UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
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ATLANTA, GEORGIA 30303-8931

November 18, 2003

Virginia Electric and Power Company
ATTN.: Mr. David A. Christian
Senior Vice President and
Chief Nuclear Officer
Innsbrook Technical Center - 2SW
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION - NRC SAFETY SYSTEM DESIGN AND PERFORMANCE CAPABILITY INSPECTION REPORT NOS. 05000338/2003010 AND 05000339/2003010

Dear Mr. Christian:

On October 24, 2003, the Nuclear Regulatory Commission (NRC) completed a safety system design and performance capability inspection at your North Anna Power Station, Units 1 and 2. The enclosed report documents the inspection findings which were discussed on October 24, 2003, with Mr. D. Heacock and other members of your staff.

This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations, and with the conditions of your operating license. Within these areas, the inspection involved selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of the inspection, no findings of significance were identified.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document 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/

Charles R. Ogle, Chief
Engineering Branch 1
Division of Reactor Safety

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

Enclosure: (See page 2)

Enclosure: NRC Inspection Report Nos. 05000338/2003010, 05000339/2003010
w/Attachment: Supplemental Information

cc w/encl:
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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.:	05000338/2003010 and 05000339/2003010
Licensee:	Virginia Electric and Power Company (VEPCO)
Facility:	North Anna Power Station, Units 1 & 2
Location:	1022 Haley Drive Mineral, Virginia 23117
Dates:	October 6 - 10, 2003 October 20 - 24, 2003
Inspectors:	N. Merriweather, Senior Reactor Inspector (Lead Inspector) F. Jape, Senior Project Manager G. Laska, Operations Engineer K. Maxey, Reactor Inspector R. Moore, Senior Reactor Inspector C. Smith, Senior Reactor Inspector
Accompanied by:	J. Moorman, Team Leader, Region II N. Staples, Reactor Safety Intern, Region II
Approved by:	Charles R. Ogle, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000338/2003-010, IR 05000339/2003-010; 10/06-10/2003 and 10/20-24/2003; North Anna Power Station, Units 1 and 2; Safety System Design and Performance Capability Inspection.

This inspection was conducted by a team of regional inspectors. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

No findings of significance were identified.

B. Licensee-Identified Violations

None.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events and Mitigating Systems

1R21 Safety System Design and Performance Capability (71111.21)

This team inspection reviewed selected components and operator actions that would be used to prevent or mitigate the consequences of a steam generator tube rupture (SGTR) event. Components in the main steam (MS) system, auxiliary feedwater (AFW) system, steam generator (SG) blowdown system, chemical and volume control system (CVCS), reactor coolant system (RCS), safety injection (SI) system, and radiation monitoring (RM) system were included. This inspection also examined supporting equipment, equipment which provides power to these components, and the associated instrumentation and controls. The SGTR event is a risk-significant event as determined by the licensee's probabilistic risk assessment.

.1 System Needs

.11 Process Medium

a. Inspection Scope

The team reviewed the water sources for components and systems required for the mitigation of the SGTR event. These included the Reactor Water Storage Tank (RWST) and its refill capability, Volume Control Tank (VCT), and Emergency Condensate Storage Tank (ECST). The team reviewed the availability, reliability and adequacy of the water sources with respect to the anticipated water source requirements for the SGTR event. The team reviewed design criteria information, drawings, vendor manuals, and calculations to determine the minimum water levels for pump net positive suction head (NPSH) and tank volume to verify that the design and Updated Final Safety Analysis Report (UFSAR) accident analysis assumptions were consistent with system and equipment capability.

In addition to the above, the team reviewed calibration procedures and calibration records for the level instruments used on the CST, RWST, and VCT to verify that the procedures accurately incorporated set point values delineated in calculations of record.

b. Findings

No findings of significance were identified.

.12 Energy Sources

a. Inspection Scope

The team reviewed the air supply for pneumatically operated valves used to mitigate the SGTR event. The team reviewed the availability and reliability of the air supply as well as quality controls for the air system. The team reviewed valve design drawings, vendor

manuals, and periodic air quality test results to verify that station air quality standards were consistent with vendor recommendations, regulatory guidance, and industry standards. Periodic tests which verified the air supply capacity of the assured air supply flasks for the SG power operated relief valves (PORVs) were reviewed.

The team reviewed the adequacy of voltage supplied to a select sample of pump motors and motor operated valves (MOVs) required to mitigate a SGTR event. The team performed a design review for probable common cause failure modes of MOVs that would result from inadequate equipment utilization voltage. The team reviewed design basis documents, calculations of record, vendor information, and approved design output drawings for the Unit 1 Class 1E 4160 volt alternating current (VAC) and 480 VAC electrical distribution system. The team reviewed electrical and mechanical calculations to verify the capability of selected Generic Letter (GL) 89-10 MOVs to perform their design function under steady state degraded voltage conditions and transient voltage starting conditions. The team reviewed the analysis of the Class 1E electrical distribution system to verify that sufficient starting and running voltages exist at the 4160 VAC and 480 VAC emergency busses to operate such loads as the high and low head safety injection pump motors, the residual heat removal (RHR) pump motors, the AFW pump motors, and the service water pump motors.

b. Findings

No findings of significance were identified.

