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

March 8, 2006

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

SUBJECT: SURRY POWER STATION - NRC COMPONENT DESIGN BASES INSPECTION REPORT 05000280/2006006 AND 05000281/2006006

Dear Mr. Christian:

On February 10, 2006, the 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 findings which were discussed on February 9, 2006, with Mr. Jernigan 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 license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

The report documents one NRC-identified finding of very low safety significance (Green). This finding was determined to involve a violation of NRC requirements. However, because of its very low safety significance and because it had been entered into your corrective action program, the NRC is treating this issue as a non-cited violation in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny this non-cited violation you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; and the NRC Resident Inspector at the Surry Power Station.

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

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

Docket Nos.: 50-280, 50-281
License Nos.: DPR-32, DPR-37

Enclosure: NRC Inspection Report 05000280/2006006 and 05000281/2006006
w/Attachment: Supplemental Information

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NAME	RMoore	Mas-Penaranda	CPeabody	KLandis	COgle		
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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-280, 50-281

License Nos.: DPR-32, DPR-37

Report Nos.: 05000280/2006006, 05000281/2006006

Licensee: Virginia Electric and Power Company (VEPCO)

Facility: Surry Power Station, Units 1 & 2

Location: 5850 Hog Island Road
Surry, VA 23883

Dates: January 9 - February 10, 2006

Inspectors: R. Moore, Lead Inspector
J. Leivo, Contractor
C. Peabody, Reactor Inspector/ NSPDP
B. Holland, Reactor Inspector
D. Mas-Penaranda, Reactor Inspector
H. Anderson, Contractor

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

Enclosure

TABLE OF CONTENT

SUMMARY OF FINDINGS

IR 05000280/2006006, 05000281/2006006; 01/09/2006 - 01/13/2006, 01/23/2006 - 01/27/2006, 02/06/2006 - 02/10/2006; Surry Power Station, Units 1 & 2; Component Design Bases Inspection.

This inspection was conducted by a team of four NRC inspectors from the Region II office and two NRC contract inspectors. One Green finding, which was a non-cited violation, was identified during this inspection. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609, "Significance Determination Process" (SDP). Findings for which the SDP 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 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Green. The team identified a Green, non-cited violation (NCV) of Technical Specification 6.4.A.3, Unit Operating Procedures and Programs, for a non-conservative emergency contingency action (ECA) procedure setpoint regarding low RWST level. Specifically, the licensee failed to adequately address the potential for vortexing at low RWST levels into the determination of the RWST level for operator action to secure LHSI and HHSI pumps drawing suction from the RWST, in Procedures 1,2-ECA-1.1, Loss of Emergency Coolant Recirculation, Rev. 23. When the NRC notified the licensee of this condition, the licensee entered it into the corrective action program, and proceeded to revise the ECA setpoint in the affected procedures.

This finding is greater than minor because it is associated with the procedure quality attribute of the Mitigating Systems cornerstone and affected the cornerstone objective of ensuring reliable, available, and capable systems that respond to initiating events to prevent undesirable consequences. This finding is of very low safety significance because no loss of safety function occurred and operators have been trained to identify loss of pump suction. This finding has been entered into the licensee's corrective action program as PI S-2006-0334. (Section 1R21.3)

B. Licensee-Identified Violations

None

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Mitigating Systems and Barrier Integrity

1R21 Component Design Bases Inspection (71111.21)

.1 Inspection Sample Selection Process

The team selected risk significant components and operator actions for review using information contained in the licensee's Probabilistic Risk Assessment (PRA). In general this included components and operator actions that had a risk achievement worth factor greater than two or Birnbaum value greater than 1E-6. The components selected were located within the safety injection, safety-related ventilation, and vital electrical distribution systems, as well as components required for reduced reactor coolant system inventory operations during shutdown, and switchyard components needed for recovery from a loss of offsite power condition. The sample selection included 18 components, five operator actions, and six operating experience items. Additionally, the team reviewed two modifications by performing activities identified in IP 71111.17, Permanent Plant Modifications, Section 02.02.a. and IP 71111.02, Evaluations of Changes, Tests, or Experiments.

The team performed a margin assessment and detailed review of the selected risk-significant components to verify that the design bases have been correctly implemented and maintained. This design margin assessment considered original design issues, margin reductions due to modification, or margin reductions identified as a result of material condition issues. In addition, the licensee's Design Margin Issues List was used to provide additional insights into identifying low margin equipment. Equipment reliability issues were also considered in the selection of components for detailed review. These included items such as failed performance test results, significant corrective action, repeated maintenance, Maintenance Rule (a)1 status, GL 91-18 conditions, NRC resident inspector input of problem equipment, system health reports, industry operating experience 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 are included in the following sections of the report. A specific list of documents reviewed is included in the attachment to this report.

.2 Results of Detailed Reviews

.2.1 Detailed Component and System Reviews

.2.1.1 Residual Heat Removal (RHR) Pumps - Shutdown Operations

a. Inspection Scope

The team reviewed the Updated Final Safety Analysis Report (UFSAR), Technical Specifications (TS), Design Basis Document (DBD) and supporting calculations, pump procurement specifications, manufacturer pump test curves and piping drawings to identify the RHR pumps' design bases for shutdown operations. This included review of measures to assure adequate net positive suction head (NPSH) and to prevent potential vortex formation for the RHR pumps in a reduced reactor coolant system (RCS) inventory condition, and associated operating procedures. Testing, maintenance, and corrective action documentation were reviewed to assess the performance capability of the RHR pumps' operation for reactor coolant system (RCS) reduced inventory conditions.

b. Findings

No findings of significance were identified.

.2.1.2 Low Head Safety Injection (LHSI) Containment Sump Suction

a. Inspection Scope

This component group included the motor operated valves (MOVs), 1/2-SI-MOV-1860A/B; check valves, 1/2-SI-47 and 1/2-SI-56; and piping between the containment sump and the LHSI pumps. The team reviewed MOV calculations and test documentation to verify that design basis accident conditions and allowable degraded voltage conditions were incorporated into motor actuator setpoint determinations. Motor sizing and valve performance was verified for anticipated operating conditions. Thermal overload (TOL) calculations and installation work orders were reviewed to verify installed TOLs were correctly sized. Maintenance history, Plant Issue Reports (PIs), foreign material exclusion (FME) controls and design changes were reviewed to assess the potential for flowpath obstruction and material degradation. Maintenance history was reviewed to verify that check valves were periodically tested and inspected.

b. Findings

No findings of significance were identified.

.2.1.3 LHSI Pumps/Motors

a. Inspection Scope

The team reviewed the design basis and testing documentation to identify and verify implementation of design requirements related to flow, developed head, NPSH, vortex formation, minimum flow and runout protection, and motor sizing requirements for all LHSI operating conditions. Design calculations and periodic test documentation and results were reviewed to verify that LHSI pump 1-SI-P-1A design and licensing performance requirements were met for the various operating configurations, including

the high pressure recirculation (piggyback) configuration in which the LHSI pumps provide flow to the suction of the HHSI pumps. Maintenance, in-service testing (IST), corrective action, and design change history were reviewed to assess potential component degradation and impact on design margins or performance.

Pump motor assessment included review of the adequacy of the available power supply under worst case conditions, pump motor brake horse power (BHP) for anticipated loading, as well as the testing, setting, and coordination of overcurrent protective relays. The team verified the pump installation and periodic maintenance were consistent with vendor recommendations and that the pump start logic was consistent with design assumptions and appropriately tested.

b. Findings

No findings of significance were identified.

