UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET SW SUITE 23T85
ATLANTA, GEORGIA 30303-8931

September 25, 2001

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

SUBJECT: NORTH ANNA POWER STATION - NRC INSPECTION REPORT 50-338/01-08, 50-339/01-08

Dear Mr. Christian:

On August 31, 2001, the Nuclear Regulatory Commission (NRC) completed an inspection at your North Anna Power Station. The enclosed report documents the inspection findings which were discussed on August 31, 2001, with Mr. C. Funderburk and other members of your staff.

The 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.

No findings of significance were identified during the inspection.

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 Publically Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Sincerely,

/RA/

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

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

Enclosure: See page 2

Enclosure: NRC Inspection Report Nos. 50-338, 339/01-08, with Attachment

cc w/encl:
Stephen P. Sarver, Director
Nuclear Licensing and
Operations Support
Virginia Electric and Power Company
Electronic Mail Distribution

William R. Matthews
Vice President--Nuclear Operations
Virginia Electric and Power Company
Electronic Mail Distribution

D. A. Heacock
Site Vice President
North Anna Power Station
Electronic Mail Distribution

Executive Vice President
Old Dominion Electric Cooperative
Electronic Mail Distribution

County Administrator
Louisa County
P. O. Box 160
Louisa, VA 23093

Donald P. Irwin, Esq.
Hunton and Williams
Electronic Mail Distribution

Attorney General
Supreme Court Building
900 East Main Street
Richmond, VA 23219

Distribution w/encl:
N. Kalyanam, NRR
RIDSNRRDIPMLIPB
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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-338 and 50-339
License Nos.:	NPF-4 and NPF-7
Report Nos.:	50-338/01-08 and 50-339/01-08
Licensee:	Virginia Electric and Power Company (VEPCO)
Facility:	North Anna Power Station, Units 1 and 2
Location:	1022 Haley Drive Mineral, VA 23117
Dates:	August 13-17, 2001 (week 1) August 27-31, 2001 (week 2)
Lead Inspector:	F. Jape, Senior Project Manager
Team:	E. Christnot, Resident Inspector (Oconee) P. Fillion, Reactor Inspector A. Hutto, Resident Inspector (Robinson) J. Lenahan, Senior Reactor Inspector K. Maxey, Reactor Inspector
Approved by:	Charles R. Ogle, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000338-01-08, IR 05000339-01-08, on 08/13-31/2001, Virginia Electric and Power Company, North Anna Power Station, Units 1 & 2, safety system design.

This safety system design and performance capability inspection was conducted by regional inspectors. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609 "Significance Determination Process" (SDP). The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described at its Reactor Oversight Process website at http://www.nrc.gov/NRR/OVERSIGHT/index.html. Findings for which the SDP does not apply are indicated by "No Color" or by the severity level of the applicable violation.

No findings of significance were identified.

REPORT DETAILS

1. REACTOR SAFETY
Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Safety System Design and Performance Capability (71111.21)

.1 System Needs

a. Inspection Scope

Energy Source

Emergency Diesel Generator (EDG) and the Station Blackout Diesel Generator (SBODG) Diesel Fuel Oil

The team reviewed design documentation, drawings, calculations, technical manuals, test documentation, and installed equipment to verify that an adequate supply of fuel oil was available to operate the EDG and SBODG for the period of time assumed in the accident analysis. Included in the review were the following: calculations for sizing of the fuel oil storage tanks, design of the fuel oil transfer pumps, and diesel testing performed to determine the fuel consumption rate and fuel oil volume required for seven days operation. The team also reviewed the station acceptance criteria for fuel oil quality to verify these were consistent with the EDG and SBODG vendor recommendations and applicable industry standards.

EDG and SBODG Starting Air

The team reviewed design documentation and equipment specifications to verify that the air start system capability and storage capacity were consistent with design basis assumptions. This included calculations for air receiver sizing and test documentation to verify multiple start capability.

Electrical Power Supplies

Coordination of overcurrent protective devices in selected portions of the direct current (dc) distribution system was reviewed. The acceptance criterion was that selective coordination existed such that only the faulted circuit would be de-energized.

Controls

Undervoltage Relays

The team reviewed the elementary diagrams depicting the control circuits for the undervoltage relays. This review encompassed the set of relays which sense voltage at the secondary of each reserve startup standby transformer (RSST); the set of relays which sense voltage on each transfer bus for the purpose of bus protection; the set of relays which sense voltage on the transfer busses for the purpose of initiating the station

blackout (SBO) sequence if required; and the loss-of-voltage and degraded grid voltage protection relays at the safety-related busses. The review focused on whether the control logic would be vulnerable to common cause failures.

Circuit Breakers

The team reviewed elementary diagrams for 4160 volt circuit breakers controlling the flow of power from the SBODG to the safety-related busses. The review focused on the potential for common cause failures, and whether the logic described in the Updated Final Safety Analysis Report (UFSAR) was implemented. Also, the team reviewed the licensee's calculation of voltage drop in selected control circuits associated with the SBODG where the breaker being controlled is in the control building and the control switch is in the SBODG building.