.13 Instrumentation and Controls

a. Inspection Scope

The team reviewed electrical elementary diagrams in order to verify that the electrical controls and instrumentation systems required to mitigate a SGTR event operated in accordance with design bases document descriptions and were consistent with the UFSAR description. The team reviewed the controls for the centrifugal charging pumps (CCPs), the AFW pumps, the residual heat removal pumps, and selected MOVs associated with operation of these pumps. A review and evaluation of electrical elementary diagrams for selected radiation monitors was also performed in order to verify the equipment operating logic and to identify the sources of the power supplies.

The team reviewed surveillance procedures and calibration test records for process instrument channels monitoring SG narrow range and wide range level, SG pressure, SG flow, RCS pressure, pressurizer level, RCS temperature, CST low water level, and radiation monitors to verify that actions were prescribed consistent with the instrument design including setpoint documents.

b. Findings

No findings of significance were identified.

.14 Operator Actions

a. Inspection Scope

The team reviewed plant operating procedures, including emergency operating procedures (EOPs), abnormal operating procedures (APs), and annunciator responses (ARs) that would be used in the identification and mitigation of a SGTR event. The team reviewed the procedures to verify that they were written clearly and unambiguously, and were technically adequate. The procedures were also reviewed for consistency with the UFSAR description of a SGTR event and the Westinghouse Owner's Group Emergency Response Guidelines. The step deviations identified from the Westinghouse Owner's Group Emergency Response Guidelines were reviewed to verify that they were justified and reasonable.

The team conducted discussions with licensed operators and reviewed job performance measures and training lesson plans pertaining to SGTR events to ensure that training was consistent with the procedures. In addition, the team observed a simulator scenario of a SGTR event to verify that operator training and procedural guidance were adequate to identify a SGTR event and implement post-event mitigation strategies. The operator action times for performance of SGTR event mitigation activities were compared to the times assumed in the accident analysis.

b. Findings

No findings of significance were identified.

.15 Heat Removal

a. Inspection Scope

The team reviewed the reliability and availability of cooling for equipment required to mitigate the SGTR event. This included cooling water to AFW pumps, SI pumps, and CCPs. The team reviewed vendor manuals, design documentation, drawings, and surveillance and test procedures to verify the vendor recommendations for equipment operation were satisfied.

The team reviewed operator actions that may have to be performed to assure that adequate heat removal capability would be available to mitigate a SGTR event. Examples of procedures reviewed included those for refilling of the RWST and placing the RHR system in service.

b. Findings

No findings of significance were identified.

.2 System Condition and Capability

.21 Installed Configuration

a. Inspection Scope

The team performed field inspections of accessible SGTR mitigation mechanical equipment in AFW, CVCS, MS, SI, and SG blowdown systems to assess general material condition, identify degraded conditions, and verify the installed configuration was consistent with design drawings and design inputs to calculations. Additionally, the team assessed potential flooding and missile impacts on SGTR mitigation equipment.

The team also performed field inspections of portions of the Class 1E electrical distribution system, including 4160 VAC switchgear, 480 VAC load centers, 480 VAC MCCs, and 125 volts direct current batteries. The team also inspected selected radiation monitoring installations used to mitigate a SGTR event and vital bus Inverters 1-I and 1-II.

The team examined the material condition of the level instruments on the CST and the protection and routing for redundant sensing lines. This review was performed to verify that the observable material condition was acceptable and that redundant instrumentation sensing lines were adequately routed and protected to prevent common cause failure of the instruments.

b. Findings

No findings of significance were identified.

.22 Operation

a. Inspection Scope

The team reviewed operating procedures, system lineups, system drawings and walked down selected portions of the MS, AFW, CVCS, SI, RM, instrument air, and electrical power systems to verify that system alignments were consistent with design and licensing basis assumptions.

The team performed walkdowns of selected tasks to verify that human factors in the procedures and in the plant (e.g., clarity, lighting, noise, accessibility, labeling) were appropriate to support effective use of the procedures. Specifically, the team walked down procedure performance, with radiological control technicians and chemistry personnel, that would be used to help operators identify the SG involved in the SGTR event; and walked down, with an operator, the EOP requirement to manually operate a SG PORV on the intact SGs by manually opening the appropriate valves.

In addition, the team reviewed the operator work-around program to ensure that degraded equipment conditions, that could adversely impact control room operators during a SGTR event, were properly identified and prioritized. The team also reviewed

the licensee's adverse weather program to assess the protection against adverse weather for significant structures, systems, and components used in the mitigation of a SGTR event.

b. Findings

No findings of significance were identified.

.23 Design

a. Inspection Scope

Mechanical Design

The team reviewed mechanical design calculations, specifications, and the UFSAR accident analysis to identify the design criteria which defined the required capacity and capability of SGTR mitigation mechanical equipment. Surveillance test procedures and equipment monitoring activities were also reviewed to verify the design criteria were appropriately translated into acceptance criteria. The team reviewed NPSH calculations for the AFW, and charging pumps to verify that adequate NPSH was available from each of the applicable water sources. Design changes were reviewed to verify that system and equipment design functions were appropriately evaluated and maintained. Design changes reviewed included replacement of charging pump casings, heads and seal housings; replacement of a turbine driven AFW pump recirculation flow orifice; a SG blowdown system upgrade; and replacement of main steam safety valve (MSSV) mounting bolts.

