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

February 24, 2012

Mr. David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company
Dominion Nuclear
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: SURRY POWER STATION - NRC COMPONENT DESIGN BASES INSPECTION - INSPECTION REPORT 05000280/2011011 AND 05000281/2011011

Dear Mr. Heacock:

On, January 11, 2012, U. S. Nuclear Regulatory Commission (NRC) completed an inspection at your Surry Power Station, Units 1 and 2. The enclosed inspection report documents the inspection results, which were discussed on January 11, 2012, with Mr. B. Stanley and other members of your staff.

The inspection examined 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 licenses. The team reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents five NRC identified findings of very low safety significance (Green), which were determined to involve violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with the NRC Enforcement Policy. If you contest these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-001; with copies to the Regional Administrator Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at Surry. Further, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region II, and the NRC Resident Inspector at Surry Power Station. The information you provide will be considered in accordance with Inspection Manual Chapter 0305.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the

NRC Public Document Room or from the Publicly Available Records (PARS) component of 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/**

Rebecca L. Nease, Chief
Engineering Branch 1
Division of Reactor Safety

Docket No. 50-280, 50-281
License No. DPR-32, DPR-37

Enclosure:
Inspection Report 05000280, 281/2011011
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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/**

Rebecca L. Nease, Chief
Engineering Branch 1
Division of Reactor Safety

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Distribution w/encl:
G. McCoy, RII DRP
S. Ninh, RII DRP
S. Sanchez, RII DRP
J. Nadel, RII DRP
RIDSNRRDIRS
PUBLIC
RidsNrrPMSurry Resource

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| SIGNATURE | Via e-mail | Via e-mail | Via e-mail | Via e-mail | Via e-mail |
| NAME | J. EARGLE | D. JONES | D. MAS-PENARANDA | A. ALEN | M. ENDRESS |
| DATE | 2/ 2 /2012 | 1/ 30 /2012 | 2/ 1 /2012 | 1/ 30 /2012 | 1/ 30 /2012 |
| E-MAIL COPY | **YES** NO | **YES** NO | **YES** NO | **YES** NO | **YES** NO |
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cc w/encl:

Larry Lane
Site Vice President
Surry Power Station
Virginia Electric and Power Company
Electronic Mail Distribution

B. L. (Sonny) Stanley
Director, Nuclear Safety and Licensing
Virginia Electric and Power Company
Electronic Mail Distribution

Kenny B. Sloane
Plant Manager
Surry Power Station
Virginia Electric & Power Company
Electronic Mail Distribution

Lillian M. Cuoco, Esq.
Senior Counsel
Dominion Resources Services, Inc.
Electronic Mail Distribution

Tom Huber
Director, Nuclear Licensing & Operations Support
Virginia Electric and Power Company
Electronic Mail Distribution

Ginger L. Rutherford
Virginia Electric and Power Company
Electronic Mail Distribution

Virginia State Corporation Commission
Division of Energy Regulation
P.O. Box 1197
Richmond, VA 23209

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

Senior Resident Inspector
Surry Power Station
U.S. Nuclear Regulatory Commission
5850 Hog Island Rd
Surry, VA 23883

Michael M. Cline
Director
Virginia Department of Emergency Services Management
Electronic Mail Distribution

**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

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|---|---|
| Docket Nos.: | 05000280, 05000281 |
| License Nos.: | DPR-32, DPR-37 |
| Report No.: | 05000280/2011011 and 05000281/2011011 |
| Licensee: | Virginia Electric and Power Company |
| Facility: | Surry Power Station, Units 1 and 2 |
| Location: | Surry, VA |
| Dates: | November 14, 2011 – January 11, 2012 |
| Inspectors: | J. Eargle, Reactor Inspector (Lead)<br>D. Jones, Senior Reactor Inspector<br>A. Alen, Reactor Inspector<br>D. Mas Penaranda, Reactor Inspector<br>M. Endress, Reactor Inspector<br>B. Sherbin, Accompanying Personnel<br>G. Skinner, Accompanying Personnel |
| Approved by: | Rebecca Nease, Chief<br>Engineering Branch 1<br>Division of Reactor Safety |

Enclosure

SUMMARY OF FINDINGS

IR 05000280/2011011, 05000281/2011011; 11/14/2011 – 01/11/2012; Surry Power Station, Units 1 and 2; Component Design Bases Inspection.

This inspection was conducted by a team of five Nuclear Regulatory Commission (NRC) inspectors from the Region II office, and two NRC contract personnel. Five Green non-cited violations were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using the NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process." Findings for which the Significance Determination Process does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

NRC identified and Self-Revealing Findings

Cornerstone: Initiating Events

- Green. The team identified a non-cited violation of Technical Specification 6.4.A.3, "Unit Operating Procedures and Programs," for the licensee's failure to provide appropriate procedural guidance to assure the operator's ability to detect and correct a component cooling (CC) water low flow condition through the thermal barrier heat exchanger. The licensee entered this in their corrective action program as CR 455255.

  The licensee's failure to provide appropriate procedural guidance to assure that CC flow to thermal barrier heat exchangers was maintained greater than 35 gpm was a performance deficiency. The performance deficiency was more than minor because it was associated with the procedure quality attribute of the Initiating Event Cornerstone and adversely affected the cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the failure to translate the appropriate minimum flow requirement value into procedures adversely affected the operator's ability to detect and correct a CC water low flow condition through the thermal barrier heat exchanger which could result in entering an event with a back-up system in a degraded condition. In accordance with Nuclear Regulatory Commission Inspection Manual Chapter 0609.04, "Initial Screening and Characterization of Findings," the team conducted a Phase 1 Significance Determination Process screening and determined the finding to be of very low safety significance (Green) because assuming worst case degradation, the finding would not exceed the Technical Specification limit for any reactor coolant system leakage, and the finding did not affect other mitigation systems. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance. [Section 1R21.2.1]

Cornerstone: Mitigating Systems

- Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to use the most conservative motor currents in the analysis to determine the adequacy of thermal overloads (TOLs) at degraded voltage conditions. The licensee entered this into their corrective action program as CR 455657, CR454839, CR454841, CR454863, CR455218, and CR 456448.

The licensee's failure to use the most conservative motor currents in the analysis to determine the adequacy of TOLs at degraded voltage conditions was a performance deficiency. The performance deficiency was more than minor because it was similar to Inspector Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix E, "Example of Minor Issues", Example 3.j, which states that if "the engineering calculation error results in a condition where there is now a reasonable doubt on the operability of a system or component" the performance deficiency is not minor. Further, the performance deficiency was more than minor because it was associated with the design control attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to use the most conservative motor currents in the analysis to determine the adequacy of TOLs at degraded voltage conditions resulted in a reasonable doubt that the 480V safety related motors could perform their safety function. In accordance with Nuclear Regulatory Commission Inspection Manual Chapter 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 Significance Determination Process screening and determined the finding to be of very low safety significance (Green) because it was a design deficiency confirmed not to have resulted in the loss of operability or functionality. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance. [Section 1R21.2.10]

- Green. The team identified a non-cited violation of Technical Specification 6.4.A.7, "Unit Operating Procedures and Programs", for the licensee's failure to provide adequate instructions in the surveillance procedure for the charging pump service water system. The licensee entered this into their corrective action program as CR 456318.

  The licensee's failure to provide adequate procedural guidance to flush the charging pump service water system cross-tie components was a performance deficiency. The performance deficiency was more than minor because it was associated with the procedure quality attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the surveillance procedure that was developed as a corrective action for CR 169929 was inadequate in that it did not flush the cross-tie piping that was used in procedures 0-AP-12, and 0-FCA-7. The failure to adequately flush the cross-tie lines resulted in a lack of reasonable assurance that the components would perform their intended function. In accordance with Nuclear Regulatory Commission Inspection Manual Chapter 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 Significance Determination Process screening and determined the finding to be of very low safety significance (Green) because it was not a design deficiency, did not represent the loss of a system safety function, did not result in exceeding a Technical Specification allowed outage time, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. Additionally, the team assessed the finding using Inspection Manual Chapter 0609, Appendix F, "Fire Protection Significance Determination Process," and determined that the finding was of very low safety significance (Green) because the finding only affected the ability to reach and maintain cold shutdown conditions. The team identified a cross-cutting aspect in the resources component of the Human Performance area. Specifically, the licensee failed to provide

an adequate procedure for the maintenance of the charging pump service water system. [H.2(c)]. [Section 1R21.2.10]

- Green. The team identified a non-cited violation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," for the licensee's failure to perform condition monitoring or otherwise implement an effective preventive maintenance program for the alternate alternating current (AAC) diesel generator ventilation supply dampers and exhaust louvers. The licensee entered this into their corrective action program as CR 449898, CR 450609, CR 454673, and CR 454653.