.2.1.4 High Head Safety Injection (HHSI) Pumps/Motors

a. Inspection Scope

The team reviewed the design basis documentation to identify design requirements related to flow, developed head, NPSH, vortex formation, minimum flow and runout protection and motor sizing for all HHSI pump operating conditions and configurations. Design calculations and in-service and periodic test documentation and results for HHSI pump 1-CH-P-1B were reviewed to verify that all design performance requirements were met. Maintenance, in-service testing (IST), corrective action, and design change history were reviewed to assess the potential for component degradation and impact on design margins or performance. The team reviewed the installed charging pump flow instrumentation design, installation configuration, and calibration documentation to verify the adequacy of flow measurement used for American Society of Mechanical Engineering (ASME) Section XI testing and design flow verification.

Pump motor assessment included review of the adequacy of the available power supply under worst case conditions, pump motor brake horse power (BHP) for anticipated loading, as well as the testing, setting, and coordination of overcurrent protective relays. The team also reviewed the HHSI pump control circuit configurations for potential vulnerability to common cause failures that might be introduced by interfaces with non safety-related control circuits, including a visual inspection of the internal wiring of the auxiliary relay racks.

b. Findings

No findings of significance were identified.

.2.1.5 High Pressure Recirculation Function MOVs (Piggyback mode)

a. Inspection Scope

The team reviewed the MOV calculations for LHSI discharge to HHSI suction valves 1/2-SI-MOV-1863A/B to verify that appropriate design basis event conditions and degraded voltage conditions were used as inputs into the determination of motor actuator setpoints and sizing. Testing results were reviewed to verify valve performance was monitored and performance degradation would be identified. Calculations for TOL sizing and installation work orders were reviewed to verify appropriate TOLs were installed. The team reviewed the MOV control logic drawings and logic testing to verify that the interlock and permissive circuits satisfied requirements for redundancy and independence; the circuits included no undetectable failure vulnerability having significant consequences; and appropriate testing overlap was incorporated.

b. Findings

No findings of significance were identified.

.2.1.6 Control Room and Switchgear Ventilation Chillers

a. Inspection Scope

The team reviewed chiller specifications, vendor technical manuals, documentation of chiller condenser service water pump 1-VS-P-1A and chilled water pump 1-VS-P-2A in-service testing, system performance analyses, and maintenance of chiller equipment to verify this equipment was capable of removing design heat loads for the control room and emergency switchgear equipment spaces. This included service water flow to the chiller condensers, chilled water flow to the air handling units (AHUs), unit fan capacity, and chiller performance testing. Additionally, chiller design changes, maintenance, and corrective action histories were reviewed to assess potential degradation of design margin or performance capability. This included the potential impact on electrical loading and system protective features due to the installation of additional chiller units. The team reviewed the potential for common cause failure mechanisms associated with loss of chilled water or service water flow including rotating strainer, Y-strainer, and other potential flow path blockage or degradation.

b. Findings

No findings of significance were identified.

.2.1.7 HHSI Pump Cooling Components

a. Inspection Scope

This component group included the HHSI (charging) pump service water duplex strainers, 1/2-SW-S-2A/B; charging pump service water pumps, 1/2-SW-P-10A/B; and piping to provide cooling for the charging pumps' lube oil coolers and intermediate seal coolers. The charging pump service water duplex strainer clearance sizing and

minimum downstream flow restrictions were reviewed to assess the potential for common cause failure of HHSI pumps due to flow path obstruction. Charging pump service water pump 1-SW-P-10A capacity, required and available NPSH, and flow/developed head requirements were reviewed to verify flow capability was consistent with design requirements for the charging pump lube oil and intermediate seal coolers' heat removal. In-service and periodic testing results for 1-SW-P-10A, maintenance history, and corrective actions were reviewed to assess potential degradation of performance or design margin of cooling components. The design, installed configuration, and calibration of flow instrumentation were reviewed to verify the accuracy of cooling flow measurement. The team reviewed the sizing, start logic, environmental qualification, and installation of the 1-SW-P-10A/10B pump motors to verify the adequacy of the pump motors to support the charging pump cooling requirements.

b. Findings

No findings of significance were identified.

.2.1.8 Refueling Water Storage Tank (RWST)

a. Inspection Scope

The team reviewed the design basis information and supporting calculations and drawings to identify and verify the design assumptions regarding levels and contained volumes of water within the RWST. These design assumptions were related to the LHSI and HHSI pumps taking suction from the RWST and included available NPSH, vortexing potential, and minimum and maximum flow rates. Additionally, the volume of the RWST tank contents transferred to the containment sump was reviewed to verify adequate NPSH was available prior to a switchover from injection to recirculation mode. The team reviewed documentation of the seismic qualification of RWST attached return piping from the low head safety injection pump recirculation line to the RWST through lines 2"-CH-212-152 and 6"-CS-14-152. The team reviewed RWST vent design to verify that adequate measures were implemented to assure the tank vent remains open and functional. The potential for air voids and the adequacy of measures to prevent air voids in the normally isolated RWST unit cross-connect piping to the suction of the HHSI pumps were reviewed.

The team reviewed RWST level instrument scaling and uncertainty calculations to verify the margins in the automatic and operator action setpoints associated with RWST level included allowance for instrument uncertainty. This included review of the loop diagrams, elementary diagrams, schematic diagrams, and logic test procedures to verify the independence and adequacy of testing of the redundant logic circuits. Calibration and test results were reviewed to verify that instrument performance degradation would be identified. The team visually inspected the level transmitter configurations and outdoor enclosures, to assess observable material condition, vulnerability to hazards, and the potential for environmental impact on instrument reliability and performance.

b. Findings

No findings of significance were identified.

.2.1.9 LHSI Suction MOV from RWST

a. Inspection Scope

The team reviewed MOV calculations for the LHSI pump RWST suction valves 1/2-SI-MOV-1862(2862) A/B to verify that accident pressure and degraded voltage were used as design input for motor actuator setpoint determinations, motor sizing, and MOV testing acceptance criteria. Test results, maintenance, and corrective action histories were reviewed to verify that performance or margin degradation was identified and addressed. Sizing of thermal overloads was reviewed to verify that adequate motor thermal overload protection was provided.

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b. Findings

No findings of significance were identified.

.2.1.10 Pressurizer Power Operated Relief Valves (PORV) Air Supply

a. Inspection Scope

The team reviewed the adequacy and availability of the backup air supply for the pressurizer PORVs. This included sizing of the backup air accumulators and pressure regulating setpoints to verify the availability of backup air at adequate volumes and pressures to provide the capability to cycle each PORV consistent with the accident analysis assumptions. This review included design basis sizing calculations, accumulator drawings, and accident analysis assumptions for PORV cycling.

b. Findings

No findings of significance were identified.

.2.1.11 LHSI Discharge Check Valves

a. Inspection Scope

The team reviewed the design, installed orientation, and the licensee's actions to monitor potential degradation of LHSI pump discharge check valves, 1/2-SI-50 and 1/2-SI-58. This included periodic internal inspections and in-service flow testing to demonstrate full open and closure. Maintenance and corrective action history, test results, FME controls, and design changes were reviewed to assess the potential for material degradation and the licensee's capability to identify degradation.

b. Findings

No findings of significance were identified.