Electrical, Instrumentation and Controls Design

The team reviewed excerpts from calculations of record and approved design output drawings of Unit 1 Class 1E 4160 VAC and 480 VAC electrical distribution systems, and conducted discussions with the licensee's engineering personnel, in order to verify that the degraded voltage relay setpoint values of voltage magnitude and time delays were consistent with values incorporated in the North Anna Technical Specifications for Units 1 and 2. Calculation EE-0373, 4.16 KV Degraded Voltage and Loss of Voltage Relay Safety Limits, demonstrated that negative voltage margin could exist at the 480 V buses during both non-accident and accident conditions. The effects of the negative voltage margin at the 480 V buses on the operation of GL 89-10 MOVs, was reviewed and evaluated by the inspectors. Additionally, the inspectors discussed this issue with the licensee's engineering staff. The inspectors also reviewed engineering transmittal ET CEE 98-0019, Revision 1, Voltage Profile Analysis North Anna Power Station, Units 1 and 2, and discussed the increase in 4160 V motor slip caused by the motors having less than nominal terminal voltage under certain conditions. The analysis concerning the capability of risk significant 4160 V motors and 480 V MOVs to perform their design function, addressed in the engineering transmittal under degraded voltage conditions, was evaluated by the inspectors.

The team reviewed design changes that the licensee made to the 120 VAC Vital Bus inverters for Unit 1. A review and evaluation of Design Change 01-159, was performed to verify that replacement of the 20KVA Inverter 01-VB-INV-01, and 15KVA Inverter 01-VB-INV-02, was consistent with design and licensing basis requirements. The scope of the review included an evaluation of the replacement inverters' KVA ratings, the voltage and frequency specification for the inverters' output, and the required value of the DC input power supply voltage range. The battery sizing calculation was reviewed to verify the capability of the class 1E 125 VDC batteries to support the inverter loads.

The team reviewed instrument setpoint calculations for radiation monitoring instruments and selected level instrument channels to verify that plant instrument calibration procedures have accurately incorporated setpoint values delineated in the calculations of record.

The team reviewed calculations of record and motor vendor information for selected 4160 VAC pump motors to verify that they were adequately sized with positive margin based on the actual mechanical load demand. The team reviewed pump performance curves in order to determine the mechanical load demand and required motor break horsepower (BHP) rating. Additionally, the team reviewed the licensee's analysis of the emergency diesel generator loads to verify that it correctly incorporated the identified BHP values for the pump motors. The team also reviewed motor load current data taken during pump surveillance tests for selected 4160 V class 1E motors to verify that the motors were operating satisfactorily within design requirements.

b. Findings

No findings of significance were identified.

.24 Testing and Inspection

a. Inspection Scope

The team reviewed valve stroke time testing, MOV torque and limit switch settings, and post maintenance testing to verify that the tests and inspections were appropriately verifying that the assumptions of the licensing and design bases were being maintained and that performance degradation would be identified. The team also reviewed calibration test records for selected radiation monitors to verify that acceptance criteria specified in the procedures were met.

The team reviewed records of completed surveillance tests, preventive maintenance, and inspections, that were performed for Unit 1 Station Batteries. The reviews were performed in order to verify that battery related problems were being adequately corrected, and that the capacity of the 125 VDC class 1E batteries was adequate to supply and maintain the required emergency loads during a design basis accident. The team conducted interviews with licensee engineering personnel and reviewed selected plant procedures to verify that accepted industry practices and the requirements of the Technical Specifications had been correctly incorporated in the plant procedures.

The team reviewed the records of the Unit 1 motor driven AFW pump and valve surveillance test, and the combined CCP 1B head verification and high head safety injection branch flow verification. The reviews were performed to verify that operability of the equipment had been demonstrated and that the requirements of the Technical Specifications were being met.

b. Findings

No findings of significance were identified.

.3 Selected Components

.31 Component Degradation

a. Inspection Scope

The team reviewed inservice test program trending data, maintenance and testing documentation, calibration records, work orders, plant issue reports, and deviation reports to assess the licensee's actions to verify and maintain the safety function, reliability and availability of selected components. The Maintenance Rule functional failures of selected components for the past 5 years were also reviewed. Additionally, the team reviewed potential common cause failure mechanisms due to flooding, maintenance, parts replacement and modifications. Examples of components reviewed included MOVs, air operated valves, relief valves, check valves, radiation monitors, and pumps. A list of components reviewed is included in the Attachment.

b. Findings

No findings of significance were identified.

.32 Equipment/Environmental Qualification

a. Inspection Scope

The team reviewed environmental specifications and test reports for VCT level transmitters to verify that the instruments were suitable for their application.

b. Findings

No findings of significance were identified.

.33 Equipment Protection

a. Inspection Scope

The team reviewed the freeze protection provision for the RWST instrument lines to verify the system was adequately monitored and maintained to protect vulnerable piping. For SG PORVs, MSSVs, turbine driven AFW pumps, and CCPs, the team reviewed the

equipment specifications to verify the design was adequate for anticipated ambient conditions and system application.

b. Findings

No findings of significance were identified.

.34 Operating Experience

a. Inspection Scope

The team reviewed the licensee's applicability evaluations and corrective actions for industry experience issues related to turbine driven AFW pumps, MOVs, check valves, and instrument air system failures. The team also reviewed the licensee's evaluations of operating experience reports applicable to the SGTR event to verify that applicable insights from those reports had been applied to the appropriate components.

