



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

July 27, 2016

Mr. David A. Heacock  
President and Chief Nuclear Officer  
Virginia Electric and Power Company  
Innsbrook Technical Center  
5000 Dominion Boulevard  
Glen Allen, VA 23060

**SUBJECT: NORTH ANNA POWER STATION – NRC INTEGRATED INSPECTION  
REPORT 05000338/2016002 AND 05000339/2016002**

Dear Mr. Heacock:

On June 30, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your North Anna Power Station, Units 1 and 2. On July 13, 2016, the NRC inspectors discussed the results of this inspection with Mr. G. Bischof and other members of your staff. Inspectors documented the results of this inspection in the enclosed inspection report.

NRC inspectors documented two NRC-identified findings of very low safety significance (Green) in this report. These finding involved a violation of NRC requirements. The inspectors also documented one licensee-identified violation, which was determined to be of very low safety significance in this report. The NRC is treating the violations as non-cited violations (NCV) 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 Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-001; 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 the North Anna Power Station.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region II, and the NRC Resident Inspector at the North Anna Nuclear Power Station, Units 1 and 2.

D. Heacock

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In accordance with Title 10 Code of Federal Regulations 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

*/RA/*

Steven D. Rose, Chief  
Reactor Projects Branch 5  
Division of Reactor Projects

Docket Nos.: 05000338, 05000339  
License Nos.: NPF-4, NPF-7

Enclosure:  
IR05000338/2016002 and 05000339/2016002  
w/Attachment: Supplemental Information

cc Distribution via ListServ

D. Heacock

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D. Heacock

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Letter to David A. Heacock from Steven D. Rose dated July 27, 2016

SUBJECT: NORTH ANNA POWER STATION – NRC INTEGRATED INSPECTION  
REPORT 05000338/2016002 AND 05000339/2016002

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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: 05000338/2016002 and 05000339/2016002

Licensee: Virginia Electric and Power Company (VEPCO)

Facility: North Anna Power Station, Units 1 & 2

Location: Mineral, Virginia 23117

Dates: April 1, 2016 through June 30, 2016

Inspectors: G. Croon, Senior Resident Inspector  
G. Eatmon, Resident Inspector  
R. Kellner, Senior Health Physicist, Sections 2RS2, 2RS4  
J. Panfel, Health Physicist, Section 2RS5  
J. Rivera, Health Physicist, Sections 2RS1, 2RS3, 4OA1  
G. Ottenberg, Senior Reactor Inspector, Section 1R21  
M. Riley, Reactor Inspector, Section 1R21

Approved by: Steven D. Rose, Chief  
Reactor Projects Branch 5  
Division of Reactor Projects

Enclosure

## SUMMARY

IR 05000338/2016002, 05000339/2016002; 04/01/2016 – 06/30/2016; North Anna Power Station, Units 1 and 2. Maintenance Risk Assessments and Emergent Work Control, Component Design Basis Inspection.

The report covered a three-month period of inspection by resident inspectors and five inspectors from the region. Two NRC identified findings were identified and were determined to be non-cited violations (NCVs). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP), dated April 29, 2015. The cross-cutting aspects were determined using IMC 0310, "Aspects Within the Cross Cutting Areas," dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy dated February 4, 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 NRC identified an NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the inadequate translation of design calculations into compensatory measures when removing missile barriers. The inadequate translation of design calculations into compensatory measures when removing required passive missile shields is a performance deficiency (PD). The PD was more than minor because it was associated with the human performance attribute of the Mitigating System cornerstone and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage). Specifically, the inadequate compensatory measure resulted in the licensee having to make required changes to the compensatory measures in order to resolve missile protection concerns. The inspectors performed the initial significance determination for the finding using NRC Inspection Manual Chapter 0609, Appendix A, Exhibit 4, "External Events Screening Questions," dated July 1, 2012. The finding required a detailed risk evaluation because the safety function of the onsite emergency diesel generators (EDGs) and the function of the station blackout (SBO) diesel were assumed to be completely failed due to inadequate compensatory missile protection measures for a high wind event. The finding has a cross-cutting aspect in the area of human performance associated with the conservative bias attribute because individuals use decision making-practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop [H.14]. The licensee entered this issue into the corrective action program (CAP) as Condition Report (CR)1034958. (Section 1R13)
- Green. The NRC identified an NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to verify the adequacy of design for the protection devices at the 120VAC vital instrumentation buses. Specifically, the licensee's failure to verify that the protective devices at the Unit 1 and Unit 2 120VAC vital instrumentation buses would isolate failed equipment when supplied by the voltage regulating transformer in accordance with IEEE 308-1971 was a PD. The licensee entered this issue into their CAP as CRs 1006865 and 1013278. At the time of the inspection, the licensee was evaluating the issue to determine appropriate corrective actions. This does not present an immediate safety concern because the performance deficiency is related to a non-conformance with a design standard upon which only one train would be affected by a postulated single failure and the

other train would remain available and capable to respond to the design basis accident. The performance deficiency was determined to be more than minor because it adversely affected the Design Control attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failing to isolate failed equipment could lead to tripping the associated 120VAC vital bus, causing unnecessary loss of other safety related equipment connected to the bus. The finding was determined to be of very low safety significance (Green), because it was a deficiency affecting the design or qualification of a structure, system, or component (SSC) and the SSC maintained its operability. This finding was not assigned a cross-cutting aspect because the issue did not reflect current licensee performance. (Section 1R21)

One violation of very low safety significance that was identified by the licensee has been reviewed by the NRC. Corrective actions taken or planned by the licensee have been entered into the licensee's corrective action program. The violation and corrective action tracking numbers are listed in Section 4OA7 of this report.

## REPORT DETAILS

### Summary of Plant Status

Unit 1 began the period at approximately 100 percent rated thermal power (RTP) and operated at RTP for the entire report period.

Unit 2 began the inspection period offline for a planned refueling outage. Unit 2 started up on April 9 and returned to RTP on April 14, 2016, and operated at RTP for the remainder of the inspection period.

#### 1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

#### 1R01 Adverse Weather Protection

##### .1 Review of Offsite Power and Alternate AC Power Readiness

###### a. Inspection Scope

The inspectors reviewed plant features and procedures for operation to verify continued availability of offsite and alternative alternating current (AC) power systems were appropriate. The inspectors reviewed the licensee's procedures affecting those areas, and the communications protocols between the transmission system operator and the nuclear power plant to verify that the appropriate information was exchanged when issues arose that could impact the offsite power system. The inspectors evaluated the readiness of the offsite and alternative AC power systems by reviewing the licensee's procedures that address measures to monitor and maintain the availability and reliability of the offsite and alternative AC power systems.

###### b. Findings

No findings were identified.

##### .2 Seasonal Susceptibilities

###### a. Inspection Scope

The inspectors reviewed the licensee's adverse weather preparations for hot weather operations, specified in 0-GOP-4.1, "Hot Weather Operations," Rev. 32, and the licensee's CAP database for hot weather related issues. The inspectors walked down three risk-significant systems/areas listed below to verify compliance with the procedural requirements and to verify that the specified actions provided the necessary protection for the structures, systems, or components.

- Units 1 and 2 EDGs on April 10, 2016
- Station blackout diesel on June 20, 2016
- Station switchyard on June 28, 2016



b. Findings

No findings were identified.

.3 Impending Adverse Weather Conditions

a. Inspection Scope

The inspectors performed three site specific weather related inspection due to anticipated adverse weather conditions. The inspectors reviewed licensee adverse weather response procedures, including 0-AP-41, "Severe Weather Conditions," Rev. 64, and site preparations including work activities that could impact the overall maintenance risk assessments.

- April 10, 2016, high wind warnings with gusts up to 50 miles per hour for the area
- June 20, 2016, severe thunderstorm with lightning
- June 23, 2016, severe thunderstorm with lightning

b. Findings

No findings were identified.

1R04 Equipment Alignment

Partial Walkdowns

a. Inspection Scope

The inspectors conducted two equipment alignment partial walkdowns, listed below, to evaluate the operability of selected redundant trains or backup systems with the other train or system inoperable or out of service. The inspectors reviewed the functional systems descriptions, Updated Final Safety Analysis Report (UFSAR), system operating procedures, and Technical Specifications (TS) to determine correct system lineups for the current plant conditions. The inspectors performed walkdowns of the systems to verify the operability of a redundant or backup system/train or a remaining operable system/train with a high risk significance for the current plant configuration (considering out-of-service, inoperable, or degraded condition); or a risk-significant system/train that was recently realigned following an extended system outage, maintenance, modification, or testing; or a risk-significant single-train system. The inspector conducted the reviews to ensure that critical components were properly aligned, and to identify any discrepancies which could affect operability of the redundant train or backup system.

- 2H EDG jacket water/cooling water and breaker alignment with the 2J EDG OOS
- Unit 2 Quench Spray 'B' partial system and breaker alignment

b. Findings

No findings were identified.

## 1R05 Fire Protection

### Quarterly Fire Protection Walkdowns

#### a. Inspection Scope

The inspectors conducted focused tours of the four areas listed below that are important to reactor safety to verify the licensee's implementation of fire protection requirements as described in fleet procedures CM-AA-FPA-100, "Fire Protection/Appendix R (Fire Safe Shutdown) Program," Rev. 10, CM-AA-FPA-101, "Control of Combustible and Flammable Materials," Rev. 8, and CM-AA-FPA-102, "Fire Protection and Fire Safe Shutdown Review and Preparation Process and Design Change Process," Rev. 5. The inspectors evaluated, as appropriate, conditions related to: (1) licensee control of transient combustibles and ignition sources; (2) the material condition, operational status, and operational lineup of fire protection systems, equipment, and features; and, (3) the fire barriers used to prevent fire damage or fire propagation. Other documents reviewed are listed in the Attachment to this report.

- Units 1 and 2 main control room, Area 2
- Units 1 and 2 cable vault and tunnel, Area 3-1
- Unit 1 emergency switchgear
- Unit 2 casing cooling pump house

#### b. Findings

No findings were identified.

## 1R06 Flood Protection Measures

### .1 Internal Flood Areas

#### a. Inspection Scope

The inspectors assessed the internal flooding vulnerability of the one flood area listed below with respect to adjacent safety-related areas to verify that the flood protection barriers and equipment were being maintained consistent with the UFSAR. The licensee's corrective action documents were reviewed to verify that corrective actions with respect to flood-related items identified in condition reports were adequately addressed. The inspectors conducted a field survey of the selected areas to evaluate the adequacy of flood barriers, and floor drains to protect the equipment, as well as their overall material condition.

- Unit 1 and Unit 2 Emergency switchgear internal flooding protection from turbine building

#### b. Findings

No findings were identified.

## 1R11 Licensed Operator Regualification Program and Licensed Operator Performance

### .1 Resident Inspector Quarterly Review

#### a. Inspection Scope

The inspectors reviewed a licensed operator performance on May 31, 2016, during a simulator scenario. The scenario required classifications and notifications that were counted for NRC performance indicator input.

