April 23, 2004

Mr. Roy A. Anderson
President and Chief Nuclear Officer
PSEG Nuclear LLC - N09
P. O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2 - NRC INSPECTION REPORT 05000272/2004006 AND 05000311/2004006

Dear Mr. Anderson:

On March 12, 2004 the U.S. Nuclear Regulatory Commission (NRC) completed an engineering team inspection at the Salem Nuclear Generating Station. The enclosed inspection report presents the results of that inspection, which were discussed with Mr. D. Garchow and other members of your staff on March 12, 2004.

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.

This report documents three NRC-identified findings of very low safety significance (Green), two of which were determined to involve violations of NRC requirements. However, because of their very low safety significance and because they are entered into your corrective action program, the NRC is treating these two findings as non-cited violations (NCVs) consistent with Section VI.A of the NRC Enforcement Policy. If you contest any NCV in this report, 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, D.C. 20555-0001; with copies to the Regional Administrator, Region I; the Director, Office of Enforcement, and the NRC Resident Inspector at the Salem Nuclear Generating 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 the NRC's document system (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Lawrence T. Doerflein, Chief
Systems Branch
Division of Reactor Safety

Docket Nos. 50-272; 50-311

License No. DPR-7; DPR-75

Enclosure: Inspection Report 05000272/2004006, 05000311/2004006
w/Attachment: Supplemental Information

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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos.	50-272; 50-311
License Nos.	DPR-70, DPR-75
Report Nos.	05000272/2004006 05000311/2004006
Licensee:	PSEG LLC
Facility:	Salem Nuclear Generating Station
Location:	P.O. Box 236 Hancocks Bridge, NJ 08038
Dates:	February 23 - March 12, 2004
Inspectors:	Harold Gray, Team Leader, Division of Reactor Safety (DRS), Frank Arner, Senior Reactor Inspector, DRS Suresh Chaudhary, Senior Reactor Engineer, DRS Aniello DellaGreca, Senior Reactor Inspector, DRS Sammy McCarver, Reactor Inspector, DRS Tom Sicola, Reactor Inspector, DRS (in training) David Werkheiser, Reactor Inspector, DRS (in training) Haywood Anderson, NRC Contractor Tony Cerne, NRC Consultant
Approved By:	Lawrence T. Doerflein, Chief Systems Branch Division of Reactor Safety

Enclosure

Summary of Findings

IR 05000272/2004-006 andIR 05000311/2004-006; 02/23/04 - 03/12/04, Salem Nuclear Generating Station, Units 1 and 2; Safety System Design and Performance Capability

The inspection was conducted by five region-based inspectors, one NRC contractor, and one NRC consultant. In addition, two NRC inspectors in-training and two individuals from the State of New Jersey's Bureau of Nuclear Engineering participated in the inspection. Three findings of very low safety significance (Green) were identified, two of which were considered to be non-cited violations (NCVs). 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 may be assigned another 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. A finding of very low safety significance (Green), that is also a non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion III, was identified regarding an inadequate design analysis for a service water system modification performed on both units. The modification had changed the service water recirculation valve operating characteristics and installed orifices in the line without adequately evaluating the effect of an increase in system pressure, impact on pump margin to minimum flow requirements during transients, and impact to the service water high pressure alarm design function.

  The finding is greater than minor because it was associated with the mitigating system cornerstone attributes of design control and equipment performance and affected the capability of the system to ensure service water pressure would be maintained within previously evaluated design parameters. Based on a review of PSE&G's analyses of the issue, the team concluded that the finding was a design deficiency which was confirmed not to result in the loss of any mitigating system function. Therefore, in accordance with the SDP Phase I screening worksheet, the issue was determined to be of very low safety significance (Green).

  The team identified that a contributing cause of the finding was related to the cross-cutting area of Problem Identification and Resolution. PSEG had not fully evaluated and corrected this issue after several previous opportunities had existed to do so. (Section 1R21)

- Green. A finding of very low safety significance was identified in that the Control Air (CA) quality test program was inadequate. The test program did not verify the quality of air meets standards specified in ANSI/ISA S7.3-1975, Quality Standard for Instrument Air, as delivered to safety-related air loads.

  This finding is greater than minor because it is associated with the Procedure Quality attribute for the CA mitigating system function and, if left uncorrected, could become a more significant safety concern. The finding is of very low safety significance because it did not render the CA system inoperable and because of the CA system redundancy (Section 1R21).

Cornerstone: Barrier Integrity

- Green. The inspectors identified a finding of very low safety significance (Green), that is also a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, Design Control. Specifically, design calculations performed to verify adequate accumulator air pressure for Low Temperature Overpressure (LTOP) conditions and acceptable system leakage rates used incorrect design inputs. These non-conservative calculations were referenced during future system evaluations and also used as the basis for operability determinations and alarm set points.

  This finding is greater than minor because it was associated with the design control attribute for the power operated relief valve (PORV) mitigating system function. The design calculations formed the bases for subsequent non-conservative operability reviews which affected the objective of adequately ensuring the capability of the PORV accumulators. Because the LTOP condition is only of concern during periods where the reactor is in cold shutdown, the inspectors evaluated the finding using Appendix G, Shutdown Operations to NRC IMC 0609, Significance Determination Process (SDP). The team concluded that this issue was of very low safety significance (Green) since the function had always been maintained.

  The inspectors identified that a contributing cause of the finding was related to the cross-cutting area of Problem Identification and Resolution in that Design Engineering personnel had failed to identify and correct errors and discrepancies between design calculations of record. (Section 1R21).

B. Licensee-Identified Violations

None.

Report Details

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Safety System Design and Performance Capability (IP 71111.21)

a. Inspection Scope

The team reviewed the design and performance capability of the Service Water (SW) and the Control Air (CA) systems, as well as selected supporting or supported components at the Salem Nuclear Generating Station (Salem). The inspection was performed in accordance with NRC Inspection Procedure (IP) 71111.21, Safety System Design and Performance Capability. The team reviewed the design basis documents, the Updated Final Safety Analysis Report (UFSAR), Technical Specifications (TSs), design calculations, and other supporting documents to ensure that the systems could be relied upon to meet their functional requirements. In addition, the team used licensee probabilistic risk assessment (PRA) insights and the NRC Risk Informed Inspection Notebook information to focus inspection activities on components and procedures that would mitigate the effects of postulated events. Components selected for a detailed design basis review included the SW pumps, the SW strainers, and valves SW20 and SW26. Documents reviewed during the inspection are listed in the Attachment.

.1 **Service Water (SW) System**

The team reviewed the SW system responses to a single passive failure during normal plant operation and during accident scenarios involving a single active failure coincident with loss of coolant accident (LOCA) and loss of offsite power (LOOP) or single active failure coincident with a design basis earthquake (DBE) and a LOOP. The team's review included applicable SW system normal, abnormal and emergency operating procedures, as well as, operator training lesson plans. The team compared this operating information with the applicable design basis documents and the SW system Failure Modes and Effects Analysis to evaluate the consistency between the design assumptions and the expected system response controlled by procedure requirements.

The team interviewed operations training personnel regarding operating scenarios involving the SW system and use of the abnormal operating procedures (AOPs) and emergency operating procedures (EOP). The team reviewed the capability of the operators to use a crosstie of the Units 1 and 2 SW systems if required to mitigate beyond design basis events. The team reviewed procedures and interviewed operations and training personnel to assess the operators readiness to implement contingency actions requiring in-plant actions to align the SW system to perform a support function (e.g., SW to auxiliary feedwater). The team also raised specific issues with the trainers regarding the SW system operability guidelines, in order to confirm that proper emphasis was placed upon such operational principles in the training scenarios, as well

as to determine the technical adequacy and clarity of the procedures being used by the licensed operators.

The service water system licensing basis documents were reviewed to verify proper integration of the licensing requirements into operations and surveillance procedures and training plans. The team reviewed specific design features at Salem involving the potential shared use of the SW system between Units 1 and 2. Procedural controls, operator training and the physical configuration of components were examined to verify compliance with 10 CFR 50, Appendix A, General Design Criteria. A crosstie of the chilled water system between Units 1 and 2 was an original design feature that had been removed from service. The team verified that the affected design and licensing basis documents and plant operating and training procedures were appropriately revised.