The team reviewed the elementary diagrams depicting the control circuits for breakers 15D1, 15E1 and 15F1, which are between the RSSTs and the transfer busses, for conformance with the UFSAR and the potential for common cause failure.

Operator Actions

The team reviewed pertinent operating procedures for the loss of offsite power (LOOP) and SBO events to verify that the instructions specified appropriate operator actions and that those actions could be performed in a timely manner commensurate with the significance of the action. The operator actions were also reviewed for consistency with the accidents described in the UFSAR and licensing basis documents. This review included emergency contingency actions (ECAs), abnormal procedures (APs) and maintenance operating procedures (MOPs) related to the restoration of power to the emergency buses from offsite and onsite sources. The team performed a walkdown of selected contingency operator actions delineated in these procedures for coping with the loss of all alternating current (AC) power. Selected actions included the energizing and loading of emergency buses from the SBODG, cross-connecting of charging flow for reactor coolant pump seal cooling between units, and local operation of the steam generator (SG) power operated relief valves (PORVs) for decay heat removal. The team verified that sufficient emergency lighting was installed in these areas to allow operators to accomplish these tasks under blackout conditions. The team performed walkdowns of the Unit 1 and 2 control rooms and reviewed annunciator response procedures to determine that appropriate indications, alarms, and controls are available to the operators to allow diagnosis, monitoring and response to LOOP and SBO events. The team also reviewed selected related job performance measures to determine that the licensee had training in place to measure the operations staff's ability to perform the risk significant operator actions that mitigate the LOOP and SBO events.

The team reviewed operating procedures for local operation the 4160 volt breakers, 480 volt breakers, switchyard restoration, diesel air system, and the station battery chargers to verify that the systems can be restored during LOOP and SBO conditions.

The team reviewed abnormal operating procedures for the loss of electrical power, loss of the turbine driven auxiliary feedwater pump, loss of both motor-driven auxiliary feedwater pumps, and loss of the emergency condensate storage tank to verify that

directions were in place for contingency actions to be taken during LOOP and SBO conditions.

The team reviewed job performance measures for the local operation of both the 4160 volt and the 480 volt breakers, and starting the diesel air system in the Lister Diesel driven air compressor mode to verify that personnel were trained to perform these contingency actions that could be taken during LOOP and SBO conditions.

b. Findings

No findings of significance were identified.

.2 System Conditions and Capability

a. Inspection Scope

Installed Configuration

The team performed a field walkdown of accessible equipment related to the operation of the EDGs, the SBODG, and their support systems during LOOP and SBO conditions. In addition, a walkdown was performed to examine the charging pumps and the associated unit cross-connect lines and the SG PORVs and their backup air supply reservoirs and check valves. This review was performed to assess material condition, identify degraded equipment and verify installed configuration was consistent with design drawings and calculation design inputs.

The team performed a walkdown inspection of the 34.5 kV distribution system which is located in the switchyard to observe the material condition of the equipment and conformance to design drawings as well as system alignment procedures. The high voltage transformers which connect to the 34.5 kV system were also examined, and transformer tap positions were compared to calculation inputs. The RSST area was inspected for material condition and conformance to design documents. The physical configuration and layout of the transfer buses, breakers, and 4160V bus were inspected to verify that adequate separation existed to minimize interactions among the three paths for power flow from offsite and the SBODG source. The team examined various mimic boards, meters and switches in the main control room related to the connection between the safety-related buses and offsite power sources.

Design

SBO One Hour Coping Period

The team reviewed design basis documents and design calculations which established the basis for the one hour coping period for the SBO event. Documents reviewed included vendor documents and design calculations to determine if the reactor coolant pump shaft seals are capable of restricting leakage from the reactor coolant system following a loss of seal cooling water due to a station blackout and to determine if the core would remain covered with water for at least one hour.

Emergency Condensate Storage Tanks (ECSTs)

The team reviewed construction drawings for the ECSTs to determine if any internal bladder or liner existed such that failure or degradation could lead to common cause failure of water supply to the auxiliary feedwater (AFW) pumps. It was determined that these tanks have a carboline phenoline internal coating. The team reviewed the results of internal coatings inspections of these tanks with the licensee's coatings program engineer to determine if the coating condition is intact with no potential for degradation which could either block AFW flow or clog the AFW pump oil coolers. The team also reviewed the schedule for future inspections to verify that the ECST internal coating condition will be sufficiently monitored as it is recognized that the coating for the Unit 2 tank is nearing the end of its service life.

Emergency Diesel Generators Support Systems

The team performed a design review of the EDG support systems such as the fuel oil system and the service water system for potential common cause failures of risk significant components which could cause failure of the EDGs to perform during accident conditions. The review included design basis documents, calculations, vendor information and design drawings. Field inspection of the as-built plant configuration was also performed to verify conformance with the drawings and design basis documents.

SBODG Battery

The team reviewed Calculation EE-0511 to verify the SBODG batteries were adequately sized and that voltage drops in long control circuits were considered. DC panel size and rating requirements, along with battery charger and distribution cable sizing were also examined.