The inspectors observed the following elements of crew performance in terms of communications: (1) ability to take timely and proper actions; (2) prioritizing, interpreting, and verifying alarms; (3) correct use and implementation of procedures, including the alarm response procedures; (4) timely control board operation and manipulation, including high-risk operator actions; and (5) oversight and direction provided by the shift supervisor, including the ability to identify and implement appropriate TS actions. The inspectors observed the post training critique to determine that weaknesses or improvement areas revealed by the training were captured by the instructor and reviewed with the operators. Documents reviewed are listed in the Attachment to this report.

#### b. Findings

No findings were identified.

### .2 Quarterly Control Room Operator Performance Observations

#### a. Inspection Scope

During the inspection period, the inspectors conducted two observations of licensed reactor operators actions and activities to ensure that the activities were consistent with the licensee procedures and regulatory requirements. These observations took place during both normal and off-normal plant working hours. As part of this assessment, the inspectors observed the following elements of operator performance: (1) operator compliance and use of plant procedures including technical specifications; (2) control board/in-plant component manipulations; (3) use and interpretation of plant instruments, indicators and alarms; (4) documentation of activities; (5) management and supervision of activities; and, (6) communication between crew members.

The inspectors observed and assessed licensed operator performance during the following events:

- April 5, 2016 during control rod drive worth performance test
- June 24, 2016 during normal operations

#### b. Findings

No findings were identified.

## 1R12 Maintenance Effectiveness

### a. Inspection Scope

For the two equipment issues listed below, the inspectors evaluated the effectiveness of the respective licensee's preventive and corrective maintenance. The inspectors performed walkdowns of the accessible portions of the systems, performed in-office reviews of procedures and evaluations, and held discussions with licensee staff. The inspectors compared the licensee's actions with the requirements of the Maintenance Rule (10 CFR 50.65), and licensee procedure ER-AA-MRL-10, "Maintenance Rule Program," Rev. 6. Other documents reviewed are listed in the Attachment to this report.

- WO59102973291, AMSAC PLC-B Failure
- WO59102920281, SBO Diesel Fuel Oil Filter Leak

### b. Findings

No findings were identified.

## 1R13 Maintenance Risk Assessments and Emergent Work Control

### a. Inspection Scope

The inspectors evaluated, as appropriate, the four activities listed below for the following: (1) effectiveness of the risk assessments performed before maintenance activities were conducted; (2) management of risk; (3) appropriate and necessary steps taken to plan and control the resulting emergent work activities upon identification of an unforeseen situation; and, (4) adequate identification and resolution of maintenance risk assessments and emergent work problems. The inspectors reviewed these maintenance activities to verify that the licensee was in compliance with the requirements of 10 CFR 50.65 (a)(4) and the data output from the licensee's safety monitor associated with the risk profile of Units 1 and 2. The inspectors reviewed the corrective action program to verify that deficiencies in risk assessments were being identified and properly resolved.

- SBO Diesel on F transfer bus on April 26, 2016
- Excavate all EDG and SBO Diesel fuel oil lines simultaneously from April 18, 2016 to April 25, 2016
- 1-VG-RI-180-3 vent stack B particulate radiation monitor spurious alarms on June 11, 2016
- Leak investigation and tube plugging on 1-QS-MR-1 on May 23, 2016

### b. Findings

Introduction: The inspectors identified a green NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the inadequate translation of design calculations into compensatory measures when removing missile barriers. Specifically, the licensee failed to meet design parameters defined in Technical Specification (TS) 3.0.9 for Required Barriers, Technical Requirement (TR) 12.4, "Weather-Generated Missile Protection," and further supported by Calculation ET-N-10-0010, "Technical Information for Developing a Missile Barrier TRM." TS 3.0.9 and bases specifies required barriers

for uniting events like external flooding or tornado/high winds and the required barrier configuration for continued system operability. TR 12.4 and supporting Calculation ET-N-10-0010 specifies generic acceptable compensatory missile shields for buried pipe that would withstand a missile impact and were not reflected in the compensatory measures executed by the licensee when removing the passive missile barrier protecting both the 'A' train and the 'B' train of the fuel oil pipes for the 1H EDG, 1J EDG, 2H EDG, 2J EDG and the SBO Diesel. The licensee immediately implemented changes to the compensatory measures for the fuel oil pipes in order to realign with the compensatory missile shields described in the Technical Requirement and the calculation.

Description: On April 18, 2016, the licensee began excavation of the 1H EDG, 1J EDG, 2H EDG, 2J EDG and SBO Diesel buried fuel oil pipes. These fuel oil pipes transfer diesel fuel oil from the fuel oil pump house to the diesel day tanks underground that provides passive missile protections, as required by design per the USFAR Section 3.3 for Wind and Tornado Design Criteria and Section 9.5.4 for Emergency Diesel Generator Fuel-Oil Storage and Transfer System. Each Diesel has an 'A' train and a 'B' train to support the transfer of fuel oil.

The licensee implemented Operational Risk Assessment procedure WM-AA-301, Attachment 3 and Attachment 14, "High Risk Contingency Plan Actions," for excavating the buried fuel oil pipes from Work Order, WO59102745250. The contingency actions identified in Attachment 14 for the excavation of buried fuel oil pipes includes risk mitigation actions for high wind events and extended periods of no work activity, as identified below:

"Missile shielding contingency plans will be ready to either have a dump truck to fill 6 feet of fill over the pipes or place a metal missile shield over the pipes if 0-AP-41 (Severe Weather Conditions) is entered" and "During extended work cessation, all exposed piping shall be covered with sufficient/equivalent missile protection (e.g. steel plate). Exposed piping shall be covered at the end of each work day."

The licensee elected to cover the work area with an unsupported metal plate which did not meet the design parameters defined in Technical Requirement 12.4, "Weather-Generated Missile Protection," and further supported by Calculation ET-N-10-0010, "Technical Information for Developing a Missile Barrier TRM." TR 12.4 and supporting Calculation ET-N-10-0010 specifies generic acceptable compensatory missile shields for buried pipe that would withstand a missile impact and were not reflected in the compensatory measures executed by the licensee. When the inspectors questioned the complete removal of a required missile barrier, the licensee developed CR1034958, "Inadequate temporary tornado missile protection recommended by Engineering," that referenced Calculation CE-1802, "Design of Temporary Missile Shield Required for Service Water Lines Manway Shaft Excavation." The licensee failed to recognize calculation CE-1802 does not apply to the excavation of the fuel oil pipes because, the calculation clearly states:

"...can be used only for a single shaft at locations shown on DCP Drawing N-92008-0-2FC2AC or N-9200800-2FC2Z."

Both drawings identify Service Water manway access shafts. There are no supporting documents to conclude that Calculation CE-1802 applies to excavation of the 10 fuel oil pipes.

On April 20, 2016, after the inspectors challenged the licensee's complete removal of a required missile barrier as defined in TS 3.0.9, the licensee replaced the metal plate compensatory measure with fill material as identified in the "High Risk Contingency Plan Actions," and is identified as one of the acceptable generic compensatory measures identified in TR 12.4. On April 24, 2016, the licensee entered Technical Requirement 12.4 for "Weather Generated Missile Protection." Specifically, the licensee entered TR 12.4, Condition 'A' for the "required passive missile protection feature nonfunctional" and implemented the compensatory actions identified in ET-N-10-0010, "Technical Information for Developing a Missile Barrier TRM," and documented in the bases for TR 12.4 for the excavation of the fuel oil pipes. The licensee exited the TR 12.4 in the evening of April 25, when the original passive missile shielding to the fuel oil lines was restored.

Analysis: The inadequate translation of design calculations into compensatory measures when removing required passive missile shields is a performance deficiency (PD). The performance deficiency was more than minor because it was associated with the human performance attribute of the Mitigating System cornerstone and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage). Specifically, the inadequate compensatory measure resulted in the licensee having to make required changes to the compensatory measures in order to resolve missile protection concerns. The inspectors performed the initial significance determination for the finding using NRC Inspection Manual Chapter 0609, Appendix A, Exhibit 4, "External Events Screening Questions," dated July 1, 2012. The finding required a detailed risk evaluation because the safety function of the onsite EDGs and the function of the SBO Diesel were assumed to be completely failed due to inadequate compensatory missile protection measures for a high wind event. A detailed risk evaluation was performed by a regional Senior Risk Analyst (SRA) in accordance with NRC IMC 0609 Appendix A using the NRC North Anna SPAR Probabilistic Risk Assessment (PRA) model. The major assumptions of the bounding analysis included: a seven day exposure interval, all EDG and SBO Diesel fuel oil lines assumed failed by F2-F5 tornado, no EDG recovery after day tank depletion and the event modelled as a non-recoverable Station Blackout. The dominant sequence was a non-recoverable weather related loss of offsite power leading to a station blackout after EDG day tank depletion, followed by failure of all EDGs and the SBO Diesel due to the PD, and failure of the operator to maintain local control of the turbine driven Auxiliary Feedwater (AFW) pump leading to core damage due to failure of core heat removal. The short exposure period and the low frequency of the tornado initiator limited the risk. The detailed risk evaluation determined that the increase in core damage frequency due to the PD was  $<1E-6$ /year, a GREEN finding of very low safety significance.

The finding has a cross-cutting aspect in the area of human performance associated with the conservative bias attribute because individuals use decision making-practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop (H.14)

Enforcement: The inspectors identified a green NRC-identified NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states in part, "Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions." Contrary to this requirement, the licensee's failed to correctly translate calculations into compensatory measures when removing required missile barriers as specified in TS 3.0.9. Specifically, the licensee failed to implement a compensatory missile shield as specified in Technical Requirement 12.4 and father described in ET-N-10-0010, "Technical Information for Developing a Missile Barrier TRM," when removing the passive missile barrier protecting both the 'A' train and the 'B' train of the fuel oil pipes for the 1H EDG, 1J EDG, 2H EDG, 2J EDG and the SBO Diesel. Because this finding is of very low safety significance and has been entered into the licensee's corrective action program as CR1034958, this violation is being treated as an NCV, consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000338, 339/2016002-01, Inadequate Translation of Design Calculations into Compensatory Measures when Removing Missile Barriers Could Result in EDGs and SBO Diesel Inoperable.

## 1R15 Operability Determinations and Functionality Assessments

### Operability and Functionality Review

#### a. Inspection Scope

The inspectors reviewed five operability determinations (OD) and functionality assessments, listed below, affecting risk-significant mitigating systems, to assess, as appropriate: (1) the technical adequacy of the evaluations; (2) whether continued system operability was warranted; (3) whether other existing degraded conditions were considered as compensatory measures; (4) whether the compensatory measures, if involved, were in place, would work as intended, and were appropriately controlled; and (5) where continued operability was considered unjustified, the impact on TS Limiting Conditions for Operation and the risk significance in accordance with the SDP. The inspectors' review included a verification that ODs were made as specified by procedure OP-AA-102, "Operability Determination," Rev. 13. Other documents reviewed are listed in the Attachment.

- Review of Eval-16-11, Unit 2 – Operating with Potential Primary Side Loose Part
- Review of CR1032656, Unit 2 - Charging pump B failed to develop the required head
- Review of CR1033477, Unit-2 – Leakage past reactor head vents
- Review of OD3027519, Unit 2 – Deviating condition on 2QS-MOV-202B
- Review of OD3031263, Unit 2 – Non-conforming 'J' EDG exhaust pipe support due to inadequate embedment of two anchor bolts

#### b. Findings

No findings were identified.