The inspection team reviewed the SW system design basis documentation to confirm the system was analyzed to meet the design basis requirements for supplying sufficient individual component flows, satisfying maximum pump flow requirements, and ensuring saturation pressure margin in the containment fan cooler units (CFCUs) was adequate. The SW system hydraulic model, CFCUs' setpoint calculations, and the fully degraded curves for the new (SW) pumps were reviewed to verify that SW system design met the supported equipment flow requirements for each TS operating mode. The team also reviewed engineering calculations that determine heat exchanger differential pressures and SW system flow rates to monitor bio-fouling of the 23 and 25 CFCUs and CFCU motor coolers were appropriately translated into periodic test acceptance criteria. Similarly, the team reviewed the Unit 1 component cooling water (CC) system thermal-hydraulic analysis to verify that the maximum allowable fouling of 11 CC heat exchanger (CCHX) was appropriately translated into acceptance criteria for periodic monitoring of the 11 CCHX.

The engineering analyses regarding the SW pumps were reviewed to confirm that maximum pump flows, net positive suction head requirements, and available net positive suction head were documented for each TS mode of operation. These design basis parameters were documented at initial installation and degraded SW pump conditions. The team also evaluated the calculations for the development of the fully degraded pump curves used for minimum flow analyses.

The design basis for the (SW) strainers, with respect to the control of the design basis for the size of material (debris) the strainer filter media will allow to pass and control of the criteria for the maximum "gap" between the wear surfaces of the rotating strainer drum and strainer body were reviewed. The inspection team reviewed Design Change No. 1EC-3685, 11 Service Water (SW) Pump Strainer Filter Media Size Change, and its associated safety screening to confirm the design basis was evaluated and maintained in the design change which enlarged the strainer media opening from 0.0315 inches to 0.063 inches. Engineering Change Authorization ECA 80002087; 22 Service Water Pump Strainer (2SWE8) "O"-Ring and Replacement of 100 Flat Type Filter Media with 100 Box Cone Type Filter Media, was reviewed to confirm the design basis was evaluated and maintained in the design change which modified the original wear surface

interface (without an O-ring / maximum “gap” of </= 0.083 inches) to the modified wear surface interface (with an O-ring / maximum “gap” of </= 0.063 inches). The inspection team also reviewed Equivalency Replacement Evaluation Change No. 80009391; Model A, 20" Auto Self-Cleaning Type Pump Strainer Filters. The design change process and equivalent replacement processes utilized to modify the wear surface interface for the associated strainers were evaluated.

To verify SW system and component availability for the performance of design functions, the team reviewed SW system administrative work controls, SW system operability guidelines and the status of operational logs. The team interviewed various plant personnel responsible for risk management, system status, and design change control to verify the adequacy of programs and procedures addressing the adequacy of the control of risk in system alignments and work control practices. The team reviewed a selected sample of work orders, engineering evaluations, Maintenance Rule functional failure evaluations, operability determinations, and operating experience (OE) reviews. The team also reviewed the operator work-around list, system engineer tracking and trending data, system health reports, temporary modifications, equipment status log and corrective action database to assess the overall health of the SW system.

The team conducted several partial walkdowns of accessible portions of control room instrumentation and in-plant system equipment, including a detailed walkdown with the respective system engineers, to verify that the operational readiness, configuration control, and material condition of the SW system and components were consistent with the design basis. The walkdowns included inspection of the Unit 1 and Unit 2 SW intake structure (SWIS), pumps, valves, piping, strainers, and traveling screens. The operating parameters of equipment compared to functional requirements in the appropriate sections of the UFSAR to verify that there were no obvious deficiencies. The walkdowns were also conducted to confirm the existence of adequate controls over nonconforming material and any hazards (e.g., seismic II/I configurations) that could compromise the design function of safety-related SW system components. The team also assessed the consistency of the plant to the approved design configuration (e.g., P&IDs), as-built details (e.g., pipe hanger drawings), system modifications (e.g., piping changes and class breaks), and engineering changes (e.g., valve actuator replacements).

The inspection team reviewed evaluation S-C-SW-MEE-0953 and procedure S1.OP-SO.SW-0005(Q) in conjunction with walkdown and material condition observations to evaluate the effectiveness of equipment design, operation, and maintenance features and controls in preventing foreign materials from entering the pump bays downstream of the traveling screens in the flow path to the individual SW pumps during normal operations as well as during severe weather conditions.

Using the Salem PRA Notebook for the SW system, the team selected two components (valves SW20 & SW26) susceptible to a common cause failure that could lead to the complete loss of the SW system during design basis events for detailed inspection. Walkdown inspections of this high risk-ranked equipment were conducted with particular emphasis upon train separation, physical independence, and other common mode

concerns that adequate design features were intended to address. Also, certain SW system modifications (e.g., SW pump full flow test line installation) were checked not only for compliance with their design package criteria, but also for any potential adverse impact upon other important safety equipment in the proximate area.

The Salem simulator was also visited and a control board walkdown was conducted with simulator instructors to verify simulator fidelity with the plant controls, particularly where field modifications had been effected.

The team reviewed surveillance test procedures and test results, including inservice testing (IST), for the SW system. Trending of the IST data was discussed with the IST Program Manager. The team also verified that configuration control was maintained following changes to design requirements as a result of modifications (e.g., SW39 valves' stroke time changes).

.2 **Control Air (CA) System**

The CA system is risk significant due to the safety-related air loads it supports, but is not included in the plant TS limiting conditions for operations. The inspection team reviewed the design, maintenance, and performance capability of the CA system and selected portions of the station air (SA) system that normally supplies CA. The review was performed to verify that the CA system configuration and operation were consistent with the current design basis, and that the CA system was able to perform its function to support safety related components.

The mechanical design review focused on the capability of the SA and CA systems, under design basis and transient conditions. Additionally, the current performance and test criteria for the SA and CA compressors, receivers, and accumulators were reviewed to ensure consistency between allowable component performance and minimum allowable capabilities assumed in the accident analyses and associated design basis calculations.

The team also reviewed and compared the updated Integrated Air Load Management Program (IALMP) calculation and the Control Air System Load Study to verify consistency of the updated IALMP results and conclusions with the emergency control air compressor (ECAC) capacity, the original load demand, and the new load demand with these calculations. The calculation for the design basis and capacity of the station air and control air receivers was also reviewed. The team reviewed the station and control air systems flow model and test calculation with regard to air system pipe roughness. The original flow model development and benchmark test were performed in the early 1990s. Given the potential CA piping degradation due to moisture since 1990, the inspectors verified that the assumed absolute roughness value would remain a conservative assumption.

The team reviewed a sample of procedures and operator actions pertaining to loss of CA and associated CA loads. System interfaces (instrumentation, controls, and alarms)

were reviewed to assess the support to operator decision making, operator response to anomalous conditions, and the successful completion of recovery activities.

The team assessed the reliability and unavailability performance of the SA and CA systems by reviewing a selected sample of corrective and preventive maintenance work orders (WOs) performed and notifications initiated during the past two years. The team reviewed post-maintenance test results for a sample of WOs to verify the capability of air system components to perform their intended safety functions. The team also reviewed maintenance rule quarterly performance reports and interviewed the system engineers to understand the reliability and availability of the air systems.

The team reviewed the licensee's CA system commitments in the Salem response (NLR-N89062/NLR-N900123) to Generic Letter (GL) 88-14. The team interviewed the technician who performed the test to satisfy the commitment, reviewed the recurring work task procedures used for testing the CA quality and reviewed the quality standard used by the technician.

The inspectors conducted a detailed walkdown of accessible portions of the SA and CA systems with the system engineer to verify the systems were consistent with design documents, calculations, assumptions, and commitments. The team also walked down supporting systems and internally inspected select redundant air panels. The team used the UFSAR, TSs, and P&IDs as references during the walk-downs to verify the physical installation was consistent with design basis assumptions for major components. This included piping, piping supports, redundant air panels, receivers, and compressors. During field walkdowns, the team examined the material condition of the systems, and the physical line-up of the major components. A sample of air system equipment operating parameters were reviewed to verify that there were no obvious deficiencies. The inspection used the information in the appropriate sections of the UFSAR to determine the functional requirements of the systems.