  The licensee's failure to perform condition monitoring or otherwise implement an appropriate preventative maintenance program for the AAC ventilation dampers and louvers was a performance deficiency. This performance deficiency was more than minor because it was associated with equipment performance attribute of the mitigating system cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the lack of an effective preventative maintenance program on the ventilation system affected the reliability of the exhaust fan louvers, as evidenced by exhaust fan louver, 0-VS-F-702, being stuck open, and challenged the assurance that these components would remain capable to support the functionality of the AAC diesel. In accordance with Nuclear Regulatory Commission Inspection Manual Chapter 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 Significance Determination Process screening and determined the finding to be of very low safety significance (Green) because it was not a design deficiency, did not represent the loss of a system safety function, did not result in exceeding a Technical Specification allowed outage time, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance. [Section 1R21.2.13]

- Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's use of a non-conservative net positive suction head required (NPSHr) value in the analysis that determined the adequacy of the net positive suction head available (NPSHa) for the recirculation spray pumps. The licensee entered this into their corrective action program as CR 454236.

  The licensee's use of a non-conservative NPSHr value in the analysis that determined the adequacy of the NPSHa for the recirculation spray pumps was a performance deficiency. The performance deficiency was more than minor because it was similar to Inspection Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix E, "Examples of Minor Issues", Example 3j, which states that if the engineering calculation error resulted in a condition where there was a reasonable doubt on the operability of a system the performance deficiency is not minor. Further, the performance deficiency was more than minor because it was associated with the design control attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the higher NPSHr for the outside recirculation spray pumps, due to the temperature correction, exceeded the NPSHa and resulted in a reasonable doubt that the outside recirculation spray pumps could perform their functions under the most limiting conditions. In accordance with

Nuclear Regulatory Commission Inspection Manual Chapter 0609.04, “Initial Screening and Characterization of Findings”, the team conducted a Phase 1 Significance Determination Process screening and determined the finding to be of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance. [Section 1R21.2.14]

Licensee-Identified Violations

None

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 1 $X10^{-6}$. The sample included sixteen components, including three associated with containment large early release frequency, and five operating experience (OE) items.

The team performed a margin assessment and a detailed review of the selected risk-significant components to verify that the design bases had been correctly implemented and maintained. This margin assessment 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, Regulatory Issue Summary 05-020 (formerly Generic Letter 91-18) conditions, NRC resident inspector input of problem equipment, system health reports, industry OE, and licensee problem equipment lists. Consideration was also given to the uniqueness and complexity of the design, operating experience, 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 (16 Samples)

.1 Thermal Barrier Heat Exchanger (2-RC-P-1A/B/C)

a. Inspection Scope

The team reviewed the plant Technical Specifications (TS), Updated Final Safety Analyses Report (UFSAR), Design Bases Documents (DBDs), and Piping And Instrumentation Drawings (P&IDs) to establish an overall understanding of the design bases of the thermal barrier heat exchangers for Unit 2 Reactor Coolant Pumps (RCPs) A, B and C. Design calculations and site procedures were reviewed to verify that the design bases and design assumptions had been appropriately translated into these documents. Operating procedures were reviewed to verify that component operation and alignment were consistent with design and licensing bases assumptions. Test procedures and recent test results were reviewed against design bases documents 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. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system

documents were reviewed in order to verify that potential degradation was monitored or prevented and that the component replacement was consistent with inservice/equipment qualification life. The team also reviewed the calculations for increased service water (SW) maximum temperature to ensure that the required heat transfer would still occur in the thermal barrier heat exchanger.

b. Findings

Introduction: The team identified a Green non-cited violation (NCV) of TS 6.4.A.3, "Unit Operating Procedures and Programs," for the licensee's failure to provide appropriate procedural guidance to assure the operator's ability to detect and correct a component cooling (CC) water low flow condition through the thermal barrier heat exchanger.

Description: CC water provides cooling to the three RCP thermal barrier heat exchangers to protect the RCP seals. The CC high temperature alarm is used as the indication of low CC flow to the thermal barrier heat exchangers. The control room also has a flow meter showing CC flow through each individual thermal barrier heat exchanger, but that flow is not logged. The team noted that the minimum design flow required by Westinghouse documentation is 35 gpm for each thermal barrier heat exchanger.

The team reviewed annunciator response procedure (ARP) ARP-2C-A3, "RCP 1A Thermal Barrier CC Hi Temp," Rev. 1, which states that a high temperature alarm may be caused by inadequate CC water flow. The only action required by the procedure with respect to inadequate flow is to check that the discharge valve is open. The procedure does not specify a minimum flow required nor define what "inadequate" flow is, therefore, if the alarm was received, the operators would not be able to effectively troubleshoot and correct a degraded flow condition. In addition, the licensee did not have any administrative mechanism in place to track CC flow through the thermal barrier heat exchanger on a routine basis. During the inspection, the team observed CC flow on indicators in the control room and found Unit 2 RCP C CC flow to be below the Westinghouse specified minimum flow of 35 gpm. The licensee entered the low CC flow on Unit 2 RCP C into their corrective action program (CAP) as CR 455255, and increased the CC flow to greater than 35 gpm.

Analysis: The licensee's failure to provide appropriate procedural guidance to assure that CC flow to thermal barrier heat exchangers was maintained greater than 35 gpm was a performance deficiency. The performance deficiency was more than minor because it was associated with the procedure quality attribute of the initiating event cornerstone and adversely affected the cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the failure to translate the appropriate minimum flow requirement value into procedures adversely affected the operator's ability to detect and correct a CC water low flow condition through the thermal barrier heat exchanger which could result in entering an event with a back-up system in a degraded condition. In accordance with Nuclear Regulatory Commission (NRC) Inspection Manual Chapter (IMC) 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 Significance Determination Process (SDP) screening and determined the finding to be of very low safety significance (Green) because assuming worst case degradation, the finding would not exceed the TS limit for any reactor coolant system (RCS) leakage, and the finding did not affect other mitigation

systems. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance.

Enforcement: TS 6.4.A.3, "Unit Operating Procedures and Programs" states, in part, that detailed written procedures with appropriate check-off lists and instructions shall be provided for actions to be taken for specific and foreseen malfunctions of systems or components including alarms, primary system leaks and abnormal radioactivity changes. Contrary to the above, since original plant operation, the licensee failed to maintain adequate procedures for malfunctions of the CC system. Specifically, the licensee failed to provide appropriate procedural guidance in procedure ARP 2C-A3, Rev. 1 to assure the operator's ability to detect and correct a CC water low flow condition through the thermal barrier heat exchangers. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP (CR 455255), it is being treated as an NCV consistent with Section 2.3.2 of the NRC Enforcement Policy: 05000281/2011011-01, "Failure to Provide Appropriate Procedural Guidance for Component Cooling Water Flow to the Thermal Barrier Heat Exchangers."

.2 34.5kV Bus 7

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and electrical drawings to establish an overall understanding of the design bases of the 34.5kV Bus 7. The team reviewed Modification 05-021 to determine whether the final design accomplished the objective of the modification, was consistent with the requirements of General Design Criteria - 17, and whether the installed modification was adequately tested. The team reviewed schedules, procedures, and task descriptions used for 34.5kV switchyard routine maintenance to determine whether they were adequate to ensure equipment reliability. The team reviewed system health reports and completed work documents to determine whether there were any adverse equipment trends. The team reviewed corrective action histories, and repair documents associated with the April 2011 tornado damage to the 34.5kV switchyard to determine whether corrective actions were adequate to restore the switchyard to full functionality and reliability. The team reviewed the overcurrent protection scheme, including drawings and calculations to determine whether the busses were adequately protected and immune from spurious tripping. The team reviewed corrective action history, system health reports, and maintenance records to determine whether there were any adverse operating trends. The team performed a visual inspection of Bus 7 status indication in the main control room to determine whether the arrangement of indicating lights and mimics enabled accurate recognition of bus status. In addition, the team performed a visual inspection of the 34.5kV switchyard, including the buses, circuit breakers, protective relays, and 125Vdc control power batteries to assess material condition and the presence of hazards.

b. Findings

No findings were identified.

.3 4160V Bus 1H

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and electrical drawings to establish an overall understanding of the design bases of the 4160V Bus 1H. The team reviewed bus loading calculations to determine whether the 4160V system had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed 125Vdc system voltage calculations to determine whether adequate voltage was available for switchgear control and protective relays. The team reviewed the design of the degraded voltage protection scheme to determine whether it afforded adequate voltage to safety related devices at all voltage distribution levels. This included review of degraded voltage relay setpoint calculations, motor starting and running voltage calculations, and motor control center control circuit voltage drop calculations. The team reviewed the overcurrent protection scheme for the 4160V buses including drawings and calculations to determine whether loads were adequately protected and immune from spurious tripping. The team reviewed corrective action history, system health reports, and maintenance records to determine whether there were any adverse operating trends. In addition, the team performed a visual inspection of the 4160V safety buses to assess material condition and the presence of hazards.

b. Findings

No findings were identified.

.4 480V Bus 1H-1

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and electrical drawings to establish an overall understanding of the design bases of the 480V Bus 1H1. The team reviewed bus loading calculations to determine whether the 480V system had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed the overcurrent protection scheme for the 480V buses including drawings and calculations to determine whether loads were adequately protected and immune from spurious tripping. The team reviewed corrective action history, system health reports, and maintenance records to determine whether there were any adverse operating trends. In addition, the team performed a visual inspection of the 480V safety buses to assess material condition and the presence of hazards.

b. Findings

No findings were identified.