.2.1.12 Reactor Vessel Level Indication - Reduced Inventory Operations

a. Inspection Scope

The team reviewed the two independent methods, which included a standpipe and an ultrasonic level measuring device, used to monitor reactor vessel level when the RCS is in a reduced inventory condition. The review was to verify the adequacy of margins associated with the reactor vessel low level setpoint alarms and input to RHR pumps' NPSH and vortex analyses and included instrumentation design, uncertainty calculations, and operating procedures. The team also reviewed testing, calibration, maintenance, and corrective action history, to verify that equipment accuracy and reliability were being maintained.

b. Findings

No findings of significance were identified.

.2.1.13 Upper Canal Level Instrumentation

a. Inspection Scope

The team reviewed the level instrumentation for its capability to provide sufficiently accurate indication of the upper canal water level and reviewed the capability of the control circuits to provide a close signal to the circulating water isolation MOVs when required. This included verifying that the initiation setpoint was consistent with the design basis assumptions for isolating circulating water and that the control and indication circuit design incorporated appropriate single failure and independence criteria. Additionally, the team reviewed the installed instrumentation configuration to verify the adequacy of environmental protections, to verify that installation was consistent with the manufacturer's recommendations, and to observe the material conditions. The calibration documentation and corrective action history were reviewed to verify the instrumentation accuracy was monitored and maintained.

b. Findings

No findings of significance were identified.

.2.1.14 Emergency Diesel Generators (EDG) Start Logic and Circuits

a. Inspection Scope

The team reviewed the design of the EDG start circuit, to verify its capability to actuate the air start motors and start the diesels within the ten-second time period required by

TS. Additionally, the team reviewed the identification and resolution of recent EDG start circuit problems and the potential impact on design assumptions regarding EDG start time. Industry experience on air start components was reviewed to determine applicability to Surry equipment. The team reviewed the testing, detectability of device failures, potential for test preconditioning, validity of test acceptance criteria, and results of past testing to verify the capability to monitor start system performance and identify degradation.

b. Findings

No findings of significance were identified.

.2.1.15 Volume Control Tanks (VCT) Level Indication

a. Inspection Scope

The team reviewed the instrumentation design and the design basis for establishing the setpoint for an automatic switchover from the VCT to the RWST for the charging pump suction, to assure that the design adequately addressed charging pump NPSH and vortex considerations. The team reviewed detailed drawings to verify calibration and setpoint calculation assumptions. The team reviewed the logic functional testing for the switchover, and reviewed test results to verify appropriate overlap testing of the instrument loop. A field inspection of the installed instrumentation was performed to assess observable material condition, instrument impulse line slopes, and vulnerability to hazards such as flooding and missiles. The calibration results were reviewed to verify setpoint accuracy was maintained.

b. Findings

No findings of significance were identified.

.2.1.16 Degraded Voltage Relays (27 relays)

a. Inspection Scope

The team reviewed the uncertainty calculation for the relays as well as the calibration procedures and results to verify that the licensee had appropriately accounted for uncertainties in the degraded voltage protection circuits. The team reviewed the licensee's analyses to verify the TS allowed 88 percent of 4160 volts alternating current (VAC) bus relay setting resulted in no adverse impact on equipment operation. This review was to verify that under degraded voltage conditions at the 4160 VAC bus, motor terminal voltages were greater than or equal to 90 percent of motor rated voltages; MOV pickup voltage conditions were adequate; MOVs could develop the required torque; and the emergency bus minimum voltage was greater than the degraded relay reset value. The last three calibrations of the vital 4160 VAC H bus degraded voltage relays were reviewed to assess performance history and to verify that the calibration and measuring and test equipment (M&TE) tolerances were consistent with the uncertainty calculation

assumptions. Also, the team performed and independent voltage drop calculation from the 1H1-2 Motor Control Center to MOV 1-SI-MOV-1863A, to assess the adequacy of the licensee's voltage drop calculation.

b. Findings

No findings of significance were identified.

.2.1.17 Switchyard Control Power - Restoration of Off Site Power

a. Inspection Scope

The team reviewed the design and installation of the battery which provided control power for operation of the switchyard breakers and disconnects needed to restore offsite power following a loss of off site power. The station's four-hour coping period licensing commitment was the basis for assessing the switch yard battery load profile. The team performed a field review to assess observable material conditions and verify field conditions were consistent with equipment manufacturer's recommendations for the switchyard batteries. Testing and periodic maintenance were reviewed to assess the licensee actions to monitor equipment degradation

b. Findings

No findings of significance were identified.

.2.1.18 Safety-Related Instrument Bus - Inverters and Chargers

a. Inspection Scope

The team reviewed the design basis and equipment capability for the 120 VAC safety related instrument bus inverters and chargers, which provide the licensee's uninterruptible power supply (UPS) associated with each instrument bus. The team verified the isolation of safety-related circuits from non safety-related circuits, reviewed the adequacy of equipment performance testing and maintenance, and assessed potential common cause failure mechanisms. System related PIs were reviewed to assess the recent performance history of the equipment. The team also reviewed the voltage drop to the RWST unit cross-connect valve pilot solenoids, which are served from the 120 VAC instrument bus, to verify that adequate voltage would be available at the terminals of the solenoids under design basis conditions.

b. Findings

No findings of significance were identified.

.3 Review of Low Margin Operator Actions

a. Inspection Scope

The team performed a margin assessment and detailed review of a sample of risk significant, time critical operator actions. Where possible, margins were determined by the review of the assumed design basis and UFSAR response times and performance times documented by job performance measures (JPM) results. For the selected components and operator actions, the team performed a walk through of associated Emergency Procedures (EPs), Abnormal Procedures (APs), Annunciator Response Procedures (ARPs), and other operations procedures with an appropriate plant operator to assess operator knowledge level, adequacy of procedures, and availability of special equipment when required. The following operator actions were reviewed:

- Operator actions in response to a loss of all AC power
- Operator actions in response to a small break loss of coolant accident (SBLOCA) - Transfer to recirculation and post-LOCA cooldown
- Operator actions required for Unit(s) 1 / 2 cross-connects for:
  - Unit 1 and Unit 2 RWSTs
  - Unit 1 and Unit 2 cross-plant charging capability
  - Unit 1 and Unit 2 cross-plant auxiliary feedwater supply
- Operator actions in response to inadequate core cooling
- Operator actions in response to recovery from a loss of emergency coolant recirculation

b. Findings

Introduction: The team identified a Green, non-cited violation (NCV) of TS 6.4.A.3, Unit Operating Procedures and Programs, for a non-conservative emergency contingency action (ECA) procedure setpoint regarding low RWST level. Specifically, the licensee failed to adequately address the potential for vortexing at low RWST levels into the determination of the RWST level for operator action to secure LHSI and HHSI pumps drawing suction from the RWST, in Procedures 1,2-ECA-1.1, Loss of Emergency Coolant Recirculation, Rev. 23.

Description: Appropriate instructions were not provided in Procedures 1,2-ECA 1.1 Rev. 23, for operator actions to secure the LHSI and HHSI pumps' suction from the RWST on low level. In particular, the stated setpoint for operator actions at 3 percent level would not preclude damage or degradation to these pumps due to vortex formation in the RWST in all cases.

The procedures instruct control room operators to secure the pumps when RWST level falls to 3 percent. However, subsequent steps in the procedures specify using the pumps again after an adequate suction source is recovered. The inspectors were concerned that if the pumps were damaged or degraded due to vortexing at low-levels in the RWST, that the pumps may not be able to subsequently perform their safety function.