## 1R18 Plant Modifications

### Temporary Modifications

#### a. Inspection Scope

The inspectors reviewed the one completed temporary plant modification design change packages (DCO) listed below. The inspectors conducted a walkdown of the installation, discussed the desired improvement with system engineers, and reviewed the 10 CFR 50.59, Safety Review/Regulatory Screening, technical drawings, test plans and the modification package to assess the TS implications. Other documents reviewed are listed in the Attachment to this report.

- TM-59-02-2016-120, "Extension to Unit 2 Head Vent Splatter Shield"

#### b. Findings

No findings were identified.

## 1R19 Post Maintenance Testing

#### a. Inspection Scope

The inspectors reviewed five post maintenance test procedures and/or test activities, listed below, for selected risk-significant mitigating systems to assess whether: (1) the effect of testing on the plant had been adequately addressed by control room and/or engineering personnel; (2) testing was adequate for the maintenance performed; (3) acceptance criteria were clear and adequately demonstrated operational readiness consistent with design and licensing basis documents; (4) test instrumentation had current calibrations, range, and accuracy consistent with the application; (5) tests were performed as written with applicable prerequisites satisfied; (6) jumpers installed or leads lifted were properly controlled; (7) test equipment was removed following testing; and, (8) equipment was returned to the status required to perform in accordance with VPAP-2003, "Post Maintenance Testing Program," Rev. 14.

- WO59102099196, 1J emergency diesel generator standby jacket cooling pump motor repair
- WO59102793853, 2-CH-FL-2, charging system, filter change out
- WO59102982084, 2-HV-F-87B fan bearing repair
- WO59102982087, 2-HV-AC-162 restraint repairs
- WO59102982092, 1-SS-RM-123, B steam generator blow down sample radiation monitor

#### b. Findings

No findings were identified.



1R21 Component Design Basis Inspection(Closed) Unresolved Item (URI) 05000338, 339/2015007-01: Adequacy of Class 1E 120VAC Vital Bus Designa. Inspection Scope

During the 2015 North Anna Component Design Bases Inspection, the team identified a URI regarding the adequacy of the Unit 1 and Unit 2 Class 1E 120VAC Vital Bus Design. The inspectors reviewed the updated UFSAR, TS, and design calculations to determine if the protective devices on the 120VAC vital buses ensured proper coordination such that failed equipment would not cause unnecessary loss of other safety related loads needed during design basis accidents.

b. Findings

Introduction: The NRC identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to verify the adequacy of design for the protection devices at the 120VAC vital instrumentation buses. Specifically, the licensee's failure to verify that the protective devices at the Unit 1 and Unit 2 120VAC vital instrumentation buses would isolate failed equipment when supplied by the voltage regulating transformer in accordance with IEEE 308-1971 was a PD.

Description: UFSAR Section 8.3.1.1.2.2., "Compliance with IEEE Criteria," stated that "In accordance with IEEE 308, the station service power system and its components are designed to operate during and after a design-basis event, retain its safety features, and keep its parameters within their specified limits." IEEE 308 stated that the purpose of the standard was to provide the principal design criteria and the design features of the Class 1E electric system that enable the systems to meet their functional requirement under the condition produced by the design basis events and to provide the minimum operational conditions of the Class 1E electric systems under which the station will be permitted to operate. Section 5.2.6 of IEEE 308-1971, "Protective Devices," stated "Protective devices shall be provided to isolate failed equipment."

Calculation 14258.79-E-4, "Short Circuit Currents – 120V AC Vital Buses and Miscellaneous Circuits – Appendix R Evaluation," Revision 1, Addendum C, stated that the maximum short circuit available to the 120VAC vital buses from the Units 1 and 2 20KVA inverters was 200% of rated full load current, equaling 334A, and 175% of full rated current, equaling 365A, when supplied by the 25KVA voltage regulating transformer. These values were input into Technical Report EE-0118, "10 CFR Part 50 Appendix R Electrical Distribution System Coordination Study," Revision 2, to verify proper breaker coordination for the 120 VAC Vital instrumentation buses.

In 2003, the licensee received correspondence from the vital inverter vendor stating that the steady state short circuit current for the regulating transformer was approximately 200% of rated full load current, which was different than what was assumed in the technical report. The memo also stated that the half cycle instantaneous fault current for the inverter and regulating transformer would be approximately 500% of rated full load current, equaling 833A and 1042A for the inverter and transformer, respectively. These values were not evaluated in the technical report.

The team noted that when the 120VAC instrument buses were supplied by the regulating transformer, a condition allowed by TS, breaker coordination could not be verified for the 120VAC buses based on the instantaneous fault values concurred on by the vendor. Specifically, coordination could not be verified for the breakers associated with the 1-I and 2-I 120VAC buses. TS 3.8.7 allows the regulating transformer to supply the vital buses for  $\leq 24$  hours while the batteries are being equalized and TS 3.8.9 allows the licensee to consider the vital buses operable while they are energized from this transformer. The team was concerned that TS could allow the licensee to be on the regulating transformer when coordination could not be verified for the 120VAC buses. The lack of breaker coordination could result in the loss of additional engineered safety features during a design bases event. The licensee entered this issue into their corrective action program (CAP) as condition reports (CRs) 1006865 and 1013278.

Analysis: The licensee's failure to verify that the protective devices at the Unit 1 and Unit 2 120VAC vital instrumentation buses would isolate failed equipment when supplied by the 25KVA voltage regulating transformer in accordance with IEEE 308-1971 was a performance deficiency. The performance deficiency was determined to be more than minor because it affected the Design Control attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failing to isolate failed equipment could lead to tripping the associated 120VAC vital bus, causing unnecessary loss of other safety related equipment connected to the bus. The finding was assessed using IMC 0609, Attachment 4, "Initial Characterization of Findings," issued June 19, 2012, for Mitigating Systems, and IMC 0609, Appendix A, "The Significance Determination Process for Findings At-Power," issued June 19, 2012, and was determined to be of very low safety significance (Green), because it was a deficiency affecting the design or qualification of a structure, system, or component (SSC) and the SSC maintained its operability. This finding was not assigned a cross-cutting aspect because the issue did not reflect current licensee performance.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," stated, in part, that "Design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews." UFSAR Section 8.3.1.1.2.2 stated that the licensee complied with IEEE 308-1971. Section 5.2.6 of IEEE 308-1971, "Protective Devices," stated, "Protective devices shall be provided to isolate failed equipment." Contrary to the above, since 2003, the licensee did not provide for verifying or checking the adequacy of design of the 120VAC vital buses, such as by the performance of design reviews, to ensure that the protective devices would isolate the failed equipment such that a fault would not result in an unnecessary loss of other safety-related equipment. Failing to isolate failed equipment could lead to tripping the 120VAC vital bus, causing unnecessary loss of other safety related equipment connected to the bus. At the time of the inspection, the licensee was evaluating the issue to determine appropriate corrective actions. This violation does not present an immediate safety concern because the performance deficiency is related to a non-conformance with a design standard upon which only one train would be affected by a postulated single failure and the other train would remain available and capable to respond to the design basis accident. Because this violation was of very low safety significance (Green) and was entered into the licensee's CAP as CRs 1006865 and

1013278, this violation is being treated as an NCV, consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000338, 339/2016002-02, Adequacy of Class 1E 120VAC Vital Bus Design.

## 1R22 Surveillance Testing

### a. Inspection Scope

For the five surveillance tests listed below, the inspectors examined the test procedures, witnessed testing, or reviewed test records and data packages, to determine whether the scope of testing adequately demonstrated that the affected equipment was functional and operable, and that the surveillance requirements of TS were met. The inspectors also determined whether the testing effectively demonstrated that the systems or components were operationally ready and capable of performing their intended safety functions.

#### In-Service Test:

- 2-PT-77.11C, "Control Room Chiller 2-HV-E-4C Pump and Valve Test," Rev. 42

#### Other Surveillance Tests:

- 2-PT-57.1A, Unit 2, safety Injection pump 1A
- 2-PT-74.2A, Unit 2, component cooling water pump 1A
- 1-PT-71.3Q, Unit 1, motor drive auxiliary feedwater pump 3B
- 1-PT-71.1Q, Unit 1, turbine drive auxiliary feedwater pump 2

### b. Findings

No findings were identified.

Cornerstone: Emergency Preparedness

## 2. RADIATION SAFETY (RS)

### 2RS1 Radiological Hazard Assessment and Exposure Controls

#### a. Inspection Scope

Hazard Assessment and Instructions to Workers: During facility tours, the inspectors directly observed labeled radioactive material and postings for Radiation Areas (RAs) and High Radiation Areas (HRAs) established within the Radiologically Controlled Area (RCA) of Unit 1 (U1) and Unit 2 (U2) Reactor and Auxiliary Buildings, Spent Fuel Pool (SFP), and the Independent Spent Fuel Storage Installation (ISFSI). The inspectors independently measured radiation dose rates or directly observed conduct of licensee radiation surveys for selected RCA areas. The inspectors reviewed and verified survey records for several plant areas including surveys for alpha emitters, airborne radioactivity, and gamma surveys with a range of dose rate gradients. The inspectors reviewed several radiation work permit (RWP) details to assess communication of radiological control requirements and current radiological conditions to workers. The inspectors reviewed selected Electronic Dosimeter (ED) dose and dose rate alarms, to

verify workers properly responded to the alarms and that the licensee's review of the events was appropriate. The inspectors observed jobs in radiologically risk-significant areas including HRAs and areas with, or with the potential for airborne activity.

Contamination and Radioactive Material Control: The inspectors observed the release of potentially contaminated items from the RCA and from contaminated areas. The inspectors also reviewed the procedural requirements for, and equipment used to perform, the radiation surveys for release. During plant walk downs, the inspectors evaluated radioactive material storage areas and containers, assessing material condition, posting/labeling, and control of materials/areas. In addition, the inspectors reviewed the sealed source inventory and verified labeling, storage conditions, and leak testing of selected sources.

Radiological Hazards Control and Work Coverage: The inspectors evaluated licensee performance in controlling worker access to radiologically significant areas and monitoring jobs in-progress during the weeks of the onsite inspection. For HRA tasks involving significant dose rate gradients, the inspectors evaluated the use and placement of whole body and extremity dosimetry to monitor worker exposure. The inspectors reviewed RWPs for use in airborne areas, ensuring the prescribed controls were appropriate for the conditions as identified in radiological surveys and air samples. ED alarm set points and worker stay times were evaluated against area radiation survey results for containment and auxiliary building activities.

Risk Significant High Radiation Areas and Very High Radiation Area Controls: The inspectors evaluated access barrier effectiveness for selected Locked High Radiation Area (LHRA) and Very High Radiation Area (VHRA) locations. Changes to procedural guidance for LHRA and VHRA controls were discussed with Radiation Protection (RP) supervisors. During plant walk downs of the Reactor and Auxiliary Buildings, the inspectors verified the posting/locking of LHRA/VHRA areas. Established radiological controls (including airborne controls) were evaluated for selected tasks, including work with U-2 reactor vessel up-flow modification, cutting of intermediate/hot leg drain lines, steam generator primary side maintenance, and lifting/setting of reactor vessel head. In addition, licensee controls for areas where dose rates could change significantly as a result of plant shutdown and refueling operations were reviewed and discussed.