.5 125Vdc Distribution Panel 1A (1-EPD-DCS-1A)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and electrical drawings to establish an overall understanding of the design bases of the 125Vdc distribution panel 1A. The team reviewed procedures and completed work documents for molded case circuit

breaker testing and replacement to determine whether the station's practices were consistent with industry standards. The team reviewed voltage drop calculations for selected circuits to determine whether adequate voltage was available to safety related circuits under worst case accident conditions. In addition, the team performed a visual inspection of the 125Vdc distribution panel to assess material condition and the presence of hazards.

b. Findings

No findings were identified

.6 Reactor Coolant Pump Thermal Barrier Isolation Valves and Flow Instruments

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the RCP isolation valves and flow instruments. The team reviewed the isolation valves to verify their capability to perform the required design bases functions. The team reviewed recent corrective actions, test procedures and test results; performed walkdowns of the valves and related instruments; and conducted interviews with responsible engineering personnel. The team reviewed the test procedures associated with the valves to verify the valves and instruments were being tested in accordance with the design bases.

The team reviewed instrument setpoint and uncertainty calculations, as well as calibration procedures and calibration test records to verify that the thermal barrier flow instruments were in accordance with the design bases. The last two completed calibration test records were reviewed to confirm that instrument setpoints were consistent with setpoint calculations. Also, the team reviewed a sample of condition reports to confirm that the licensee adequately identified and corrected adverse conditions. In addition, the team reviewed the maintenance history to verify actions were taken to correct and prevent problems.

b. Findings

No findings were identified.

.7 Engineer Safeguard Features – Recirculation Spray Logic

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and electrical drawings to establish an overall understanding of the design bases of the recirculation spray (RS) Logic. The team reviewed control diagrams to verify that the refueling water storage tank level instrument and consequence limiting safeguard Hi-Hi signal (containment pressure instruments) input to the engineer safeguard features– RS Logic was consistent with the design bases and operational requirements. Also, the team reviewed instrument setpoint and uncertainty calculations, as well as calibration procedures and calibration test records to verify that the instruments were in accordance with their design bases. The last two completed calibration test records were reviewed to confirm that instrument setpoints were consistent with setpoint calculations. In addition, the team reviewed a

sample of condition reports to confirm that the licensee adequately identified and corrected adverse conditions. The team also reviewed the maintenance history to verify actions were taken to correct and prevent problems.

The team reviewed control diagrams to verify that the operation of the RS suction and discharge motor operated valves (MOVs), were consistent with the design bases and operational requirements. Associated electrical calculations were reviewed to confirm that the design basis minimum voltage at the MOV motor terminals was consistent with the design inputs used in the MOV thrust calculations, and that the thermal overload (TOL) heaters protecting the motors would not prematurely trip. Additionally, the team performed a walkdown to verify material condition of the valve motor.

b. Findings

No findings were identified

.8 Engineer Safeguard Features – Unit 1 and 2 Non-Essential Service Water Isolation

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the non-essential SW isolation system logic. The team reviewed system flow diagrams, instrumentation and control drawings, elementary and schematic diagrams, instrument setpoint documents, as well as calibration procedures and test records to verify that the instrumentation and controls were appropriately being monitored and maintained consistent with the design and licensing bases requirements. The team also conducted component walkdowns to verify that the installed configurations would support their design bases function under accident conditions and had been maintained to be consistent with design assumptions.

b. Findings

No findings were identified

.9 Condenser Inlet and Outlet Isolation Motor Operated Valves (2-CW-200A/B and 206A/B)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the condenser inlet and outlet MOVs. Design calculations (i.e., differential pressure and required torque/thrust) and site procedures were reviewed to verify that the design bases and design assumptions had been appropriately translated into these documents. Component walkdowns were conducted to verify that the installed configurations would support their design bases function under accident conditions and had been maintained to be consistent with design assumptions. Operating procedures were reviewed to verify that component operation and alignments were consistent with design and licensing bases assumptions. Test procedures and recent test results were reviewed against design bases documents 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. Vendor documentation, system health

reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented. Additionally, the team reviewed the calculations for the degraded voltage at the MOV terminals, to ensure that the proper voltage was utilized in the MOV torque calculations.

b. Findings

No findings were identified

.10 Charging Pump Service Water Pumps (2-SW-P-10A/B)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the charging pump service water (CPSW) pumps. The team evaluated the CPSW pumps to verify that their performance satisfied design bases flow rate requirements during postulated transient and accident conditions. To determine design basis performance requirements and operational limitations, the team reviewed design basis documents including CPSW system hydraulic calculations, operating instructions and procedures, system drawings, surveillance tests, and modifications. Surveillance test results were reviewed to determine whether established test acceptance criteria were satisfied. The surveillance acceptance criteria were compared to design bases assumptions and requirements to verify adequate margins for allowable pump degradation limits. Net positive suction head (NPSH) requirements were reviewed to ensure satisfactory pump suction performance during transient and accident conditions. Thermal performance calculations for the heat exchangers in the CPSW system were reviewed to ensure adequate flow rates were delivered to remove design bases heat loads. In addition, the team walked down the pump rooms, interviewed system and design engineers, reviewed system health reports and reviewed condition reports to assess the current condition of the pump.

The team reviewed control diagrams for the pumps' motors to verify component controls would be functional during accident/event conditions. Voltage and short circuit calculations were reviewed to verify energy sources would be available and adequate during accident/event conditions. Motor protection setting calculations were reviewed to verify that the motors were adequately protected.

b.1 Findings

Introduction: The team identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to use the most conservative motor currents in the analysis used to determine the adequacy of TOLs at degraded voltage conditions.

Description: The purpose of ET-CEE-02-002, Rev. 1, was to provide a more quantitative analysis of the overcurrent settings and the higher motor currents expected for degraded voltage conditions. The team noted that motor currents used in the engineering transmittal were typically obtained from the review of work orders performed during surveillance runs following preventative maintenance. The team also noted that the engineering transmittal only evaluated the overcurrent protection for Bus 1H, because

the licensee concluded that all of the emergency buses were similar and the results for one bus applied to all four emergency buses. The team concluded that the licensee's method of obtaining the running currents for the pumps did not consider the effects of variation of pump flow, discharge pressure, or temperature which could cause higher running currents. Additionally, the team determined that some of the TOLs installed in the plant were different than what was analyzed in the engineering transmittal, and that some of the TOLs installed in the plant were not in accordance with STD-EEN-0011, Standard for Protective Device Settings, Rev. 7. As a result, the licensee had to re-evaluate the adequacy of TOLs on the safety-related 480V motors.

The licensee entered these issues into the CAP (CR 455657, CR454839, CR454841, CR454863, CR455218, and CR 456448) and performed a prompt operability determination. The prompt operability determination concluded that the TOLs installed on the control room ventilation fan motors, the boric acid transfer pump motors, and CPSW pump motors were adequate. This determination was based on the licensee's use of the service factors of 1.15, referenced in the vendor manuals, which was not previously credited. This resulted in the POD concluding that the 480V motors would remain fully capable of meeting their design bases functions.

Analysis: The licensee's failure to use the most conservative motor currents in the analysis used to determine the adequacy of TOLs at degraded voltage conditions was a performance deficiency. The performance deficiency was more than minor because it was similar to NRC IMC 0612, "Power Reactor Inspection Reports," Appendix E, "Example of Minor Issues", Example 3.j, which states that if "the engineering calculation error results in a condition where there is now a reasonable doubt on the operability of a system or component" the performance deficiency is not minor. Further, the performance deficiency was more than minor because it was associated with the design control attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to use the most conservative motor currents in the analysis used to determine the adequacy of TOLs at degraded voltage conditions resulted in a reasonable doubt that the 480V safety-related motors could perform their safety function. In accordance with NRC IMC 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 SDP screening and determined the finding to be of very low safety significance (Green) because it was a design deficiency confirmed not to have resulted in the loss of operability or functionality. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance.

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part , that "design control measures shall provide for verifying or checking the adequacy of design , such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Contrary to the above, since March 28, 2002, the licensee failed to verify or check the adequacy of the motor currents used in ET-CEE-02-002 to determine the adequacy of TOLs at degraded voltage conditions. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP (CR 455657, CR454839, CR454841, CR454863, CR455218, and CR 456448), it is being treated as an NCV consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000280,

281/2011011-02, Failure to Implement Design Control Measures to Verify the Adequacy of TOLs at Degraded Voltage Conditions."

b.2 Findings

Introduction: The team identified a Green NCV of TS 6.4.A.7, "Unit Operating Procedures and Programs", for the licensee's failure to provide adequate instructions in the surveillance procedure for the CPSW system.

Description: FSAR Section 9.9, "Service Water System," states, in part, that a CPSW system is provided for each reactor unit; and that the CPSW system is designed to provide cooling water from the (SW) system to the charging pump intermediate seal coolers and to the charging pump lubricating oil coolers. The Unit 1 and Unit 2 CPSW systems are cross-tied via associated piping and valves. The cross-tie valves (1-SW-269 and 2-SW-443) are normally closed. To mitigate a loss of system function on one unit, the licensee would open the normally closed cross-tie valves. The use of the cross-tie is proceduralized in procedures 0-AP-12.00, Service Water System Abnormal Conditions, Rev. 13, and 0-FCA-7.00, Limiting Mechanical Equipment Room 3 or 4 Fire, Rev. 11. The licensee credits the manual operation of the cross-tie valves in their risk model.

