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

October 1, 2015

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 COMPONENT DESIGN BASES INSPECTION REPORT 05000338/2015007 AND 05000339/2015007

Dear Mr. Heacock:

On August 21, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your North Anna Power Station and discussed the results of this inspection with Mr. G. Bischof and other members of your staff. Additional inspection results were discussed with Mr. G. Bischof and other members of your staff on September 30, 2015. Inspectors documented the results of this inspection in the enclosed inspection report.

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

If you contest the violation or significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC resident inspector at the North Anna Power Station.

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

NRC's Agencywide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA: Eric Stamm for/

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

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

Enclosure:
Inspection Report 05000338/2015007 and 05000339/2015007
w/ Attachment: Supplementary Information

cc: Distribution via Listserv

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-338, 50-339
License Nos.:	NPF-4, NPF-7
Report Nos.:	05000338/2015007 and 05000339/2015007
Licensee:	Virginia Electric and Power Company (VEPCO)
Facility:	North Anna Power Station, Units 1 & 2
Location:	Mineral, VA 23117
Dates:	July 20, 2015 – August 21, 2015
Inspectors:	G. Ottenberg, Senior Reactor Inspector (Lead) S. Herrick, Reactor Inspector M. Riley, Reactor Inspector G. Skaggs Ryan, Resident Inspector C. Baron, Contractor (Mechanical) O. Mazzoni, Contractor (Electrical)
Approved by:	Jonathan H. Bartley, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY

IR 05000338/2015007, 05000339/2015007; 07/20/2015 – 08/21/2015; North Anna Power Station, Units 1 and 2; Component Design Bases Inspection.

This inspection was conducted by a team of three Nuclear Regulatory Commission (NRC) inspectors from Region II, one resident inspector, and two NRC contract personnel. One Green non-cited violation (NCV) was identified. The significance of inspection findings is indicated by their color (Green, White, Yellow, Red) using the NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," dated April 29, 2015. 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.

NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Green. The team identified a non-cited violation (NCV) of 10 Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to control deviations from their piping design code of record for the auxiliary feedwater (AFW) system discharge lines. The licensee failed to consider the impact forces from a potential water hammer event as required by USA Standard (USAS) B31.1.0. The licensee entered this issue into their corrective action program as CR1003896. The licensee measured the discharge line temperatures of the AFW system to verify that current seat leakage past the check valves did not support steam void formation based on the recorded temperature and pressure in the discharge line such that water hammer was avoided. Additionally, the licensee implemented weekly temperature monitoring for continued operability of the AFW discharge lines in CA3003072.

This performance deficiency was more than minor because it was associated with the mitigating systems cornerstone attribute of design control and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee did not ensure the capability of the AFW piping because they did not consider that an undiscovered steam pocket in any of the AFW pumps discharge lines could lead to a water hammer in the line when AFW is initiated during an event. The team used IMC 0609, Att. 4, "Initial Characterization of Findings," issued June 19, 2012, for Mitigating Systems, and IMC 0609, App. A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality (as shown through review of documentation related to prior identified leakage). The team determined that no cross-cutting aspect was applicable because the finding was not indicative of current licensee performance. (Section 1R21.3)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R21 Component Design Bases Inspection (71111.21)

.1 Inspection Sample Selection Process

The team selected risk-significant components and related operator actions for review using information contained in the licensee's probabilistic risk assessment. In general, this included components and operator actions that had a risk achievement worth factor greater than 1.3 or Birnbaum value greater than 1E-6. The sample included 15 components, three of which were associated with containment large early release frequency (LERF), and five operating experience (OE) items.

The team performed a margin assessment and a detailed review of the selected risk-significant components and associated operator actions to verify that the design bases had been correctly implemented and maintained. Where possible, this margin was determined by the review of the design basis and Updated Final Safety Analysis Report (UFSAR) response times associated with operator actions. This margin assessment also considered original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition issues. Equipment reliability issues were also considered in the selection of components for a detailed review. These reliability issues included items related to failed performance test results, significant corrective action, repeated maintenance, maintenance rule status, Manual Chapter 0326 conditions, NRC resident inspector input regarding problem equipment, system health reports, industry OE, and licensee problem equipment lists. Consideration was also given to the uniqueness and complexity of the design, OE, and the available defense-in-depth margins. An overall summary of the reviews performed and the specific inspection findings identified is included in the following sections of the report.