Testing

Station Blackout Diesel Generator

The team reviewed testing documentation to verify the reliability and availability of the EDGs and SBODG. The review included the acceptance criteria for testing and maintenance of the EDGs, SBODG, and associated switchgear, buses, and transformers to verify these were consistent with the plant technical specifications and vendor requirements. The team verified that the SBODG autostart function and interlocks and sequencing between the normal and alternate AC breakers had been properly configured and tested. The team also reviewed completed periodic test data for the SBODG to verify that the appropriate operating parameters were trended and were within vendor recommended limits.

Emergency Diesel Generators

The team reviewed testing documentation to verify the reliability and availability of the Unit 1 and 2 EDGs. The review included periodic test procedures and acceptance

criteria for auto-start and loading, air start and fuel oil transfer systems to verify that these functions were tested consistent with technical specification surveillance requirements. The team reviewed completed periodic test data for the four Unit 1 and 2 EDGs to verify that the appropriate operating parameters were trended and were within vendor recommended limits.

Undervoltage Relays

The team reviewed the procedures for functional and integrated testing of undervoltage relay logic circuits. This review encompassed the set of relays which sense voltage at the secondary of each RSST; the set of relays which sense voltage on each transfer bus for the purpose of bus protection; the set of relays which sense voltage on the transfer busses for the purpose of initiating the SBO sequence if required; and the loss-of-voltage and degraded grid voltage protection relays at the safety-related busses. The criterion applied to this review was that the testing was performed in accordance with the principles of NRC Generic Letter No. 96-01, “Testing of Safety-Related Logic Circuits.”

Overcurrent Relays

The team reviewed data sheets from past calibrations of the overcurrent relays associated with breakers 15D1 and 15D2 which connect the RSSTs to the transfer busses. The review focused on whether or not any set point drift was taking place as this could be a potential common mode failure mechanism leading to a loss of power.

b. Findings

No findings of significance were identified.

.3 Selected Components

a. Inspection Scope

Component Inspection

The team reviewed maintenance and testing documentation to assess the licensee’s actions to verify and maintain the safety function, reliability, and availability of selected components for the EDGs and SBODG, and equipment required to function during an SBO event. EDG and SBODG components included the diesels, fuel oil transfer system check valves and relief valves, storage tanks, the air starting system, diesel lubrication oil, turbine-driven auxiliary feedwater pump, 480 V breakers, and the radiator fans and louvers.

Component Degradation

The team reviewed the predictive/preventive maintenance program for the two 500 - 36.5 kV transformers, the 230 - 36.5 kV transformer and the 34.4 - 4.16 kV RSSTs. Actual data sheets from the last performance of the maintenance procedures were

reviewed to look for any out-of-specification measured values. The maintenance interval was also considered.

Reviews were made of maintenance records to determine the number of failures that may have occurred on the 34.5 kV cables and on the 4160 - 480 V dry type transformers. Records were also reviewed to determine the number of failures to close or trip on demand that may have occurred on the 4160 V circuit breakers over the last three years. The team reviewed corrective maintenance work orders for the RSSTs, 500 kV, and 230 kV transformers for the past ten years to identify any recurring problems.

The team reviewed the licensee activities for inspection and testing of the turbine driven auxiliary feedwater pump and associated support equipment to identify performance degradation.

Equipment Protection

The team reviewed the application of the surge arresters installed to protect the 34.5 kV cables against lightning strikes. These cables run underground, but they connect to an outdoor overhead bus at both ends. The acceptance criteria was that the arresters would limit voltage spikes to levels less than the voltage rating of the cables.

b. Findings

No findings of significance were identified.

.4 Identification and Resolution of Problems

a. Inspection Scope

The team reviewed plant issue reports and action requests (PIs/ARs) and respective corrective actions related to the EDGs. The team verified that the licensee was identifying procedural deficiencies at an appropriate threshold, that the deficiencies were entered into the corrective action program, and that corrective actions were being taken for the identified deficiencies.

The team also reviewed selected self-assessment reports which documented the results of the licensee's periodic self-assessments performed in the areas of engineering and emergency support, and related systems required to mitigate the LOOP/SBO events. The team reviewed the PIs /ARs that had been initiated by the licensee resulting from self-assessment findings.

The team reviewed licensee event reports for North Anna covering the last 10 years to look for problems involving loss of offsite power or other related problems with the electrical distribution system and considered the long term corrective action.

The team reviewed various summaries of plant issues covering the last ten years, and selected ten related to electrical systems for further review. These are listed in the Attachment to this report.

The team evaluated the licensee's test procedures for the undervoltage relay logic testing in light of the problems described in NRC Information Notice 92-40, "Inadequate Testing of Emergency Bus Undervoltage Logic Circuitry." The team also reviewed the licensee's evaluation of NRC Information Notice 95-05, "Undervoltage Protection Relay Settings Out of Tolerance Due to Test Equipment Harmonics" and NRC Information Notice 97-21, "Availability of Alternate AC Power Source Designed for Station Blackout Event."