Radiation Worker Performance and RP Technician Proficiency: The inspectors observed radiation worker performance through direct observation of jobs. Jobs observed included U-2 reactor vessel up-flow modification, cutting of intermediate/hot leg drain lines, steam generator primary side maintenance, and lifting/setting of reactor vessel head. The inspectors also observed health physics technicians (HPTs) providing pre-job/RWP briefings, releasing material from the RCA, and providing field coverage of jobs. Occupational workers' adherence to selected RWPs and HPT proficiency in providing job coverage were evaluated through direct observations and interviews with licensee staff. ED alarm set points and worker stay times were evaluated against area radiation survey results for reviewed RWPs.

Problem Identification and Resolution: Condition reports associated with radiological hazard assessment and control were reviewed and assessed. The inspectors evaluated the licensee's ability to identify, characterize, prioritize, and resolve the identified issues in accordance with procedure PI-AA-200, Corrective Action, Rev. 29. The inspectors

also evaluated the scope of the licensee's internal audit program and reviewed recent assessment results.

Radiation Protection activities were evaluated against the requirements of UFSAR Section 12; TS Sections 5.7; 10 CFR Parts 19 and 20; and approved licensee procedures. Licensee programs for monitoring materials and personnel released from the RCA were evaluated against 10 CFR Part 20 and IE Circular 81-07, Control of Radioactively Contaminated Material. Documents and records reviewed are listed in the Attachment.

The inspectors completed the required seven samples specified in IP 71124.01.

b. Findings

No findings were identified.

2RS2 As Low As Reasonably Achievable (ALARA)

a. Inspection Scope

Work Planning and Exposure Tracking: The inspectors reviewed planned work activities and their collective exposure estimates for the previous Unit 1 (U1) refueling outage (1RFO24) and the current Unit 2 (U2) refueling outage (2RFO24). ALARA planning packages were reviewed for the following tasks: Shielding installation and removal, Rx vessel upflow modification, steam generator (S/G) insulation replacement, and S/G eddy current testing. For the selected tasks, the inspectors reviewed established dose goals and discussed assumptions regarding the bases for the current estimates with responsible ALARA planners. The inspectors evaluated the incorporation of exposure reduction initiatives and operating experience, including historical post-job reviews, into RWP requirements. Day-to-day collective dose data for the selected tasks were compared with established dose estimates and evaluated against procedural criteria (trigger points) for additional ALARA review. Where applicable, changes to established estimates were discussed with ALARA planners and evaluated against work scope changes or unanticipated elevated dose rates.

Source Term Reduction and Control: The inspectors reviewed the collective exposure three-year rolling average from 2012 - 2014. The inspectors reviewed the historical dose data and contrasted it to the current and projected future dose values. The inspectors reviewed dose reduction activities that were being pursued during the current outage, and those that are being implemented, which include zinc injection, macroporus resin overlays, and effective water management for shielding (e.g. S/G secondary side filled, RCS loops filled for insulation removal, etc.) to reduce dose rates during work activities.

Radiation Worker Performance: Radiation worker performance was observed and evaluated as part of IP 71124.01 and is documented in section 2RS1. While observing job tasks, the inspectors evaluated the use of remote technologies to reduce dose including teledosimetry and remote visual monitoring.

Problem Identification and Resolution: The inspectors reviewed and discussed selected Corrective Action Program (CAP) documents associated with ALARA program implementation. The inspectors evaluated the licensee's ability to identify and resolve

the issues in accordance with licensee procedure PI-AA-200, Corrective Action, Rev. 29. The inspectors also evaluated the scope of the licensee's internal audit program and reviewed recent assessment results.

ALARA program activities were evaluated against the requirements of FSAR Section 12, TS Sections 5.4, Procedures, 5.5, Programs and Manuals, and 5.7, High Radiation Area; 10 CFR Part 20; and approved licensee procedures. Records reviewed are listed in the report Attachment.

The inspectors completed the required five samples specified in IP 71124.02.

b. Findings

No findings were identified.

2RS3 In-Plant Airborne Radioactivity Control and Mitigation

a. Inspection Scope

Engineering Controls: The inspectors reviewed the use of temporary and permanent engineering controls to mitigate airborne radioactivity during U2R24 refueling outage. The inspectors observed the use of portable air filtration units for work in contaminated areas of the RCB and reviewed filtration unit testing certificates. The inspectors evaluated the effectiveness of continuous air monitors and air samplers placed in work area "breathing zones" to provide indication of increasing airborne levels.

Respiratory Protection Equipment: The inspectors reviewed the use of respiratory protection devices to limit the intake of radioactive material. This included review of devices used for routine tasks and devices stored for use in emergency situations. As part of IP 71124.02, the inspectors reviewed ALARA evaluations for the use of respiratory protection devices during work underneath the reactor vessel head. Selected Self-Contained Breathing Apparatus (SCBA) units and negative pressure respirators (NPRs) staged for routine and emergency use in the Main Control Room (MCR) and other locations were inspected for material condition, SCBA bottle air pressure, number of units, and number of spare masks and air bottles available. The inspectors discussed SCBA repair and maintenance with licensee staff and reviewed maintenance records for selected SCBA units for the past two years. The inspectors evaluated SCBA and NPR compliance with National Institute for Occupational Safety and Health certification requirements. The inspectors also reviewed records of air quality testing for supplied-air devices and SCBA bottles.

The inspectors discussed with the licensee and reviewed training material for the donning, doffing, and use of various types of respiratory protection devices, including SCBA bottle change-out and use of corrective lens inserts. Respirator qualification records (including medical qualifications) were reviewed for several MCR operators and emergency responder personnel in the Operations, Maintenance and HP departments. The inspectors also observed the performance of a respirator fit test.

Problem Identification and Resolution: CRs associated with airborne radioactivity mitigation and respiratory protection were reviewed and assessed. The inspectors evaluated the licensee's ability to identify and resolve the issues in accordance with procedure PI-AA-200, Corrective Action, Rev. 29.

Licensee activities associated with the use of engineering controls and respiratory protection equipment were reviewed against FSAR Section 12; TS Section 5; 10 CFR Part 20; RG 8.15, "Acceptable Programs for Respiratory Protection"; and applicable licensee procedures. Documents and records reviewed are listed in the Attachment.

The inspectors completed the required four samples specified in IP 71124.03.

b. Findings

No findings were identified.

2RS4 Occupational Dose Assessment

a. Inspection Scope

External Dosimetry: The inspectors reviewed National Voluntary Laboratory Accreditation Program (NVLAP) certification data (including Thermoluminescent Dosimeter (TLD) testing for neutron, gamma, and beta exposures) and discussed program guidance for storage, processing, and results for active and passive personnel dosimeters currently in use. Licensee procedures for shallow and deep dose assessments for workers with identified skin contaminations were reviewed and discussed. Comparisons of ED and personnel dosimeter data were reviewed and discussed in detail. In addition, inspectors evaluated the use of extremity dosimetry, multi-badging, and re-positioning of whole body dosimetry during 2RFO24 maintenance activities. In addition, results of gamma and neutron perimeter monitoring dosimeters for the ISFSI were reviewed.

Internal Dosimetry: Program guidance (including Derived Air Concentration (DAC)-hr tracking), instrument detection capabilities, and assessment results for internally deposited radionuclides were reviewed in detail. The inspectors reviewed selected routine *in vivo* (Whole Body Count) analyses from October 2015 to April 2016. In addition, capabilities for collection and analysis of special bioassay samples were evaluated and discussed with licensee staff. In addition, evaluation and follow-up of two individuals having positive whole body counts during the inspection were reviewed.

Special Dosimetric Situations: The inspectors evaluated the licensee's use of multi-badging, extremity dosimetry, and dosimeter relocation within non-uniform dose rate fields and discussed worker monitoring in neutron areas with licensee staff. The inspectors also reviewed the licensee's use of multi-badging for individuals performing primary side S/G inspection activities during 2RFO24 and monitoring records for declared pregnant workers (DPW) from May 2014 to current. In addition, the adequacy of shallow dose assessments for selected Personnel Contamination Events (PCEs) occurring between September 2014 and March 2016 were reviewed and discussed.

Problem Identification and Resolution: The inspectors reviewed and discussed selected CAP documents associated with occupational dose assessment. The inspectors evaluated the licensee's ability to identify and resolve the identified issues in accordance with procedure PI-AA-200, Corrective Action, Rev. 29. The inspectors also discussed the scope of the licensee's internal audit program and reviewed recent assessment results.

Occupational dose assessment program activities were evaluated against the requirements of FSAR Section 12, TS Sections 5.4, Procedures, 5.5, Programs and Manuals, and 5.7, High Radiation Area; 10 CFR Parts 19 and 20; RG 8.40, Methods for Measuring Effective Dose Equivalent from External Exposure; and approved licensee procedures. Procedures, documents, and records reviewed are listed in the report Attachment.

The inspectors completed the required five samples specified in IP 71124.04.

b. Findings

No findings were identified.

2RS5 Radiation Monitoring Instrumentation

a. Inspection Scope

The inspectors reviewed the licensee's radiation monitoring instrumentation programs to verify the accuracy and operability of radiation monitoring instruments used to monitor areas, materials, and workers to ensure a radiologically safe work environment and to detect and quantify radioactive process streams and effluent releases.

Walkdowns and Observations During tours of the site areas, the inspectors observed installed radiation detection equipment including the following instrument types: area radiation monitors (ARMs), continuous air monitors, personnel contamination monitors (PCMs) (including hand and foot monitors), small article monitors (SAMs), and personnel monitors (PMs). The inspectors observed the physical location of the components, noted the material condition, noted flow measurement devices, input and output of flow to monitors, and compared sensitivity ranges with UFSAR requirements. In addition to equipment walk-downs, the inspectors observed source checks and alarm setpoint testing of a PCM-2 monitor and discussed the function checks and calibrations of various portable and fixed detection instruments, including ion chambers, a telepole, PM-7, PCM-12, and SAMs. Material condition of source check devices, device operation, and establishment of source check acceptance ranges were also discussed with calibration lab personnel.

Calibration and Testing Program The inspectors reviewed the last calibration records for selected ARMs, PCMs, PMs, SAMs, and containment high-range ARMs and the most recent calibration record for a whole body counter. Inspectors reviewed records of survey instrument function/source checks and observed and discussed performance of required checks with calibration lab personnel. Calibration source documentation was reviewed for the ARM high-range calibrator and the Cs-137 (J.L. Shepherd) source used for portable instrument checks. Calibration stickers on portable survey instruments were reviewed and inspections of storage areas for 'ready-to-use' equipment were completed



during walkdowns. The inspectors reviewed alarm setpoint values for selected ARMs, PCMs, PMs, and SAMs. The inspectors also reviewed count room daily performance checks and calibration records for germanium detectors and liquid scintillator counters.

Operability and reliability of selected radiation detection instruments were reviewed against details documented in the following: 10 CFR Part 20; NUREG-0737, "Clarification of TMI Action Plan Requirements"; UFSAR Chapters 11; TS Section 3.3 and 3.7, and applicable licensee procedures. Documents reviewed are listed in the Attachment.