.2 Component Reviews

a. Inspection Scope

Components

- Quench Spray Pumps [1-QS-P-1A and 1-QS-P-1B]
- Casing Cooling Pumps [1-RS-P-3A and 1-RS-P-3B]
- Air-Operated Valves and Manual Valves Needed to Re-align the Turbine Driven Auxiliary Feedwater (TDAFW) Pump to an Alternate Steam Generator [1-FW-PCV-159A(B), 1-HCV-100A(B)(C), 1-FW-155, 1-FW-64, 1-FW-96, 1-FW-149, 1-FW-62, 1-FW-94, and 1-FW-126]
- Motor-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-MOV-100A(B)(C)]
- Emergency Diesel Generator Lubricating Oil System [1-EG-P-4H, 1-EG-P-4J, 1-EG-CLR-600H, 1-EG-FL-600H, 1-EG-S-600H, and 1-EG-P-603H]

- TDAFW Pump [1-FW-P-2]
- 4160 Volt to 480 Volt Transformers [1-EE-ST-1J, 1-EE-ST-1J1, 1-EE-ST-1H, and 1-EE-ST-1H1]
- Vital Inverters [1-VB-INV-01 and 1-VB-INV-03]
- Emergency Diesel Generator Batteries [1-EG-B-01A and 1-EG-B-03C]
- Emergency Diesel Generator and Protective Relaying
- Reserve Station Service Transformer "C" [1-EP-ST-2C]
- Turbine Building Flooding Protective Circuitry [1-DB-LS-103, 1-DB-LS-104, 1-CW-LS-106A-1, 1-CW-LS-106A-2, and 1-CW-LS-106A-3]

Components with LERF Implications

- Main Steam Trip Valves [1-MS-TV-101A(B)(C)]
- Main Steam Non-return Valves [1-MS-NRV-101A(B)(C)]
- Recirculation Spray Heat Exchanger Inlet, Outlet, and Return Valves [1-SW-MOV-103A(B)(C)(D), 1-SW-MOV-104A(B)(C)(D), and 1-SW-MOV-105A(B)(C)(D)]

For the 15 components listed above, the team reviewed the plant technical specifications (TS), UFSAR, design bases documents (DBDs), and drawings to establish an overall understanding of the design bases of the components. Applicable design calculations and procedures were reviewed to verify that the design and licensing bases had been appropriately translated into these documents. Test procedures and recent test results were reviewed against DBDs to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents, and that individual tests and analyses served to validate component operation under accident conditions. Maintenance procedures were reviewed to ensure components were appropriately included in the licensee's preventive maintenance program. System modifications, vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action program documents were reviewed (as applicable) in order to verify that the performance capability of the component was not negatively impacted, and that potential degradation was monitored or prevented. Maintenance Rule information was reviewed to verify that the component was properly scoped, and that appropriate preventive maintenance was being performed to justify current Maintenance Rule status. Component walkdowns and interviews were conducted to verify that the installed configurations would support their design and licensing bases functions under accident conditions and had been maintained to be consistent with design assumptions.

Additionally, the team performed the following component-specific reviews:

- The team observed a simulator scenario involving the recovery of the quench spray pumps to verify the actions could be accomplished by the operators upon recognition of their failure to start on a high containment pressure signal.
- The team inspected spare valve cages for Air-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-PCV-159A, 1-FW-PCV-159B, 1-HCV-100A, 1-HCV-100B, 1-HCV-100C] and for Motor-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-MOV-100A, 1-FW-MOV-100B, and 1-FW-MOV-100C] in the station warehouse to verify that these valves would not be susceptible to clogging if the auxiliary feedwater system supply was aligned to the service water or fire protection systems.