The team also reviewed a sample of modifications to the SA and CA systems as well as changes to the licensing basis or plant design that could impact the functionality or reliability of the systems. The team reviewed a selected sample of Units 1 and 2 completed surveillance test procedures for adequacy and acceptability of test results. The team also reviewed performance data acquired during CA system IST activities of risk-significant air loads to verify that the results demonstrated functional capability and met the acceptance criteria. Select performance data was reviewed to verify that test results reflected design conditions.

The team reviewed selected components supported by CA to determine if the system configurations met the design criteria. In particular, the power operated relief valves (PORVs) were evaluated due to their risk significance in relation to a loss of CA, and low temperature over pressure (LTOP) and inadvertent safety injection (SI) actuation events. A selected sample of design calculations, operability determinations, performance tests, and system drawings were reviewed and discussed with licensee personnel. The sample of documents selected and the personnel selected for interview were based on historic system leak rates greater than the calculated values.

.3 **SW and CA Electrical and Instrumentation and controls (I&C)**

The team reviewed the control wiring diagrams of selected service water and control air system components to verify their operation, including automatic initiation, conformed with the system operation described in the updated final safety analysis report. The review included control of pumps, air compressors, and valves critical to the correct operation of the systems. The team reviewed both alternating and direct current power distribution to ensure that a single failure of an electrical component or source did not impair the ability of the systems to perform their safety function. The review confirmed that sufficient instrumentation was provided to initiate automatic functions and to monitor the operation of the systems during a design basis accident and/or loss-of-offsite power.

The team reviewed the emergency diesel generator (EDG) load calculations to verify that selected loads had been correctly identified and to ensure that the loading was within the capacity and capability of the EDGs. The team also reviewed the load flow analysis and voltage drop calculations to verify that adequate voltage was provided to the safety-related loads during worst-case loading.

In addition, the team reviewed: the vital alternating current (ac) coordination analysis to ensure that the protective devices were adequately rated; the service water pump test results to ensure that motor loads had been correctly represented in the EDG loading analysis and that adequate motor protection had been provided; environmental qualification of selected components to verify that they would be capable of performing their required safety function; and setpoint calculations and calibration status of selected instrumentation to verify that the selected components would operate within the intended system operation parameters. The team reviewed selected plant modifications and associated safety evaluations to ensure that such modifications did not affect the design basis of the systems modified.

b. Findings

1. **Service Water System Pressure**

Introduction. A finding of very low safety significance (Green), that is also a non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion III, was identified regarding an inadequate design analysis for a service water system modification performed on both units. The modification had changed the service water recirculation valve operating characteristics and installed orifices in the line without adequately evaluating the effect of an increase in system pressure, impact on pump margin to minimum flow requirements during transients, and impact to the service water high pressure alarm design function. As a result the operators were challenged to comply with procedures to keep SW system pressure below procedural requirements. Additionally, the high header pressure alarm design function of alerting operators to a potential overpressure condition was degraded since the unit was operated during winter months with the alarm

actuated and its function to alert the operators to higher pressure conditions under postulated transients was masked by its continuous actuated status.

Description. The service water system pumps discharge into a common header that then directs flow to components requiring service water cooling. Attached to the common discharge header are two air-operated flow control valves that are controlled by pressure sensed in the discharge header. The valves open at a preset pressure and direct flow back to the intake structure to ensure long term pump minimum flow requirements are achieved. Prior to the 1997 timeframe, the recirculation lines experienced excessive cavitation and vibration when the valves were open. This caused failures in instrument lines and welds. To eliminate this problem PSEG developed and installed a modification (DCP 2EC-3468) that relocated/added orifices in the lines and raised the operating set point for the recirculation valves from 130 to 150 psig. The modification also lowered the high pressure alarm setpoint from 150 to 135 psig which essentially resulted in the alarm coming in during low load conditions. This had the effect of raising the system operating pressure to a point that, while within the design pressure of the system piping, created conditions under low load where downstream components were subjected to pressures which slightly exceeded their documented design.

In response to the team's questions, Salem Engineering performed flow modeling for conditions such as a loss of off-site power which would result in the start of a third SW pump and isolation of various turbine building loads. This model revealed that system pressure would exceed the design pressure of several components in the service water system and approach minimum flow conditions for the pumps. The team noted that under the conditions where the high pressure alarm is normally annunciated (lit) during plant operation, the design function of alerting the operators to high pressure conditions would be masked under a postulated transient such as a loss of offsite power (LOOP) and could result in pumps operating under degraded low flow conditions. Additionally, the differential pressure experienced by the recirculation air-operated valves would exceed the differential pressure for which they had been evaluated to open against. During the review of the team's questions in this area, PSEG Engineering determined that the Turbine Generator Area (TGA) Isolation valves, (SW20, SW26) which close on a safety injection signal or loss of offsite power, would also potentially be subjected to higher differential pressures than previously evaluated.

Analysis. The performance deficiency associated with this issue is ineffective design control. The subject modification had not fully evaluated system functionality assuming worst-case conditions that maximize system pressures. Additionally, the capability for the operators to follow their procedural guidance and maintain system pressure below component design pressure of 150 psig had not been adequately evaluated. The finding is more than minor because it was associated with the mitigating system cornerstone attributes of design control and equipment performance and affected the capability of the system to ensure service water pressure would be maintained within previously evaluated design parameters.

Manual Chapter 0609, Appendix A - SDP was used to determine the risk associated with this finding. PSEG performed an evaluation of the impact on components in the system due to existing operation and postulated operation under transient conditions outside design pressure parameters. The SW heat exchangers were built to ASME Code requirements with a design pressure of 150 psig and a hydrostatic test pressure of 225 psig. Analysis performed using a conservative system line-up and design pump curves indicated a header pressure of 188 psig was possible during a LOOP event. This pressure would exist until operators took action to reduce system pressure. The team reviewed PSE&G's operability review of the issue and concurred that it was reasonable to assume the system component heat exchangers would have remained functional considering an increased pressure condition.

PSE&G engineering performed a conservative analyses which simulated a LOOP scenario (third SW pump starts and Turbine building loads isolate) in the SWS computer model and determined that a pump deadheading condition (strong pump/weak pump interaction) would not exist. PSE&G determined that while an individual pump flowrate could fall below the vendor minimum flowrate requirement, the condition would not result in imminent failure of the pump due to the cold-water conditions of this particular scenario. The team determined that PSE&Gs evaluation used reasonable assumptions and appropriate inputs. Additionally, PSE&G reviewed the capability of the TGA isolation valves to close under the higher differential pressures calculated from their model and determined that the valves were still capable of closing. Based on a review of PSE&Gs evaluations, the team concluded that the finding was a design deficiency which was confirmed not to result in the loss of any mitigating system function. Therefore, in accordance with the SDP Phase 1 screening worksheet, the issue was determined to be of very low safety significance (Green).

The team identified that a contributing cause of the finding was related to the cross-cutting area of Problem Identification and Resolution. PSEG had not evaluated and corrected this issue after several previous opportunities had existed to do so. Specifically, during this inspection, the licensee documented in Notification 20179066 that quality assurance personnel had previously written notifications for periods of operation with high service water header pressure (Notifications 20050446, 20050446). Additionally, the team noted that a recent Notification, 20171357, dated December 21, 2003, had again been ineffective in addressing the issue. The team noted that corrective actions associated with the high pressure alarm condition had been closed out and ineffective in addressing the issue or determining the full extent of the concern.

Enforcement. 10 CFR Part 50, Appendix B, Criterion III, requires, in part, that design control measures shall provide for verifying or checking the adequacy of design. Contrary to this requirement, the design which implemented a modification to the set points for the recirculation valves and the control room alarm and installed orifices in the recirculation lines, did not adequately verify the adequacy of the design and evaluate the potential for higher pressure conditions in the service water system and the impact on the design function of the high pressure alarm. During the inspection, PSE&G took actions to alert the operators of the potential for this condition and also took steps to lower SW header pressure in accordance with procedures. Because this issue has

been entered in the licensees corrective actions program (Notifications 20179066 and 201800087) this violation is being treated as a non-cited violation (NCV), consistent with Section VI.A.1 of the NRC Enforcement Policy: NCV 05000272/2004006-01; 05000311/2004006-01, Ineffective design control associated with Service Water design change and ineffective corrective actions relative to SW high pressure conditions.

2. **Control Air Testing**

Introduction. It was identified that the Control Air (CA) quality test program was inadequate. The test program did not verify the quality of air meets standards specified in ANSI/ISA S7.3-1975, as delivered to safety-related significant air loads. This finding was determined to be of very low significance (Green).