The team identified that the licensee does not periodically flow test, clean, or inspect the charging pump service water system cross-tie piping. The team determined that fouling in the piping likely exists because of the inadequate preventative maintenance over the life of the plant. Additionally, the team noted that the licensee had previously utilized the CAP (CA081505) to evaluate issues with the silting/fouling of SW structures, systems and components. One of the corrective actions associated with this issue, (CA 169929 - Engineering to Institute a Long Term Process for High Flow Flushing of CPSW Lines) was the development of operations surveillance procedure, 1/2-OSP-SW-010, Unit 2 Charging Pump Service Water Piping Flush, Rev. 0. The purpose of the procedure was to provide instructions for performing high flow flushing of the CPSW system piping every 18 months. The team determined that the procedure was inadequate because it failed to flush the cross-tie portions of the CPSW system. The licensee entered this concern into the CAP as CR 456318, "CPSW Crosstie has Potential for Fouling." The licensee determined that the issue is not an operability concern because although the cross-tie is credited in maintenance rule and the probability risk analysis, it is not credited in the safety analysis or technical specification.

Analysis: The licensee's failure to provide adequate procedural guidance to flush the CPSW system cross-tie components was a performance deficiency. The performance deficiency was more than minor because it was associated with the procedure quality attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the surveillance procedure that was developed as a corrective action for CA 169929 was inadequate in that it did not flush the cross-tie piping that was used in procedures 0-AP-12, and 0-FCA-7. The failure to adequately flush the cross-tie lines resulted in a lack of reasonable assurance that the components would perform their intended function. In accordance with NRC IMC 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 SDP screening and determined the finding to be of very low safety significance (Green) because it was not a design deficiency, did not represent the loss of

a system safety function, did not result in exceeding a TS allowed outage time, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. Additionally, the team assessed the finding using IMC 0609, Appendix F, "Fire Protection Significant Determination Process," and determined that the finding was of very low safety significance (Green) because the finding only affected the ability to reach and maintain cold shutdown conditions. The team identified a cross-cutting aspect in the resources component of the Human Performance area. Specifically, the licensee failed to provide an adequate procedure for the maintenance of the charging pump service water system. [H.2(c)].

Enforcement: Technical Specification 6.4.A.7," Unit Operating Procedures and Programs," states, in part, that detailed written procedures with appropriate check-off lists and instructions shall be provided for preventive maintenance operations which would have an effect on the safety of the reactor. Contrary to the above, the licensee implemented a preventive maintenance procedure that was not appropriate. Specifically, since April 2011, procedure 2-OSP-SW-010, Rev. 0 failed to provide documented instructions to flush all portions of the charging pump service water system piping that was susceptible to blockage. The susceptible piping is utilized to mitigate loss of charging pump service water system events and postulated fire events in the charging pump service water pump rooms. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP (CR 456318), it is being treated as an NCV consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000280 & 281/2011011-03, "Failure to Provide Adequate Instructions in the Operations Surveillance Procedure for the Charging Pump Service Water System."

.11 High Head Safety Injection/Charging Pumps (2-CH-P-1A/B/C)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the High Head Safety Injection/Charging Pumps. The team evaluated the pumps to verify that the performance satisfied design bases flow rate requirements during postulated transients. Surveillance test results were reviewed to determine whether established test acceptance criteria were satisfied. The acceptance criteria were compared to design basis assumptions and requirements to verify there were adequate margins for allowable pump degradation limits. NPSH and vortexing requirements were reviewed to ensure satisfactory pump suction performance during transient and accident conditions. Additionally, the inspectors walked down the pump rooms, interviewed system and design engineers, and reviewed system health reports and selected condition reports to assess the current condition of the pump and motor driver. The team also reviewed ventilation design bases calculation to ensure the room temperature was controlled within the environmental limits of the equipment. The team reviewed the operating procedures for plant heat-up and cooldown to ensure low temperature overpressure protection controls were in place to limit charging pump flow rate for a mass injection transient into the RCS during water solid RCS operation.

The team reviewed control diagrams for the pumps' motors to verify component controls would be functional during accident/event conditions. Voltage and short circuit calculations were reviewed to verify energy sources would be available and adequate

during accident/event conditions. Motor protection setting calculations were reviewed to verify that the motors were adequately protected.

b. Findings

No findings were identified

.12 Emergency Service Water Pumps (1-SW-P-1A/B/C)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the Emergency Service Water (ESW) pumps. The team evaluated the ESW pumps to verify that the performance satisfied design bases flow rate requirements during postulated transient and accident conditions. The team reviewed the ESW system hydraulic calculations, operating instructions and procedures, system drawings, surveillance tests, and modifications to verify performance requirements and operational limitations. Surveillance test results were reviewed to determine whether established test acceptance criteria were satisfied. The acceptance criteria were compared to design bases assumptions and requirements to verify there were adequate margins for allowable pump degradation limits. NPSH and submergence requirements were reviewed to ensure satisfactory pump suction performance during transient and accident conditions. The team reviewed the diesel engine mechanical support systems including lube oil, fuel oil, combustion air filter replacement records, fuel oil consumption calculations, fuel oil storage requirements, and engine cooling requirements. The team also reviewed seismic qualification documents for the engine fuel oil storage tank, batteries, and pump mounting bolts. The inspectors reviewed external flooding and tornado design features of the ESW pumphouse to ensure the structure was designed for these external events.

The team reviewed Generic Letter 89-13 inspection results for silting at intake bay to ensure the intake area was maintained in good condition. Ventilation design bases calculations were reviewed to ensure the pump area temperature was controlled within the environmental limits of the equipment. The team also walked down the ESW pump house area, interviewed system and design engineers, and reviewed system health reports and selected condition reports to assess the current condition of the pump and diesel engine driver.

The team reviewed ESW pump battery sizing and loading calculations to verify that loads do not exceed battery bank capacity. Periodic maintenance and testing practices on the batteries were reviewed to verify that the equipment was maintained in accordance with industry practices. The team also performed a visual non-intrusive inspection of the batteries to assess installation, configuration, observable material condition, and potential vulnerability to hazards.

b. Findings

No findings were identified

.13 Emergency Diesel Generator Auxiliaries - Air Start System

a. Inspection Scope

The team reviewed the plant FSAR, TS, DBDs, and P&IDs to establish an overall understanding of the design bases of the emergency diesel generator air start system. Design calculations and site procedures were reviewed to verify that the design bases and design assumptions had been appropriately translated into these documents. The team reviewed system modifications over the life of the component to verify that the subject modifications did not degrade the component's performance capability and were appropriately incorporated into relevant drawings and procedures. Component walkdowns were conducted to verify that the installed configurations would support its design bases functions under accident conditions and had been maintained to be consistent with design assumptions. Operating procedures and alarm response procedures were reviewed to verify that component operation and alignments were consistent with design and licensing bases assumptions. Test procedures and recent test results were reviewed against design basis documents 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. An interview with the system engineer was conducted to discuss the history of the system maintenance, and details of the corrective actions that had been completed. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and that component replacement was consistent with inservice/equipment qualification life.

b. Findings

Introduction: The team identified a Green NCV of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," for the licensee's failure to perform condition monitoring or otherwise implement an effective preventive maintenance (PM) program for the alternate alternating current (AAC) diesel generator ventilation supply dampers and exhaust louvers.

Description: Calculation ME-0392, "AAC Diesel Generator Room Heat Load", Rev. 0 requires ventilation of 110,000 cubic feet per minute (CFM) across the AAC diesel building in order not exceed a temperature of 104°F while the diesel is running. The AAC diesel room ventilation system consists of five motor operated intake damper sets (0-VS-MOD-700A/B, 701A/B, 702A/B, 703A/B, 704A/B), two large exhaust fans, (0-VS-F-700/701 - rated at 55,000 CFM), and one small exhaust fan (0-VS-F-702 - rated at 26,000 CFM). Each of the exhaust fans is equipped with a passive louver design that opens and closes on the differential pressure across the associated fan (opens when fan is running and closes when de-energized). Also, the exhaust fans are located on the west wall (opposite to the supply dampers) of the building with the small fan installed in-between the large fans. The control scheme and operation of the ventilation system automatically maintains the room temperature below 104°F with the use of thermostats. The small fan provides room cooling when the diesel is in standby whereas the larger fans operate when the diesel is in operation. When the diesel is in standby, the smaller

exhaust fan automatically starts at a temperature setting of 80°F. If the diesel is started and the room temperature reaches 90°F, the control logic starts the two larger fans and de-energizes the smaller fan. When the smaller fan de-energizes, its associated louver needs to close in order to prevent short-circuiting outside air (due to the proximity to the larger fans) which reduces the air flow drawn across the room by the larger fans.

During a walk-down the inspectors identified that the louver of the small fan was partially stuck open (~ 90% open), with the fan not running. The inspectors questioned the exhaust fans capability to maintain the 104°F design temperature since calculation ME-0392 required the full capacity of both large fans (110,000 CFM) to be available. The licensee performed a functionality assessment, and determined that if the full rated capacity of the small fan (26,000 CFM) was short-circuited through the failed louver the AAC diesel remained capable of performing its function with reduced ventilation margin. The licensee entered this issue into their CAP as CR 449898, CR 450609, and CR 454653.