- The team reviewed and evaluated the capability of the emergency diesel generator batteries to provide power to equipment necessary to cope during a station blackout event.
- The team reviewed Air-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-PCV-159A, 1-FW-PCV-159B, 1-HCV-100A, 1-HCV-100B, 1-HCV-100C] to verify the capacity of the associated air accumulators to ensure operation of the air-operated valves for at least 30 minutes.
- The team reviewed Air-Operated Valves and Manual Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-PCV-159A, 1-FW-PCV-159B, 1-HCV-100A, 1-HCV-100B, 1-HCV-100C, 1-FW-155, 1-FW-64, 1-FW-96, 1-FW-149, 1-FW-62, 1-FW-94, and 1-FW-126] to verify the time available for the operators to realign these valves under accident conditions with postulated single failures.
- The team reviewed Motor-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-MOV-100A, 1-FW-MOV-100B, and 1-FW-MOV-100C] to verify the Thermal Overload settings were appropriate to prevent tripping the valves under accident conditions.
- The team reviewed Motor-Operated Valves Needed to Re-align the TDAFW Pump to an Alternate Steam Generator [1-FW-MOV-100A, 1-FW-MOV-100B, and 1-FW-MOV-100C] to verify the time available for the operators to realign these valves under accident conditions with postulated single failures.
- The team reviewed Main Steam Trip Valves [1-MS-TV-101A, 1-MS-TV-101B, 1-MS-TV-101C] closing times to verify the resulting steam hammer transient would be acceptable.
- The team reviewed Main Steam Trip Valves [1-MS-TV-101A, 1-MS-TV-101B, 1-MS-TV-101C] environmental conditions to verify the qualification of associated electrical equipment in the area.
- The team observed a simulator exercise to verify the station's response to a steam generator tube rupture event with a single active failure of an AFW pump would not result in overfilling the ruptured steam generator and that the radiological releases would be terminated within 30 minutes.

b. Findings

No findings were identified. However, the following unresolved item (URI) was identified.

(Opened) Adequacy of Class 1E 120VAC Vital Bus Design

Introduction: The team identified an unresolved item (URI) regarding the adequacy of design for the 120VAC Vital Buses.

Description: Calculation 14258.79-E-4, "Short Circuit Currents – 120V AC Vital Buses and Miscellaneous Circuits – Appendix R Evaluation," Rev.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," Rev. 2, to verify proper breaker coordination for the 120 VAC Vital instrumentation buses.

In 2003, the licensee received concurrence from the vital inverter vendor stating that while the steady state short circuit current limit was indeed approximately 200% of rated full load current for the inverter, the steady state short circuit current was approximately 200% of rated full load current for the regulating transformer, which was different than what was assumed in the technical report. The memo also stated that the ½ 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 noticed 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 <=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 as CR1006865. This issue is a URI pending the determination of whether a violation of NRC requirements exists. (URI 05000338/2015007-01; 05000339/2015007-01, Adequacy of Class 1E 120VAC Vital Bus Design)

.3 Operating Experience

a. Inspection Scope

The team reviewed five operating experience issues for applicability at the North Anna Power Station. The team performed an independent review of these issues and, where applicable, assessed the licensee's evaluation and dispositioning of each item. The issues that received a detailed review by the team included:

- NRC Generic Letter 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps"
- NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- NRC IN 84-06, "Steam Binding of Auxiliary Feedwater Pumps"
- NRC IN 94-24, "Inadequate Maintenance of Uninterruptible Power Supplies and Inverters"
- NRC IN 08-09, "Turbine-driven Auxiliary Feedwater Pump Bearing Issues"

b. Findings

Failure to Consider Potential Water Hammer Impact Loading on AFW piping

Introduction: The team identified a non-cited violation (NCV) of 10 Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to control deviations from their piping design code of record for the auxiliary

feedwater (AFW) system discharge lines. The licensee failed to consider the impact forces from a potential water hammer event as required by USA Standard (USAS) B31.1.0.

Description: The Unit 1 and Unit 2 AFW system discharge piping check valves 1FW-68, -100, -132 and 2FW-70, -102, and -134, were designed to provide a boundary between the main feedwater (MFW) and the AFW systems. The piping downstream of these valves is normally exposed to high pressure and temperature MFW system operating conditions, while the upstream piping is normally exposed to lower pressure and temperature AFW system standby conditions. As a result, any significant leakage through these check valves could result in high temperature MFW fluid entering the lower pressure AFW system piping and flashing to steam. This condition could result in a steam void in the AFW system piping. Starting the AFW pump associated with the leaking check valve would rapidly pressurize the piping and could result in a severe water hammer event and damage to the AFW and/or MFW system piping and pipe supports. This piping was not analyzed for the resulting water hammer impact loading conditions. The team determined that the licensee had not implemented other measures to ensure the water hammer event would not occur, such as periodically monitoring AFW piping temperatures to detect significant check valve leakage.

The team noted that these check valves were classified as Category 'C' in the U1/U2 IST Program Plan for Interval 4, "Inservice Testing Program Plan for Pumps and Valves, Fourth Inspection Interval," dated December 15, 2010 to December 14, 2020. As Category 'C' valves, there was no defined acceptable seat leakage limit for the AFW line check valves at the MFW boundary. Thus, some unknown amount of leakage is expected during normal operation. Additionally, several instances of actual seat leakage were identified on both Unit 1 and Unit 2 check valves. The following condition reports are historical examples of check valve leakage covering Units 1 and 2: CR378515, CR476664, CR538669, and CR568511.