Description. During the review of notifications and work orders associated with the CA system, it was noted that this system has a documented history of excessive debris issues, (N20041778, N20054467, N20057159). Also noted was a number of CA loads that have malfunctioned within the past two years due to instrument lines clogged with debris, (N20163560, N20154543, N20153293, N20137366, N20133239). The most recent failure has been a loss of the 23 Chiller due to a redundant control air panel sensing line orifice being clogged with corrosion products (N20163560, Inspection Report 2003009: NCV 50-272/03-09-04).

The debris encountered is normally characterized as a reddish / brown substance. The licensee has placed the CA system in a Maintenance Rule (a)(1) status due to failures of safety related equipment due to poor CA quality, (2003 Q4 CA System Health Report). All air quality test results reviewed from the present test program, which are taken at the exit of the CA dryers and at the air header (1A, 1B, 2A, 2B) drains, recorded satisfactory results. Due to failures of safety-related equipment due to poor CA quality, the team questioned the validity of the test results. The CA quality test program is administered by the licensee using recurring work tasks on a quarterly periodicity.

The team determined through a review of PSE&G's GL 88-14 response that an undocumented change in the committed periodicity (monthly) of CA quality testing had occurred. The licensee had committed to a monthly quality test, but at an undetermined time, changed this to a quarterly test. Concerning the air quality tests, the recurring work task used by the test technician specifies an uncontrolled blowdown at the test connection for an unspecified time, just prior to test equipment hook-up and test data collection. The team questioned the ability to attain a representative air sample at the instrument under these conditions as specified in the standard. The team determined that the methodology and limited scope of the test locations did not meet the intent of the air quality test program and ANSI/ISA S7.3.

The licensee issued a notification (N20180967) to evaluate the periodicity change and initiate a commitment change for the test frequency. Concerning the test program, the licensee has amended a current notification to reevaluate the CA quality test program (N20171082, O70035761-50: 3/12/2004)

Analysis. The deficiency associated with this finding is the failure to have an adequate test program to test the quality of CA, as delivered to safety related air devices. Considering the type of notifications written against CA quality and the significant SA / CA events over the past two years, it was reasonably within the licensee's ability to foresee and correct this deficiency. The finding is greater than minor because it affects the procedure quality attribute of the mitigating systems cornerstone for the CA system. This also affects the equipment performance attribute of the mitigating systems cornerstone for the CA system safety-related loads. However, the issue was determined to have very low safety significance (Green) using Phase One of the NRC Significance Determination Process (SDP) for At-Power Situations, since it did not involve an actual loss of safety function and CA remained operable.

Enforcement. No violation of regulatory requirements occurred. The licensee entered this issue into the Salem corrective action program (N20171082, O70035761-50: 3/12/2004) and initiated actions to review the CA quality test program. (FIN 05000272 /2004006-02; 05000311/2004006-02), Ineffective Control Air Quality Testing.

3. **Control Air pressure and backup for the PORV**

Introduction. The inspectors identified a finding of very low safety significance (Green), that is also a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." Specifically, design calculations performed to verify adequate accumulator air capacity for Low Temperature Overpressure (LTOP) conditions and acceptable system leakage rates used incorrect design inputs. Additionally, these calculations did not incorporate air usage required to pressurize system piping (dead volume) during valve stroking. These non-conservative calculations were referenced during future system evaluations and also used as the basis for operability determinations and alarm set points.

Description. In December 1992, evaluations S-C-CA-MDC-1169, "Comparison of PORV Air Usage Requirements Versus Control Air System Containment Accumulator Capacity" and S-C-CA-MEE-0433-01, "Comparison of Power Operated Relief Valve (PORV) Air Usage Requirements Versus Control Air System Containment Accumulator Capacity," and related calculations were performed. The purpose of the calculations was to determine whether or not the accumulators in the PORV system would hold enough air, at the most limiting conditions, to cycle the PORVs 100 times per Final Safety Analysis Requirements (FSAR) for LTOP Conditions. These calculations resulted in the determination that with a starting pressure of 85 PSIG in the accumulators, there would be sufficient air to stroke the valves the required number of times prior to reaching 77 psig. The 77 psig was the minimum pressure below which the manufacturer would not guarantee valve operation at LTOP conditions.

In addition to the LTOP function, the team reviewed analyses related to the ability of the accumulators to satisfy minimum PORV cycling required for the Inadvertent Safety Injection Event found in the FSAR. Upon reviewing evaluation S-1-RC-MEE-1272, "Evaluation of the Pressurizer PORVs for Inadvertent Safety Injection," (December 1997) the inspectors noted that the previous LTOP calculations (S-C-CA-MDC-1169 and

S-C-CA-MEE-0433-01) were referenced. The inspectors noted that 50.5 ft^3 accumulator volume was used and that a dead volume of 5/8 inch and 1/4 inch in the valve casings were accounted for, which increased air required per valve stroke by 89.2% and 47.4% respectively. These same discrepancies were noted in calculation VP1405.F02-001 performed by another vendor for the same analysis. During this review, the inspectors noted that the 1992 LTOP calculations had used an incorrect end-cap shape to determine the volume of the accumulators. This error resulted in the non-conservative calculated Accumulator volume of 55 cubic feet instead of 50.5 cubic feet. Also, the 1992 LTOP calculations had not incorporated the amount of air required to pressurize the airlines and valve housing (dead volume) prior to valve stroking. In response to the teams questions, PSE&G Engineers determined that the 50.5 ft^3 was the proper volume, and that dead space must be accounted for in these analyses.

The team noted that a subsequent engineering operability determination analysis was performed in 2002 in response to a failed PORV accumulator leak test. The analysis, while referencing the 1992 calculations, used the proper accumulator volume referenced in the 1997 calculation. However, the operability analyses had not accounted for the dead volume. When the team performed a similar evaluation using the same initial accumulator pressure assumption of 85 psig, the proper accumulator size and incorporating the dead volumes recommended at the end of the 1997 calculations (3/16 inch), it was determined that at the conditions specified, the PORVs would only stroke 84 times before reaching the minimum pressure of 77psig. This did not satisfy the design intent of achieving 100 strokes. The inspection team noted that PSE&G engineers had not identified the discrepancies between the 1997 and 1992 design inputs when they had performed the 2002 operability determination.

After noting the aforementioned issues with design calculations and engineering evaluations, the inspection team investigated other possible changes or modifications to the system which may have referenced the erroneous calculations. Design Change # 2EC-3416 performed May 9, 1996, which changed the low air pressure alarm set point for the system to 90 PSIG references the 1992 calculations. This modification was performed prior to the 1997 calculations but was never reevaluated following more up-to-date analyses.

Analysis. The performance deficiency is that calculations of record were nonconservative with respect to the LTOP PORV accumulator design bases evaluation. Additionally, there had been several opportunities (calculations, operability analyses and modifications) to address the discrepancy with the 1992 calculation of record, however the error was neither identified nor corrected. Ultimately, an operability determination was performed which was non-conservative due to the errors. Specifically, the calculations performed in 1992 did not adequately consider system parameters to determine air available for PORV actuation.

This finding is greater than minor, because it was associated with the design control attribute for the PORV mitigating system function. The design calculations formed the bases for subsequent non-conservative operability reviews which affected the objective of adequately ensuring the capability of the PORV accumulators. Because the LTOP

condition is only of concern during periods where the reactor is in cold shutdown, the inspectors evaluated the finding using Appendix G, Shutdown Operations, of NRC IMC 0609, Significance Determination Process (SDP).

The team noted that normal Control Air system pressure was maintained at greater than 100 psig, and there was no evidence that system pressure was below the actual pressure required to show full operability of the valves. Additionally, the initial 1992 calculation was revised by PSE&G using a 90 psig starting point (based on the existing alarm setpoint) vice the previous initial assumption of 85 psig and accounted for dead space and proper accumulator volume. By revising these initial assumptions, the conclusion of functionality for the LTOP condition was not affected. Therefore, the team concluded through the SDP Appendix G evaluation that this issue was of very low safety significance (Green) since the function had always been maintained. The inspectors identified that a contributing cause of the finding was related to the cross-cutting area of Problem Identification and Resolution in that Design Engineering personnel had failed to identify and correct errors and discrepancies between design calculations of record.