The team also reviewed the PM and corrective action history for the AAC diesel ventilation system and noted that neither the air supply dampers nor the exhaust fan louvers were monitored through periodic PM. The exhaust fans were serviced every 18 months per GMP-008, Drive Belt Inspection and Adjustment; however, the inspectors noted this procedure does not inspect, maintain, or otherwise monitor the condition of the exhaust louvers. Also, the inspectors identified that the air supply motor operated dampers have no PMs. Based on these observations, and the degraded condition of exhaust fan louver 0-VS-F-702, the team concluded that, since implementation of the maintenance rule, the PM program for the AAC diesel ventilation supply dampers and exhaust louvers had been ineffective in providing assurance that the components would remain capable of performing their intended function. The licensee entered this issue into their CAP as CR 454673 to evaluate and develop an effective PM program for the AAC diesel ventilation system.

Analysis: The licensee's failure to perform condition monitoring or otherwise implement an appropriate PM program for the AAC diesel ventilation dampers and louvers was a performance deficiency. This performance deficiency was more than minor because it was associated with equipment performance attribute of the mitigating system cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the lack of an effective PM program on the ventilation system affected the reliability of the exhaust fan louvers, as evidenced by exhaust fan louver, 0-VS-F-702, being stuck open, and challenged the assurance that these components would remain capable to support the functionality of the AAC diesel. In accordance with NRC IMC 0609.04, "Initial Screening and Characterization of Findings," the team used the mitigating systems column to perform a Phase 1 SDP screening and determined the finding to be of very low safety significance (Green) because it was not a design deficiency, did not represent the loss of a system safety function, did not result in exceeding a TS allowed outage time, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance.

Enforcement: 10 CFR 50.65(a)(1) states, in part, that the licensee shall monitor the performance or condition of structures, systems and components (SSC) within the scope of the rule as defined by 10 CFR 50.65(b), against license-established goals, in a manner sufficient to provide reasonable assurance that such SSCs are capable of fulfilling their intended function.

10 CFR 50.65(a)(2) states, in part, that monitoring as specified in 10 CFR 50.65(a)(1) is not required where it has been demonstrated that the performance or condition of an SSC is being effectively controlled through the performance of appropriate preventive maintenance, such that the SSC remains capable of performing its intended function.

Contrary to the above, since May 1996, the licensee failed to demonstrate that the conditions of the AAC diesel ventilation supply dampers, (0-VS-MOD-700A/B, 701A/B, 702A/B, 703A/B, 704A/B), and the exhaust fans louvers (0-VS-F-700/701/702) were effectively controlled through the performance of appropriate preventive maintenance and did not otherwise monitor performance against licensee established goals. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP (CR 449898, CR 450609, CR 454673, and CR 454653), it is being treated as an NCV consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000280, 281/2011011-04, "Failure to Monitor or Perform Effective Preventive Maintenance on the AAC Diesel Ventilation Supply Dampers and Exhaust Fans Louvers."

.14 Inside and Outside Recirculation Spray Pumps (1-RS-P-1A and 1-RS-P-2B)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the inside recirculation spray (IRS) and outside recirculation spray (ORS) pumps. Design calculations (i.e., NPSH, vortex formation and prevention, and minimum developed head/flow requirements) and site procedures were reviewed to verify that the design bases and design assumptions had been appropriately translated into these documents. Component walkdowns were conducted to verify that the installed configurations would support their design bases functions under accident conditions and had been maintained to be consistent with design assumptions. Operating procedures were reviewed to verify that component operation and alignments were consistent with design and licensing bases assumptions. Test procedures and recent test results were reviewed against design bases documents 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. Vendor documentation, system health reports, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented.

The team reviewed control diagrams for the pumps' motors to verify component controls would be functional during accident/event conditions. Voltage and short circuit calculations were reviewed to verify energy sources would be available and adequate during accident/event conditions. Motor protection setting calculations were reviewed to verify that the motors were adequately protected.

b. Findings

Introduction: The team identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's use of a non-conservative net positive suction head required (NPSHr) value in the analysis that determined the adequacy of the net positive suction head available (NPSHa) for the RS pumps.

Description: Surry's RS system is designed to provide the necessary cooling and depressurization of containment after a loss-of-coolant-accident. The RS system consists of four pumps of the vertical deep-well type that take suction from a common containment sump strainer assembly. The two IRS pumps are located inside the containment structure, and the two ORS pumps are located outside the containment structure.

Calculation SM-1476, "Surry GOTHIC Analysis of NPSH Available for the Low Head Safety Injection and RS Pumps", Rev. 1 evaluates the adequacy of the NPSHa for the low head safety injection and RS pumps. This analysis evaluates the most limiting conditions that result in minimum NPSH and verifies the NPSHa always exceeds the pump's NPSHr. Calculation SM-1476 uses an NPSHr of 9.19ft at 3300gpm for the RS pumps. The inspectors noted that the NPSHr values referenced in SM-1476 were lower than that recommended by the manufacturer's pump curve (14.6ft @3300 gpm). The licensee indicated the NPSHr of 9.19ft that was referenced in the analysis originated from a NPSHr reduction test performed by the licensee in 1977.

The inspectors identified that the 1977 NPSHr reduction test was performed at near boiling-water temperatures (~209°F). This temperature is approximately 30°F higher than the containment sump liquid temperature at the time of minimum NPSH (approximately 20 minutes into the accident) in the accident analysis. The inspectors concluded that the licensee failed to correct the NPSHr obtained from the 1977 test for the minimum expected containment sump liquid temperature. The temperature correction resulted in an NPSHr increase of 0.33ft (9.52ft total). This resulted in a negative zero margin (-0.03ft) for the most limiting case analyzed in SM-1476 for the ORS. Margin for the IRS pumps was reduced but was still adequate to meet the NPSHr.

The licensee entered this issue into their CAP as CR454236 and performed an operability determination where they recovered positive NPSH margin from the strainer head losses assumed in the analysis. SM-1476 assumed a head loss of 3.10ft across the containment sump strainers for the first four hours into the accident; however, the licensee indicated that during early RS pump operation, the strainer head loss is less than 2.0ft and provides an additional 1.1ft of head, which is sufficient to support the operability of the pumps. Also, the licensee indicated the duration of minimum NPSH is very short (approx. 1 minute) and NPSHa is gradually recovered as containment conditions improve.

Analysis: The licensee's use of a non-conservative NPSHr value in the analysis that determined the adequacy of the NPSHa for the RS pumps was a performance deficiency. The performance deficiency was more than minor because it was similar to NRC IMC 0612, "Power Reactor Inspection Reports," Appendix E, "Examples of Minor Issues", Example 3j, which states that if "the engineering calculation error resulted in a condition where there was a reasonable doubt on the operability of a system" the performance deficiency is not minor. Further, the performance deficiency was more than

minor because it was associated with the design control attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the higher NPSHr for the ORS pumps, due to the temperature correction, exceeded the NPSHa and resulted in a reasonable doubt that the ORS pumps could perform their functions under the most limiting conditions. In accordance with NRC IMC 0609.04, "Initial Screening and Characterization of Findings", the team conducted a Phase 1 SDP screening and determined the finding to be of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The finding was reviewed for cross-cutting aspects and none were identified since the performance deficiency was not indicative of current licensee performance.

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, " Design Control" requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, since July 2006, the licensee failed to verify or check the adequacy of design inputs used in SM-1476, Rev. 1 to determine the adequacy of the NPSHa to the RS pumps under the most limiting conditions of plant operation. Specifically, the increase in required NPSH for the ORS pumps exceeded the NPSH available and resulted in reasonable doubt that the ORS pumps could perform their functions under the most limiting conditions. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP (CR454236), it is being treated as an NCV consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000280, 281/2011011-05, "Failure to Implement Design Control Measures to Verify the Adequacy of Inputs Into the RS NPSHa Analysis."

.15 Service Water to Recirculation Spray MOVs (1-SW-MOV-103A/B, 104A/D, & 105A/D)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the MOVs. Design calculations (i.e., differential pressure and required torque/thrust) and site procedures were reviewed to verify that the design bases and design assumptions had been appropriately translated into these documents. Component walkdowns were conducted to verify that the installed configurations would support their design bases function under accident conditions and had been maintained to be consistent with design assumptions, and to verify equipment is adequately protected. Test procedures and recent test results were reviewed against design bases documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident conditions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and that the component replacement was consistent with inservice/equipment qualification life.