The potential for this severe water hammer impact loading was discussed in NRC IN 84-06, "Steam Binding of Auxiliary Feedwater Pumps." The IN identified that significant leakage from the MFW system into the AFW system could result in the AFW pumps becoming inoperable due to steam binding and could also lead to the "potential for water hammer damage if an AFW pump discharges relatively cold water into a region of the piping system that contains steam." In 1984, the licensee evaluated the concerns of IN 84-06 and determined, in part, that "back leakage has never occurred at North Anna," and therefore did not implement routine monitoring to detect back leakage, as suggested in the IN. The licensee addressed potential steam binding of AFW pumps, but did not address the potential for water hammer in the AFW discharge piping.

The licensee committed to meeting USAS B31.7-1969, "Nuclear Power Piping," in North Anna's Updated Final Safety Analysis Report, section 3.2.2. The USAS B31.7 quality standard required, in Subsection 3, "Requirements for Class III Piping," Chapter 3-II, that the design of Class III piping shall be in accordance with the requirements of Chapter II of USAS B31.1.0. Chapter II of USAS B31.1.0, "Power Piping," section 101.5.1, "Impact," required that "impact forces caused by all internal and external conditions shall be considered in the piping design."

The licensee entered this issue into the corrective action program as CR1003896. The licensee measured the discharge line temperatures of the AFW system and confirmed that current seat leakage past the check valves did not support steam void formation based on the recorded temperature and pressure in the discharge line. Additionally, the licensee implemented weekly temperature monitoring for continued operability of the AFW discharge lines in CA3003072.

Analysis: The team determined that failure to consider impact forces on the AFW system piping as required by USAS B31.1.0 was a performance deficiency and a failure to meet 10 CFR 50, Appendix B, Criterion III, "Design Control." This performance deficiency was more than minor because it was associated with the mitigating systems cornerstone attribute of design control and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee did not ensure the capability of the AFW piping because they did not consider that an undiscovered steam pocket in any of the AFW pumps discharge lines could lead to a water hammer in the line when AFW is initiated during an event. The team used IMC 0609, Att. 4, "Initial Characterization of Findings," issued June 19, 2012, for Mitigating Systems, and IMC 0609, App. A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality (as shown through review of documentation related to prior identified leakage). The team determined that no cross-cutting aspect was applicable because the finding was not indicative of current licensee performance.

Enforcement: The team identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which required, in part, that design control "measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled." Contrary to the above, since 1984, the licensee did not control a deviation from their quality standard for piping design. Specifically, the licensee was committed to meeting USAS B31.7-1969, "Nuclear Power Piping," for their piping design. Standard B31.7-1969 required the use of USAS B31.1.0, "Power Piping," for the design of class III piping, which included the AFW system piping, and USAS B31.1.0 required that impact forces caused by all external and internal conditions be considered in the piping design. The licensee did not consider impact forces for postulated credible water hammer events. In response to this issue, the licensee evaluated the temperature of the piping where current check valve leakage was observed, and instituted periodic monitoring of the piping temperatures to eliminate the potential for water hammer. This violation is being treated as an NCV consistent with section 2.3.2 of the Enforcement Policy. The violation was entered into the licensee's corrective action program as CR 1003896. (NCV 05000338/2015007-02 and 05000339/2015007-02, "Failure to Consider Potential Water Hammer Impact Loading on AFW piping.")

4OA6 Meetings, Including Exit

On August 21, 2015, the team presented the inspection results to Mr. G. Bischof and other members of the licensee's staff. Additional inspection results were discussed with Mr. G. Bischof and other members of the licensee's staff on September 30, 2015. The inspectors verified that no proprietary information was retained by the inspectors or documented in this report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:
J. Leberstien, Technical Consultant, Licensing
D. Hinspater, Supervisor, Nuclear Projects
M. Nichols, Operations
J. McEnroe, Electrical Engineer
M. Phillips, Corporate Electrical Engineer
C. Bock, Substation Engineer
B. Clarke, Substation Engineer
M. Morris, Electrical I&C Systems Engineer
J. Chapman, Electrical I&C Systems Engineer
B. Morrison, Corporate Engineering Manager

NRC personnel
S. Rose, Chief, Projects Branch 5, Division of Reactor Projects
G. Kolcum, Senior Resident Inspector, Division of Reactor Projects, North Anna Resident Office
G. MacDonald, Senior Reactor Analyst, Division of Reactor Projects