Enforcement. 10 CFR 50, Appendix B, Criterion III, Design Control, requires design control measures to be in place that shall provide for verifying or checking the adequacy of design. Contrary to the above, the design of the system, as determined in 1992, was not reviewed for adequacy following updated analysis considerations (1997), and second checks of system analyses (1997 and 2002) were not sufficient to identify discrepancies between analyses and therefore correct inadequate calculations (1992) or reevaluate significant modifications (1996). Because this finding is of low safety significance, and has been entered into PSEG's Corrective action program), this violation is being treated as a NCV, consistent with Section VI.A of the NRC Enforcement Policy: NCV 05000272/2004006-03; 05000311/2004006-03, Calculations of control air accumulator volume were nonconservative with respect to the LTOP PORV accumulator design bases evaluation.

4OA2 Identification and Resolution of Problems (IP 71152)

a. Inspection Scope

The team assessed whether licensee personnel were identifying issues with the SW, control air, and supporting systems at the proper threshold and entering them in the corrective action program. Specifically, the inspectors reviewed a selection of notifications (problem identification documentation), and Quality Assurance (QA) audits to verify that problems were identified, documented, and effectively resolved in a timely manner.

The team also reviewed other records [e.g., licensee event reports (LERs); NRC inspection findings] for causal factors and corrective actions that could be related to issues identified by the team during the current inspection. During this review, the team noted that the significance of operating the SW system in a normally cross-tied mode had been previously identified by the licensee as a fact that should be emphasized in design basis documents and any procedures impacted by this operational alignment (reference: LER 27295025). The team assessed the adequacy of licensee corrective measures involving SW system procedures and operational guidance and discussed the assessment results with the appropriate licensee personnel.

b. Findings and Observations

The inspectors identified that contributing causes of two of the Green findings in this inspection were related to the cross-cutting area of Problem Identification and Resolution; however, no other findings of significance were identified.

4OA4 Cross Cutting Aspects Of Findings

The inspectors identified that a contributing cause of an issue related to ineffective design control for a SW modification was related to the cross cutting area of Problem Identification & Resolution. The licensee had not effectively evaluated a high SW pressure alarm condition although several opportunities had previously existed to do so.

The inspectors identified a contributing cause associated with an issue related to non-conservative calculations of record with respect to the LTOP PORV accumulator design bases evaluation. The contributing cause was related to the cross cutting area of Problem Identification & Resolution in that design engineering personnel had failed to identify and correct errors and discrepancies between design calculations of record.

4OA6 Meetings, Including Exit

Management Meeting

The team presented the inspection results to Mr. D. Garchow and other members of the Salem staff at an exit meeting on March 12, 2004. The team verified that this inspection report does not contain proprietary information.

ATTACHMENT

SUPPLEMENTAL INFORMATION

Key Points Of Contact

J. Balcita	Electrical contact
H. Berrick	Licensing Response Team Back-up
R. Binz	Inservice Testing Program Manager
T. Carrier	Nuclear Safety Supervisor
R. Crispin	Operations Contact
P. Cusik	Notifications for Failures
T. DelGaizo	Salem Contractor
J. Ellis	Senior Nuclear Simulator Instructor
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G. Gardner	Service Water System Engineer
J. Garecht	SRO, Root Cause Team Leader
A. Johnson	Design Engineering - Civil / Structural
K. King	Mechanical, Service Water Design Engineer
P. Kwok	Mechanical Engineer
P. Lindsay	Technical Response Team Lead
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A. Maier	Maplewood Technician
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K. Miller	System Engineer - Control Air
J. Rowey	Design Engineering - Mechanical, Service Water
T. Sikora	System Engineer (Backup) - Control Air
G. Siebold	Design Engineer - Control Air
G. Sith	Supervisor Salem Systems - BOP
R. Villar	Licensing Response Team Lead

List of Items Opened, Closed, and Discussed

Opened and Closed

NCV 05000272; 05000311/2004006-01	Ineffective design control associated with Service Water design change and ineffective corrective actions relative to SW high pressure conditions.
FIN 05000272; 05000311/2004006-02	Ineffective Control Air Quality Testing.
NCV 05000272; 05000311/2004006-03	Calculations of control air accumulator volume were non-conservative with respect to the LTOP PORV accumulator design bases evaluation.

List of Acronyms

AC or ac	Alternating current
CA	Control Air
CFCU	Containment Fan Cooling Unit
CFR	Code of Federal Regulations
DBE	Design Basis Earthquake
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
I&C	Instrumentation and Controls
IALMP	Integrated Air Load Management Program
IST	Inservice Test
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
LTOP	Low Temperature Overpressure
NCV	Non Cited Violation
NRC	Nuclear Regulatory Commission
OE	Operating Experience
P&IDs	Piping & Instrumentation Drawings
PORV	Power Operated Relief Valve
QA	Quality Assurance
SA	Station Air
SDP	Significance Determination Process
SW	Service Water
SWIS	Service Water Intake Structure
TGA	Turbine Generator Area
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
WO	Work Order

List of Documents Reviewed

Design and Licensing Basis Documents:

DE-CB.SW-0047(Q), Configuration Baseline Documentation for the Service Water System, Rev. 7
Detail Specification No. 79-6270, Service Water Intake Structure Sump Pumps, Rev. 0
Salem Generating Station PRA System Notebook, Service Water System (SWS), dated 12/12/03

UFSAR Sections:

3.1, Conformance with NRC General Design Criteria
3.2.1, Seismic Classification
3.6, Protection against Dynamic Effects associated with the Postulated Rupture of Piping
9.2.1, Service Water System
9.2.2, Component Cooling System

Technical Specifications:

TS 3/4.6.2.3, Containment Cooling System
TS 3/4.7.4, Service Water System
TS 3/4.7.10, Chilled Water System - Auxiliary Building Subsystem
TS 3/4.4.3, Relief Valves
TS 3/4.4.2, Safety Valves
TS 3.4.9.3, Overpressure Protection Systems

Plans, Policies and Programs:

DE-PS.ZZ-0011(Q), Seismic II/I Program, Rev. 0
SH.MD-AP.ZZ-0023(Q), Scaffold Program, Rev. 5
SH.MD-DG.AA-0023(Q), Scaffolding Erection, Modification and Dismantling Desk Top Guide, Rev. 2
Salem Service Water System Reliability Improvement Action Plan

Procedures and Surveillance Tests:

S1.OP-AB.SW-0001(Q), Loss of Service Water Header Pressure, Rev. 11
S1.OP-AB.SW-0002(Q), Loss of Service Water - Turbine Header, Rev. 8
S1.OP-AB.SW-0003(Q), Service Water Bay Leak, Rev. 5
S1.OP-AB.SW-0004(Q), Loss of Service Water During Service Water Header Outage, Rev. 3
S1.OP-AB.SW-0005(Q), Loss of All Service Water, Rev. 0
S2.OP-PT.SW-0001(Q), Flushing of Emergency Auxiliary Feed Supply Line, Rev. 7
S2.OP-ST.SW-0004(Q), Inservice Testing - 24 Service Water Pump, Rev. 23
S2.OP-ST.SW-0006(Q), Inservice Testing - 26 Service Water Pump, Rev. 20
S2.OP-ST.SW-0016(Q), Inservice Testing Service Water Accumulator Discharge Valves, Rev. 0
S1.OP-SO.SW-0006(Q), Service Water Accumulator Operation, Rev. 3
SC.OP-SO.SW-0008(Q), Service Water Test-Line Cross Connect Alignment, Rev. 2
S1.OP-SO.SW-0001(Q), Service Water Pump Operation, Rev. 18
S1.OP-SO.SW-0005(Q), Service Water System Operation, Rev. 28
S1.OP-ST.SW-0011(Q), Inservice Testing Service Water 1SW26 Valve Modes 5-6, Rev. 5
SH.OP-DG.ZZ-0011, Station Seasonal Readiness Guide, Rev. 1
S1-OP-AR.ZZ-0002(Q), 11 SW HDR PRESS HI response card
S2.OP-PT.CA-0005(Q), PORV Accumulator Check Valve Backleakage Test, Rev. 1
S2.OP-DL.ZZ-0003(Q), Primary Plant Log - 01/26/04, 02/02/04, 02/09/04
SC.MD-GP.ZZ-0200(Q), MOVATS checkmate II Check Valve Analysis System, Rev. 0
S1.OP-PT.CA-0001(Q), Emergency Control Air Compressor Functional Test, Rev. 13 (performed as SAP Order # 30095997/ # 30070004 / # 300975510 / # 300256800 / # 300951020 / # 30075982 / # 30099115)
S1.OP-PT.SW-0016(Q), 11 Component Cooling Heat Exchanger Heat Transfer Performance Data Collection, Rev. 14 (performed October 10-11, 2002)
S2.OP-PT.CA-0001(Q), Emergency Control Air Compressor Functional Test, Rev. 14 (performed as SAP Order # 30091665/ # 30096393 / # 30093958 / # 30100403)
S2.OP-PT.SW-0007(Q), Service Water Biofouling Monitoring Containment Fan Coil Units, Rev. 12 (performed December 22-23, 2003)
NC.MD-AP.ZZ-0052(Q), Foreign Material Exclusion, Rev. 0
SC.OP-AB.ZZ-0003(Q), Component Biofouling (Action Level II), Rev. 8
SC.OP-SO.ZZ-000(Q), Component Biofouliing (Action Level I), Rev. 1
SC.IC-CM.CA-0001(Q), Maintenance of Redundant Air System Valves and Actuators, Rev. 9
SC.OP-SO.CA-0001(Q), SBO Diesel Control Air Compressor, Rev. 10