Problem Identification and Resolution The inspectors reviewed and discussed selected Corrective Action Program (CAP) documents associated with radiological instrumentation. The reviewed items included CRs, self-assessment, and quality assurance audit documents. The inspectors evaluated the licensee's ability to identify and resolve the issues in accordance with procedure PI-AA-200, Corrective Action, Rev. 29. Documents reviewed are listed in the Attachment.

The inspectors completed the required three samples specified in IP 71124.05.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA1 Performance Indicator (PI) Verification

.1 Initiating Events

a. Inspection Scope

The inspectors performed a periodic review of the two Unit 1 and 2 PIs listed below to assess the accuracy and completeness of the submitted data and whether the performance indicators were calculated in accordance with the guidance contained in Nuclear Energy Institute (NEI) 99-02, "Regulatory Assessment Performance Indicator Guideline," Rev. 7. The inspection was conducted in accordance with NRC inspection procedure 71151, "Performance Indicator Verification." Specifically, the inspectors reviewed the Unit 1 and Unit 2 data reported to the NRC for the period April 1, 2014 through March 31, 2015. Documents reviewed included applicable NRC inspection reports, licensee event reports, operator logs, station performance indicators, and related CRs.

Cornerstone: Mitigating Systems

- High Pressure Injection (2 units)
- Cooling Water (2 units)

Cornerstone: Barrier Integrity

- Reactor Coolant System Leakage (2 units)

For the period of July 1, 2015, through June 30, 2016, the inspectors reviewed operating logs, train unavailability data, maintenance records, maintenance rule data, PIPs, consolidated derivation entry reports, and system health reports to verify the accuracy of the PI data reported for each PI.

b. Findings

No findings were identified.

.2 Radiation Protection

a. Inspection Scope

The inspectors reviewed the Occupational Exposure Control Effectiveness PI results for the Occupational Radiation Safety Cornerstone from June 2015 through March 2016. The inspectors reviewed electronic dosimeter alarm logs and CRs related to controls for exposure significant areas. The inspectors also reviewed licensee procedural guidance for collecting and documenting PI data. Documents reviewed are listed in the Attachment.

The inspectors reviewed the Radiological Control Effluent Release Occurrences PI results for the Public Radiation Safety Cornerstone from June 2015 through March 2016. For the assessment period, the inspectors reviewed cumulative and projected doses to the public contained in liquid and gaseous release permits and CRs related to Radiological Effluent TS/Offsite Dose Calculation Manual issues. The inspectors also reviewed licensee procedural guidance for collecting and documenting Performance Indicators data. Documents reviewed are listed in the Attachment.

b. Findings

No findings were identified.

40A2 Problem Identification and Resolution

.1 Review of Items Entered into the Corrective Action Program

As required by NRC inspection procedure 71152, "Identification and Resolution of Problems," and in order to help identify repetitive equipment failures or specific human performance issues for follow-up, the inspectors performed a daily screening of items entered into the licensee's CAP. This review was accomplished by reviewing daily CR report summaries and periodically attending daily CR Review Team meetings.

.2 Annual Sample: Review of CR1036685, "Maintenance Rule Unavailability Has Been Exceeded on 2-CH-P-1C"

a. Inspection Scope

The inspectors performed a review regarding the licensee's assessments and corrective actions for CR1036685 to ensure that the full extent of the issue was identified, an appropriate evaluation was performed, and appropriate corrective actions were specified

and prioritized. The inspectors also evaluated the CR against the requirements of the licensee's CAP as specified in licensee procedure, PI-AA-200, "Corrective Action Program," Rev. 25 and 10 CFR 50, Appendix B.

b. Findings and Observations

A licensee-identified violation was identified and documented in Section 4OA7 of this inspection report. In general, the inspectors verified that the licensee had identified problems at an appropriate threshold and entered them into the CAP database, and had proposed or implemented appropriate corrective actions.

.3 Semi-annual Trend Review

a. Inspection Scope

As required by IP 71152, "Identification and Resolution of Problems," the inspectors performed a review of the licensee's CAP and associated documents to identify trends that could indicate the existence of a more significant safety issue. The inspectors' review was focused on open corrective actions greater than five years old, but also considered the results of daily inspector CAP item screenings discussed in section 4OA2.1 above, licensee trending efforts, licensee human performance results and inspector observations made during in-plant inspections and walk-downs. The inspectors' review primarily considered the six-month period of January 2016 through June 2016, although some examples expanded beyond those dates when the scope of the trend warranted. The review also included issues documented outside the normal CAP in major equipment problem lists, plant health reports, independent nuclear oversight reports, self-assessment reports, and maintenance rule reports. The inspectors compared and contrasted their results with the results contained in the licensee's latest quarterly trend reports. Corrective actions associated with a sample of the issues identified in the licensee's trend report were reviewed for adequacy.

b. Observations and Findings

No findings were identified. In general, the licensee performs adequate monitoring of their programs for adverse trends. The inspectors reviewed corrective actions associated with problem identification reports for potential trends. The inspectors determined that the licensee adequately identified adverse trends and their corrective actions were adequate to address any identified adverse trends.

4OA3 Event Followup

(Closed) LER 05000338/2016003-00: Engineered Safety Feature Actuation Due to Loss of Power to "A" Reserve Station Service Transformer

The inspectors followed up on actions taken in response to the loss of power to the "A" reserve station service transformer (RSST) on April 29, 2016 at 2214. North Anna Power Station entered 0-AP-10 (Loss of Electrical Power) due to the loss of Bus 5, 'A' RSST, and Construction Power. 1J Bus was initially powered from its 2B Station Service Alternate Source. 'A' RSST is currently energized by Bus 4. All appropriate actions were taken and 0-AP-10 was exited on April 30, 2016.

Apparent cause was animal encroachment on top of Transformer #3 causing a short and trip of switchyard breakers. The inspectors reviewed the Licensee Event Report (LER), the licensee's apparent cause evaluation, and corrective action documents to verify the accuracy of the LER and that the corrective actions were appropriate. The inspectors did not identify any performance deficiencies. This issue was entered in the licensee's corrective action program as CR 1036017.

#### 4OA5 Other Activities

##### World Association of Nuclear Operations (WANO) Peer Review

The inspectors reviewed the final report for the WANO Peer Review of North Anna Power Station conducted in October 2015. The inspectors reviewed the report to ensure that issues identified were consistent with the NRC perspectives of licensee performance and to verify if any significant safety issues were identified that required further NRC follow-up. The inspectors determined that no additional NRC follow-up was required

#### 4OA6 Meetings, Including Exit

On July 13, 2016, the resident inspectors presented the inspection results to Mr. G. Bischof and other members of the staff, who acknowledged the findings. The inspectors verified no proprietary information was retained by the inspectors or documented in this report.

#### 4OA7 Licensee-Identified Violations

The following violation of very low safety significance (Green) was identified by the licensee and is a violation of NRC requirements which meets the criteria of the NRC Enforcement Policy, for being dispositioned as a NCV.

10 CFR Part 50.65 section (a)(2) requires, in part, that the performance or condition of a structure, system, or component is being effectively controlled through the performance of appropriate preventative maintenance, such that the structure, system, or component remains capable of performing its intended function. In accordance with this requirement, the licensee established procedure ER-AA-MRL-100, "Implementing Maintenance Rule," to consistently apply requirements. One requirements of ER-AA-MRL-100 is monitoring equipment unavailability or out-of-service time on a rolling 12 month average. The allowed unavailability time for each charging pump is 438 hours. Contrary to the established goals, on May 5, 2016, the licensee identified Unit 1 'C' charging pump, 1-CH-P-1C, has accrued 517.3 hours of unavailability and Unit 2 'C' charging pump, 2-CH-P-1C, has accrued 588.0 hours of unavailability. By exceeding the established unavailability hour goals, licensee failed to control the condition of 1-CH-P-1C and 2-CH-P-1C to ensure the component remains capable of performing its intended function. Subsequently, both charging pumps are being evaluated under 10 CFR Part 50.65 (a)(1) for failure to meet established unavailability goals. The licensee's failure to control the condition of 1-CH-P-1C and 2-CH-P-1C to ensure the components remained capable of performing their intended function was a PD. The PD was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to

ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The inspectors performed the significance determination for the finding using NRC Inspection Manual Chapter 0609, Appendix A, Attachment 2, dated July 1, 2012 and determined the risk significance was very low (GREEN), because the charging system maintained operability in accordance with TS. The licensee entered this condition into their CAP as CR1036685 and CR1036687.

ATTACHMENT: SUPPLEMENTAL INFORMATION

## SUPPLEMENTAL INFORMATION

### KEY POINTS OF CONTACT

#### Licensee personnel:

M. Becker, Manager, Nuclear Outage and Planning  
G. Bischof, Site Vice President  
B. Gaspar, Manager, Nuclear Site Services  
R. Hanson, Manager, Nuclear Protection Services  
E. Hendrixson, Director, Nuclear Site Engineering  
L. Hilbert, Director, Nuclear Station Safety & Licensing  
J. Jenkins, Manager, Nuclear Maintenance  
J. Leberstien, Technical Advisor, Licensing  
F. Mladen, Plant Manager  
J. Plossl, Supervisor, Nuclear Station Procedures  
J. Schleser, Manager, Nuclear Organizational Effectiveness  
J. Slattery, Manager, Nuclear Operations  
W. Standley, Manager, Nuclear Training  
D. Taylor, Manager, Station Licensing  
M. Whalen, Technical Advisor, Licensing

### LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

#### Opened and Closed

5000338, 339/2016002-01	NCV	Inadequate Translation of Design Calculations into Compensatory Measures when Removing Missile Barriers Could Result in EDGs and SBO Diesel Inoperable (Section 1R13)
05000338, 339/2016002-02	NCV	Adequacy of Class 1E 120VAC Vital Bus Design (Section1R21)

#### Closed

05000338/2016003-00	LER	Engineered Safety Feature Actuation Due to Loss of Power to "A" Reserve Station Service Transformer (Section 4OA3)
05000338, 339/2015007-01	URI	Adequacy of Class 1E 120VAC Vital Bus Design (Section1R21)

#### Discussed

None

## LIST OF DOCUMENTS REVIEWED

### **Section 1R04: Equipment Alignment**

#### Procedures, Guidance Documents, and Manuals

2-MOP-6.90, Maintenance Operating – Emergency Diesel Generator 2-EE-EG-2H, Rev. 65  
2-OP-6.1A, Valve Checkoff – 2H Diesel Engine Cooling Water, Rev. 9  
2-OP-6.6A, Emergency Generator Pre-Operation Check for 2H and 2J Diesel, Rev. 33  
2-OP-7.4A, Valve Checkoff – Quench Spray System, Rev. 10  
2-PT-63.4, Quench Spray and Chemical Addition System Valve Lineup Verification, Rev. 10  
2-PT-63.1B, Quench Spray System – “B” Subsystem, Rev. 35