The team specifically reviewed the following events:

- N-2003-3475, Steam Generator Tube Degradation at Diablo Canyon.
- N-2003-3165-E1, Steam Generator Sludge Lance Tube Wear
- IN 03-05, Failure To Detect Freespan Cracks in PWR Steam Generator Tubes.
- OE 15901, Steam Generator Sludge Lance Damage to U-Tubes
- IN 02-21-SI, Axial Outside-Diameter Cracking Affecting Thermally Treated Alloy 600 Steam Generator Tubing

b. Findings

No findings of significance were identified.

.35 Steam Generator Inservice Inspection

a. Inspection Scope

The team performed a limited-scope review of the inservice inspection program for the SGs to verify that SG tubes were being inspected as required by Technical Specifications and procedures. The periodic self assessment of the SG monitoring and inspection program, as described in NEI 97-06, was reviewed to verify the assessment covered all of the objectives of the self-assessment plan.

b. Findings

No findings of significance were identified.

.36 Foreign Material Exclusion (FME) Control Program And Loose Parts Monitoring

a. Inspection Scope

The team reviewed procedural guidelines and performance records for the loose parts monitoring system to verify that these systems were operational and were being used to monitor for loose parts in the RCS. In addition, the team reviewed records of foreign material control activities to verify that this program was being utilized. The documents reviewed were:

- VPAP-1302, Foreign Material Exclusion Program, Revision 18
- ICP-1-VLPM-1, Vibration and Loose Parts Monitor, Revision 19
- 1-PT-28, Vibration and Loose Parts Monitoring Functional (ITS-Channel Operational) Test, Revision 011
- SEAP-0002, Shift Technical Advisor, Revision 7
- FSAR Section 5.2.5.3, Loose Parts Monitoring, Revision 39

b. Findings

No findings of significance were identified.

.4 Identification and Resolution of Problems

a. Inspection Scope

The team reviewed selected system health reports, maintenance records, work-around list, surveillance test records, calibration test records, and plant issue reports to verify that design problems were identified and entered into the corrective action program. The team reviewed plant issue reports related to selected SGTR mitigation equipment to assess the scope of the licensee's extent-of-condition reviews and the adequacy of the corrective actions.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

40A6 Meetings, Including Exit

The lead inspector presented the inspection results to Mr. D. Heacock, and other members of the licensee staff, at an exit meeting on October 24, 2003. The licensee acknowledged the findings presented. Proprietary information is not included in this inspection report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

J. Davis, Director, Station Operations and Maintenance
D. Heacock, Site Vice President
J. Leberstien, Supervisor, Licensing
B. Morrison, Supervisor, Nuclear Engineering
A. Royal, Manager, Nuclear Training
J. Scott, Supervisor, Nuclear Training - Operations
W. Shura, Supervisor, Nuclear Training - Technical Support
B. Standley, Supervisor Nuclear Engineering
M. Whalen, Supervisor Licensing

NRC (attended exit meeting)

J. Moorman, Team Leader, NRC Region II
M. Morgan, Senior Resident Inspector

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

None.

LIST OF DOCUMENTS REVIEWED

Instructions/Procedures

OPAP-0002, Operations Department Procedures, Revision 7
1-OP-7.7, RWST System Operation, Revision 42
1-OP-31.2A, Valve Checkoff Auxiliary Feedwater, Revision 22
1-AR-D-B3, Pressurizer Lo-Lo Pressure SI or Reactor Trip, Revision 1
1-AR-J-H1, MS Loops 1A,B,C, Aux Steam Loop Hi Radiation, Revision 1
1-AR-J-H1, MS Loops 1A,B,C, Aux Steam Loop Alert, Revision 1
1-AR-K-D2, RM System Hi Rad Level, Revision 2
1-AR-K-D4, RM System Hi-Hi Rad Level, Revision 1
1-AR-K-G6, N-16 Radiation Detector, Revision 2
1-AR-K-B8, N-16 System Trouble, Revision 1
1-AP-5, Unit 1 RM System, Revision 20
1-AP-24, SG Tube Leak, Revision 14
1-AP-24.1, Shutdown SG Tube Leak, Revision 18
1-E-0, Reactor Trip or Safety Injection, Revision 30
1-E-3, SGTR, Revision 19
1-ES-3.1, Post SGTR Cooldown Using Backfill, Revision 11
1-ECA-3.1, SGTR With Loss of Reactor Coolant-Subcooled Recovery Desired, Revision 15
1-ECA-3.2, SGTR With Loss of Reactor Coolant-Saturated Recovery Desired, Revision 14