SC.OP-PT.CA-0001(Q), SBO Diesel Control Air Compressor Test, Rev. 9
S-C-A300-MGS-0002, Cleaning and Cleanness Control Internal Surfaces, Rev. 2
S1.OP-DL.ZZ-0006(Q), Primary Plant Log, Rev. 37
S1.OP-AB.CA-0001(Q), Loss of Control Air, Rev. 11
S2.IC-DC.CA-0001(Q), Calibration of Redundant Air System Panels, Rev. 4
SH.OP-AP.ZZ-0188(Q), Operability Assessment and Equipment Control Program, Rev. 13
MP S1-09706 (SAP), Quarterly CA Air Quality Recurring Task (Aux Bldg Low Point Drains)
MP S1-11602 (SAP), Quarterly CA Air Quality Recurring Task (After CA Dryers)

Modifications:

2EC-3416 Setpoint Calculation and Change of Control Air Pressure Switch and Auxiliary Air Low Pressure Alarm for Unit 2 PORVs, Rev. 1
80001108 Manual/Automatic Purge and Pressure/Vacuum Relief Isolation with both Trains of the Solid State Protection System Out-of-Service, Rev. 0
80008507 Modification of PORV Control Circuits, Rev. 1
80008741 2PR1 and 2PR2 Control Circuit Modification, Rev. 1
80031928 Change the Set-point of 1PD-3399 and 1PD-3401 - High Service Water Header, Rev. 1
80045584 Salem Unit 2 Service Water and EDG Circuit Changes - Hot Shorts, Rev. 2
S-C-SW-MEE-1236 GL-96-06 Modifications SBO Evaluations, Rev. 0

Drawings / Change Notices:

205242-SIMP-0, SH. 1, No. 1 Unit Service Water Simplified P&ID, dated 4/8/99
205242-SIMP-0, SH. 2, No. 1 Unit Service water Simplified P&ID Nuclear Header Loads, dated 4/8/99
SW-1, Service Water Nuclear (for training use only), Rev. 0, dated 11/20/98
SW-1-2B, SH. 4, Auxiliary Building Service Water Piping - EL. 84'0, Rev. 44, dated 7/11/96
226131D4153-12, SH. 88, No. 1 Unit Service Water Piping Hangers, dated 9/11/85
226131D4153-20, SH. 2, No. 1 Unit Service Water Piping Hangers, dated 6/11/96
231477-L-16, SH. 88, No. 1 Unit Aux. Bldg. Service Water Hangers, dated 6/1/02
1414912, Diesel-Driven Air Compressor Schematic, Electrical Control
203001-A-8789, 4160V Group Buses One Line Diagram - Unit 1, Rev. 29
203002-A-8789, 4160V Vital Buses One Line Diagram - Unit 1, Rev. 34
203003-A-8789, 460V & 230V Vital & Non-Vital Bus One Line Control Diagram - Unit 1, Rev. 44
203007-A-8789, 125VDC One Line Diagram - Unit 1, Rev. 28
203061-A-8789, 4160V Vital Buses One Line Diagram - Unit 2, Rev. 32
203062-A-8789, 4160V Group Buses One Line Diagram - Unit 2, Rev. 27
203063-A-8789, 460V & 230V Vital & Non-Vital Bus One Line Control Diagram - Unit 2, Rev. 34
203164-B-9775, No. 1 & 2 Emergency Control Air Compressors Schematic, Rev. 19
203570-B-9777, Containment Ventilation No. 11 & 21 Fan - Coil Units Schematic, Rev. 32
203822-ABL-584, Service Water traveling Screen Wash Schematic, Rev. 19
203828-B-9773, Sh 1-2, Service Water Pump (Nos. 15 & 21) DC Schematic - Unit 1
203829-B-9773, Sh 1-2, Service Water Pump (Nos. 15 & 21) DC Schematic - Unit 2
203830-B-9774, Sh 1-2, Service Water Pump (Nos. 13 & 23) DC Schematic - Unit 1
203832-B-9774, Sh 1-2, Service Water Pump (Nos. 11 & 25) DC Schematic - Unit 1
203834-B-9774, Sh 1-2, Service Water Pump (Nos. 16 & 22) DC Schematic - Unit 1
203836-B-9774, Sh 1-2, Service Water Pump (Nos. 14 & 24) DC Schematic - Unit 1
203838-B-9773, Sh 1-2, Service Water Pump (Nos. 12 & 26) DC Schematic - Unit 1
203886-B-9786, Isolation Valve No 11SW20 Schematic - Unit 1, Rev. 16
203887-B-9786, Isolation Valve No 13SW20 Schematic - Unit 1, Rev. 14
203888-B-9786, SW Intake 1B 230V, Vital Bus Isolation Valve 1SW26 Schematic - Unit 1, Rev. 15
203889-B-9786, No. 11, 12 & 13 Service Water Pump Strainers Schematic - Unit 1, Rev. 17