Licensee Calculation CME 98-011, Rev. 1, RWST Incipient Vapor Entrainment and Vortex Concerns during SI RMT Switchover and CS Pump Operation, Surry Power Station – Units 1 & 2, dated March 2, 1998, determined that the onset of vortexing would occur at 3.4 per cent RWST level. In addition, licensee calculation EE-0112, Rev. 1, RWST Level Uncertainty, dated June 8, 1995, determined that the uncertainty associated with the level instrumentation was 2.6 per cent. Thus, to ensure appropriate protection from vortexing, the inspectors concluded that the procedural guidance should have specified securing the pumps at an RWST level greater than the specified 3 percent.

The licensee verified that the 3 percent RWST level setpoint in Procedures 1,2-ECA-1.1 was not conservative. The licensee issued Plant Issue S-2006-0334 to document the deficiency and prepared procedure changes to secure any operating LHSI and HHSI pumps at a more conservative ECA setpoint of 6 percent. Additionally, a standing order to notify operators of this condition was established as an interim compensatory measure until the procedures were revised.

Analysis: Failing to provide adequate procedure guidance to preclude damage or degradation to the LHSI and HHSI pumps on loss of RWST level in Procedures 1,2-ECA-1.1 Rev. 23, is a performance deficiency. This finding is greater than minor because it is related to the procedure quality attribute of the Mitigating Systems cornerstone and affects the objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. This finding is of very low safety significance because although the HHSI and LHSI pumps could be degraded or damaged, the actual safety system function is not lost due to the availability of a standby HHSI pump and the tolerance of LHSI pumps to short term cavitation. Additionally, the procedures caution the operators to monitor pump parameters for indication of suction loss and the operators receive training on this phenomenon.

Enforcement: TS 6.4.A.3. states that detailed written procedures with appropriate checkoff lists and instructions shall be provided for actions to be taken for specific and foreseen malfunctions of systems or components. Procedures 1,2-ECA-1.1 were written, in part, to fulfill this requirement. Contrary to TS 6.4.A.3, appropriate instructions were not provided in procedures 1,2-ECA 1.1, Loss of Emergency Coolant Recirculation, Rev. 23, for operator actions to secure LHSI and HHSI pumps at a level in the RWST that would preclude pump damage or degradation due to vortex formation in the RWST. This incorrect procedure setpoint was established in 1,2-ECA 1.1, Rev 1A, dated December 29, 1989, and was in effect until identified by the NRC inspectors in January 2006. Because of the licensee actions to revise this procedure setpoint and enter this item into the station corrective action program (PI S-2006-0334), this violation is identified as a non-cited violation (NCV) consistent with Section VI.A of the NRC Enforcement Policy, and is identified as NCV 05000280/2006006-01, Non-Conservative ECA Procedure Setpoint for Operator Action to Secure LHSI and HHSI Pumps on Low RWST Level.

.4 Review of Industry Operating Experience

a. Inspection Scope

The team reviewed selected operating experience issues that had occurred at domestic and foreign nuclear facilities for applicability at Surry. The team performed an independent applicability review, and issues that appeared to be applicable to Surry were selected for a detailed review. The issues that received a detailed review by the team included:

- AOV Motive Power Potential Problems including PORV Accumulator Capacity Calculations at Diablo Canyon, dated 12/20/05, and NRC Information Notice 02-29, Recent Design Problems in Safety Function of Pneumatic Air Systems
- Potential for Gas Binding for HHSI Pumps including the Diablo Canyon ECCS Cross Over Pipe Voiding When Swapping Charging Pumps, dated 10/21/04, and NRC Information Notice 88-23, Supplements 1 - 5, Potential for Gas Binding of High Pressure Safety Injection Pumps During a Loss-of-Coolant Accident.
- Credit for Operator Actions in Place of Automatic Actions addressed in NRC Information Notice 97-78.
- Butterfly Valve Vibration Induced Degradation addressed in NRC Information Notice 2005-23.
- Review of Water Hammer Events addressed in NRC Information Notice 91-50.
- Westinghouse Motor Reverse Starter Failures at Cooper, dated 9/23/05.

b. Findings

No findings of significance were identified.

.5 Review of Permanent Plant Modifications

a. Inspection Scope

The team reviewed two modifications related to the selected risk significant components in detail to verify that the design bases, licensing bases, and performance capability of the components have not been degraded through modifications. The adequacy of design and post-modification testing of these modifications was reviewed by performing activities identified in IP 71111.17, Permanent Plant Modifications, Section 02.02.a. Additionally, the team reviewed the modifications in accordance IP 71111.02, Evaluations of Changes, Tests, or Experiments, to verify the licensee had appropriately evaluated the 10 CFR 50.59 applicability. The following modifications were reviewed:

DCP 02-060, Installation of Replacement Charging Pump 1-CH-P1B
DCP 04-055, Charging System Header Isolation MOV Replacement

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4AO6 Meetings, Including Exit

Exit Meeting Summary

On February 9, 2006, the team presented the inspection results to Mr. D. Jernigan, Site Vice President, and other members of the licensee staff. The team returned all proprietary information examined to the licensee. No proprietary information is documented in the report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

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ITEMS OPENED, CLOSED, AND DISCUSSED

Open/Closed

NCV 05000280,281/2006006-01	NCV	Non-Conservative ECA Procedure Setpoint for Operator Action to Secure LHSI and HHSI Pumps on Low RWST Level (Section 1R21.3)

Attachment

DOCUMENTS REVIEWED

Calculations

DEO-0096, Power Operated Relief Valve Redundant Bottled Air System Capability, Rev. 0
ME-143, NPSH-Available for Residual Heat Removal Pumps when the Reactor Coolant System is Partially Filled, Rev. 0
ME-145, Reactor Coolant System Level at Which Vapor Entrainment Initiates in Residual Heat Removal Suction Lines, Rev. 0
ME-0403, Determination of Motor Operated Capability and Required and Maximum Allowable Torque for Xomox Plug Valves, Rev. 2
ME-422, Analyze the Existing Lube Oil Coolers for the Charging Pumps at Surry Power Station under Design Basis Heat Loads and Conditions at Reduced Service Water Flow, Rev. 0
ME-0440 Addendum 00E, Minimum Delivered HHSI Flow and Runout Flow Test Acceptance Criteria for Replacement 1-CH-P-1B Pump using Manufacturer's Performance test Curve - Surry Unit 1. Rev. 0
ME-0616, Minimum Delivered LHSI Flow for Large Break LOCA Analysis and Acceptance Criteria for LHSI Pump Operability Verification Testing - Surry 1 & 2, Rev. 0
ME-0621, Service Water Charging Pump Subsystem Pipe 2000 Evaluation, Rev. 0
ME-0771, Minimum Delivered HHSI Flow for Loss of Coolant Accident Analysis and CH/HHSI Pump Flow Test Acceptance Criteria, Surry 1 & 2, Rev. 1
SM-743, Charging / SI Flow Balance Acceptance Criteria / Allowable Instrument Uncertainty-Surry Unit 1, Rev. 1
SM-EOP 2006-001, EOP Basis Document Change - EOP Setpoint I.1, RWST Level, Rev. 0
02071.2110-M002, Control Room Envelope Heat Load, Rev. 0
14937.07-8, and Addenda 00A-00D, Maximum Differential Pressure Across Safety Injection System Motor Operated Valves to Determine Torque and Overload Setting, Rev. 0
EE-012, Refueling Water Storage Tank Level Uncertainty, Rev. 1.
EE-0329, Ultrasonic RC System Level Channel Uncertainty, Rev. 0.
EE-0385, 4160 Undervoltage Relays, Types SLV & NGV, Channel Statistical Accuracy, Rev. 1.
EE-0724, Canal Level Probe Channel Statistical Accuracy Calculation, Rev. 0.
SM-934, RWST Volumes for Containment Analysis at Uprated Power, Figure 1, RWST Level and Alarm Setpoints, Surry Power Station, Rev. 0.
07797.06-E-001, 125 Vdc Voltage Drop Calculation for Selected Safety Related and Non-S afety Related Components, Sections 1.0 - 5.3, Section 5.4.4, Rev. 0.
1250-122-C013, 1-CH-FI-1181, 1182, 1183 Charging Pump Flow Loop Accuracy Calculation, Rev. 2.
1250-122-L018, 1-SW-FI-153A/B Chg. Pump Service Water Pump Loop Accuracy, Rev. 0.
14937.2890, Calculation No. 3, Loop Accuracy, Reactor Coolant System Coolant Level - Cold Shutdown, Rev. 0.
EE-0502, 4.16kV Degraded Voltage & Loss of Voltage Relay Safety Limits, Rev. 1
14257.29-E-1, Consolidation of MCC Control Circuit Calculations, Rev.0
EE-0501, Motor Terminal Voltage for Motor-Operated Valves, Rev.1
EE-0034, Surry Voltage Profiles, Rev. 2
EE-0334, Emergency Bus Fault Current Analysis, Rev.0
EE-0335, Relay Setting of Feeder Breakers on Buses 1H and 1J, Rev.0