1-ECA-3.3, SGTR Without Pressurizer Pressure Control, Revision 14
1-PT-57.1C, ECCS Subsystem (Valves), Revision 9
2-PT-46.3A.3, Primary-to-Secondary Leak Rate Alarm Setpoint Calculation, Revision 5
2-PT-46.3A.2, Weekly Primary-to-Secondary Leak Rate Evaluation, Revision 8
2-PT-46.3A.1, Hand Calculation of Primary -to-Secondary Leak Rate, Revision 4
1-PT-213.14, Operations Periodic Test - Air Valves Stroke Time Measurement, Revision 14
1-PT-59.8, Verifying Operability of Freeze Protection on Unit 1 RWST Level Transmitters, Revision 5
1-PT-213.14, Valve In-service Inspection (Misc.) Test Procedure for 1-1A-TV-102A/B, Revision 14
1-PT-212.14, Valve In-service Inspection - Backup Air Supply for AFW Valves, Revision 7
OPT-226, Instrument Air Performance Testing, Revision 5
0-ECM-0101-02, Installation or Removal of Jumper Cables over Individual Cells of Main Station, Emergency Diesel Generator (EDG) and AAC EDG Stationary Batteries, Revision 11
0-ECM-0101-01, Main Station, EDG and Fire Pump Diesel Battery Repairs, Revision 14

Drawings

Stone & Webster Dwg. 11715-FV-44A-7, RWST, 1&2-QS-TK-1, Revision 7
Copes Vulcan Drawing E-1-14483, 14 Inch MOV Gate Valve Assembly, Revision 4
11715-FV-43A-6, 110,000 Gallon Condensate Storage Tank, Revision 6.
Pump Test Performance Curve- Ingersol Rand, N445, (dated 4/24/72), N440 MDAFW Pumps (dated 4/13/72)
Westinghouse Test Performance Curves, 35096-L, dated 9/12/72
11715/12050-325-2D, VCT, dated 5/24/71
Crosby Valve & Gage Co. HA-G-52950, High Capacity Nozzle Type Safety Valve (MSSV), dated 2/4/71
11715-FM-095B, Sheet 1&2, Chemical and Volume Control System, North Anna Power Station (NAPS) Unit 1, Revisions 32&38
11715-FM-074A, Sheets 1,2,3,4, Feedwater System, NAPS Unit 1, Revisions 9,39,43,and 47
11715-FM-096A, Sheet 1, SI System, NAPS Unit 1, Revision 39
11715-FM-070B, Sheets 1,2,3, Main Steam System, NAPS Unit 1, Revisions 34,36,and 40
11715-FM-094A, Sheets 1&2, Residual Heat Removal System, NAPS Unit 1, Revisions 16 and 20
11715-ESK-6DR, Elementary Diagram 480 V Circuits MOVs, Sheet 40, 01-CH-MOV-115C & E, Revision 18
11715-ESK-6DM, Elementary Diagram 480 V Circuits MOVs, Sheet 36, 01-CH-MOV-115B & D, Revision 17
1175-FM-098A, Flow/Valve Operating Numbers Diagram SG Blowdown System, Revision 27
NA-DW-271C351, Elementary Diagram VCT Level Control Sheet 19, Revision 0
NA-DW-7382D29, RWST Level Protection III, Revision 3
11715-FE-1BB, One Line Diagram, Electrical Distribution System, North Anna Power Station Units 1 and 2, Revision 19
11715-FE-1D, 4160 V One Line Diagram-Sheet 3 Emergency Bus 1H and 1J, North Anna Power Station, Revision 20

11715-FE-1R, 480 V One Line Diagram Emergency MCC 1J1-2 Cable Tunnel, North Anna Power Station Revision 29
11715-FE-1Q, 480 V One Line Diagram Emergency MCC 1H1-2 Cable Tunnel, North Anna Power Station, Revision 38
11715-FE-1Z, 480 V One Line Diagram Emergency MCC 1H1-1 and 1H1-4 Emergency Switchgear Room, cable Tunnel, North Anna Power Station, Revision 27
11715FE-1AA, 120 VAC One Line Diagram Vital Bus-1, North Anna Power Station, Revision 18
11715-FE-1AE, 120 VAC and 125 VDC One Line Diagram Vital Power North Anna Power Station, Revision 26
11715-ESK-5AA, Elementary Diagram 4160 V Circuits, Auxiliary Steam Generator Feed Pump 1-FW0P-3A, North Anna Power Station, Unit 1, Revision 13
11715-ESK-5AB, Elementary Diagram 4160 V Circuits, Auxiliary Steam Generator Feed Pump 1-FW0P-3B, North Anna Power Station, Unit 1, Revision 20
11715-ESK-5R, Elementary Diagram 4160 V Circuits, Residual Heat Removal Pump 1-RHP-1A, North Anna Power Station, Unit 1, Revision 20
11715-ESK-5S, Elementary Diagram 4160 V Circuits, Residual Heat Removal Pump 1-RHP-1B, North Anna Power Station, Unit 1, Revision 13
11715-ESK-5AL, Elementary Diagram 4160 V Circuits, Charging Pump 1-CH-P-1A, North Anna Power Station, Unit 1, Revision 13
11715-ESK-5AM, Elementary Diagram 4160 V Circuits, Charging Pump 1-CH-P-1B, North Anna Power Station, Unit 1, Revision 10
11715-ESK-5AN, Elementary Diagram 4160 V Circuits, Charging Pump 1-CH-P-1C, North Anna Power Station, Unit 1, Revision 15
11715-ESK-6DR, Elementary Diagram 480 V Circuits Motor Operated Valves, Sheet 40, 01-CH-MOV-1115C & E, North Anna Power Station Unit 1, Revision 18
11715-ESK-6DM, Elementary Diagram 480 V Circuits Motor Operated Valves, Sheet 36, 01-CH-MOV-1115B & D, North Anna Power Station Unit 1, Revision 17
11715-ESK-6DN, Elementary Diagram 480 V Circuits Motor Operated Valves, Sheet 37, 01-CH-MOV-1289A, B & 1373, North Anna Power Station Unit 1, Revision 16
11715-ESK-6DZ, Elementary Diagram 480 V Circuits Motor Operated Valves, Sheet 48, 01-CH-MOV-1275A, B & C, Power Station Unit 1, Revision 11
11715-ESK-6DT, Elementary Diagram 480 V Circuits Motor Operated Valves, Sheet 42, North Anna Power Station Unit 1, Revision 18
11715-FE-1E, 125 VDC One Line Diagram, North Anna Power Station, Sheet 1, Revision 25
11715-FE-1E, 125 VDC One Line Diagram, North Anna Power Station, Sheet 2, Revision 24
1-15E500-2, Key Diagram Station Auxiliary Power System, Revision 24
1-45W700-1, Key Diagram, 120 VAC & 125 VDC Vital Plant Control Power System, Revision 14
1-45W703-9, Wiring Diagram, 125 VDC Vital Battery Board V, Single Line, Revision 7