LIST OF ITEMS OPENED, CLOSED, DISCUSSED, AND UPDATED

Opened

05000338 & 339/2015007-01	URI	Adequacy of Class 1E 120VAC Vital Bus Design [Section 1R21.2]

Opened and Closed

05000338 & 339/2015007-02	NCV	Failure to Consider Potential Water Hammer Impact Loading on AFW piping [Section 1R21.3]

LIST OF DOCUMENTS REVIEWED

Calculations

11715-24N, Quench Spray Pumps Specification Requirements, Rev. 0
11715-349N, Head Loss in Quench Spray – Train "A", Rev. 0
11715-350N, Head Loss in Quench Spray – Train "B", Rev. 0
11715-ES-007, Recirculation Spray System Design, Rev. 0
13075. 62-NPB-125-XF, Time History Analysis of Steamhammer due to Turbine Trip Closing for Main Steam Piping Contained in 11715-MSK-101A, Rev. 0
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum A, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum B, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum C, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum D, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum E, Rev. 1
13075.49-ES-194, Maximum Sump Water Level Final NPSH Modification, Addendum F, Rev. 1
13075.62-NPB-120-XF, Time History Analysis of Steamhammer due to Turbine Trip for Main Steam Piping Contained in 12050-MSK-101A, Rev. 0
13929.11-2, Ampacity Calculation – Emergency Buses – Sources, Rev. 1
13929.11-2, Ampacity Calculation – Emergency Buses – Sources, Rev. 1, Addendum A, Cable Ampacity Upon Removal of Three of Twelve Conductors from RSST A to Transfer Bus "D", Rev. 1
13929.11-2, Ampacity Calculation – Emergency Buses – Sources, Rev. 1, Addendum B, Cable Ampacity Upon Removal of Three of Twelve Conductors from RSST B to Transfer Bus "E", Rev. 1
Calc 59-01-PT-71.1Q, 1-FW-P-2, Turbine Driven AFW Pump, dated 2/5/14
CE-0911, Seismic Verification of Emergency Diesel Generator Aux and Fuel Oil Pump and Lube Oil Pump Control Panels, dated 2/21/92
CME-99-0067, Motor Operated AFW Pumps Discharge Piping Rerating North Anna Power Station – Units 1 & 2, Rev. 0
Coltec Engineering Report R-6.06-0260, Emergency Diesel Generator Cooling System Evaluation, dated 1/20/1995
EE-0008, North Anna Voltage Profiles, Addendum I, Rev. 2
EE-0027, Emergency Diesel Generator Load Sequencing, Rev. 3
EE-0092, North Anna Refueling Water Storage Tank Level Uncertainty, Rev. 4
EE-0343, Relay Settings for Safety Bus 1H, Rev. 0
EE-0373, 4.16kV Degraded Voltage & Loss of Voltage Relay Safety Limits, Rev. 2
EE-0394, EDG Fault Current and Voltage, Rev. 0
EE-0500, Motor Terminal Voltage for Motor-Operated Valves, Rev. 3
EE-0806, Coordination curves showing cable withstand, dated 8/4/2015
EWR 86-331, Engineering Work Request, Is It Necessary to Put Glycolin Diesels During Winter, dated 10/28/86
M-100, Time Required to Flood the Turbine Building After REJ Failure, Rev. 0
ME-0317, Addendum F, Revised MOV Test Limitations and Margin Calculations and Support DC NA-11-01023 (OGR Change for 1-SW-MOV-105C), Rev. 0
ME-0317, Service Water Motor Operated Valve Operating Torque Requirements, Rev. 0
ME-0317, Service Water Motor Operated Valve Operating Torque Requirements, Addendum E, Rev. 0
ME-0435, Auxiliary Feedwater System Piping Design Pressure, Rev 5

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453729	453729	455557	461957	461957
461957	465747	465806	465806	465806
466136	466136	466209	466463	466481
467387	467435	484081	484081	494306
497328	497393	497947	501352	523685
525331	525532	528303	528404	532965