The team reviewed the licensee's evaluation for a notification of potential defect issued on March 26, 1997, by Asea Brown Boveri T&D Company pursuant to 10 CFR Part 21 on the subject of trip devices used on K-Line low-voltage circuit breakers.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA6 Management Meeting

The lead inspector presented the inspection results to Mr. C. Funderburk, Manager, Station Operations and Maintenance, and other members of the licensee's staff on August 31, 2001. The licensee acknowledged the findings presented. Proprietary information is not included in the inspection report.

PARTIAL LIST OF PERSONS CONTACTED

Licensee
J. Crossman, Acting Director, Nuclear Safety and Licensing
J. Disosway, Supervisor Electrical
A. Dowell, Supervisor I&C
C. Funderburk, Manager, Station Operations and Maintenance
E. Hendrixson, Manager, Site Engineering
J. Leberstien, Licensing Engineer
L. Martin, Supervisor Nuclear Engineering, Plant Auxillary Systems
B. Standley, Supervisor EOP/I&C
B. Thomas, Supervisor Mechanical

Other licensee employees contacted included engineers, operations personnel, corporate specialist and administrative personnel.

NRC
J. Canady, Resident Inspector North Anna
M. Morgan, Senior Resident Inspector North Anna
C. Payne, Acting Engineering Branch Chief

ITEMS OPENED, CLOSED, OR DISCUSSED

None

LIST OF DOCUMENTS REVIEWED

Procedures

2-AR-F-F5, AAC System Trouble, Rev. 4
2-AR-F-F6, AAC Diesel Generator Trip, Rev. 4
2-AR-F-G5, AAC Diesel Generator Running, Rev. 1
2-AR-F-G6, Bus OL and Breaker 15F5 Alarms, Rev. 6
0-AR-6, Engine Control Panel 0-AAC-PNL-2, Rev. 4
CH-93.210, Fuel Oil, Sampling and Analysis Control, Rev. 2
CH-72.W02, Free Water and Particulate: Lube Oil and Fuel Oil, Rev. 0
CH-72.W01, Water and Sediment in Oils, Rev. 0
CH-72.V01, Saybolt Universal Viscosity, Rev. 2
CH-72.G01, Specific Gravity and Degrees API Gravity, Rev. 3
1-ECA-0.0, Loss of All AC Power, Rev. 18
1-ECA-0.1, Loss of All AC Power Recovery Without SI Required, Rev. 11
1-ECA-0.2, Loss of All AC Power Recovery With SI Required, Rev. 10
0-OP-6.4, Operation of the SBO Diesel (SBO Event), Rev. 7-P1
VPAP-0104, NBU Management Self-Assessment Program, Rev. 7
VPAP-0808, Emergency Diesel Generator Reliability Program, Rev. 5
VPAP-1601, Corrective Action, Rev. 14
0-MPM-0707-01, Quarterly Oil Sampling of Emergency Diesel, Rev. 3
0-ECM-0101-02, Installation or Removal of Jumper Cables Over Individual Cells of Main Station and Emergency Diesel Generator Stationary Batteries, Rev. 9
NA-M-DSE-613, LTC Controller Maintenance on Transformer RSST A, Rev. 2
1-PT-36.11H, Degraded Voltage/Loss of Voltage Functional and ESF Response, Rev. 15
1-EPM-1804-13, Protective Relay Maintenance for RSST A Leads Undervoltage and Overload Alarm Circuit, Rev. 1
1-PT-36.17A, Channel Calibration for Station Blackout-Unit 1 Train A Bus 1D and Bus 1F, Rev. 01
1-PT-36.17B, Channel Calibration for Station Blackout-Unit 1Train B Bus 1D and Bus 1F, Rev. 01
1-PT-36.13H, Engineered Safety Feature Actuation System Channel Calibration for 4160-Volt Emergency Bus H Undervoltage, Rev. 11
1-PT83.1, Simulated Loss of Offsite Power and ESF Actuation-H Bus, Rev. 35
1-EPM-1804-04, Protective Relay Maintenance for Bus 1D Undervoltage, Rev. 1
1-PT-71.4, Auxiliary Feedwater Pump Time Response and Logic Test, Rev. 28
2-PT-71.4, Auxiliary Feedwater Pump Time Response and Logic Test, Rev. 26
1-PT-36.9.1H, Degraded Voltage/Loss of Voltage Functional Test: 1H Bus, Rev. 4
1-PT-80, AC Sources Operability Verification, Rev. 16
2-Pt-T-80, AC Sources Operability Verification, Rev. 11
1-LOG-12, Emergency Diesel Generator Log (Operating), Rev. 16 (Completed on 7/23/01)
1-LOG-12, Emergency Diesel Generator Log (Operating), Rev. 16 (Completed on 7/29/01)
1-LOG-12, Emergency Diesel Generator Log (Operating), Rev. 16 (Completed on 8/05/01)
1-LOG-12, Emergency Diesel Generator Log (Operating), Rev. 16 (Completed on 8/08/01)
1-LOG-12, Emergency Diesel Generator Log (Operating), Rev. 16 (Completed on 8/12/01)