#### Corrective Action Documents

CR533296, 2-QS-P-1B motor heaters not energized, 11/21/2013

#### Work Orders

59102679477

#### Other

Unit 2 Safety Related Work Order Review, April 3, 2016

### **Section 1R05: Fire Protection**

#### Procedures, Guidance Documents, and Manuals

0-FPMP-2.12, “Dry Chemical Fire Extinguisher Maintenance,” Rev. 3  
0-FPMP-2.6, “Fire Extinguisher and Hose Station Inspection – Aux Buildings, Fuel Building, Clean Change, Health Physics, and Units 1 and 2 Instrument Shop,” Rev. 2  
CM-AA-FPA-10, Fire Protection/Appendix R (Fire Shutdown) Program, Rev. 2  
1-FS-S-3, Unit 1 Emergency Switchgear Instrument Rack and Air Conditioning Rooms Service Building, Elev. 254 ft (S-54) Safe Shutdown Equipment, Rev. 13  
2-FS-CC-1, Firefighting Preplan, Casing Cooling Pump House, Unit 2, Safe Shutdown Equipment, May 28, 1992

### **Section 1R06: Internal Flooding**

#### Procedures, Guidance Documents, and Manuals

2-AR-D-G7, Turb Bldg Flood Alarm Trouble, Rev. 0  
0-MCM-1305-01, Removal and Installation of Removable Flood Walls for Chiller Rooms and Emergency Switchgear, Rev. 7  
NF-AA-PRA-370, Probabilistic Risk Assessment Procedures and Methods: MRule (a)(4) Risk Monitor Guidance, Rev. 16

#### Records and Data

Station Logs for March 29-April 2, 2016

#### Work Orders

59102955004 dated 3/30/2016

59102955004 dated 4/2/2016

Other

25784-000-30R-L01G-00001, Flooding Walkdowns Results Report for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Flooding, November 2012  
 Note BK-PRA-NAPS-RA.PR.3, NAPS Probabilistic Risk Assessment Notebook Risk Analysis – Input to PRA Risk Summary, Rev. 5  
 Plant Health Issues List dated 6/2/2016

**Section 1R12: Maintenance Effectiveness**Procedures, Guidance Documents, and Manuals

MA-AA-100, “Conduct of Maintenance,” Rev. 10  
 WM-AA-100, “Work Management,” Rev. 25  
 WM-AA-101, “Work Order Planning,” Rev. 5

**Section 1R13: Risk Assessment**Procedures, Guidance Documents, and Manuals

High Risk Contingency Plan Actions for “Excavate the ten fuel oil pipes for License Renewal/Underground Piping and Tank Integrity Program Inspection,” Approved January 28, 2016  
 0-AP-41, Severe Weather Conditions, Rev. 65  
 RIS 01-009: Control of Hazard Barriers, April 2, 2001  
 NF-AA-PRA-370, Probabilistic Risk Assessment Procedures and Methods: MRule (a)(4) Risk Monitor Guidance, Rev. 16

Corrective Action Documents

CR1034958, Inadequate temporary tornado missile protection recommended by Engineering, 4/20/2016

Records and Data

WM-AA-301, Operation Risk Assessment, Rev. 11  
 North Anna Power Station Logs for April 18-28, 2016  
 Calculation CE-1802, Design of Temporary Missile Shield Required for the Service Water Lines Manway Shaft Excavation, July 28, 2005  
 ET-N-10-0010, Technical Information for Developing a Missile Barrier TRM, Rev.

**Section 1R15: Operability Determinations and Functionality Assessments**Procedures, Guidance Documents, and Manuals

OP-AA-102-1001, Development of Technical Basis to Support Operability, Rev. 10  
 0-MCM-1110-02, Installation of the Reactor Vessel Head, Rev. 48  
 AD-AA-100-Attachment 2, Technical Procedure Approval for ‘0-MCM-1110-02, Installation of the Reactor Vessel Head,’ dated March 25, 2016  
 0-OP-4.16, Pre-Core Loading, Core Mapping and Fuel Assembly Gap Inspection, Rev. 20  
 AD-AA-100-Attachment 2, Technical Procedure Approval for ‘0-OP-4.16, Pre-Core Loading, Core Mapping, and Fuel Assembly Gap Inspection,’ dated March 26, 2016  
 FME Recovery Plan for the Missing Screw from the Gauge Tool in the Unit 2 Vessel, Rev. 1

Corrective Action Documents

CR1032656, Data Obtained for step 6.2.15 of 2-PT-138.3B is below the pump perf. curve.  
 CR1037139, Degraded southeast baseplate on 2J EDG exhaust pipe support SH-127, May 10, 2016



CA3026894, Prior to Core Onload – Engineering to document retrieval of screws from the FSCR #16-022, Facility Safety Review Committee Meeting for “LTR-RES-1650-Westinghouse Letter - Reactor Coolant Pump (RCP) Evaluation for Missing Screw from Gauging Tool at North Anna Unit 2,” March 27, 2016  
 CR1030800, FMR Inspection of Long Handled Tool Working in Cavity Unsat, March 17, 2016

Records and Data

NAPS U2 Operations Log for March 27, 2016  
 Evaluation from Westinghouse regarding the Reactor Coolant Pump (RCP) Evaluation for Missing Screw from Gauging Tool at North Anna Unit 2 dated March 21, 2016  
 ETE-NA-2016-0030, Engineering Technical Evaluation of 2-PT-138.3B Test Results, April 5, 2016  
 Eval-16-11, North Anna 2 – Operating with Potential Primary Side Loose Part, Rev. 1

Other

OD3031263, 2J EDG exhaust pipe support non-conforming, May 12, 2016

**Section 1R18: Plant Modifications**

Procedures, Guidance Documents, and Manuals

CM-AA-DDC-201, Design Changes, Rev. 16  
 0-OP-62.1, Operation of Area Radiation Monitors, Rev. 8  
 1-OP-62.3, Process Radiation Monitors, Rev. 21

Records and Data

TM-59-02-2016-120, “Extension to Unit 2 Head Vent Splatter Shield”

**Section 1R19: Post Maintenance Testing**

Procedures, Guidance Documents, and Manuals

1-MCM-1401-02, “Removal and Installation of U1 Terry Turbine Woodward Governor,” Rev. 6  
 1-PT-71.1Q, “1-FW-2, Turbine Driven Auxiliary Feedwater Pump and Valve Test,” Rev. 61

Corrective Action Documents

CR572803, “1-FW-P-2 (Steam Driven AFW pump) governor did not maintain speed during PT”

Work Orders

WO59102099196  
 WO59102982087  
 WO59102982084  
 WO59102982092  
 WO59102793853

**Section 1R21: Component Design Basis Inspection**

Calculations

NA-CALC-ELE-14258.79-E-4 (ADD-001-00C), Short Circuit Currents-120VAC Vital Buses and Miscellaneous Circuits-Appendix R Evaluation, Rev. 1  
 Technical Report EE-0118, 10CFR50 Appendix ‘R’ Electrical Distribution System Coordination Study, Rev. 2

**Section 1R22: Surveillance Testing**Procedures, Guidance Documents, and Manuals

2-PT-57.1A, Unit 2, Emergency Core Cooling – Low Head Safety Injection Pump, Rev. 63  
 2-PT-74.2A, Unit 2, Component Cooling Pump 2-CC-P-1A Test, Rev. 36  
 1-PT-71.3Q, Unit 1, 1-FW-P-3B B Motor Driven Auxiliary Feedwater Pump Valve Test, Rev. 52  
 1-PT-71.1Q, Unit 1, 1-FW-P2 Turbine Driven Auxiliary Feedwater Pump and Valve test, Rev. 66

**Section 2RS1: Radiological Hazard Assessment and Exposure Control**Procedures and Guidance Documents

PI-AA-200, Corrective Action, Rev. 29  
 RP-AA-201, Access Controls for High and Very High Radiation Areas, Rev. 8  
 RP-AA-202, Radiological Posting, Rev. 8  
 RP-AA-222, Radiation Surveys, Rev. 3  
 RP-AA-223, Contamination Surveys, Rev. 4  
 RP-AA-224, Airborne Surveys, Rev. 2  
 RP-AA-225, Unrestricted Release of Material, Rev. 5  
 RP-AA-226, Alpha Monitoring”, Rev. 4  
 RP-AA-240, Discrete Radioactive Particle Control, Rev 2  
 RP-AA-230, Personnel Contamination Monitoring and Decontamination, Rev. 9

Records and Data

0-HSP- ISFSI-001, Independent Spent Fuel Storage Installation (ISFSI) Health Physics TLD Survey Surveillance, 4<sup>th</sup> Quarter 2015  
 0-PT-120, Health Physics Periodic Test, Sealed Source Contamination (sealed source leak test records for June 2015 and December 2015), 12/3/15  
 NSTS Annual Inventory Reconciliation Report, dated 1/7/16  
 RWP 15-1224, Load, Transport, and Store NUHOMS Spent Fuel Dry Storage Casks, Rev. 1  
 RWP 16-2260, Steam Generator Primary Side Maintenance, Rev. 2  
 RWP 16-2252, Lift and Set Reactor Vessel Head, Lift and Set Upper Internals, Rev. 0  
 RWP 16-2262, Inspect intermediate and Hot Leg Drain Lines, Rev. 1  
 RWP 16-2275, Reactor Vessel Upflow Modification, Rev. 1  
 Standing Order Number 223, Maintenance on the JL Shepherd instrument calibrators, 9/24/15  
 Survey Map Number 58C, Unit 2 Containment 216’ Elevation RX Head Stand, 3/11/16  
 Survey Map Number 66V, ISFSI Pad, 2/19/16  
 Survey Map Number 230, Reactor Cavity Unit 2, 3/22/16 and 3/25/16  
 Survey Map Number 259, Unit 2 Containment 241’ A Loop Room, 3/8/16, 3/22/16, and 3/23/16  
 Survey Map Number 278, Steam Generator Platform A, 3/10/16, 3/11/16  
 WMG Common DAW Nuclide Distribution Report, October 2015

Condition Reports

RP-AA-111-1009, Radiological Survey Program Review, 9/24/15  
 CR574819  
 CR575060  
 CR582441  
 CR1000386  
 CR1010757  
 CR1028415  
 CR1032903

**Section 2RS2: Occupational ALARA Planning and Controls**

Procedures, Guidance Documents, and Manuals

RP-AA-103, ALARA Program, Rev. 2

RP-AA-103-1000, Department, Station and Fleet ALARA Committees, Rev 4

RP-AA-274, Radiation Work Permits, Rev. 4

RP-AA-300, ALARA Reviews and Reports, Rev. 8

RP-AA-301, ALARA Goals, Rev. 3

RP-AA-302, ALARA 5-Year Plan, Rev. 0

Records and Data

ALARA Daily Report, 3/23/2016, 4/6/2016

ALARA Plan 15-013, Perform Reactor Coolant Pump (RCP) Maintenance During N 1 R24 (RWP 15-3204)

ALARA Plan 15-011, Disassemble/Reassemble Reactor Head (RWP 15- 3251)

ALARA Plan 16-006, Remove & Install Insulation in all RCA's (RWP 16-2210)

ALARA Plan 16-007, Remove Pad Insulation & Install Metal Reflective Insulation on "A,B,C" Steam Generators Lower Assemblies (RWP 16-2276)

ALARA Plan 16-016, Perform RCP Motor Inspections & PMs (RWPs 16-2204 and 16-2270)

ALARA Plan 16-021, Install/Remove Temp Shielding and Perform Hot Spot Flushes during N2R24 (RWP 16-2222)

