PT-105.1.6, Rev. 2, Fire Protection-Fire Damper Functional Operability Test, 6/25/2015  
 WO 59102319548, 2-PT-105.1.6, Rev. 3, Fire Protection-Fire Damper Functional Operability Test, 6/22/2015  
 WO 59102780151 (Install) / WO59102780155 (Remove), Temporary Modification No. 1214, Removal of Automatic Reset Function to 2H Appendix R Lockout Relays, 9/26/2014  
 WO 59102376708, Seal Penetration 2FC001N11 in Unit 2 Cable Tray Room Floor

WO 59102503014, Seal Penetration Openings 02EE-EG-04C Cabinet  
 WO 00432789-01, 1-FP-P-1 Pressure Switch Calibration, 9/29/2000  
 WO 00468932-01, 1-FP-P-1 Pressure Switch Calibration, 2/01/2003  
 WO 00733539-01, 1-FP-P-1 Pressure Switch Calibration, 11/02/2006  
 WO 59101657793, 1-FP-P-1 Pressure Switch Calibration, 2/19/2010  
 WO 59102076626, 1-FP-P-1 Pressure Switch Calibration, 8/16/2012  
 WO 59102502781, 1-FP-P-1 Pressure Switch Calibration, 12/3/2014  
 WO 59075271301, Fire Protection, Main Fire Loop Flow Test, 1/15/2010  
 WO 59102058297 Fire Protection, Main Fire Loop Flow Test, 5/08/2012  
 WO 59102835769, Aux. Shutdown Panel Monitoring Instrumentation – Channel Check,  
 9/03/2015  
 WO 59102731706/0-ECM-2808-02, Troubleshooting and Repair of Emergency Lights,  
 Completed 08/18/2015  
 WO 59102731706/0-EPM-2808-18, Charging Emergency Light Batteries, Completed  
 08/18/2015  
 WO 59102844518/0-PT-107.0, Appendix R Locker Inspection, Completed 08/25/2015  
 WO 59102857701/0-PT-107.0, Appendix R Locker Inspection, Completed 09/17/2015  
 WO 59102852615/0-EPM-2808-09, Inspection and Testing of Appendix R Emergency Light  
 WO 602482, U2 Service Water Spray Array SI Signal Actuation Cross-Tie Test, 10/02/2014  
 WO 665881, U1 Service Water Spray Array SI Signal Actuation Cross-Tie Test, 3/21/2015

#### Condition Reports (CRs) Generated as a Result of this Inspection

1014828, ELTs for AFW need to be repositioned  
 1014829, 2-ELT-ELT-FW9A needs to be repositioned  
 1014830, 2-ELT-ELT-FW9B needs to be repositioned  
 1014831, Question on 2-ELT-ELT-CV3D  
 1014840, 2-ELT-ELT-FW1A needs to be repositioned  
 1015161, SE-0008 head loss calculation for main fire Loop not revised to reflect DC 07-016  
 changes  
 1015188, U2 QSPH sump pump does not appear to be working  
 1015185, Update Drawing 12050-FM-314A, 10/23/2015  
 1015585, Sequential Starting of Fire Pumps  
 1017081, Handswitch not periodically tested for Halon damper isolation  
 1017083, During the 2015 TFPI, a discrepancy noted in Appendix R procedure 2-FCA-11  
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 1017234, Discrepancy found in calculation SM-1769 for AFW throttling TCOA (2015 TFPI Item)  
 1017244, TFPI Three observations from NRC on B5b RCS cooldown walk through  
 1017255, TFPI TRM 7.5 revision needed to address concern with 2-MS-TV-211A circuit in  
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## LIST OF ACRONYMS AND ABBREVIATIONS

|                 |   |
|-----------------|---|
| AFW             | auxiliary feedwater   |
| AOP             | Abnormal Operating Procedure  |
| APCSB           | Auxiliary and Power Conversion Systems Branch                           |
| B.5.b           | Refers to a section of Interim Compensatory Measures Order, EA-02-026   |
| BTP             | Branch Technical Position   |
| CAP             | Corrective Action Program   |
| CC              | component cooling   |
| CFR             | Code of Federal Regulations   |
| CO <sub>2</sub> | carbon dioxide  |
| CR              | Condition Report  |
| CVCS            | chemical & volume control system  |
| CV&T            | cable vault and tunnel  |
| ECM             | electrical corrective maintenance                                       |
| ELU             | emergency lighting unit   |
| EPM             | electrical preventative maintenance                                     |
| ESGR            | emergency switchgear room   |
| FA              | fire area – a volume within the plant enveloped by 3-hour fire barriers |
| FCA             | fire contingency action   |
| FHA             | fire hazards analysis   |
| FPP             | fire protection program   |
| FPR             | Fire Protection Report  |
| FSSD            | fire safe shutdown  |
| Halon 1301      | Bromotrifluoromethane gas   |
| HHSI            | high head safety injection  |
| HVAC            | heating, ventilating and air conditioning                               |
| IN              | Information Notice  |
| IP              | Inspection Procedure  |
| IR              | inspection report   |
| ISI             | in-service inspection   |
| IST             | in-service testing  |
| KV              | kilovolts   |
| MCR             | main control room   |
| MOV             | motor operated valve  |
| NCV             | non-cited violation   |
| NFPA            | National Fire Protection Association                                    |
| NRC             | Nuclear Regulatory Commission   |
| NUREG           | An explanatory document published by the NRC                            |
| OMA             | operator manual action  |
| PORV            | power operated relief valve   |
| RCP             | reactor coolant pump  |
| RCS             | reactor coolant system  |
| RHR             | residual heat removal   |
| SDP             | significance determination process                                      |
| SER             | Safety Evaluation Report  |
| SSA             | safe shutdown analysis  |
| SSD             | safe shutdown   |
| TCOA            | time critical operator action   |
| TRM             | Technical Requirements Manual   |
| UFSAR           | Updated Final Safety Evaluation Report                                  |
| WO              | Work Order  |