The team reviewed the control diagrams for the MOVs to verify component controls would be functional and provide desired control during accident/event conditions. Degraded voltage calculations at the MOV terminals were reviewed to verify it was

consistent with design inputs used in the MOV thrust calculations, and that the thermal overload heaters protecting the motors would not trip prematurely.

b. Findings

No findings were identified

.16 Recirculation Spray Coolers (1-RS-E-1A/D)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the RS system coolers. Calculations supporting heat transfer and flow requirements were reviewed to verify that design bases and design assumptions had been appropriately translated into design calculations. Chemical maintenance and sampling procedures and results for wet lay-up of RS coolers piping were reviewed to verify that the process medium would be available and unimpeded during accident conditions. Test procedures and recent test results were reviewed against design basis documents to verify that acceptance criteria were supported by calculations or other engineering documents, and to ensure that design and licensing bases were met and that tests and/or analyses served to validate component operation under accident conditions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and that the component replacement was consistent with inservice/equipment qualification life.

b. Findings

No findings were identified

.3 Operating Experience (5 Samples)

a. Inspection Scope

The team reviewed five OE issues for applicability at Surry Power Station. The team performed an independent review for 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 Information Notice 2009-10, "Transformer Failures – Recent Operating Experience"
- NRC Information Notice 2007-05, "Vertical Deep Draft Pump Shaft And Coupling Failures"
- NRC Information Notice 2007-01, "Recent Operating Experience Concerning Hydrostatic Barriers"
- NRC Generic Letter 2007-01, "Inaccessible Or Underground Power Cable Failures That Disable Accident Mitigation Systems Or Cause Plant Transients"

- NRC Information Notice 1993-58, “Nonconservatism In Low-Temperature Overpressure Protection For Pressurized-Water Reactors”

b. Findings

No findings were identified.

4OA6 Meetings, Including Exit

On January 11, 2012, the team presented the inspection results to Mr. Stanley and other members of the licensee’s staff. Proprietary information that was reviewed during the inspection was returned to the licensee or destroyed in accordance with prescribed controls.

ATTACHMENT: SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:
B. Garber, Licensing Supervisor
M. Wilda, Engineering Supervisor
M. Adams, Director Station Engineering
C. Olsen, Manager Station Engineering
B. Stanley, Director Station Safety & Licensing
K. Sloane, Plant Manager

NRC personnel
R. Nease, Chief, Engineering Branch Chief 1, Division of Reactor Safety, RII
S. Sanchez, Senior Resident Inspector, Division of Reactor Projects, Surry Resident Office
J. Nadel, Resident Inspector, Division of Reactor Projects, Surry Resident Office

Attachment

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

| | | |
|---|---|---|
| 05000280, 281/2011011-01 | NCV | Failure to Provide Appropriate Procedural Guidance for Component Cooling Water Flow to the Thermal Barrier Heat Exchangers (Section 1R21.2.1) |
| 05000280, 281/2011011-02 | NCV | Failure to Implement Design Control Measures to Verify the Adequacy of TOLs at Degraded Voltage Conditions (Section 1R21.2.10) |
| 05000280, 281/2011011-03 | NCV | Failure to Provide Adequate Instructions in the Operations Surveillance Procedure for the Charging Pump Service Water System (Section 1R21.2.10) |
| 05000280, 281/2011011-04 | NCV | Failure to Monitor or Perform Effective Preventive Maintenance on the AAC Diesel Ventilation Supply Dampers and Exhaust Fans Louvers (Section 1R21.2.13) |
| 05000280, 281/2011011-05 | NCV | Failure to Implement Design Control Measures to Verify the Adequacy of Inputs Into the RS NPSHa Analysis (Section 1R21.2.14) |

List of Documents Reviewed

Calculations

07797.06-E-001, 125VDC Voltage Drop Calculation for Selected Safety Related and Non-safety Related Components, Rev. 0
07797.15-E-001, Calculation of Cable Ampacities for 4kV Loads, Rev. 0
12846.60-CS-15A, Block Wall Analysis-Wall No. IS-27-2-1, 3/23/81
13930.09-4, Voltage Drop Calculations for Class 1E Motor Loads, Rev. 1
14257.29-E-1, MCC Control Circuit Calcs, Rev. 0
14937.07-M-1, Maximum Differential Pressure Across Service and Circulating Water MOVs to Determine the Proper Torque and Overload Settings
14937.44-US(B)-068, NPSHa for HHSI and LHSI Pumps from RWST, Rev. 1 and Addendum 0A
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EE-0501 Motor Terminal Voltage for MOVs, Rev. 1
EE-0702, RCP Thermal Barrier Component Cooling Water System Flow Loop Accuracy, Rev. 6
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ME-0392, Alternate AC (AAC) Diesel Generator Room Heat Load Calculation, Rev. 0
ME-0406, Evaluation of Design Flow Requirements to Charging Pump Seal Coolers and Intermediate Seal Coolers, Rev. 0
ME-0422, Charging Pump Lube Oil Cooler Heat Duty Analysis, Rev. 0
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ME-0621, Service Water Charging Pump Subsystem Pipe 2000 Evaluation, Rev. 0
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SM-1476 (Add. A – G), Surry GOTHIC Analysis of NPSH Available for the LSHI and RS Pumps, Rev. 1
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Completed Procedures

0-OPT-SW-001, Periodic Test, ESW Pump, 1-SW-P-1A, 6/27/11, 8/30/11
0-OPT-SW-002, Periodic Test, ESW Pump, 1-SW-P-1B, 6/4/11, 8/30/11
0-OPT-SW-003, Periodic Test, ESW Pump, 1-SW-P-1C, 6/12/11, 7/10/11
0-OPT-SW-004, Inservice Inspection System Pressure Test of Service Water Pump 1-SW-P-1A and Associated Piping, 10/19/09
0-OPT-SW-007, Comprehensive Test, ESW Pump, 1-SW-P-1A, 11/19/10
0-OPT-EG-006, EDG 3 Compressor Discharge CV Leak Test, 8/6/07, 3/13/09, 8/2/10
1-OPT-EG-006, EDG 1 Compressor Discharge CV Leak Test, 6/19/07, 12/12/08, 7/17/10
1-OSP-RS-001, Checking for water in the Recirculation Spray Heat Exchangers, 12/08/10, 3/11/11, 6/10/11
1-PT-25.2, Testing of Service Water Valves To and From Recirculation Spray Heat Exchangers, 5/9/09

2-OPT-CH-001, Charging Pump Operability and Performance Test for 2-CHP-1A, 5/21/11, 6/14/10
2-OPT-CH-002, Charging Pump Operability and Performance Test for 2-CHP-1B, 3/16/11, 12/30/10
2-OPT-CH-003, Charging Pump Operability and Performance Test for 2-CHP-1C, 5/13/11, 1/13/11
2-OPT-SI-024, Charging Pump Head Curve Verification and Comprehensive Test, 12/5/09
2-PT-18.8, Charging Pump Service Water Performance, 6/28/11 and 3/28/11
2-OPT-EG-007. EDG 2 Starting Air System Refueling Interval Test, 9/02/10, 12/12/08, 7/17/10

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507799 01, Inspect – Service 480V Bkr, 10/21/2004
507799 01, P.M. 480V Bkr, 10/21/2004
00513201, Fabricate and Install Battery Rack, 01-SW-P-1A, 5/27/05
00513202, Fabricate and Install Battery Rack, 01-SW-P-1B, 5/27/05
00513203, Fabricate and Install Battery Rack, 01-SW-P-1C, 5/27/05
516862 01, P.M. 480V Bkr, 8/9/2005
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604955 01, Inspect and Adjust 14-H-2, 2/6/2006
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00607159-01, Inspect RS HX/UT Vent Piping- 1-RS-E-1B, 5/19/2006
00607160-01, Inspect RS HX/UT Vent Piping- 1-RS-E-1C, 5/19/2006
767114 01, 10 Year Refurbish 4160V Ckt Bkr 15H7, 11/1/2007
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785455 01, 10 Year Refurbish 4160V Ckt Bkr For Use In 15H8, 10/2/2007
4490711 01, 10 Year Inspect P.M. Swgr Bus, 11/11/2004
0034583401, PM MCC Breaker 1-SW-MOV-103A, 2/4/1997
0034585401, PM MCC Breaker 1-SW-MOV-105D, 3/13/1997
0037869401, Implement DCP-98-005, 01-SW-MOV-105A, 10/17/2001
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0041494201, PM MCC Breaker 1-SW-MOV-104A, 3/23/2000
0047190501, PM MCC Breaker 1-SW-MOV-103A, 4/30/2003
0047191501, PM MCC Breaker 1-RS-MOV-155A, 5/8/2003
0047191701, PM MCC Breaker 1-SW-MOV-105A, 5/5/2003
0047192101, PM MCC Breaker 1-RS-MOV-156A, 5/8/2003
0047193401, PM MCC Breaker 1-SW-MOV-103B, 4/30/2003
0047193901, PM MCC Breaker 1-SW-MOV-105D, 5/5/2003
0048917301, PM MCC Breaker 1-SW-MOV-104D, 5/5/2003
0050184201, 10 Year Refurbishment and Upgrade Kit ISRS Pump 1-RS-P-1A, 11/4/2004
0050777401, PM MCC Breaker 1-RS-MOV-155B, 8/2/2004
0050777701, PM MCC Breaker 1-RS-MOV-156B, 11/5/2004
0052665801, PM/CAL – Validyne Mux-01A, 6/27/2005
0052851303, Replace Thermal Overload Heaters for EDG Fuel Oil Pumps, 6/19/2005