Maintenance Procedures

0-ECM-0301-01, Trouble-Shooting and Repair of 480-Volt Motor Control Center Breaker Assemblies and 480-Volt Air Circuit Breakers, Rev. 9
0-EPM-0302-02, BBC/ITE 480-Volt K-Line Breaker and Associated Switchgear Cubicle Maintenance, Rev. 23
0-EPM-0302-04, BBC/ITE 480-Volt K-Line Breaker 9-Year Inspection, Rev. 14
1-MPM-0102-01, Unit 1 Auxiliary Feed Pump Preventive Maintenance, Rev. 4
1-PT-41.2.2, Auxiliary Shutdown Panel Instrument Calibration (1-FW-P-101A), Rev. 3
1-PT-41.2.3, Auxiliary Shutdown Panel Instrument Calibration (1-FW-P-101B), Rev. 2
1-PT-41.2.4, Auxiliary Shutdown Panel Instrument Calibration (1-FW-P-101C), Rev. 2
1-PT-41.5, Steam Generator B Wide Range Level (L-FW-1487) Channel Calibration, Rev. 0
1-PT-41.6, Steam Generator C Wide Range Level (L-FW-1497) Channel Calibration, Rev. 0
1-PT-44.2.16, Auxiliary Feedwater Flow Rate To SG 1A Calibration, Rev. 3
1-PT-44.2.18, Auxiliary Feedwater Flow Rate To SG 1C Calibration, Rev. 3
0-ICP-MIS-G-001, Turbine Driven Auxiliary Feedwater Pump Lube Oil Reservoir Level Switch Calibration, Rev. 5
1-ICP-FW-P-100A, Steam Generator A Feedwater Inlet Pressure (P-FW-100A) Cal, Rev. 6
1-ICP-FW-P-103A, Turbine Driven Auxiliary Feedwater Pump Suction Pressure Switch (P-FW-103A) Calibration, Rev. 1
1-ICP-MS-P-1464, Steam Header Pressure (P-MS-1464) Calibration, Rev. 2
0-MOP-26.64, Switchyard Walkdown and Restoration, Rev. 6
1-MOP-26.77, A RSS Transformer and D Transfer Bus, Rev. 15
1-MOP-26.79, C RSS Transformer and F Transfer Bus, Rev. 15
1-MOP-6.70, 1-EE-SW-1H 4160-Volt Emergency Bus, Rev. 23
1-MOP-6.71, 1-EE-SW-1J 4160-Volt Emergency Bus, Rev. 24
2-MOP-6.70, 2H 4150-Volt Emergency Bus, Rev. 21

Operating Procedures

0-MOP-26.10, 480-Volt Breaker Local Manual Operation, Rev. 0
0-MOP-26.11, 4160-Volt Breaker Local Manual Operation, Rev. 2
0-MOP-26.64, Switchyard Walkdown and Restoration, Rev. 7
1-OP-6.7, Diesel Air System, Rev. 7
1-OP-26.4.1, Main station Battery Chargers 1-II and 1-II, Rev. 9

Abnormal Operating Procedures

0-AP-10, Loss of Electrical Power, Rev. 27
0-AP-48, Charging Pump Cross-Connect, Rev. 7
1-AP-15, Loss of Component Cooling, Rev. 18
1-AP-22.1, Loss of 1-FW-P-2 Turbine Driven AFW Pump, Rev. 12
1-AP-22.4, Loss of Both Motor-Driven AFW Pumps, Rev. 4
1-AP-22.5, Loss of Emergency Condensate Storage Tank 1-CN-TK-1, Rev. 5
1-AP-33.2, Loss of RCP Seal Cooling, Rev. 7

Periodic Test Procedures

1-PT-36-13H, Engineered Safety Feature Actuation System Channel Calibration For 4160-Volt Emergency Bus H Undervoltage (Loss of Voltage/Degraded Voltage), Rev. 11
1-PT-36-13J, Engineered Safety Feature Actuation System Channel Calibration For 4160-Volt Emergency Bus J Undervoltage (Loss of Voltage/Degraded Voltage), Rev. 10
1-PT-212.16, Valve Inservice Inspection (Backup Air Supply to Main Steam PORV), Rev. 5
1-PT-81.1A, Emergency Diesel Generator Fuel Oil Transfer Pumps 1-EG-P-1HA and 1-EG-P-1HB Test, Rev. 10
1-PT-81.1B, Emergency Diesel Generator Fuel Oil Transfer Pumps 1-EG-P-1JA and 1-EG-P-1JB Test, Rev. 9
1-PT-82.5, Fuel Oil Transfer System Operability Test, Rev. 7
1-PT-89.2A, Fuel Oil Analysis: 1-FO-TK-1, 1-EG-TK-2A, 1-EG-TK-2A, and 1-FP-TK-4, Rev. 7
1-PT-89.1A, Fuel Oil Sampling - A Tanks and Misc. Tanks, Rev. 15
0-PT-82.11, Quarterly Test of 0-AAC-DG-OM, Alternate AC Diesel Generator (SBO Diesel), on D Transfer Bus, Rev 11
0-PT-82.14, SBO Diesel Generator Test (Start By Simulated LORSS Power), Rev. 10
2-PT-82.2B, 2J Diesel Generator Test (Simulated Loss of Off-Site Power), Rev. 46
2-PT-83.1, Simulated Loss of Off-Site Power (LOOP) and ESF Actuation - H Bus, Rev. 28
2-PT-83.7H, 2H EDG 24-Hour Run, Rev. 6
0-PT-82.14, SBO Diesel Generator Test (Start By Simulated LORSS Power), Rev. 10
2-PT-82.2B, 2J Diesel Generator Test (Simulated Loss of Off-Site Power), Rev. 46
2-PT-83.1, Simulated Loss of Off-Site Power (LOOP) and ESF Actuation - H Bus, Rev. 28
2-PT-83.7H, 2H EDG 24-Hour Run, Rev. 6 (completed on 3/17/01)