EE-0306, Evaluation of MI MOV Thermal Overload Settings, Rev.2

Operating Procedures

0-AP-50.00, Opposite Unit Emergency, Rev. 21
1-OSP-SI-002, Rev. 3 - OTO1, Charging Pump Head Curve Verification, Performed 11/06/04 and 05/11/03
1-OP-RC-004, Draining the RCS to Reactor Flange Level, Section 5.5, Draining the RCS from 22% Pressurizer Level to Flange Level, Rev. 15.
1-OP-RC-013, Reactor Head Vent and Standpipe Operation, Section 5.4, Placing the Standpipe in Service, Section 5.5, Removing the Standpipe from Service, Rev. 6.
1-OSP-ZZ-004, Unit 1 Safety Systems Status List for Cold Shutdown / Refueling Conditions, Attachment 10, Minimum RCS Level Versus RHR Flow (1-RC-LI-100A), Rev. 29.

Maintenance Procedures

0-MCM-0417-10, Rev. 6, ALOYCO Swing Check Valve Inspection and Overhaul, Performed 11/01/01, 10/11/03, 05/03/03, and 04/01/02
0-MPM-0210-01, Rev. 012, Control Room Chillers Performance Checks, Performed 11/08/05 and 11/03/05
1-EMP-P-RT-05A, Protective Relay Calibration and Megger Test for 4160V Buses “1H” and “1J” Equipment, Rev. 5, 06/22/04, 04/16/03, 03/18/03, 05/07/03
2-EMP-P-RT-09A, Protective Relay Calibration and Megger Test for 4160V Buses “2H” and “2J” Equipment, Rev.7, 07/22/03, 10/06/03, 09/09/03, 10/06/03, 08/19/03, 04/19/05, 09/10/03,
0-ECM-0302-03, 480 Volt K-Line Breaker Maintenance, Rev. 23, 10/21/01, 09/24/04, 10/31/04, 10/21/03, 09/22/03
SU-M-SOM-800, Surry Switchyard 125 VDC Control Battery (Protective Relay and Control) Maintenance / Discharge Test, Rev.3, 1/12/05,1/10/06

Test Procedures

0-OPT-VS-001, Rev. 024, Control Room Air Conditioning System Pump and Valve Inservice Testing, Performed 12/18/05, 09/24/05, and 07/10/05
1-OPT-CH-002, Rev. 037, Charging Pump Operability and Performance Test for 1-CH-P-1B, Performed 11/28/05, 09/10/05, and 06/13/05
1-OPT-SI-002, Rev. 011, Refueling Test of the Low Head Safety Injection Check Valves to the Cold Legs, Performed 11/23/04, 05/11/03, and 10/23/01
1-OPT-SI-005, Rev. 023, LHSI Pump Test, Performed 06/08/05, 09/01/05, and 12/01/05
1-OPT-SI-007, Rev. 14, Refueling Test of the High Head Safety Injection Check Valves to the Cold Legs
1-OPT-SI-007, Rev. 12 OTO 1, Refueling Test of the High Head Safety Injection Check Valves to the Cold Legs, Performed 11/06/04
1-OPT-SI-007, Rev. 11 OTO 1, Refueling Test of the High Head Safety Injection Check Valves to the Cold Legs, Performed 05/29/03
1-OPT-SI-008, Rev. 011, Refueling Test of the High Head Safety Injection Check Valves to the Hot Legs, Performed 11/06/04
1-OPT-SI-009, Rev. 011, Refueling Test of the LHSI Check Valves to the Hot Legs, Performed 11/19/0, 11/07/04, 04/25/03, and 10/23/01

1-OPT-SI-017, Rev. 007, Closure Test of LHSI Pump Discharge Check Valves 1-SI-50 and 1-SI-58 and Recirculation Check Valves 1-SI-53 and 1-SI-61
1-PT-18.8, Rev. 023, Charging Pump Service Water Pump Performance, Performed 12/16/05, 09/26/05, and 07/01/05
PT 8.6, Instrument Periodic Test, Recirculation Mode Transfer Signal, Automatic Switch over Logic Test, Rev. 12.
PT-8.8, Instrumentation Periodic Test, Intake Canal Level Logic Testing, Rev. 9.
0-ECM-0704-01, EDG Start and Shutdown Circuit Relay Adjust and Replacement, Rev. 12

Calibration / Test Procedures and Reports

1-EPT-1801-01, Bus 1H Protective Relay Testing [degraded voltage relays], Rev 12, results for 11/12/04, 5/8/03, 10/27/01.
2-EPT-1801-01, Bus 2H Protective Relay Testing [degraded voltage relays], Rev 13, results for 5/5/05, 10/10/03, 4/4/02, 10/27/01.
1-IPM-CH-L-112, Instrument Preventive Maintenance, Volume Control Tank Level Loop L-1-112 Channel Calibration [includes comparator output logic tests], Rev. 2, and results for 10/2/01, 5/4/03 (Unit 1); 3/31/02, 10/4/03, 5/14/05 (Unit 2); L-115: 10/21/01, 5/4/03, 11/13/04 (Unit 1); 3/31/02, 10/4/03, 5/4/05 (Unit 2).
1-IPM-CW-L-101, Instrument Preventive Maintenance, Calibration of Canal Level CW-L-101, Rev. 5, and results for 2/27/05, 12/1/03, 1/12/02.
2-IPM-RC-L-205, Instrument Preventive Maintenance, Calibration of Reactor Coolant System Narrow Range Level Loop 2-RC-L-205, Rev. 5, and results for 9/7/03, 3/19/02, 9/14/00.
1-IPM-SW-F-120A, Instrument Preventive Maintenance, Charging Pumps Service Water Flow Loop F-SW-120A Calibration [includes sensing line flush procedures], Rev. 3.
1-IPM-SW-FI-153, Instrument Preventive Maintenance, Charging Pumps Service Water Flow ASME Pump Program Flow Indicators 1-SW-FI-153A and 1-SW-FI-153B, Rev. 2, and results for 4/18/05, 10/30/03, 1/7/01.
1-IPT-CC-CS-L-100A, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-100A Channel Calibration, Rev. 3, and results for 8/30/01, 9/2/01, 4/13/03, 5/10/03, 10/19/04.
1-IPT-CC-CS-L-100C, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-100C Channel Calibration, Rev. 3, and results for 9/1/01, 5/10/03, 9/21/03, 10/19/04.
1-IPT-CC-CS-L-100D, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-100D Channel Calibration, Rev. 4, and results for 9/1/01, 4/12/03, 5/9/03, 9/25/04, 10/18/04.
2-IPT-CC-CS-L-200A, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-200A Channel Calibration, Rev. 5, and results for ½4/02, 3/16/02, 9/15/03, 2/22/05, 4/17/05.
2-IPT-CC-CS-L-200C, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-200C Channel Calibration, Rev. 4, and results for 3/7/02, 3/16/02, 9/15/03, 10/28/03, 4/12/05, 4/17/05.
2-IPT-CC-CS-L-200D, Instrument Periodic Test, Refueling Water Storage Tank Level Loop L-200D Channel Calibration, Rev. 7, and results for 2/23/02, 3/16/02, 9/14/03, 10/28/03, 3/26/05, 4/17/05.
1-IPT-CC-CW-L-102, Instrument Periodic Test, Intake Canal Level Probe 1-CW-LS-102 Time Response Test and Channel Calibration, Rev. 4, and results for 10/2/01, 4/4/03, 10/4/04.
2-OSP-EP-001, Waveform analysis for 2A-1 UPS, performed 1/19/06.