0053016701, CH Pump Motor 1B Service and Inspection 4160V, 9/13/2005
0067311893, R/P 500kV (Storm Damage), 9/8/2011
0074599803, Build Breaker for Use in 14J-8, 5/11/2006
0074749401, Replace Thermal Overload Heaters for 1-DA-P-1A and 1-DA-P-1B, 3/5/2007
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0076522801, CH Pump Motor 1B Service and Inspection 4160V, 7/18/2007
0076768415, DCP 07-005 for 1-LM-Loop-P-100A, 10/22/2007
0077397801, CH Pump Motor 1A Service and Inspection 4160V, 9/11/2007
0078114501, CH Pump Motor 1C Service and Inspection 4160V, 1/16/2008
0078168201, Protection Relay Calibration Test CH Pump Motor Breaker 1A, 12/4/2007
38102106425, PM Inspect/Service 4160V Ckt Bkr 15H1, 10/30/2010
38102109766, CH Pump Motor 1A Service and Inspection 4160V, 11/20/2009
38102109795, CH Pump Motor 1C Service and Inspection 4160V, 5/25/2010
38102112952, Recirculation Spray Pump Motor Service & Inspection, 11/25/2008
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38102118150, PM MCC Breaker 1-SW-MOV-105A, 7/9/2010
38102118198, PM MCC Breaker 1-SW-MOV-103B, 1/6/2011
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38102133579, PM/CAL – Validyne Mux-01A, 3/10/2009
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38102159948, Protective Relay Maint Ckt Bkr. 15H1, 4/20/2009
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38102166209, 10 Year Refurbish 4160V Ckt Bkr 15H11, 11/8/2010
38102166224, 10 Year Refurbish 4160V Ckt Bkr 15H3, 6/22/2010
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38102174705, Operational Check Relay Circuit Bkr 15H4, 4/27/2009
38102181787, Perform PM on Lister Diesel - 03-EG-C-2-ENGINE, 6/8/2011
38102189738, Relay Cal Bus Bkr 15H4, 4/28/2010
38102193204, Inspect RS HX/UT Vent Piping - 1-RS-E-1A, 11/26/2010
38102193276, Inspect RS HX/UT Vent Piping - 1-RS-E-1D, 11/26/2010
38102253983, PT: Service Water Flow Test of RS Heat Exchangers 1A/1D, 10/26/2010
38102254746, ESF Actuation With Under/Degraded, 5/8/2009
38102257709, Relay Testing, 4/27/2009
38102262326, Distribution Panel Breaker Replacement, 4/28/2009
38102262336, Distribution Panel Breaker Replacement, 4/29/2009
38102292484, Perform PM on Lister Diesel - 02-EG-C-2-ENGINE, 9/23/2011
38102325723, Operation Circuit Protection Relay Circuit CH Pump Motor 1C, 10/26/2009
38102325946, Operation Circuit Protection Relay Circuit CH Pump Motor 1B, 5/11/2009
38102326162, Protection Relay Calibration Test CH Pump Motor Breaker 1C, 10/26/2009
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38102338625, Open/Inspect/Repair Check Valve for 02-CC-556 RCP 2B Thermal Barrier CC Inlet Dnstr Chk Valve, 5/15/2008

38102345447, 2-OPT-CW-001, 547 Day Freq. PT: Leak Test, Circ Water Inlet & Outlet 96" Valves, 11/23/09
38102369034, PM: Inspect Belts/Lube Bearings (00-VS-F-702-Blower), 1/25/2010
38102388495, Perform PM on Lister Diesel - 01-EG-C-2-ENGINE, 6/15/2011
38102450538, Battery Replacement / Diesel Engine 24V 1A, 2/3/2010
38102468652, PT: EDG 2 Starting Air System Refueling Interval Test, 9/3/2010
38102479314, Battery Replacement / Diesel Engine 24V 1B, 1/21/2010
38102483081, Battery Replacement / Diesel Engine 24V 1C, 4/17/2010
38102503296, PT: EDG 3 Starting Air System Refueling Interval Test, 12/3/2010
38102504338, PM: Limitorque Operator Lube and Inspect, SMB/2, 3/14/11
38102514670, PT: EDG 2 Compressor Discharge Check Valve Test, 8/2/2010
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38102532680, 10 Year Refurbish 4160V Spare Ckt Bkr, 4/15/2009
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38102564763, Turbine Building Flood Control Testing, 11/23/2010
38102566499, ESF Actuation with Under/Degraded, 12/1/2010
38102568279, 547 Day Freq. PT: Functional Test of Low Canal Level, dated 11/27/10
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38102676636, Protection Relay Calibration Test CH Pump Motor Breaker 1A, 1/11/2011
38102677192, Protection Relay Calibration Test CH Pump Motor Breaker 1C, 4/30/2011
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38102677264, Protection Relay Calibration Test CH Pump Motor Breaker 1B, 5/6/2011
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38102678851, Operation Circuit Protection Relay Circuit CH Pump Motor 1B, 1/11/2011
38102684870, Open/Inspect/Repair Check Valve for 02-CC-556 RCP 2B Thermal Barrier CC Inlet Dnstr Chk Valve, 11/16/2009
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38102706687, 0-NPT-CW-001-U2RFO, 547 Day Freq. PT: Determination of Total CW/SW Canal Isolation Valve Leakage, Rev. 1, dated 5/31/11
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38102738478, Reset of Thermal Overloads, 2/4/2010
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38102756382, Battery Replacement / Diesel Engine 24V 1C, 2/16/2011
38102834969, 28 Day Freq. PT: Emergency Service Water Pump 1-SW-P-1A, 2/6/2011
38102850144, 10 Year Refurbish 4160V Spare Ckt Bkr, 10/26/2010
38102858605, 84 Day Freq. PT: Quarterly Testing of CW and SW System VOC-22B, 3/22/11
38102860077, Replace RC Filters, 10/1/2010
38102906005, PT: Leak Test of 1-RS-E-1B, 11/16/2011
38102957103, Investigate and Repair Operator Not Coming Out of Manual, 1/27/11

Corrective Action Documents
CR119125, New Oil Type in Lube Manual Does Not Meet EQ Requirements

CR331358, Incorrect Oil Specified in Work Orders for 1-RS-P-2A/2B
CR332739, 1-SW-MOV-103A Leak back into U1 “C” CW Header Impacting SW Pipe Maintenance
CR332897, Low Reading Found During UT Thickness Reading on Recirc Spray Service Water Pipe
CR341269, Diver Cleaning of "A" ESWP
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CR343839, 01 -SW-P-1 B Engine With Two Anchor Bolts Having Less Than Full Thread Engagement
CR354739, Leakage Discovered During VT-2 Examination of 1-SW-P-1B LO Cooler Inlet Piping
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CR369643, 1-SW-P-1B Diesel Foundation is Spalling
CR401519, Suspect 1-SW-MOV-103A Leak-by
CR402787, Coating Repair Required on 1-RS-E-1D SW Outlet Piping
CR403529, High Vibrations on Point 1 of 1-RS-P-2A
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CR405506, 103B Valve Leaks-by. Replace Seat
CR405545, 1-SW-MOV-103A or 1-SW-MOV-103B Leak-by
CR408256, Unit 1 SW supply line to 1-RS-E-1A/1D Level Maintenance With 1-SW-MOV-103A/B Leak-by
CR410511, 1-OSP-SW-001 Un-sat, Water Level in 1-RS-E-1A/1D SW Piping Below 11'9"
CR418580, Air Start Motor Abutment During Performance of 2-OPT-EG-001
CR427579, 2-CH-P-1A in Alert Due to Vibrations at Pt.22
CR444183, CDBI Self Assessment – Documentation of EDG and AAC Air Start Volume Design Basis
CR444552, Operator Identified Oil Level Low in the Gear Box Sight Glass for 2-CH-P-1C
CR 002199, Water Intrusion in ESGR and Turbine Building Basement
CR 091494, Calculation EE-0035 Does Not Consider Frequency Variation
CR 091698, Stated Max DP Conditions in ET are Less Than Required in Design Bases Event
CR 103851, AOV Program Diagnostic Test Request for Unit 1 2009 RFO
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CR 354739, Leakage Discovered during VT-2 Examination of 1-SW-P-1B LO Cooler Inlet Piping
CR 358236, 2-CC-95 Failed 2-OPT-CC-010
CR 358240, 2-CC-557 Failed 2-OPT-CC-010
CR 367609, 1-CW-S-1B Screen Has Worn Bushings/Bearings
CR 367849, Inappropriately Set TOL Installed for Boric Acid Transfer Pump (1-CH-P-2D)
CR 368184, 2-CW-MOV-206B Exceeded Test Plan Limit on As Found/As Left Test
CR 369514, Shear Pin Broke on 1-CW-S-1D
CR 382223, As Found TOL are H1117H per Work Order But Should Be H1113
CR 404430, Valves Associated with Vital Bus 1-I Breaker 13 Repositioned to Close.
CR 411545, MOV Will Not Come out of Manual and Cycle Electrically
CR 422536, 1-CC-TV-140A Failed Closed During 1-PT-8.5 and Could Not Be Reopened
CR 422550, Loose Lead in Hi Hi CLS Cabinet
CR 425580, ACE018652 Extent of Condition for Loose Lead in the Hi Hi CLS Test Circuit.
CR 427579, 2-CH-P-1A in Alert Due to Vibrations at Pt.22