Completed Surveillance Procedures and Test Records

1-PT-82.2A, 1H Diesel Generator Test (Simulated Loss of Offsite Power), Rev. 25 (completed on 5/09/01)
1-PT-82.2A, 1H Diesel Generator Test (Simulated Loss of Offsite Power), Rev. 25 (completed on 5/09/01)
1-PT-82.3A, 1H Diesel Generator Test (Simulated Loss of Offsite Power in Conjunction with an ESF Actuation), Rev. 24 (completed on 11/03/00)
1-PT-82.4A, 1H Diesel Generator Test (Standby ESF Actuation), Rev. 23 (completed on 5/09/01)
1-PT-82H, 1H Diesel Generator Test Slow Start Test, Rev. 22 (completed on 6/03/01)
1-PT-83.4H, Loss of Offsite Power (LOOP) on Bus 1H for Shutdown, Rev. 13 (completed on 3/13/00)
1-PT-83.7H, 1H EDG 24 Hour Run, Rev. 4OTO1 (completed on 3/17/00)
1-PO-1, Emergency Power System, (completed 2/27/77)
1-PO-1A, Emergency Power System, (completed 10/25/77)
2-PO-1, Emergency Power System, (completed 1/12/79)

Job Performance Measures

N0461, Start the Emergency Diesel Air System in Lister-diesel-drive operation (1-OP-6.7)
N0843, Operate a 4160-volt breaker locally (0-MOP-26.11, SOER-98-2)
N1455, Operate a 480-volt breaker locally (0-MOP-26.10, SOER-98-2)

N1665, Align Station Blackout Diesel for Manual Start
N1666, Place the SBO Diesel Generator in Parallel Service with a RSST
N1667, Place the SBO Diesel Generator in Service to Supply an Emergency Bus
N1668, Remove the SBO Diesel from Service Following EDG Restoration
N1669, Remove the SBO Diesel from Service Following RSST Restoration
N1671, Prepare the SBO Diesel for Loading Following an Automatic Start
R214, Perform the Immediate Operator Actions in Response to a Loss of All AC Power
R701, Depressurize All Steam Generators in Response to a Loss of All AC Power
R723, Establish Thermal Barrier and Seal Injection Flow Following a Loss of RCP Seal Cooling
R724, Respond to a Loss of RCP Seal Cooling

Calculations

CE-0886, Seismic Review of Buried Fuel Oil Lines for the Emergency Diesel Generators, Rev. 0
M-107, Pressure Loss from the Air Receiver to the Emergency Diesel Generator, dated 3/21/78
ME-0232, Time Required to Drain Pressurizer Upper Head and Part of the Upper Plenum Through RCP Seals at Station Blackout, Rev. 0
ME-0282, EDG Fuel Oil Tanks, Rev. 0
ME-0410, SBO Diesel Day Tank Level versus Usable Fuel, Rev. 1
SE-0018, Emergency Diesel Generator Tank Capacity, Rev. 1, dated 5/8/95
SM-0688, RCS Volume for Use with RC Pump Seal Leakage for Station Blackout, Rev. 0
EE-0511, NA SBO 125VDC Battery System Design, Rev. 1
EE-0550, NA AAC System 480V Low Voltage Breaker Settings, Rev. 0

Drawings

11715-ESK-11CC, Elementary Diagram Station Blackout Sequence, Rev. 1
11715-ESK-11D, Elementary Diagram Loss of Reserve Station Power- Sh 1
11715-ESK-11E, Elementary Diagram Loss of Reserve Station Power- Sh 2
11715-ESK-11P, Elementary Diagram Loss of Reserve Station Power- Sh 3
11715-ESK-11R, Elementary Diagram Emergency Bus 1H Undervoltage Circuit Testing, Rev. 11
13075-ESK-11D-1, Elementary Diagram RSST Feeder Undervoltage
11715-FB-035A, Flow/Valve Operating Numbers Diagram Yard - Fuel Oil Lines, Rev. 30
11715-FB-4A-13, Yard - Fuel Oil Lines - Sh 1
11715-FB-4B-14, Yard - Fuel Oil Lines - Sh 2
11715-FB-4C-17, Flow Diagram, Yard - Fuel Oil Lines - Sh 3
11715-FB-4D, Fuel Oil Lines - Sh 4
11715-FB-4E, Piping Arrangement - Plans and Sections, Fuel Oil - Heater Boiler Room & F. O. Pump RM 1, Rev. 0
11715-FB-035A, Flow/Valve Operating Numbers Diagram, Yard - Fuel Oil Lines - Sh 1, Rev. 33
11715-FB-035A, Flow/Valve Operating Numbers Diagram, Yard - Fuel Oil Lines - Sh 2, Rev 30
11715-FE-1A, Main One Line Diagram, Rev. 28
11715-FE-1BB, Electrical Distribution System One Line, Rev. 9
11715-FE-1BD, One Line Switching Diagram, Rev. 3
11715-FE-1BH, 0-AAC-SW-0L1 Bus 0L One line Diagram, Rev. 1
11715-FE-1BJ, 0-AAC-SW-0M1 Bus 0M One Line Diagram, Rev. 0