ALARA Plan 16-024, Perform Unit 2 Upflow conversion modification per NA-DC- 15-00053 (RWP 16-2275)

ALARA Plan 16-026, "A & C" S/G Primary Inspections & Testing (RWP 16-2260)

ALARA Post-Job Review, ALARA Plan 16-007, R & R S/G Insulation during U-2 RFO (DC 15-00020) (RWP16-2276)

ALARA Post-Job Review, ALARA Plan 15-013, Perform Reactor Coolant Pump (RCP) Maintenance during N1R24 (RWP15-3204)

ALARA Post-Job Review, ALARA Plan 16-024, Rx Vessel Upflow Modification Including Lower Internals Lift and Set (DCP 15-00053) (RWP 16-2275)

ALARA Post-Job Review, ALARA Plan 16-026, S/G Primary Side Maintenance and Eddy Current on 2-RC-E-1A & 2-RC-E-1C (RWP16-2260)

EPRI Standard Radiation Monitoring Program (SRMP) Data, North Anna Unit 1, Cycle 24

EPRI Standard Radiation Monitoring Program (SRMP) Data, North Anna Unit 2, Cycle 24

EPRI (SRMP) Data Spreadsheet, North Anna Unit 1 and 2 Comparison 1989 thru 2015

Excel Spreadsheet, 2015 ALARA Master File, 2/10/2016

Excel Spreadsheet, 2016 ALARA Master File, 2/10/2016

North Anna Power Station 5 Year Exposure Reduction Plan 2016-2021, Rev. 0

North Anna Power Station 2015 Unit One Refueling Outage N1R24 ALARA Report

RP-AA-200-Attachment 1, Station ALARA Goals – 2015, 11/4/2014

RP-AA-200-Attachment 1, Station ALARA Goals – 2016, 12/8/2016

Station ALARA Committee Meeting Minutes [N2R24 ALARA Plans >2000 mRem Approval], 1/4/2016

Temporary Shielding Log, VPAP-2105 Attachment 3, 3/23/16

Temporary Shielding Request (TSR) 16-TSR-021, S/G Diaphragm (U-2 RC 262' motor cube(s))

TSR 16-TSR-007, Fuel Transfer Tube (Water Shields)

TSR 16-TSR-025, U-2 RC 262' inside Transfer Canal (Fuel Cart Pivot Pin)

TSR 16-TSR-006, U-2 RC 216' (Rx Head Stand Shadow Shield)

TSR 16-TSR-034, U-2 RC 291' Over Filled Cavity (Manipulator Bridge 2-MH-CRN-5) [Upflow Mod]

Unit 2 Outage RWP Summary, Including ED Alarm Setpoints and Briefing Requirements, 3/24/2016

ALARA Work In Progress Review (WIPR) Number 2, RWP 15-3204 Task 2, Perform Reactor Coolant Pump (RCP) Maintenance during N1R24, 50% review, 3/15/2015  
 WIPR Number 2, RWP 15-3204 Task 2, Perform Reactor Coolant Pump (RCP) Maintenance during N1R24, 80% review, 3/17/2015  
 WIPR, RWP 16-2256 Task 1, Rx Cavity Decon After Head Set, Other review [elevated dose rates in cavity after draindown], 4/4/2016  
 WIPR Number 1, RWP 16-2214 Task 1 & 2, Inspect, Remove and Replace snubbers during Unit 2 outage, 50% review, 3/15/2016  
 WIPR Number 16-003, RWP 16-2209, Install/Remove Scaffold during N2R24, 50% review, 3/15/2016  
 WIPR Number 16-007, RWP 16-2276, R & R S/G Insulation during U-2 RFO, 50% review, 3/15/2016  
 WIPR Number 16-011, RWP 16-2209, Install/Remove Scaffold during N2R24, 80% review, 3/18/2016  
 WIPR Number 16-013, RWP 16-2214 Task 1 & 2, Inspect, Remove and Replace snubbers during Unit 2 outage, 80% review, 3/21/2016  
 WIPR Number 16-014, RWP 16-2210, Remove/Replace Insulation, 50% review, 3/21/2016  
 10 CFR Part 61 Analysis Results: U-2 DAW (10/14), 10/22/2014; Common DAW (10/2015), 11/12/2015

#### RWPS

15-3251, Rev 0 and 1, Disassemble and Reassemble Reactor Vessel Head  
 15-3204, Rev 0, Mechanically/ Electrically disconnect/ reconnect RCP motors, perform PM's 1 year motor inspections  
 16-2209, Rev 0, Install and Remove Scaffolding during 2R24  
 16-2210, Rev 0, Remove and Replace Insulation during Unit 2 Outage  
 16-2214, Rev 0, Perform as found / as left small and large bore snubber inspections  
 16-2222, Rev. 0, Install and Remove temporary shielding packages and includes hot spot flushes in support of the outage  
 16-2276, Rev 0, Remove and Replace Steam Generator Insulation during Unit 2 outage. Includes scaffold support

#### Radiological Surveys

Multiple Surveys for Disassemble/Reassemble Reactor Head, RWP-15-3215, 3/3-3/23/2015  
 Multiple Surveys for Intermediate Leg Drain Line Repairs, RWP-15-3262, 3/15-3/20/2015

#### Corrective Action Program (CAP) Documents

CR558748  
 CR560852  
 CR575060  
 CR576266  
 CR578881  
 CR1024738

### **Section 2RS3: In-Plant Airborne Radioactivity Control and Mitigation**

#### Procedures and Guidance Documents

C-HP-1042.122, Quantitative Fit Testing: PORTACOUNT PRO Fit Testing System, Rev. 12  
 HP-1042.451, Self-Contained Breathing Apparatus Maintenance, Rev. 4  
 HP-1042.510, Atmosphere Supplying Respiratory Equipment Performance Verification, Rev. 8  
 HP-1042.520, Respiratory Protection Program Equipment Criteria and Verification, Rev. 6

HP-1042.525, Use of the POSICHEK 3 Computerized Performance Tester to Verify Performance of Respiratory Protection Equipment, Rev. 4  
 PI-AA-200, Corrective Action, Rev. 29  
 RP-AA-160, Donning and Removal of Respiratory Protection Equipment, Rev. 0  
 RP-AA-162, Issue and Control of Respiratory Protection Equipment, Rev. 3  
 RP-AA-163, Inspection and Inventory of Respiratory Protection Equipment, Rev. 5  
 RP-AA-226, Alpha Monitoring”, Rev. 4  
 0-OP-21.11, Fuel Building Ventilation Lineup for Evolutions Over Spent Fuel Pool, Rev. 32

#### Records and Data

O-PT-77.4A, Laboratory Analysis 1-HV-FL-3A - ECCS PREACS, 4/22/14 and 7/9/15  
 O-PT-77.4B, Laboratory Analysis 1-HV-FL-3B - ECCS PREACS, 6/5/13 and 9/30/14  
 O-PT-77.14A, ECCS PREACS Train A Filter In-Place Test 1-HV-FL-3A, 6/27/13 and 12/5/14  
 O-PT-77.14B, ECCS PREACS Train A Filter In-Place Test 1-HV-FL-3B, 2/27/14 and 7/16/15  
 1-PT-76.10A, Control Room Emergency Ventilation System - Laboratory Analysis For 1-HV-FL-8, 8/6/13 and 6/2/15  
 1-PT-76.12A, Control Room Emergency Ventilation System - Post-Maintenance Test on the HEPA Filter of 1-HV-FL-8, 7/23/13 and 5/21/15  
 1-PT-76.13A, Control Room Emergency Ventilation System - Post-Maintenance Test of the Charcoal Filters of 1-HV-FL-8, 7/23/13 and 5/21/15  
 Airgas USA LLC Certificates of Analysis for multiple SCBA bottles, 9/10/15  
 Air Sample Analysis Report (Lapel), 16-2252-0311-0543, Head Lift, 3/11/16  
 Air Sample Analysis Report (Lapel), 16-2252-0311-0548, Head Lift, 3/11/16  
 Air Sample Analysis Report, 16-2252-0311-0632, U-2 RC 216 Lower Head to Head Stand, 3/11/16  
 Air Sample Analysis Report, 16-2260-0311-1536, U-2 A S/G Rmv Diaphragm Gas Grab, 3/11/16  
 Air Sample Analysis Report, 16-2262-0323-0221, U-2 241' A Cube Cutting Loop Drain Line, 3/23/16  
 Air Sample Analysis Report, 13-2262-0323-0342, U-2 "A" Loop Rm Cut out Loop Drain Line, 3/23/16  
 Air Sample Analysis Report, 13-2275-0324-1355, Remove Hoses from Cavity, 3/24/16  
 C-HP-1033.610, Attachment 3, Continuous Air Monitor Setpoint Log, CAM SN 1029, 1/14/16  
 C-HP-1042.510, Attachment 3, Breathing Air Quality Verification Record, Breathing Air Sources 2-SA-109 and 2-SA-111, 2/23/15 and 8/26/15  
 C-HP-1042.510, Attachment 4, SCBA Cylinder Hydrostatic Test Records: ON118430 - 9/25/13, ON119093 - 7/9/13, ON119849 - 5/20/13, and ON119469 - 6/6/13  
 HP-1042.525, Attachment 1, Respiratory Equipment Performance Verification Logs: SCBA #3 - 8/27/14 and 8/26/15, SCBA #8 - 1/12/15 and 1/13/16, and SCBA #10 - 1/12/15 and 1/13/16  
 MSA Posi3 USB Test Results: SCBA #3 - 8/19/14 and 8/12/15, SCBA #8 - 1/8/15 and 1/12/16, and SCBA #10 - 1/8/15 and 1/12/16  
 Portable Ventilation / Vacuum Cleaner Leak Test Record, ID Number 25, 1/30/15 and 12/8/15  
 Portable Ventilation / Vacuum Cleaner Leak Test Record, ID Number 35, 6/15/14 and 1/2/16  
 Portable Ventilation / Vacuum Cleaner Leak Test Record, ID Number 38, 1/2/16  
 Respiratory Protection Training (Fleet), Initial Computer Based Training (CBT): RPT-1-Reason For Use, RPT-2-Types of Respirators, RPT-3-Issue and Use of Respirators, and RPT-4-General Safety Concerns  
 TEDE ALARA Review, 16-2252-1, Lift Reactor Vessel Head from Vessel and move to Head Stand in Containment Basement, 12/9/15

TEDE ALARA Review, 16-2260, U-2 A, C Steam Generator Eddy Current, 1/28/16  
 TEDE ALARA Review, 16-2262, Cut out/replace A Cold Leg Drain, 3/10/16  
 TEDE ALARA Review, 16-2275, U-2 Upflow Modifications, 2/11/16