Calculations

Stone and Webster Calculation (SWEC)-14937.44-US(B)-068, NPSH Available to HHSI and LHSI Pump From RWST, Revision 1
ME-0584, Maximum AFW Flow and NPSH Analysis, dated 11/4/99
11715-106N, NPSH on Charging Pumps form RWST, dated 7/28/71
SM-1152, NAPS ECST Heat Removal Capacity Using TS Minimum Volume, Revision 0

1-SC-5.16, Contained Volume Calculation for the 110,000 Gallon ECST, dated 6/4/80
EE-0058, NAPS Pressurizer Level Protection and Indication CSA, Revision 1
EE-0092, North Anna RWST Level Uncertainty, Revision 1
EE-0100, North Anna ECST Level Uncertainty, Revision 1
EE-0107, Assessment of Rack Drift from Westinghouse 7300 RPS/ESFAS Instrumentation Monthly Periodic Test Results, dated 5/30/96
EE-0152, North Anna VCT Level Indication Uncertainty, Revision 2
ET-NAF-990045, Instrument Uncertainty Allowance for RWST Level, Revision 0
EE-0373, 4.16 KV Degraded and Loss of Voltage Relay Safety Limits, Revision 1
EE-0008, North Anna Voltage Profiles, Revision 6
EE-0025, North Anna Station Electrical Load List, Revision 7
EE-0500, Motor Terminal Voltage for Motor Operated Valves, Revision 3
EE-0009 125VDC, VDC System Analysis, Revision 1
EE-0009 Addendum E, 125VDC System Analysis New Inverters 1-I, 1-II, 2-I, 2-II, Revision 1
EE-0009 Addendum D, 125 VDC System Analysis-Unit 1 Duty Cycles and SBO Cases for Units 1 and 2, Revision 1
14258.79, Short Circuit Currents 120 VAC Vital Buses and Miscellaneous Circuits, North Anna Units 1 and 2, Appendix R Evaluation, Revision 1

Technical Specifications

Section 3.3.3 and Bases, Post Accident Monitoring (PAM) Instrumentation
Section 3.3.5, Loss of Power (LOP) Emergency Diesel Generator (EDG) Start Instrumentation
Section 3.4, RCS Operational Leakage
Section 3.4.13 and Bases, RCS Operational LEAKAGE
Section 3.5.2 and Bases, ECCS - Operating
Section 3.5.3 and Bases, ECCS - Shutdown
Section 3.5.4 and Bases, Refueling Water Storage Tank (RWST)
Section 3.7.4 and Bases, Atmospheric Dump Valves (ADVs)
Section 3.7.5 and Bases, Auxiliary Feedwater (AFW) System
Section 3.8.1 and Bases, AC Sources - Operating
Section 3.8.4 and Bases, DC Sources - Operating
Section 3.8.5 and Bases, DC Sources - Shutdown
Section 3.8.6 and Bases, Battery Cell Parameters

Completed Maintenance and Tests

ICP-MS-1-RM-170, High Range Effluent Monitor MS-170, dated 3/13/03
ICP-MS-1-RM-176, High Range Effluent Monitor MS-176, dated 1/8/02
ICP-MS-1-RM-176, High Range Effluent Monitor MS-176, dated 4/8/03
ICP-P-1-L-112, VCT Level, dated 9/16/01
ICP-P-1-L-112, VCT Level, dated 3/24/03
ICP-P-1-L-115, VCT Level, dated 9/20/01
ICP-P-1-L-115, VCT Level, dated 3/3/03
ICP-RC-1-T-1413, Wide Range Temperature (Hot Leg) Protection Channel 1, dated 3/21/03
ICP-RC-1-L-1459, L-1459 Pressurizer Level Protection Channel 1, dated 2/27/03