533387 558442 565845 568706 573799
574520 580894

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0-MPM-0701-02, Mechanical Preventative Maintenance, 6-Year Preventative Maintenance of Emergency Diesel Generators, Rev. 20
0-OP-39.1, Turbine Building Flooding, Rev. 9
0-OP-59.1, Increasing / Re-Increasing Lake Level Gate Schedule, Rev. 42
0-PT-75.1, Service Water System-Valves (Monthly), Rev. 20, Performed 6/14/2015
1-AP-22.1, Loss of 1-FW-P-2 Turbine Driven AFW Pump, Rev. 16
1-AP-22.1, Loss of 1-FW-P-2 Turbine-Driven AFW Pump, Rev. 16
1-AP-22.5, Loss of Emergency Condensate Storage Tank 1-CN-TK-1, Rev. 9
1-AP-22.5, Loss of Emergency Condensate Storage Tank 1-CN-TK-1, Rev. 9
1-AP-31, Loss of Main Feedwater, Rev. 13
1-AR-20, Annunciator Response, Emergency Diesel 1H-Local, Rev. 23
1-AR-D-G7, 1-EI-CB-21D Annunciator G7, Turbine Building Flood Alarm Trouble, Rev. 1
1-AR-D-G7, 1-EI-CB-21D Annunciator G8, Cond Tube Clean Pit Hi-Hi Level, Rev. 1
1-DRP-02, Air Operated Valve Setpoints, Rev. 12
1-E-0, Reactor Trip or Safety Injection (with Eleven Attachments), Rev. 49
1-E-1, Loss of Reactor or Secondary Coolant, Rev. 27
1-LOG-4, U1 Control Board (Modes 1-4), Rev. 112, Performed 7/4/2015
1-LOG-6F, Unit 1 Safeguards, Operations-Daily, Rev. 110
1-MOP-6.90, Maintenance Operating, Emergency Diesel Generator 1-EE-EG-1H, Rev. 69
1-OP-1.4, Unit Startup from Mode 4 to Mode 3, Rev. 73
1-OP-31.2, Operating Procedure, Steam Generator Auxiliary Feedwater System, Rev. 36
1-OP-6.8A, Operating Procedure, Valve Checkoff-Emergency Generator Fuel Oil System, Rev. 6
1-OP-7.8, Refueling Water Chemical Addition Tank, Rev. 22
1-PT-212.14, Valve Inservice Inspection (Backup Air Supply for Aux. Feedwater Valves), Rev. 11
1-PT-212.9, Valve Inservice Inspection (Main Steam), Rev. 19
1-PT-213.11, Valve Inservice Inspection (Service Water), Rev. 22, Performed 5/19/2015
1-PT-214.18, Valve Inservice Inspection (Misc. Outside Containment Isolation Valve Position Indication), Rev. 13, Performed 3/25/2015
1-PT-36.32, Steam Line Isolation Operational Test, Rev. 9
1-PT-57.3, Containment Recirculation Spray Sump and LHSI Suction Header / Recirc Spray Suction Header Visual Examination, Rev. 27, Performed 3/22/2015
1-PT-57.4, Safety Injection Operational Test, Rev. 57
1-PT-58.4, Containment Recirc Spray System – Casing Cooling Tank Boron Concentration, Rev. 13, Performed 7/2/2015
1-PT-61.3, Containment Type C Test, Rev. 33, Performed 4/29/2012
1-PT-61.3, Containment Type C Test, Rev. 35, Performed 10/6/2013
1-PT-61.3, Containment Type C Test, Rev. 37, Performed 3/25/2015