11715-FE-1D, 4160V One Line Diagram-Sheet 3 Emergency Bus 1H and 1J, Rev. 20
11715-FE-21AV, Elementary Diagram 4160V Breaker 0-AAC-BKR-05L2 Bus 0L to Bus 0M Tie Station Blackout System, Rev. 0
11715-FE-21BA, Elementary Diagram 4160V Breaker 0-AAC-BKR-05M1 AAC Output Breaker Station Blackout System, Rev. 0
11715-FE-21BC, Elementary Diagram 4160V Breaker 0-AAC-BKR-05M3 Bus 0M to Bus 0L Tie Breaker Station Blackout System, Rev. 1
11715-FE-21BT, Elementary Diagram 4160V Breaker 0-AAC-BKR-05L1 Bus 0L to Bus E Tie Station Blackout System, Rev. 0
11715-FE-21B, AC Elementary Diagram Station Service Transformers, Rev. 16
11715-FE-21G, Elementary Diagram 4160V Bus 1A Breaker 15A1, 15A2, and Bus 1B Breaker 15B1, 15B2, Rev. 18
11715-FE-21K, Elementary Diagram 4160V Breaker 15D1, 15E1, 15F1, and 15G10, Rev. 22
11715-FE-21L, DC Elementary Diagram 4160V Normal Buses A, B, C & Transfer Buses D, E, & F Undervoltage
11715-FE-21T, DC Elementary Diagram 4160 V Emergency Bus 1H Undervoltage, Rev. 29
11715-FV-43A-6, 110,000 Gallon Condensate Storage Tank 1&2-CN-TK-1

Engineering Documents

Engineering Work Request (EWR) 86-100, Change EDG Lube Oil to Chevron, dated 2/21/86
Engineering Transmittal ET N 01-020, Rev. 0, Acceptability of Using Mobilgard 450 NC as Engine Oil, dated 2/15/01
CEE 01-0007, Evaluation of Adequacy of Jumpering One Cell from EDG 1H Battery
Engineering Log dated 5/3/00, Discussion of Inspection of Underground Fuel Oil Tank Vaults

SELF-ASSESSMENTS

59 - ENGSA - 99-002, Engineering Interface with Work Planning / Scheduling Process
59 - ENGSA - 2000-01, REA Process Effectiveness
59 - ENGSA - 2000-02, EPIX Assessment - Equipment Performance Information Exchange
59 - ENGSA - 2000-03, Engineering Work Management
59 - ENGSA - 2000-04, Review of IST Pump Instrumentation Accuracy Calculations

Design Criteria

System Design Basis Document for Emergency Diesel Generator System, SDBD-NAPS-EG, Rev. 3, dated 8/18/00
System Design Basis Document for Power Generation Distribution System, SDBD-NAPS-EA, Rev. 1, dated 12/20/00
System Design Basis Document for Auxiliary Feedwater System, SDBD-NAPS-AFW, Rev. 3, dated 6/15/00

UFSAR

Section 3.11.3, Corrosion Prevention for Underground Piping
Section 9.5.4, Emergency Diesel Generator Fuel Oil Storage and Transfer System
Section 9.5.5, Diesel-Generator Cooling Water System
Section 9.5.6, Diesel-Generator Starting System

Technical Specifications (TS)