1-ICP-RC-P-1402, RCS Pressure (Wide and Narrow Range) Protection Channel 1 Calibration, dated 2/26/03
1-ICP-SS-RM-123, SG B RM (RM-SS-123) Calibration, dated 1/18/02
1-ICP-SV-RM-121, Condenser Air Ejector In Line Radio Gas RM (RM-SV-121) Calibration, dated 3/17/03
1-ICP-RC-P-1402, RCS Pressure (Wide and Narrow Range) Protection Channel 1 Calibration, dated 8/22/01
1-ICP-RC-P-1403, RCS Pressure (Wide and Narrow Range) Protection Chanel IV Calibration, dated 8/22/01
1-ICP-RC-P-1403, RCS Pressure (Wide and Narrow Range) Protection Channel IV Calibration, dated 2/26/03
1-ICP-CN-L-100A, Missile Protected CST Level Calibration, dated 10/16/02
2-ICP-CN-L-200A, Missile Protected CST Level Calibration, dated 10/16/02
1-PT-32.2.1, SG A Narrow Range Level Protection Channel I (L-FW-1474) Channel Calibration, dated 3/7/03
1-PT-32.2.4, SG B Narrow Range Level Protection Channel I (L-FW-1484) Channel Calibration, dated 3/7/03
1-PT-32.2.7, SG C Narrow Range Level Protection Channel I (L-FW-1494) Channel Calibration, dated 3/7/03
1-PT-32.4.1, SG A Steam Flow and Feed Flow Protection Channel III (F-MS-1474 and F-FW-1477) Channel Calibration, dated 3/5/03
1-PT-32.4.3, SG B Steam Flow and Feed Flow Protection Channel III (F-MS-1484 and F-FW-1487) Channel Calibration, dated 3/5/03
1-PT-32.4.5, SG C Steam Flow and Feed Flow Protection Channel III (F-MS-1494 and F-FW-1497) Channel Calibration, dated 3/5/03
1-PT-32.6.1, Steam Line Pressure Protection Channel II (P-1474) Instrumentation Calibration, dated 2/25/03
1-PT-32.6.4, Steam Line Pressure Protection Channel II (P-1484) Instrumentation Calibration, dated 2/25/03
1-PT-32.6.7, Steam Line Pressure Protection Channel II (P-1494) Instrumentation Calibration, dated 2/25/03
1-PT-41.4, SG A Wide Range Level (L-FW-1477) Channel Calibration, dated 2/28/03
1-PT-41.5, SG B Wide Range Level (L-FW-1487) Channel Calibration, dated 2/28/03
1-PT-41.6, SG C Wide Range Level (L-FW-1497) Channel Calibration, dated 2/28/03

Modifications

Design Change (DC) 95-216, Unit 2 Charging Pump Discharge Header and Seal Housing replacement, dated 3/21/96
DC-99119, Blowdown System Upgrade, NAPS Unit 2, dated 7/29/99
DC-95-127, Charging Pump Casing Replacement, NAPS Unit 1, dated 7/3/96
DC-02-133, Replace Terry Turbine Restriction Orifice, NAPS Unit 1, dated 7/9/02
DC-02-119, Replace MSSV Bolting with Superbolt Torque Nuts, NAPS Unit 2, dated 8/30/02
DC-01-159, Replacement of Vital Bus Inverters 1-I, & 1-II; 2-I, & 2-II

Completed Work Orders (WOs) and Work Requests (WRs)

00487073 01, Disassemble Actuator, Inspect, and Repair, for 1-RH-MOV-1700, dated 3/25/03
00407572 02, Replace 1-FW-68, AFW to SG Inlet Check Valve, dated 3/21/00
00436100 01, Inspection of Check Valve 1-FW-100, dated 9/21/01
00473071 01, Inspection of Check Vavle 1-FW-132, dated 3/16/03
00436166 01, Inspection of Check Valve 1-MS-19, dated 9/23/01
00487070 01, 1-RH-MOV-1700 Valve Operator Failed to Torque out in Open Direction, Disassemble/inspect/repair, dated 3/18/03

Completed Surveillance Procedures, Preventive Maintenance (PM), and Test Records

HP-3010.040, Radiation Monitoring System Setpoint Determination, Revision 14
1-PT-46.3A.2, Weekly Primary-to-Secondary Leak Rate Evaluation, dated 9/24/03
1-PT-57.4, Safety Injection Functional Test, Attachment 11, Test of Charging Pump Suction Swap-over Function, dated 3/31/03
1-SV-RM-121, Unit 1 Condenser Air Ejector, dated 4/19/03
1-SS-RM-122, Unit 1 A S/G Blowdown, dated 3/31/98
1-SS-RM-123, Unit 1 B S/G Blowdown, dated 11/17/02
1-SS-RM-124, Unit 1 C S/G Blowdown, dated 11/17/02
1-SV-RM-125, Unit 1 High Capacity Blowdown, dated 3/31/98
1-MS-RM-170, Unit 1 A Main Steam Line, dated 3/31/98
1-MS-RM-171, Unit 1 B Main Steam Line, dated 3/31/98
1-MS-RM-172, Unit 1 C Main Steam Line, dated 3/31/98
1-MS-RM-176, Unit 1 Aux Feedwater Pump Exhaust, dated 3/31/98
1-PT-88.2H, Station Battery 1-II Modified Performance Test, Revision 000
1-PT-87B, Intercell Connection Resistance Test for Battery 1-II, Revision 001
1-PT-86, Quarterly DC Distribution System Test for Battery 1-II, Revision 032
1-PT-85, DC Distribution System, Revision 050
1-WP-EBATT12, Main Station Battery Replacement 1-II, Revision 000