1-PT-63.1A, Quench Spray System – “A” Subsystem, Rev. 36, Performed 7/8/2015
1-PT-63.1A.2, Quench Spray System – “A” Subsystem Comprehensive Pump Test, Rev. 5, Performed 4/10/2014
1-PT-63.1B, Quench Spray System – “B” Subsystem, Rev. 38, Performed 5/27/2015
1-PT-63.1B.2, Quench Spray System – “B” Subsystem Comprehensive Pump Test, Rev. 5, Performed 2/25/2014
1-PT-63.3, Quench Spray System – Spray Header Air Test, Rev. 5, Performed 3/27, 1993
1-PT-63.4, Quench Spray and Chemical Addition System Valve Lineup Verification, Rev. 8, Performed 6/4/2015
1-PT-64.1.1, Outside Recirculation Spray Pump 1-RS-P-2A, Rev. 28, Performed 3/21/2015
1-PT-64.1.2, Outside Recirculation Spray Pump 1-RS-P-2B, Rev. 28, Performed 3/21/2015
1-PT-64.3, Recirculation Spray System – Spray Header Air Test, Rev. 9, Performed 10/3/2004
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1-PT-64.4A.2, Casing Cooling Pump (1-RS-P-3A) Biennial IST Comprehensive Pump Test, Rev. 3, Performed 11/8/2013
1-PT-64.4B., Casing Cooling Pump (1-RS-P-3B) Test, Rev. 22, Performed 6/15/2015
1-PT-64.4B.2, Casing Cooling Pump (1-RS-P-3B) Biennial IST Comprehensive Pump Test, Rev. 3, Performed 12/16/2013
1-PT-64.7, Outside Recirc Spray and Casing Cooling System Valve Lineup Verification, Rev. 6, Performed 5/23/2015
1-PT-64.8, Flow Test of the Inside Recirculation Spray Pumps, Rev. 29, Performed 3/22/2015
1-PT-66.3, Containment Depressurization Actuation Operational Test, Rev. 52, Performed 3/16/2015
1-PT-71.12, AFW System Valve Position Verification, Rev. 7
1-PT-71.1Q, Operations Periodic Test, 1-FW-P-2, Turbine Driven Auxiliary Feedwater Pump and Valve Test, Rev. 62
1-PT-71.4, AFW Pump Test Response and Logic Test Including SW Pump and SBO Diesel Auto Start Tests on U1 Loss of Reserve Power, Rev. 39
1-PT-71.5, Auxiliary Feedwater Line Flush, Rev. 13
1-PT-82H, Operations Periodic Test, 1H Emergency Diesel Generator Slow Start Test, Rev. 55
2-AP-22.5, Loss of Emergency Condensate Storage Tank 2-CN-TK-1 (With Three Attachments), Rev. 11
2-EPM-080d1-01, Testing the Flood Control System, Rev. 7
CHAP-0105, Auxiliary Cooling Water System Chemistry Control Program (North Anna), Rev. 24
CM-AA-CLC-301, Engineering Calculations, Rev. 9
CM-AA-CLC-301-1001, Guidance and Reference Documents, Engineering Calculations, Rev. 7
Crackle Test Procedure
DNES-AA-ME/MOV-1001, Motor-Operated Valves, Rev. 7
DNES-AA-MOV-1001, Motor-Operated Valve Diagnostic Test Preparation and Evaluation, Rev. 1
DNES-NA-EE/MOV-1001, Over-Current and Voltage Phase Imbalance Analysis for MOVs, Rev. 2
ER-AA-AOV-100, Air Operated Valve Program Categorization, Rev. 1
ER-AA-AOV-101, Design Basis Review, Rev. 1
ER-AA-AOV-102, AOV Testing and Control of Setup Parameters, Rev. 2
ETE-NA—2014-0040, Preventive Maintenance Optimization Strategy of the North Anna Emergency Diesel Generators, Rev. 0. Dated 9/10/14.
Fairbanks Morse Technical Manual NA-VTM-000-59-F173-00002, Rev. B
NA-PROCNA-ADM-AD-AA-102, Procedure Use and Adherence, Rev. 10
O-EPM-2004-01, Testing Level Switches, Rev. 17

OP-AA-102, Operability Determination, Rev. 12
PI-AA-200, Corrective Action, Rev. 24
PI-AA-300, Cause Evaluation, Rev. 7
PI-AA-300-3001, Root Cause Evaluation, Rev. 5
PI-AA-300-3002, Apparent Cause Evaluation, Rev. 9
Visgage Procedure, Pocket Viscosity Comparator, Model 38 & 76 Operating Instructions
VPAP-0812, Station Lubrication Program, Rev. 16
VPAP-1802, Quality Assurance Program Elements for Supply Chain Management, Rev. 12