2-PT-70.0, Reactor Coolant Level Transmitter (LT-RC-200A), Rev. 5, and results for 4/25/05, 10/12/03, 10/9/03, 9/24/03, 9/22/03, 3/25/02.
Emergency diesel generator (EDG) start test results from OPT–EG-001, 12/12/05 (EDG 1), 9/19/05 (EDG 1), 6/27/05 (EDG1), 12/5/05 (EDG 2), 9/12/05 (EDG 2), 6/20/05 (EDG 2), 12/19/05 (EDG 3), 9/26/05 (EDG 3).

Design Changes/Modifications

DCP 02-031, 09/16/02, Pressurizer Power Operated Relief Valve Backup Air System Pressure Regulator Setpoint Change / Surry / Unit 1
DCP 02-060, Installation of Replacement Charging Pump 1-CH-P-1B, 11/21/02
DCP 04-046, Safety Injection (MOV) Modification / Surry Unit 1 & 2, 9/21/04
DC-86-03, Setpoint Change Request, VCT Level LC-1112 & LC-1115, 6/30/86.
DC-86-16-2, Level Instrumentation to Prevent Loss of Shutdown Cooling, Surry Unit 2, 10/21/86.
DC-90-10-2, Independent RC System Level Indication Surry Unit 2, 2/8/91.
DC-00-042, CW Canal Level Probe Missile Shield Replacement, Surry 1 & 2, 1/11/01.
DCP 04-089, Replacement of the Thermal Overload for 01-SI-MOV-1865A & 1865C/Surry/Unit 1, 06/01/01
DCP 07-622, Replacement of the Control Room Chiller 480V Molded Case Circuit Breakers/ Surry/ Unit 1 & 2, 10/11/01
DCP 04-055, Ch System Header Isolation MOV Modification, ½7/05
DCP 03-057, Allow More Margin for Various Motor Operated Valves / Surry/ Unit 1 & 2, 06/01/01
DCP 04-100, Replace Circuit Breakers and Verify Thermal Overload Settings for Control Room and Emergency Switchgear Room Air Handlers/Surry/Unit 1 & 2, 06/01/01

Problem Investigation Reports (PIs)

S-1998-2155, CH/HHSI Pump RWST Cross Connect Flow Path Has Not Been Flow Tested and Does Not Have a Calculation of Record Verifying its Ability to Provide Designed Flow
Significant Event Notification 212, High Bearing Temperatures Cause Inoperability of Both Decay Heat Removal / Low Pressure Injection Pumps (operating experience from Arkansas Nuclear One)
S-2005-2294, 2-SI-P-1B Pump Will Not Rotate Freely
S-2005-05127, Mechanical Equipment Room 3 Piping Supports associated with the Service Water System have Degraded Support to Floor Mounting Bolts
S-1998-4407-E1, (OE evaluation) Potential Loss of High Pressure Injection and Charging
Capability from Gas Intrusion, undetected low level in volume control tank.
S-2004-0085-R1/S-2004-0640-E1, orifice/dp incorrectly scaled for service water flow to charging pumps.
S-2004-3977-E2 and Root Cause Evaluation, Emergency diesel generator no. 2 failure to start.
S-2005-0139-E1, Unusual noise from RLC section of 2A2 UPS
S-2005-0210, Failure analysis performed by OEM (ESI) on EDG start SOV, air start motors, and air start valve; corrosion in air start valve
S-2005-0887, Test connection came loose during start test
S-2005-0888, Slow response of auto start relay STL01
S-2005-1192-E1 and root cause evaluation, inverter inrush during start
S-2005-1525-E1 and root cause evaluation, intermittent relay failure in feedback loop.

S-2005-1826-R1, 1/4 inch of white boric acid identified from packing of 2-RC-170 [standpipe level instrument piping] during 2-OPT-RC-10.1, RCS CSD walkdown.
S-2005-1827-R1, >½ inch of white boric acid identified from packing of 2-RC-174 [standpipe level instrument piping] during 2-OPT-RC-10.1, RCS CSD walkdown.
S-2005-1850-R1, While performing standpipe calibration on 2-RC-LT-200, found inactive boric acid on 2-RC-172, -174 valve bodies
S-2005-2745, Fluctuation of 2A2/2A1 battery amperes
S-2005-3107-E1, Voltage spikes on UPS 2A-1; faulty transducer.
S-2005-3392, 2-EP-UPS-2B-1 system ac output voltage lower than other UPSs
S-2005-3424, Slower than normal start time for EDG 3, possible pinion gear abutment
S-2005-3468-R1, Momentary out-of-synch light on UPS 1B1
S-2005-3970, Adequacy of available fault current for clearing faults without degrading 120 VAC vital bus
S-2005-3973, Synch board problem on 1-EP-UPS-1B-2
S-2005-4389-E2, Battery charger failed to start following PM
S-2005-4463, Slower than normal start time for EDG 3, possible pinion gear abutment
S-2005-4627, While testing EDG 2, air start motors did not crank a second time when engine injector control lever was released; mispositioning of timer thumbwheel
S-2005-4635, While testing EDG 2, VSR1 relay was not energized and VSR2 relay was energized; procedure discrepancy
S-2005-4637, Failure of EDG 2 start circuit during test, relay failure
S-2005-4690, Fluctuation of 2A-1 DC output
S-2005-5004-E2 and root cause evaluation, procedure deficiency
S-2005-5190-E1, While testing EDG 3, leads improperly connected
S-2005-5192, Failure of EDG 3 relays during autostart testing
S-2005-5194, During return to service testing of EDG 3, air pressure alarm not received, motor driven fuel pump did not stop, fast start reset light stayed lit, various other anomalies
S-2005-5201, During return to service of EDG 3, additional start signal received after engine stop pushbuttons depressed
S-2005-5208, During test of EDG 3, delay in start time; possible pinion gear abutment
S-2005-5209, During test of EDG 3, autostart signal occurred after stop pushbuttons were depressed; trickle current from indicating lights
S-2005-5284, Low voltage alarm on 2-EP-UPS-2B-1-PANEL
S-2005-5442, During test start of EDG 1, slower than normal start time, pinion gear abutment.
S-2005-5563, During test of RMT transfer, time delay relay failed