TS Section 3/4.8.1, Electrical Power Systems, AC Sources

Miscellaneous Documents

WCAP 10541, Reactor Pump Seal Performance Following a Loss of ALL AC Power, Rev. 0, dated April, 1984, and Rev. 2, dated November, 1986
Training Module NCRODP-25, Station Diesel Generator Systems
EDG System Engineer's Notebook, Summary of Results of EDG Start and Loading Tests
EDG 1H Diesel (Lubrication) Oil Test Results, 6/4/00, 8/27/00, 11/19/00, 2/11/01, 5/8/01, and 7/29/01
EDG 1J Diesel (Lubrication) Oil Test Results, 3/24/00, 6/18/00, 9/11/00, 12/3/00, 2/25/01, and 5/22/01
EDG 2H Diesel (Lubrication) Oil Test Results, 5/29/00, 6/12/00, 8/20/00, 11/12/00, 2/5/01, and 4/29/01
EDG 2J Diesel (Lubrication) Oil Test Results, 5/19/00, 9/3/00, 11/26/00, 2/19/01, 5/11/01, and 8/5/01
AAC DG Diesel (Lubrication) Oil Test Results, 4/17/00, 6/13/00, 9/7/00, 2/21/01, 5/2/01, and 8/8/01
Vendor Technical Manual 59-A412-00011, Instructions for ABB Single-Phase Voltage Relays, November 1990
Vendor Technical Manual RC-5105-A, Class 1E Electrical Equipment I-T-E 27D/H Undervoltage Relays, January 1982
Vendor Technical Manual 59-G533-00030, Instructions for Static Voltage Relay, June 1992
Vendor Technical Manual 50-385-ESELTC-X, Safeguards Test Cabinets, February 1975
Category 1 Root Cause Evaluation Response-N-2000-1049-E1, Unit 2 Turbine Trip Due To Fault of Unite 2 C SS Transformer
Dissolved Gas Analysis and PCB Content for NA Transformer 1, August 2001
Preventive Maintenance Test Results for Transformers 1,2, 3 and RSSTs
OE-N-1998-4360-E1,PT21 97-03: Miswired ABB K-Line Low Voltage AC Circuit Breakers, February 1998

Plant Issues

PI-N-1998-1633, Breaker 05M1 Failed to Close
PI-N-1998-1920, SBO EDG Room Normal Exhaust Fan Breaker Tripped
PI-N-1999-0736, Cable Fault at Transformer 2G2
PI-N-1999-1608, No 480V Molded Case Circuit Breakers in MCC OMI in PM Program
PI-N-1999-1648, SBO EDG Room Normal Exhaust Fan Breaker Tripped
PI-N-1999-2029, Cable Fault at Breaker 15G4

PI-N-1999-3142, Problems Maintaining Proper EDG Battery Float Voltage
PI-N-2000-0881, 34.5kV Shunt Reactor Banks Not Correct on Drawing
PI-N-2000-1037, Breaker 25C7 Trip Due Transformer 2C1 Fault
PI-N-2000-1049, Reactor Trip Due to Fault on Unit 2 C SS Transformer
PI-N-2000-1139, Problems Maintaining Proper EDG Battery Float Voltage
PI-N-2001-0457, 34.5kV Shunt Reactor Banks Not Correct on Drawing
PI-N-2001-1227, Problems Maintaining Proper EDG Battery Float Voltage
PI-N-2001-1230, Battery 1-EG-B-01A Cell 4 Jumpered
PI-N-2001-2216, Instrument 2-RCS-TR-2409D Out of Acceptable Range
PI-N-2001-2223, Analyzer for instrument 1-GW-02R/H2R-102 Out of Tolerance High
PI-N-2001-2229, Valve 2-HV-RV-2205C Failed As-found Lift Pressure
PI-N-2001-2230, Instrument 2-HV-PI-702C Out of Specifications Low
PI-N-2001-2240, Instrument 2-HV-TS-702C Out of Specifications and Non-repeatable
PI-N-2001-2246, Instrument 2-HV-TS-701C Tripped Low
PI-N-2001-2251, Instrument 1-RW-LI-105 Out of Specifications Low
PI-N-2001-2270, Instrument 1-EI-CB-49E Out of Tolerance
PI-N-2001-2303, Instrument 1-RC-TR-1410 Out of Specifications Low
PI-N-2001-2307, Instrument 1-FP-TK-06 Out of Specifications Low
PI-N-2001-2309, As-found for Reset for Instrument 1-IA-PS-117B Out of Specifications Low
PI-N-2001-2323, As-found Data Points Out of Tolerance Low for Instrument 2-FW-FR-2478
PI-N-2001-2335, Failed Detector for Instrument 2-SV-RM-221 Causing HI and HI-HI Alarm
PI-N-2001-2341, Power Supply to instrument 1-NM-1NFD-1270 Out of Tolerance Low
PI-N-2001-2350, As-found Data for Instrument 1-ICP-QS-T-100A Out of Specifications High

Work Requests

W/O 00430623, Clean and Coat EDG Storage Tank Piping and Fittings
W/O 00430624, Clean and Coat EDG Storage Tank Piping and Fittings
W/O 00413802, Investigate/Repair/Replace Feeder Breaker
W/O 00435690, Investigate/Repair as Needed For Feedwater Flow to Steam Generator Low Indication

Corrective Actions Initiated as a Result of this Inspection

Plant Issues

N-2001-2388, Enhanced awareness of response to SBO events
N-2001-2278, Degraded conduit seals for underground cable
N-2001-2385, Sediment in SBO battery cells
N-2001-2334, Drawing error-bus connection shown incorrectly
N-2001-2405, Margin for lightning arresters for RSST underground cables

Label Error

0-AAC-BKR-05M3 CHANGE “L” to “OL” for the breaker

Procedure Change

0-AR-6(A-6) Annunciator response for the PLC alarm of SBO diesel

Drawing Change Requests

N-2001-1223, 34.5 kV Cable Not Depicted Correctly on 11715-FE-1BB
N-2001-1231, Lightening Arresters at RSST end of 34.5 kV Cable Omitted from 11715-FE-1A