Work Orders
00603587 01, MPM/3REF/01-SW-MOV, dated 3/30/2006
59101610358, Perform MOV PM, dated 3/13/2012
59101610367, Perform MOV PM, dated 3/13/2012
59101616878, 4160/480 VAC 1J Transformer Inspection, dated 4/12/12
59101616888, 4160/480 VAC 1J1 Transformer Inspection, dated 4/12/12
59101625122, MPM/6REF/01-SW-MOV, dated 3/15/2012
59101625541, Perform As-Found MOV Test, dated 9/22/2010
59101625553, Perform As-Found MOV Test, dated 3/19/2012
59101625565, Perform As-Found MOV Test, dated 3/14/2012
59101673419, 01-EE-EG-1H-Engine, MPM/6 YR/01-EE-EG-1H, dated 10/12/09
59101696703, Emergency Diesel Generator 1H Battery Capacity Test, dated 4/19/12
59101873191, Spare Operator Rebuild (1-MS-NRV-101A), dated 3/21/15
59101907990, 4160/480 VAC 1H1 Transformer Inspection, dated 9/17/13
59101908053, 4160/480 VAC 1H Transformer Inspection, dated 9/17/13
59101928799, Replace RTD, dated 7/1/2010
59101948992, IPM Replace RTD, dated 12/29/2009
59102138626, Replace Anti-Rotation Pin, dated 3/14/12
59102142035, 01-EG-CLR-600H-HTEXCH, Perform Eddy Current Testing Lube Oil Cooler, dated 3/14/13
59102142047, 1-EG-CLR-6000J-HTXECH, Perform Eddy Current Testing Lube Oil Cooler, dated 2/25/14
59102216687, 01-FW-P-2-Pump, Perform Annual Maintenance, dated 10/9/13
59102231681, 01-DB-LS-03IBISSW PM O-EPM-2004-01 /TUR/BLDILEV/PROB/TEST, dated 12/23/13
59102288849, 01-EE-EG-1H-Engine, Perform 2 Year Inspection of Lube Oil System, dated 3/7/13
59102299662, Replace Anti-Rotation Pin, dated 3/14/12
59102299663, Replace Anti-Rotation Pin, dated 3/14/12
59102299664, Replace Anti-Rotation Pin, dated 3/15/12
59102310625, Packing Adjust, dated 6/28/11
59102349886, Repack Valve, dated 10/3/11
59102413979, Noise from 1-MS-TV-101A, dated 4/23/12
59102443768, AFW Pressure Control Valve Positioner, dated 9/16/13
59102444682, Repair of Minor Fitting Leak, dated 9/16/13
59102444683, 1-FW-HCV-100A Air Leaks, dated 3/27/12
59102444690, Repair of Minor Positioner Air Leaks, dated 3/19/13
59102465721, Weld Repair, dated 4/16/12
59102564631, 01-EG-CLR-600H-HTEXCH, Tube Plugging 1-EG-CLR-600H (Contingency WO)
59102627941, SMB000 Grease Change, dated 9/30/13
59102635393, Intercell Connection Resistance Test for Battery 1J, dated 3/14/15

59102639895, Intercell Connection Resistance Test for Battery 1H, dated 3/23/15
59102649465, Emergency Diesel Generator Battery Charger 1H Service Test, dated 3/17/15
59102654683, Emergency Diesel Generator 1H Battery Capacity Test, dated 3/19/15
59102657389, Emergency Diesel Generator Battery Charger 1J Service Test, dated 3/13/15
59102665554, Torque Switch Replacement, dated 10/7/13
59102667447, Packing Adjust, dated 10/17/13
59102667968, 1-MS-NRV-101A Both Light Indication, dated 10/13/13
59102668148, Field cable for 1-MS-NRV-101A, dated 10/13/13
59102668211, Degraded Cable Jacket, dated 10/13/13
59102668435, Packing Adjust, dated 10/13/13
59102668466, 1-MS-NRV-101A Torque on Open Backseat, dated 10/13/13
59102668596, Stem/Bonnet Pressure Ring Replacement (Backseat Repair), dated 3/20/15
59102669831, Packing Adjust, dated 10/25/13
59102741991, Repair Limit Switch, dated 3/23/15
59102754419, Instrument Gauge Replacement, dated 3/22/15
59102812045, Electrical Periodic Test of DC Distribution System, dated 6/24/15
59102812529, Quarterly DC Distribution System Test for Battery 1H, dated 6/2/15
59102813855, Quarterly DC Distribution System Test for Battery 1J, dated 6/15/15
59102813865, AC Distribution and Reactor Coolant Pump Operability Verification, dated 7/1/15
59102848761, Repack Valve, dated 3/25/15
59102850988, Packing Adjust, dated 3/28/15

Corrective Action Documents Written Due to this Inspection

CR1003398, Discrepancy identified for 1-PT-88H
CR1003896, Routine method needed for monitoring AFW piping temperatures for water hammer
CR1005454, EDG Battery Charger Testing and Calculations Not Including Instrument Error
CR1005481, Enhancements to update DBD references to include SBO Documentation
CR1005622, Review of UFSAR to determine RG 1.155 reference
CR1006865, Review of Appendix R Current Fault Coordination
CR1006913, NAPS 2015 CDBI- EDG Nameplate Discrepancy Identified during CDBI Inspection
CR1006935, Service Water Usage Calculation Requires Revision
PIR1005191, Evaluate addition of cable withstand capability to 4160V switchgear coordination curves