Condition Reports

CR560004  
 CR570630  
 CR573733  
 CR580341  
 CR582140  
 CR1028242

**Section 2RS4: Occupational Dose Assessment**

Procedures, Guidance Documents, and Manuals

C-HP-1042.220, Airborne Radioactive Material Exposure Authorization, Rev. 4  
 C-HP-1031.302, Calibration of Electronic Dosimeters, Rev. 17  
 HP-1041.048, APEX In-Vivo Whole Body Counter: Operation and Performance Checks, Rev. 0  
 HP-1041.057, Whole Body Counting Individuals Using the PM-7, Rev. 3  
 HP-1041.058, APEX In-Vivo Whole Body Counter: Whole Body Counting Individuals, Rev. 0  
 HP-1041.068, APEX In-Vivo Whole Body Counter: Calibration, Rev. 0  
 HP-1041.070, Guidance for WBC Report Spectrum Analysis and Identification/Response to Clothing Contaminations, Rev. 1  
 RP-AA-104, Internal Radiation Exposure Control Program, Rev. 1  
 RP-AA-105, External Radiation Exposure Control Program, Rev. 1  
 RP-AA-131, Whole Body Monitoring, Rev. 1  
 RP-AA-132, Urine and Fecal Sampling and Analysis, Rev. 0  
 RP-AA-133, Internal Dose Calculation Based on Radionuclide Intake, Rev. 0  
 RP-AA-134, Radionuclide Intake Determination Based on Bioassay Results, Rev. 1  
 RP-AA-136, Internal Dose Calculations Based on DAC-Hour Exposure, Rev. 0  
 RP-AA-138, Declared or Expected Pregnant Woman, Rev. 2  
 RP-AA-124, Dosimetry Investigation and Processing, Rev. 5  
 RP-AA-224, Airborne Radioactivity Surveys, Rev. 2  
 RP-AA-230, Personnel Contamination Monitoring and Decontamination, Rev. 9  
 0-HSP-BSRD-001, Bioassay Program Significant Radionuclide and Whole Body Count (WBC) Action Level Determination, Rev. 0

Records and Data

APEX InVivo Library Listing Report, File Description: NAIPKLCT.NLB – NaI Peak Locate, 3/22/2016  
 APEX InVivo Library Listing Report, File Description: Inhalation Library, 3/22/2016  
 APEX InVivo Library Listing Report, File Description: STANDARD NUCLIDE LIBRARY [Medical], 3/22/2016  
 Common DAW Waste Stream Report, 10/20/2015  
 Department Clock Reset Briefing Sheet, CR574738 Number, Radiation Protection Department, 3/21/2015  
 Dosimetry records for two declared pregnant workers  
 Dosimeter Multi-Badge Documentation for Selected Individuals on RWP: 16-2253, Task 1 (Blind Fla Installation); 16-2256, Task 1 (Initial cavity Decon); and 16-2260, Task 3 (S/G Primary Side – Nozzle Dams)  
 Excel Spreadsheet File, 0-HSP-INST-002 Worksheet for Common DAW, 2/21/2016

Excel Spreadsheet File, 0-HSP-INST-002 Worksheet for U-2 DAW, 5/14/2015  
 Excel Spreadsheet File, 0-HSP-INST-002 Worksheet for U-1 DAW, 5/14/2015  
 File, PCE Log for 2014, 2/15/2016  
 File, PCE Log for 2015, 2/15/2016  
 Gamma Spectrum Filename 09-Sep-14-4000020, Particle [14-PCE-003], 9/9/14  
 Gamma Spectrum Filename 09-Sep-14-4000021, Nose Blow [14-PCE-003], 9/9/14  
 iDC-HF Calibrator Calibration Package [Electronic Dosimeter Calibrator], 6/25/2015  
 Individual Whole Body Count Record and Evaluation for 14-PCE-003, 9/9/14  
 Memo to File, NAPS Exposure Control, Technical Basis Paper for Using the PM-7 for Meeting  
 the WBC Requirement, 1/6/2000  
 Memorandum, Innsbrook Technical Center, Evaluation for Using PCM-1Bs as Passive Internal  
 Monitoring, 12/20/1995  
 Memorandum, NAPS Exposure Control, Final report on Take Home TLD Study, 6/24/2004  
 NAVLAP Certificates of Accreditation to ISO/IEC 17025:2005 for Mirion Technologies (GSD),  
 Inc, Effective dates 7/1/2014 thru 6/30/2015 and 6/11/2015 thru 6/30/2016  
 PCE Log for 2016, 4/4/2016  
 PCE Number 14-PCE-003, Particle on Skin during Work on 2-RC-MOV-2593, 9/9/2014  
 RP-AA-111-1005 Attachment 1, External Radiation Exposure Control Program Review, CSR  
 SAR002775, North Anna for the period 10/1/2012-9/15/2014, 9/19/2014  
 RP-AA-226 Attachment 1, North Anna Unit 2 Routine Facility Characterization of Alpha Source  
 Term, 2/4/2016  
 Source Certificate, S/N 99878 [Mixed Gamma for WBC Calibration], 4/1/2015  
 U-1 DAW Waste Stream Report, 3/9/2015  
 U-2 DAW Waste Stream Report, 10/1/2014  
 Whole Body Counter (WBC) Calibration File, ACCUSCAN II [Old WBC using Abacos Plus  
 software on VAX computer], 8/15/2015  
 WBC Calibration File, FastScan EXT [Initial CAL with new WBC and APEX InVivo Software],  
 7/28/2015  
 0-HSP-INST-003, DAC Value Calculation, Instrument Sensitivity Determination, and Beta  
 Activity Conversion Factor Determination  
 0-HSP-ISFSI-001, Independent Spent Fuel Storage Installation (ISFSI) Health Physics TLD  
 Surveillance [3<sup>rd</sup> Quarter 2015], 10/28/2015  
 0-HSP-ISFSI-001, Independent Spent Fuel Storage Installation (ISFSI) Health Physics TLD  
 Surveillance [4th Quarter 2015], 2/4/2016

#### Condition Reports

CR558050  
 CR574738  
 CR574819  
 CR582442  
 CR1003554  
 CR1008340  
 CR1027270  
 CR1032388

#### **Section 2RS5: Radiation Monitoring Instrumentation**

##### Procedures, Guidance Documents, and Manuals

C-HP-1033.011, Check Source Reference Readings and Geotropism Checks for Portable  
 Instruments, Rev. 5  
 C-HP-1033.012, Portable Radiation Protection Instrumentation Control, Rev. 3

C-HP-1033.022, J.L. Shepherd Model 89 Shielded Calibration System, Operation and Surveillance, Rev. 3  
 C-HP-1033.533, MGP TelePole: Calibration and Operation, Rev. 5  
 HP-1033.361, Beckman Liquid Scintillation Counter LS-6000SC: Calibration, Rev. 6  
 HP-1033.406, Ludlum Model 26: Calibration and Operation, Rev. 1  
 HP-1033.620, Portable Air Samplers Calibration and Operation  
 HP-1033.711, Eberline Personnel Monitor Model PM-7, Calibration and Operation, Rev. 3  
 HP-3010.040, Radiation Monitoring System Setpoint Determination, Rev. 24  
 RP-AA-400, Portable Survey Instrumentation, Rev. 4  
 O-HSP-INST-003, DAC Value Calculations, Instrument Sensitivity Determination, and Beta Activity Conversion Factor Determination, Rev. 1

### Records and Data

Air Sample Count Room Log, 07/04/15-07/13/15  
 Calibration Certificate - SAIC HD-29A #5627, 04/07/2016  
 Calibration Certificate - ASP-1 With NRD Detector #4060, 02/25/16  
 Calibration Certificate - MGP TelePole 6606-001, 09/01/2015  
 Calibration Certificate - Canberra Apex MCA HPGe #3, #52-P23 270A, 10/20/2015  
 Calibration Certificate - Eberline AMS-4 #1029, 01/14/2016  
 Calibration Certificate - Eberline RO-20AA #163, 03/03/2016  
 Calibration Certificate - Thermo Scientific iPCM12 -1105PCM12045, 01/11/16  
 Calibration Certificate - Eberline RM-14 #5713, 03/03/2016  
 Calibration Certificate - Eberline PM-7 #372, 02/11/2016  
 Calibration Certificate - Ludlum Model 26 #PF001218, 11/13/15  
 Certificate of Calibration, Model Number 878-10 Calibrator #104, 07/19/1984  
 Certificate of Calibration, Source #55521-76, 03/31/1998  
 Certificate of Calibration, Source #56846-76, 11/24/1998  
 Certificate of Calibration, Source #27391, 04/28/1998  
 Certificate No. 128366 – RU 374 Sealed Radioactive Source, 02/21/2009  
 Certificate No. 145900 – TT 332 Sealed Radioactive Source, 07/18/2011  
 Gamma Spectrum Filename 09-Jul-15-400018, Waste Solids, Transfer 1-CH-I-3A, 07/09/2015  
 Leak Test Certificate, Model Number 878-10 #104 Cs-137, 07/20/1984  
 NAPS Calibration Certificate – NE Technology SAM -9/SAM-11, ID Number 600, 08/12/215  
 Self-Assessment, RP-AA-111-104, Instrumentation Program Review, #003067, 06/30/2015  
 System Health Report, Q4-2015, RM-Radiation Monitors, 02/08/2016  
 Work Order 59102367117, 02-RM-RMS-260-DETECT (Containment Area Radio Gas Radiation Monitor Calibration), 11/05/2014  
 Work Order 59102781781, 02-RM-RMS-264-DETECT (Unit 2 Incore Instrument Area Radiation Monitor Calibration) 03/17/2016  
 Work Order 59102776711, 02-RM-RMS-265-DETECT (Unit 2 Containment High Range Radiation Monitor Maintenance and Calibration), 03/20/2016  
 Work Order 59102571022, 02-RM-RMS-263-DETECT (Unit 2 Containment Area Radiation Monitor Calibration), 07/18/2014  
 Work Order 5910261182, IPM/01 -RM-RM-157 (Calibrate Rad Monitor) (Control Room Radiation Monitor), 05/19/2015



Condition Reports

CR1009493  
 CR571209  
 CR572204  
 CR574543  
 CR1002749  
 CR1008217  
 CR1020503

**Section 40A1: Performance Indicator Verification**Procedures, Guidance Documents, and Manuals

RP-AA-112, Radiation Safety Performance Indicator Reporting, Rev. 4  
 EP-AA-103, Emergency Preparedness Performance Indicators, Rev. 3  
 LI-AA-500, NRC/INPO/WANO Performance Indicator and MOR Reporting, Rev. 2

Records and Data

DEP opportunities documentation for 2nd Quarter 2014 through 1<sup>st</sup> Quarter 2015  
 Drill and exercise participation records of ERO personnel for 2nd 2014 through  
 1<sup>st</sup> Quarter 2015  
 Siren test data for 2nd Quarter 2014 through 1<sup>st</sup> Quarter 2015  
 Spreadsheet of Electronic Dosimeter Dose and Dose Rate Alarms, 03/10/2015 thru 06/17/2106  
 NAPS Monthly NRC Performance Indicator Data for July 2015 through Jun 2016  
 NAPS NRC Performance Indicator Data, July 2014 thru April 2015  
 Electronic Dosimeter Dose/Dose Rate Alarm Log, June 2015 thru March 2016  
 EMS Radioactive Effluent Release Reports (Liquid and Gaseous), June 2015 thru March 2016  
 NAPS Monthly NRC Performance Indicator Data, June 2015 thru March 2016

Corrective Action Documents

CR 582080  
 CR 582085  
 CR1030167  
 CR1032902

**Section 40A2: Problem Identification and Resolution**Corrective Action Documents

CR1036685, "Maintenance Rule Unavailability Has Been Exceeded on 2-CH-P-1C"