Work Orders

00302839, Inspect service water flow orifices (6 year period).
00334357 01, Replace flow element 01-SW-FE-120A, 12/31/96.
00366877 01, Replace flow element 02-SW-FE-220B, 6/12/94.
00460083 01, ERF point out of specifications (VCT level) ½2/02.
00467669 02, Replace standpipe level transmitter, 10/12/03.
00522426 01, Repack valve 2-RC-172, -174, 5/3/05.
00430547-01, TOL Installation 1-SW-P-10B, 12/13/00
00419567-01, TOL Installation 1-SW-P-10A, 12/12/00
00414631-01, TOL Installation 2-SW-P-10B, 03/17/00
00488535-01, TOL Installation 2-SW-P-10A, 07/28/04
00414940-01, TOL Installation 1-SI-MOV-1864A, 03/29/02

00507775-01, TOL Installation 1-SI-MOV-1864B, 04/22/00
00456791-01, TOL Installation 2-SI-MOV-1864A, 10/31/04
00426059-01, TOL Installation 2-SI-MOV-1864B, 10/05/00

Drawings

11448-FV-34A, Rev. 5, Refueling Water Storage Tank Mk. No. CS-TK-1
A-44619, 09/25/92, Goulds Pumps Inc., Characteristic Curve - Serial Number C7440952-4, Equipment I.D. 1-VS-P-10, Main Control Room Service Water Pump - Control Room HVAC Upgrade (New Service Water Pumps for Supplemental Chiller Condenser Water)
IF 6083, Rev. A, Byron Jackson Division / Borg Warner Corporation, Low Head Safety Injection Pump
SK-2861, Rev. G, Aerofin Corporation / Type "C" Coil "U" Stamped VSAC Air Handling Units
113E243, Safeguards System Miscellaneous, Surry Power Station Unit 1, Rev. 11.
113E278, Misc. Relay Rack 1 Rows A through E, Surry Power Station Unit 1, Rev. 14.
11448-ESK-5P, Elementary Diagram, 4160 V Charging Pumps, Sheet 1, Rev. 24.
11448-ESK-5Q, Elementary Diagram, 4160 V Charging Pumps, Sheet 2, Rev. 27.
11448-ESK-5R, Elementary Diagram, 4160 V Charging Pumps, Sheet 3, Rev. 19.
11448-ESK-6BL1, Elementary Diagram, Sheet 1, 480 V Circuit Motor Operated Valves 01-SI-MOV-1860A & B, Surry Power Station Unit 1, Rev. 11.
11448-ESK-6BL1, Elementary Diagram, Sheet 2, 480 V Circuit Motor Operated Valves 01-SI-MOV-1862A & B, Surry Power Station Unit 1, Rev. 8.
11448-ESK-6BL1, Elementary Diagram, Sheet 3, 480 V Circuit Motor Operated Valves 01-SI-MOV-1863A & B, Surry Power Station Unit 1, Rev. 10.
11448-ESK-6BL1, Elementary Diagram, Sheet 4, 480 V Circuit Motor Operated Valves 01-SI-MOV-1885A & B, Surry Power Station Unit 1, Rev. 9.
11448-ESK-6BL1, Elementary Diagram, Sheet 5, 480 V Circuit Motor Operated Valves 01-SI-MOV-1885C & D, Surry Power Station Unit 1, Rev. 8.
11448-ESK-6BU, Elementary Diagram, Sheet 2, 480 V Circuit Motor Operated Valves 01-CH-LCV-1115C & E, Surry Power Station Unit 1, Rev. 15.
11448-ESK-6BU1, Elementary Diagram, 480 V Circuit Motor Operated Valves 01-CH-LCV-
1115B & D, Surry Power Station Unit 1, Rev. 6.
11448-ESK-6BX, Elem. Diag., Chg. Line Low Press., Surry Power Station (SPS) Unit 1, Rev. 1.
11448-ESK-6EE, Elem. Diag., Solenoid Operated Pneumatic Valves, SPS Unit 1, Rev. 1.
11448-ESK-6FF, Elem. Diag., Solenoid Operated Valves 01-SI-SOV-102A1, A2, B1, & B2, SPS 1, Rev. 9.
11448-ESK-6LL, Elem. Diag, Chg Line Low Pressure, Surry Power Station Unit 1, Rev. 1.
11448-ESK-7V, Elem Diag, Train A RMTS, Surry Power Station Unit 1, Rev. 2.
11448-ESK-7W, Elementary Diagram, Train B RMTS, Surry Power Station Unit 1, Rev. 2.
11448-ESK-7X, Elementary Diagram, RMTS Test Circuit, Surry Power Station Unit 1, Rev. 1.
11448-ESK-7YA, Interconnecting Wiring Diagram, RMTS Channel I Input, Surry Power Station Unit 1, Rev. 7.
11448-ESK-9E, Elementary Diagram, Intake Canal Low Level Isolation Actuation Circuit Train A, Surry Power Station Unit 1, Sheet 1, Rev. 1.
11448-ESK-9E, Elementary Diagram, Intake Canal Low Level Isolation Actuation Circuit Train A, Surry Power Station Unit 1, Sheet 2, Rev. 1.

11448-ESK-9E, Elementary Diagram, Intake Canal Low Level Isolation Actuation Circuit Train