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Drawings
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 2, Sheet 3 of 4, Rev. 1
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 2, Sheet 4 of 4, Rev. 1
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 1, Sheet 1 of 4, Rev. 1
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 1, Sheet 2 of 4, Rev. 1
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 1, Sheet 3 of 4, Rev. 1
11448-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 1, Sheet 4 of 4, Rev. 1
11548-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 2, Sheet 1 of 4, Rev. 1
11548-ESK-9E, Elementary Diagram Intake Canal Low Level Isolation Actuation Circuit Train B, Unit 2, Sheet 2 of 4, Rev. 1
1148-ESK-5A, Elementary Diagram 4160-480V Substa Supply ACB's Surry Power Station – Unit 1, Rev. 7
1148-ESK-5F, Elementary Diagram 4160V Component Cooling Pumps Surry Power Station – Unit 1, Rev. 17
1148-ESK-5F1, Elementary Diagram 4160V Component Cooling Pumps Surry Power Station – Unit 1, Rev. 2
1148-ESK-5G, Elementary Diagram 4160V Residual Heat Removal Pumps Surry Power Station Unit 1, Rev. 12
1148-ESK-5K, Elementary Diagram 4160V Aux Stm Gen Feed Pumps Surry Power Station – Unit 1, Rev. 28
1148-ESK-5K1, Elementary Diagram 4160V Aux Stm Gen Feed Pumps Surry Power Station – Unit 1, Rev. 6
1148-ESK-5P, Elementary Diagram 4160V Charging Pumps Sheet 1 Surry Power Station – Unit 1, Rev. 24
1148-ESK-5Q, Elementary Diagram 4160V Charging Pumps Sheet 2 Surry Power Station – Unit 1, Rev. 27
1148-ESK-5S, Elementary Diagram 4160V Bus Tie ACB – Stub Bus 1H& 1J Surry Power Station – Unit 1, Rev. 8
11448-FE-1A, Main One Line Diagram Surry Power Station – Unit 1, Rev. 38
11448-FE-1A1, 4160 Volt System Unit 1 & 2 Surry Power Station, Rev. 24
11448-FE-1A2, Electric Power Distribution One Line Integrated Schematic Surry Power Station, Rev. 36
11448-FE-1A3, One Line Diagram Switchyard Layout Surry Power Station – Unit 1 & 2, Rev. 16
11448-FE-1F, 480V One Line Diagram Surry Power Station – Unit 1, Rev. 26
11448-FE-1G, 125V DC One Line Diagram, Rev. 37
11448-FE-1L, 480V One Line Diagram Surry Power Station – Unit 1, Rev. 68
11448-FE-1L, 480V One Line Diagram, Rev. 64

11448-FE-1M, 480V One Line Diagram Surry Power Station – Unit 1, Rev. 73
11448-FY-2L, Intake Canal (Sheet 1 and 2), Rev. 4 and 3
11448-FE-4P, Wiring Diagram Consequence Limiting Safeguards Panel Train A, Rev. 25
11448-FE-4Q, Wiring Diagram Consequence Limiting Safeguards Panel Train B, Rev. 25
11448-FC-5C, CW Discharge Tunnel – Surry Power Station, Rev. 6
11448-FV-5A, Containment Recirculation Spray & Low Head Safety Injection Pump Casings
11448-ESK-6A, Elementary Diagram Pressurizer Heaters (Backup), Rev. 13
11448-ESK-6AA, Elementary Diagram – 480V Low Head Safety Injection Pumps, Rev. 11
11448-ESK-6AB, Elementary Diagram 480V Recirculation Spray Pumps (Inside Containment), Rev. 8
11448-ESK-6AC, Elementary Diagram – 480V Containment Spray Pumps, Rev. 6
11448-ESK-6AD, Elementary Diagram – 480V Recirc Spray Pumps (Outside Cont), Rev. 11
11448-ESK-6AE, Elementary Diagram – 480V Pressurizer Heater (Control), Rev. 9
11448-ESK-6AF, Elementary Diagram – 480V Primary Chilled Water Circulation Pump, Rev. 2
11448-ESK-6BN, Elementary Diagram 480V Circuit Motor Operated Valves 01-CW-MOV-106A & B, Sheet 1 of 2, Rev. 19
11448-ESK-6BN, Elementary Diagram 480V Circuit Motor Operated Valves 01-CW-MOV-106A & B, Sheet 2 of 2, Rev. 20
11448-ESK-6BN1, Elementary Diagram 480V Circuit Motor Operated Valves 01-CW-MOV-102A & B, Sheet 2 of 2, Rev. 15
11448-ESK-6BN2, Elementary Diagram 480V Circuit Motor Operated Valves 01-RS-MOV-155A & B, Rev. 13
11448-ESK-6BN2, Elementary Diagram 480V Circuit Motor Operated Valves 01-SW-MOV-103A & B, Rev. 11
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11448-ESK-6BR, Elementary Diagram 480V Circuit Motor Operated Valves 01-SW-MOV-104A & B, Rev. 14
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11448-ESK-6BR, Elementary Diagram 480V Circuit Motor Operated Valves 01-SW-MOV-105C & D, Rev. 14
11448-ESK-6BR, Elementary Diagram 480V Circuit Motor Operated Valves 01-SW-MOV-103A & B, Rev. 14
11448-ESK-6C, Elementary Diagram 480V Containment Air Recirc Fans, Rev. 8
11448-ESK-6LM, Elementary Diagram – Damper Controls – Surry Power Station, Rev. 1
11448-ESK-6LP, Elementary Diagram - Exhaust Fan 0-VS-F-701/702 – Surry Power Station, Rev. 1
11448-ESK-6LU, Elementary Diagram - Radiator Fan 0-BCW-F-1B and Exhaust Fan 0-VS-F-700 – Surry Power Station, Rev. 1
11448-FM-6D, Machine Locations – Turbine Area Sections, Sheet 1 of 1, Rev. 14
11448-ESK-7A, Consequence Limiting Safeguards Simplified Functional Block Diagram, Rev. 2
11448-ESK-7B, Elementary Diagram Consequence Limiting Safeguards Input Signal Circuit Channel 1, Rev. 4

11448-ESK-7P, Elementary Diagram Consequence Limiting Safeguards Train 2A Outputs , Rev. 21
11448-FB-9A, Floor Drainage Auxiliary Building, Sheet 1 of 1, Rev. 9
11448-FC-9H, Intake Structure-Pump, Oil Room & DET's, Rev. 6
11448-FE-10A, 125V DC One Line Diagram, Rev. 28
11448-ESK-11AA, Elementary Diagram Bus H Degraded and Undervoltage Sensing Surry Power Station – Unit 1, Rev. 10
11448-ESK-11AA1, Elementary Diagram Surry Power Station – Unit 1, Rev. 2
11448-ESK-11AB, Elementary Diagram Bus H Degraded and Undervoltage Protection Surry Power Station – Unit 1, Rev. 11
11448-ESK-11AC, Elementary Diagram Bus H Degraded and Undervoltage Protection Surry Power Sta., Rev. 7
11448-ESK-11AD, Elementary Diagram Bus J Degraded and Undervoltage Sensing Surry Power Station – Unit 1, Rev. 10
11448-ESK-11AD1, Elementary Diagram Surry Power Station – Unit 1, Rev. 2
11448-ESK-11AE, Elementary Diagram Bus J Degraded and Undervoltage Protection Surry Power Station – Unit 1, Rev. 14
11448-ESK-11AF, Elementary Diagram Bus J Degraded & Undervoltage Protection Surry Power Sta., Rev. 6
11448-FB-15A, Floor and Equipment Drains Turbine Room, Sheet 1 of 1, Rev. 22
11448-FB-27A, Plumbing and Fire Protection Service Building, Sheet 1 of 1, Rev. 19
11448-FB-27F, Plumbing Service Building, Sheet 1 of 1, Rev. 9
11448-FB -46A, Flow/Valve Operating Numbers Diagram – EDG #1 – Surry Power Station – Virginia Power (Sheet 1), Rev. 22
11448-FB -46B, Flow/Valve Operating Numbers Diagram – EDG #2 – Surry Power Station – Virginia Power (Sheet 1), Rev. 25
11448-FB -46C, Flow/Valve Operating Numbers Diagram – EDG #3 – Surry Power Station – Virginia Power (Sheet 1), Rev. 26
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11548-ESK-5Q, Elementary Diagram 4160 Charging Pumps – Unit 2, Rev. 21
11548-ESK-5R, Elementary Diagram 4160 Charging Pumps – Unit 2, Rev. 17
11548-ESK-6CR1, Elementary Diagram MISC Pump Circuits – Unit 2, Rev. 2
11548-ESK-10C, Window Arrangement Main Control Board Annunciator 2C, Rev. 15
11548-FB-15A, Floor and Equipment Drains Turbine Area, Sheet 1 of 1, Rev. 22
11548-RE-25C, Outline MN Cont Board Vertical Section 2-1 Surry Power Station – Unit 2, Rev. 24
11548-FM-072A, Flow/Valve Operating Numbers Diagram Component Cooling Water System Surry Power Station – Unit 2, Rev. 27
11548-FM-086B, Flow/Valve Operating Numbers Diagram Reactor Coolant System Surry Power Station – Unit 2, Rev. 26
11448-FM-285A, Flow/Valve Operating Numbers Diagram Cont Vacuum & Leakage Monitor System, Rev. 24
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