Plant Issue Reports (PIs)

N-2003-2167, Abnormal Plant condition, Packing Leak on 1-CH-MOV-1115D, dated 5/29/03
N-2003-2829-E1, Engineering Resolution of Identified Boric Acid Leakage Equipment, dated 7/21/03
N-2003-1724-E1, Engineering Resolution (ER) of Cracked Finger Base in Actuator for MOV 1-CH-1270A, dated 6/12/01
N-2003-1319-E1, ER of Incorrect Actuator Set Up of 1-RH-MOV-1701, dated 4/1/103
N-2003-1215-E1, ER of 1-RH-MOV-1700 Exceeding Open Direction Thrust Limit, dated 3/15/03
N-1995-1070, Different Thermal Expansion Coefficients for Materials on Unit 2 Charging Pump Casings, Heads and Seal Housings, dated 6/13/95
N-2002-0591, Temporary Modification, TM-N1-1695 to Replace Turbine Driven AFW Pump Flow Orifice Did Not Include Required Caution Statement in Flow test Procedure, dated 3/14/03
N-2002-1843, Pressure Indicator for # B MDAFW Pump Out of Calibration, dated 7/31/03
N-2002-2782, Unavailability of Qualified Parts for Valve Positioners, dated 10/10/02

N-2001-3604, Category 1 Root Cause Evaluation , Unit 2, Main Steam Dump Valve Events, dated 12/23/01
N-2001-2649-E1, Operating Experience Evaluation Response, Inadvertent Actuation of Transformer Deluge and Unrelated Failure of Feedwater Check Valve, dated 9/17/01
N-2002-3514, Nonsafety Related Components Installed in Unit 1 SG PORVs, dated 12/26/02
N-2001-2540, Check Valve 1-SI-89 Failed Seat Test, dated 9/10/01
N-2000-1342, Annunciator 1J H-2 Failed to Operate, dated 5/10/00
N-2000-2016, NRC RM Data Printer Broken, dated 8/18/2000
N-2003-0595, Power Supply Change for RM, dated 2/14/03
N-2003-1334, RM Data Acquisition System, dated 3/23/03
N-2003-1148-E1, Faulty Data Acquisition System MR Evaluation, dated 3/13/03

PIs Written Due To This Inspection

N-2003-3777, Contrary to administrative procedures (OPAP-002 and VPAP-0505) EOP E-3, SGTR has notes that infer actions for Low Pressurizer Pressure SI blocking, High Steam Flow SI blocking and Condenser Steam Dump reset, dated 10/22/03
N-2003-3795, Inadequate Documentation of Technical Evaluation for Alternate Material Replacement of Gasket in TDAFW Pump Discharge Check Valve, dated 10/22/03
N-2003-3799, NRC radiation monitors in the simulator improperly indicate high during a SGTR, dated 10/22/03

Work Requests Generated Due To This Inspection

WR 158971, Replace Missing Insulation Cover on Main Steam Line Tap, dated 10/21/03

Vendor and Technical Manuals

VP-59-F264-0008, Type 667 Diaphragm Actuator Sizes 30-76&87 Fisher Rosemount (SG PORV), Revision 9
VP-59-F264-00012, Instruction Manual and Parts List, Fisher Controls Actuator, Types 472, 473, 3572, & 2573, Revision 4
VP-59-1096-00004, Ingersol Rand Class HMTA Horizontally Split, Multistage Pumps, (TDAFWP), Revision 3
Copes-Vulcan Instruction Manual for Installation, Operation, and Maintenance of 14 inch MOV Gate Valve, Revision 4
P-59-C515-0001, Installation, Operation, and Maintenance Instruction No. I-1137 for Crosby Style HA Self-Actuated Nozzle Type Safety Valves, Revision 1

Miscellaneous Documents

N1046 Non Licensed Operator Job Performance Measure “Operate the SG PORV Locally”
SG Tube Plugging Report, October 9, 2002
Annual SG In-service Inspection Summary Report, February 26, 2003
TR-104788-R2, PWR Primary-to-Secondary Leak Guidelines, Revision 2

Evaluation of Compliance with EPRI TR-104788-R2, Section 3.3.4, Primary-to-Secondary Leakage
QDR-N-8.5, North Anna EQ Maintenance Manual Rosemount 1153D Transmitter, Revision 1
59-M856-00002, Nitrogen 16 Channel Vendor Technical Manual, Revision 1
North Anna Self Study Guides for Emergency Operating Procedures
North Anna Self Study Guides for Emergency Contingency Action Procedures

Section 1R21.31.a: Partial List Of Components Reviewed

Decay Heat Removal valve (1- MS-HCV-104)
Main Steam Safety valves (1-MS-SV-101A/B/C)
SI check valves (1-SI-83, 1-SI-47)
Steam Supply valves to TDAFW pump (1-MS-18.-57,-85)
RHR Suction valves (1-MOV-1700,-1701)
RHR valve (1-RH-HCV-1758)
Main Steam valve (1-MS-20)
SG PORVs (1-MS-PCV-101A/B/C)
RH Check valves (1-RH-7,-15)
AFW Check Valves (1-FW-68,-100,-148,-165,-183)
Main Steam Dump Valves (2-MS-TCV-100-100A/B/C)
AFW pumps
SI pumps
CCPs