A, Surry Power Station Unit 1, Sheet 3, Rev. 1.
11548-ESK-13Y, Elementary Diagram, Reactor Cooling Instrumentation, Rev. 2
11448-FE-4BJ, Wiring Diagram, Nuclear Instrumentation, Miscellaneous Relay Rack 1, Surry Power Station Unit 1, Rev. 15.
11448-FE-19AH, Elementary Diagram, Emergency Diesel Generator No. 3, Surry Power Station Unit 1, Sheet 1, Rev. 12.
11448-FE-19AK, Elementary Diagram, Emergency Diesel Generator No. 3, Surry Power Station Unit 1, Sheet 1, Rev. 10.
11448-FK-1C, Instrument Piping Reactor Containment, Surry Power Station, Rev. 13.
11448-FK-5E, Instrument Piping, Level Control, Surry Power Station Unit 1, Rev. 10.
11448-FK-5E1, Instrument Piping, Level Control, Surry Power Station Unit 1, Rev. 0.
11448-FK-8G, Miscellaneous Details, Surry Power Station, Rev. 13.
11448-FP-9A, Pressurizer Spray, Safety & Relief Tank Piping Sheet 1, Rev. 11.
5957D10, Interconnecting Wiring Diagram, Containment Spray Refuel Water Tanks and Intake Canal Level, Surry Power Station Unit 1, Rev. 11.
5965D30, Interconnecting Wiring Diagram, Loop 1 Steam Break Protection, Rev. 12.
S-00042-0-1FC9R1, DCP 00-042 Canal Level Probe Missile Shield Replacement Details, page 5, Rev. 5.
S-8833-3-E-3500, Installation Details, High Level Intake Structure, Rev 0A.
S-8833-V-88162931, Liquid Level Switch Model 8-66, Rev. 0.
S-9010-2-E-0900, Elementary Diagram, Ultrasonic Level Monitoring, Rev. 0.
S-9010-2-E-0901, Elementary Diagram, Ultrasonic Level Monitoring, Rev. 0.
S-9010-2-E-2200, Test Loop Diagram - RC System - Independent Level Indication Loop ‘B’, Rev. 0.
11448-SE-107DL, Cable Schedule MCC 1K1-MER 5 Surry Power Station, Unit 1, Sh.1, Rev.1
11448-SE-107DM, Cable Schedule MCC 1K2-MER 5 Surry Power Station, Unit 1, Sh.1, Rev.1
11448-SE-107H2, Cable Schedule 480V SWGR Surry Power Station, Unit 1, Sh.1, Rev.2
11448-SE-106R, 4160V Circuits Surry Power Station, Sh.16, Rev.10
11448-SE-106S, 4160V Circuits Surry Power Station, Sh.17, Rev.5
11448-SE-107G, 480V SWGR Surry Power Station, Sh.7, Rev.9
11448-SE-107BD, EMEG SWGR RM EMER MCC 1H1-1, Sh.2, Rev.5
11448-SE-107BJ, Cable Vault-EMER MCC 1H1-2, Sh.1, Rev.6
11448-ESK-6FB1, Elementary Diagram MCR Chillers 1-VS-E-4B, Sh.2, Rev. 4
11448-ESK-6FB1, Elementary Diagram MCR Chillers 1-VS-E-4C, Sh.3, Rev. 4
11448-ESK-6BL1, Elementary Diagram 480V Circuit MOV, 10-SI-MOV-1860A & B, Sh.1, Rev.11
11448-ESK-6BL1, Elementary Diagram 480V Circuit MOV, 10-SI-MOV-1862A & B, Sh.2, Rev.8
11448-ESK-6BL1, Elementary Diagram 480V Circuit MOV, 10-SI-MOV-1863A & B, Sh.3, Rev.10
11448-ESK-6BX, Elementary Diagram 480V Circuit MOV, 10-SI-MOV-1864A & B, Sh.1, Rev.23
11448-ESK-6BX, Elementary Diagram 480V Circuit MOV, 10-SI-MOV-1890B & C, Sh.3, Rev.24
11448-ESK-6CR1, Elementary Diagram Misc Pump Circuits Surry Power Station, Unit 1, Sh.1, Rev. 2
11448-ESK-5R, Elementary Diagram 4160V Charging Pumps, Sh. 3, Unit 1, Rev.18
11448-ESK-5Q, Elementary Diagram 4160V Charging Pumps, Sh. 2, Unit 1, Rev.24
11448-ESK-5P, Elementary Diagram 4160V Charging Pumps, Sh. 1, Unit 1, Rev.24
11448-ESK-5G, Elementary Diagram 4160V RHR Pumps, Unit 1, Rev.12
11448-ESK-6AA, Elementary Diagram 480V LHSI Pumps Surry Power Station, Unit 1, Sh.1, Rev. 11

Miscellaneous Documents

Nuclear Analysis and Fuel NE Technical Report No. 1050 - Technical and Operating Basis for Pressurizer PORV Air Bottles, 05/29/96
Technical Report ME-0147, Rev. 0, Performance Test of Surry Power Station Control Room Chillers in Single Chiller Mode
CME 98-011, Rev. 1, RWST Incipient Vapor Entrainment and Vortex Concerns during SI RMT Switch over and CS Pump Operation
ET No. CME 95-0061, Rev. 0, Charging Pump Service Water Pump Discharge Check Valve Flow - Surry Power Station Units 1 and 2
ET CME 98-014, Rev. 2, Evaluation of Operation of LHSI Pumps Recirculating to the RWST - Review of Previous Responses to the NRC IE Bulletin 88-04
ET CME-03-016, Rev. 0, Evaluation of CH/HHSI Pump Runout Condition for 1-CH-P-1A and -1B from 1-OPT-SI-007, 04-25-03 Test Results - Surry Power Station Unit 1
ET No. NAF 99-0026, Rev. 0, Containment Sump Vortexing Concerns during Recirculation
ET No. S-98-0174, Rev. 0, 1-SW-P-10A/B, Charging Pump Service Water Pumps IST Acceptance Criteria Change - Surry Power Station Unit 1
ET S-99-0004, Rev. 0, Acceptance Criteria for HHSI Flow Balance Tests to the Cold and Hot Legs Using 5% Instrument Inaccuracy - Surry Power Station Units 1 & 2
ET S-99-0175, Rev. 0, 1-SW-P-10A, Charging Pump Service Water Pump IST Acceptance Criteria Change - Surry Power Station Unit 1
ET S-01-0074, 06/25/01, Acceptance Criteria for Low Head Safety Injection Pump and Valve Procedures - Surry Power Station Units 1 and 2
ET S-03-0090, Rev. 2, IST Acceptance Criteria for 1-CH-P-1B following Pump Replacement - Surry Power Station Unit 1
ET S-04-0095, Rev. 0, IST Acceptance Criteria for 1-VS-P-1A
Memorandum A. P. Raspanti to R. K. MacManus - Virginia Power, November 15, 1993, Vortexing in T. S. Tanks
NAP-0018 / SUP-0020, Specification for Independent RCS Level Indication System, North Anna and Surry Power Stations Units 1 and 2, Rev. 0, ½2/90, Addendum 2, 7/9/90.
NUS-2030, Specification for Electrical Installation for Surry Power Station Units 1 & 2, Sections 9.2.5, 9.2.6, 9.2.7, 9.2.11, 9.2.16©), 9.2.21, 9.2.23, Rev. 13, 11/20/03
Procedural Changes Surry Power Station Units 1 & 2, Rev. 0.
NSA-93005, Subject: Surry Power Station Residual Heat Removal Operation at Mid-Loop - Impact of Updated Instrument Errors, 1/11/93.
NE Technical Report No. 801, Evaluation and Development of Setpoints for Application of Abnormal Response Guideline ARG-1, Loss of RHR while Operating at Mid-Loop Conditions, Surry Power Station Units 1 & 2, Sections 4.4, 4.5, 4.8, 4.9, December 1990.
Westinghouse Letter VPA-90-527, Subject: Virginia Power Surry Power Station, Contract No. PM-LF0014, Independent RCS Level Indication System Accuracy Documentation, 6/1/90.
SU-94-00001, Item Equivalency Evaluation Review (IEER), Orifice Plates for Service Water System, Rev. 0.

PIs Written due to CDBI:

S-2006-0283 Incorrect OE applicability review - Westinghouse reverse starters
S-2006-0279 Incorrect LHSI pump shaft/bearing clearance tolerance criteria in maintenance

	procedure
S-2006-0282	Pzr PORV air bottle calculation error
S-2006-0277	Incorrect FSAR statement regarding MDAFW pumps start
S-2006-0273	MOV-SI-1890B calculation COF value and test plan inconsistent
S-2006-0145	Inconsistent procedure guidance for SD operations RHR flow
S-2006-0131	Incorrect reference on ventilation procedure step
S-2006-0334	Non-conservative operator action setpoint value in ECA 1.1. (NCV)
S-2006-0367	Degraded material condition for RWST level instrumentation environmental enclosure
S-2006-0447	HHSI pump cooler heat calculation incorrectly identified side of tubes coated.
S-2006-0418	Non-critical error in MOV calculation
S-2006-0471	Various procedure enhancements and clarifications
S-2006-0263	Valve 1-CH-729 closed but not locked closed as indicated on P&ID
S-2006-0538	Minor field wiring discrepancy in charging pump start circuitry