203893-B-9786, Tie Valve No 11SW17 Schematic - Unit 1, Rev. 11
203894-B-9786, Isolation Valve No 12SW20 Schematic - Unit 1, Rev. 9
203895-B-9786, Tie Valve No 12SW17 Schematic - Unit 1, Rev. 8
203896-B-9786, Isolation Valve No 14SW20 Schematic - Unit 1, Rev. 9
205236-A-8761, P&ID Auxiliary Feedwater, Rev. 51
205242-A-8761, Sh. 1-7, P&ID Service Water Nuclear Area - Unit 1
205243-A-8761, Sh. 1-3, P&ID Auxiliary Building Control Air - Unit 1
211323-A-1447, Unit 1SW system - No.11Header Nuclear Area Instrument Schematic, Rev. 35
211351-B-9511, Unit 1 Control Area 1CDE 28 VDC Distribution Cabinet Wiring Diagram, Rev. 10
211357-B-9511, Sh 1-2, 28 Volt DC One Line Diagram - Unit 1
211364-B-9511, Unit 1 Control Area No. 1A 115VAC Vital Instrument Bus Wiring Diagram, Rev. 23
211370-A-8859, Sh 1-2, 115V Control System One Line - Unit 1
211627-B-9532, Sh 1, No. 1A, 1B, 1C Vital Buses Safeguard Equipment Control System Schematic, Rev. 12
212880-B-9764, No. 2 Station Air Compressor Schematic - Unit 2, Rev. 10
212881-B-9764, No. 2 Station Air Compressor Schematic - Unit 2, Rev. 6
212890-B-578, No. 1 Station Air Compressor Schematic - Unit 1, Rev. 7
212891-B-9765, No. 1 Station Air Compressor Schematic - Unit 1, Rev. 7
218460-ABL-578, Emergency Control Air Dryer Schematic - Units 1 & 2, Rev. 4
218663-BL-4037, Component Cooling Pump Room Coolers Schematic, Rev. 6
220942-B-4038, Sh. 1, No 11 Component Cooling Heat Exchanger Inlet Control Valve Schematic, Rev. 18
220977-B-9793, Penetration Area SW System Stop Valve 11SW22 Schematic - Unit 1, Rev. 9
220978-B-9793, Auxiliary Building SW System Stop Valve 11SW21 Schematic - Unit 1, Rev. 8
220979-B-9793, Penetration Area SW System Tie Valve 11SW23 Schematic - Unit 1, Rev. 10
220980-B-9793, Penetration Area SW System Tie Valve 12SW23 Schematic - Unit 1, Rev. 10
220981-B-9793, Penetration Area SW System Stop Valve 12SW22 Schematic - Unit 1, Rev. 10
223129-A-9556, SW System No. 12 Header - Nuclear Area Instrument Schematic - Unit 1, Rev. 29
223696-BL-4042, No. 1A & 2A Diesel Generators Blocking Relay and Valve Indication Schematic, Rev. 8
223720-A-1404, 125VDC One Line Diagram - Unit 2, Rev. 31
231062-A-1436, Circulating Water Intake Sodium Hypochlorite System - SW Schematic, Rev. 10
232309-A-1447, Service Water Pumps Instrument Schematic, Rev. 30
232542-B-9796, Control Air Headers 1A & 2A Isolation Valves Schematic, Rev. 9
232544-B-9796, Control Air Headers 1B & 2B Isolation Valves Schematic, Rev. 10
236250-B-9621, Sh 1-2, Vital Buses Safeguard Equipment Control System Schematic - Unit 1
236255-B-9621, Sh 1-2, Vital Buses Safeguard Equipment Control System Schematic - Unit 1
236256-B-9621, Sh 1-2, Vital Buses Safeguard Equipment Control System Schematic - Unit 1
236259-B-9621, Sh 1-2, Vital Buses Safeguard Equipment Control System Schematic - Unit 1
236261-B-9621, Sh 1-2, Vital Buses Safeguard Equipment Control System Schematic - Unit 1
239969-B-9649, No. 1 & 2 Emergency Control Air Compressor Failures and Air Header Isolation Valves Logic Diagram, Rev. 3
241107-A-9661, Sh. 1, Pressurizer Power Relief & Stop Valves & Overpressure Protection System Channel I Schematic, Rev. 13
242882-A-9678, Sh. 1, Pressurizer Power Relief & Stop Valves & Overpressure Protection System Channel II Schematic, Rev. 14
265025-A-2136, 13 kV Substation South One Line Control Diagram, Rev. 2
601234-B-9528, Unit 1 - Auxiliary Bldg. Control Area 1E-460V Bus One Line Diagram, Rev. 14
601393-B-9535, Unit 2 - Auxiliary Bldg. Control Area 2E-460V Bus One Line Diagram, Rev. 16
605357-B, Sh. 1, Service Water Accumulator Tanks Make-up Pumps 1SWE126 & 1SWE128 Schematic - Unit 1, Rev. 0

605363-B, 4160V Vital Bus 1A UV & Controls for Service Water Accumulator Tank 1SWE125 Discharge Valves - Unit 1, Rev. 0
605364-B, 4160V Vital Bus 1B UV & Controls for Service Water Accumulator Tank 1SWE127 Discharge Valves - Unit 1, Rev. 0
610546-D, 11 Service Water Component Cooling Heat Exchanger Inlet Valve Control, 1FA3891Z Loop Diagram, Rev. 1
Print #: 145041, Aux. Bldg. & Reactor Containment Control Air Piping (LBPD)
Print #: 307171, #23 Control Air: Large Bore Pipe Details (LBPD)
Print #: 307172 , #23 Control Air: Large Bore Pipe Details (LBPD)
Print #: D-338834, 1500# Control Valve
Print #: D-353176, Model D-100-160-2 ½ RA actuator converted to D1000 Style Actuator
SC.IC-PM.RC-0001(Q), Copes Vulcan Model D-1000-160-2 ½ Diaphragm Actuator
Print #: C-338326, Diaphragm actuator model D100-160-2 ½ RA
212598D 4133-7, Sheet 3A, Salem No. 1 & 2 Units Service Water Pump Piping Hangers, Rev. 7
223130B 9556-15, Salem No. 1 & 2 Units Redundant Air Supply, Rev. 15
601814A 1375-4, Station No. 1 Unit Service Water System Panel 740, Rev. 4
Design Change No. 1EC-3685, 11 SW Pump Strainer Filter Media Size Change, Rev. 1
ECA 80002087, 22 Service Water Pump Strainer, Rev. 0
316516, Diesel Driven Air Compressor, Rev. 1
203164B9775, IC & 2C-460V Vital Buses, 1 & 2 ECAC, Rev. 19
203165B9775, IC & 2C-460V Vital Buses, 1 & 2 ECAC, Rev. 11
205243A8761, No.1 Unit - Aux Bldg Control Air, Sheet 1, Rev. 43
205243A8761, No.1 Unit - Aux Bldg Control Air, Sheet 2, Rev. 38
205243A8761, No.1 Unit - Aux Bldg Control Air, Sheet 3, Rev. 33
205247A8761, No.1 Unit - React.Cont. & Penetration Area Control Air, Sheet 1, Rev. 47
205247A8761, No.1 Unit - React.Cont. & Penetration Area Control Air, Sheet 2, Rev. 56
205247A8761, No.1 Unit - React.Cont. & Penetration Area Control Air, Sheet 3, Rev. 44
205343A8763, No.1 Unit - Aux Bldg Control Air, Sheet 1, Rev. 38
205343A8763, No.1 Unit - Aux Bldg Control Air, Sheet 1, Rev. 41
205347A8763, No.2 Unit - React.Cont. & Penetration Area Control Air, Sheet 1, Rev. 40
205347A8763, No.2 Unit - React.Cont. & Penetration Area Control Air, Sheet 2, Rev. 38
205347A8763, No.2 Unit - React.Cont. & Penetration Area Control Air, Sheet 3, Rev. 33
205678A8939, No.1 & No.2 Aux Bldg Aux Feedwater Pump Panel 207, Rev. 26
211319A9508, Station Air Compressors and Control Air Dryers, Rev. 21
211319B9508, No.1 & No.2 Station Air Compressors and Control Air Dryers, Rev. 7
211322B9508, No.1 Emergency Control Air Compressor, Rev. 22
240675B9657, No.2 Unit - Emergency Control Air Compressor, Rev. 20
601233B9528, No.1 Unit - Aux Bldg Control Area 1C-460V Vital Bus One-Line, Rev. 18
601392B9535, No.2 Unit - Aux Bldg Control Area 2C-460V Vital Bus One-Line, Rev. 21
604495A1314, No.2 Unit - Yard Area Control Air - Station Blackout, Rev. 1

Calculations:

A-0-ZZ-ECS-0089(001), Load Management System, Rev. 5
ES-9.002, Salem Generating Statio Units 1 & 2 EDG Loading, Rev. 4, and outstanding changes
ES-13.006(Q), Vital AC Coordination Update Assessment
ES-15.008(Q), Salem Unit 1 & 2 Degraded Grid Study, Rev. 4
ES-15.009(Q), Essential Controls Inverter Load Study for Units 1 & 2, Rev. 6
VTD-317083, Johnston Pump Company Performance Test Set-up and Test Data, dated 3/8/94
VTD- 322354, Seismic Analysis of Valve and Actuator Assemblies for Nuclear Service, Report ES-107, Rev. 2
WS-C-SW-MEE-1162, Service Water System Failure Modes and Effects Analysis, Rev. 4
S-1-SW-MDC-1323, Equal Signal Press/Control of Valves SW122 and SW127, Rev. 0
S-1-SW-MDC-1332, Equal Signal Pressure/Control of Valves 12SW379, 12SW380, and 12SW383, Rev. 0
S-1-SW-NDC-1225, Qualification of Masoneilan Regulator on Panel 827, Rev. 0
S-1-SW-SDC-1293, Verify Seismic Adequacy of Non-Q SOV Mountings in Safety-Related Control Panels 361-1A & 361-1B, Rev. 0
S-2-SW-MDC-1304, Control Air Characterization of Valves SW122 and SW-127
S-1-SW-MDC-0466, Service Water Pump Full Flow Test Line, Rev. 1, dated 3/6/01
S-C-M600-NDC-041, Service Water System Interconnect Calculations, Salem U 1 & 2, Rev. 0
S-C-SW-MEE-1162, SW System Failure Modes and Effects Analysis, Rev. 4, dated 10/1/01
S-C-SW-MDC-1350, Service Water System MODE OPS Analysis, Rev. 4, dated 8/14/03
6S1-2023, Design of Tornado Missile Shielding for SW Accumulator Tanks, Rev. 0, dated 4/7/98
6S2-2005, Design of Tornado Missile Shielding for SW Accumulator Tanks, Rev. 0, dated 8/5/98
S-C-SW-MDC-1068, Service Water System Design Basis Temperature, Rev. 3
S-C-SW-MDC-1447, CC Heat Exchanger SW Restriction Orifice Calculation, Rev. 0
S-C-SW-MEE-1449, Change SW Pump Design Minimum Performance from 240' to 265' TDH at 10875 gpm, Rev. 1
S-C-SW-MDC-1700, Service Water Storage Tank Process Parameters, Rev. 1
S-C-CA-MEE-0433-01, Comparison of Power Operated Relief Valve (PORV) Air usage requirements versus Control Air system containment accumulator capacity
S-C-CA-MDC-1169, Evaluation of Pressure Decay of PORV Accumulators and Check Valves
VP1405.FO2-001, Available PORV cycles for Mitigation of Inadvertent SI
S-1-RC-MEE-1272, Unit 1 Evaluation of Pressurizer PORVs of Inadvertent Safety Injection, Rev. 0
Order #: TS980801170. Process Review of Request for PORV check valve leak limit increase.
S-C-CA-MDC-0462, Control Air System Load Supply, Rev. 0
S-C-CA-MDC-1639, Integrated Air Load Management Program (IALMP) Update, Rev. 0
S-C-SW-MDC-1317, Service Water System Hydraulic Model, Rev. 6
S-C-SW-MDC-1351, Service Water Pump NPSH Calculation, Rev. 2
S-C-SW-MDC-1500, Bifouling (sic) Monitoring and Trending Calculation, Rev. 1IR1
S-C-SW-MEE-0953, Service Water Traveling Screen Classification Evaluation, Rev. 1
S-1-CC-MDC-1817, Component Cooling System Thermal-Hydraulic Analysis - U 1, Rev. 4
S-C-CA-MDC-0526, Station Air and Control Air Systems Air Receivers Design Basis and Capacity Verification, Rev. 0
S-C-CA-MDC-0549, Station Air and Control Air Systems Analytical Flow Model and Test, Rev. 0

Evaluations:

10 CFR 50.59 Safety Evaluation, S97-260, Generic Letter 96-06 Modifications, dated 8/11/97
Safety Evaluation S-1-M915-MSE-243, Salem Unit 1 Chiller System Loads, dated 1/20/84
Safety Evaluation S-C-M600-MSE-0374, Interconnection of the Service Water Headers for the Chiller Condensers, Rev. 0, dated 12/10/85
S-C-SW-MEE-1162, Service Water System Failure Modes and Effects Analysis, Rev. 4
S-C-SW-MEE-0645, Service Water System Response Times, Rev. 0
S-C-M600-MSE-0214, Operation with 90 deg F River Temperature
H-1-BCXX-MEE-0214-0, Engineering Evaluation for Snubbers and Compensating Struts
PSBP 322359, Evaluation of AOV SW57 & SW223 Actuator Sizing, Rev. 3
Equivalency Replacement Evaluation Change No. 80009391, CP Rev. No. 0; Model A, 20" Auto Self-Cleaning Type Pump Strainer Filters

Engineering Change Requests:

Change No. 80055046, Replace Salem SW39 Valve/Actuator Assemblies with Equivalent Assemblies, Rev. 1, dated 9/8/03
2EC-3468, Resolving Service Water Control Valves 2SW308/2SW311 Issues

System Health Reports:

Salem Unit 1 Service Water System Health Status for period 09/01/2003 to 12/15/2003
Salem Unit 1 Service Water System Health Status for period 06/01/2003 to 08/31/2003
Salem Unit 2 Service Water System Health Status for period 09/01/2003 to 12/15/2003

Notifications:

20050446	20061441	20095624	20120828	20178952
20052231	20061968	20096789	20121949	20178998*
20052555	20062510	20096790	20125678	20179007*
20052712	20063017	20097941	20131545	20179054
20053201	20063257	20097950	20133239	20179066*
20054467	20063635	20098786	20137216	20179141*
20056745	20063754	20100614	20140156	20180087*
20057159	20064562	20101884	20143623	20180619*
20057981	20065380	20103948	20154543	20180711*
20057982	20066438	20104047	20163560	20180842*
20057984	20071181	20108864	20168954	20180872*
20057985	20073907	20109730	20171082	20180873*
20057993	20075853	20112731	20171357	20180874*
20057994	20086274*	20113521	20176608	20180967*
20059086	20088074	20118616	20176646*	20181167*
20059238	20091815	20119466	20176647	20181277*
20059712	20093713	20120736	20176739	20181332*
20061155	20094537	20120785	20178951	

(Note " * " indicates Notification issued during inspection)

Work Orders:

30000950 Calibration of14 SW Pump Auxiliary Devices, dated 1/12/2004
30068367 Calibration of SW Pressure Control Instrument Loop, 2PA9637C, I, and Z, dated 3/24/03
30075820 Calibration of SW Pressure Control Instrument Loop, 2PA9638C, I, and Z, dated 8/12/03
30094309 SBO Diesel Control Air Compressor Test, dated 11/9/03
30095602 SBO Diesel Control Air Compressor Test, dated 12/7/03
30096814 SBO Diesel Control Air Compressor Test, dated 1/7/04
60035707 Calibration of 11 Service Water Recirculation Pressure Control Loop, dated 9/20/03
800106094 Calibration of PORV Control Air Aux Switches 1PD-9859 and 1PD-9862, dated 10/16/02
950919128 Calibration of SW Pressure Control Instrument Loop, 1PA9637C, I, and Z, dated 9/25/95
950928202 Calibration of SW Pressure Control Instrument Loop, 1PA9638C, I, and Z, dated 12/5/95
890306163 1PR1&1PR2-Perf Funct.Test OP-TEMP-8904-1
930930014 Ops to Perform PORV Check Valve Testing - 05/10/1993
941119014 ISI to Perform PORV Check Valve Testing - 12/05/1994
941119082 ISI to Perform PORV Check Valve Testing - 11/29/1994
960607020 ISI to Perform PORV Check Valve Testing - 08/21/1996
981006044 ISI to Perform PORV Check Valve Testing - 07/30/1998 and 08/01/1998
990410126 Accumulator Check Valve replacement (leak) - 05/01/1999
990409214 Accumulator Check Valve replacement (leak) - 05/05/1999
Work Order Shop Papers Order 30012415; 1SWE26 / Open & Inspect WTR.Boxes / NRC 89-13 (performed April 13 -May 18, 2001)

Scheduled Maintenance Activities:

Maintenance Item S1402487; S1SW-1PD285 No. 11 Service Water Pump Discharge Strainer DP Switch Nuclear Preventative Maintenance (PM Planned Maintenance)
Maintenance Item S2402497; S2SW-2PD285 No. 21 Service Water Pump Discharge Strainer DP Switch Nuclear Preventative Maintenance (PM Planned Maintenance)

Plant Maintenance Orders:

50003706-0010 Accumulator Leakage Test Data - 10/19/1999
50003708-0010 Accumulator Leakage Test Data - 10/11/2000
50009811-0010 Accumulator Leakage Test Data - 04/24/2001
50029171-0010 Accumulator Leakage Test Data - 04/09/2002
50036139-0010 Accumulator Leakage Test Data - 10/14/2002
50052536-0020 Accumulator Leakage Test Data - 10/31/2003

Completed Inservice Testing - Surveillance Tests:

S2.OP-ST.SW-0010(Q), Inservice Testing Containment Fan Cooler Unit (CFCU) 24, Rev. 17, dated 1/15/04 and 23SW223 Retest
S1.OP-ST.SW-0016(Q), Inservice Testing Service Water Accumulator Discharge Valves, Rev. 1, dated 11/4/03, for 11SW534 & 11SW535
Salem Inservice Testing Program Basis Data Sheets & Trend Data for valves 11, 12, & 13SW39 and 21, 22, & 23SW39, dated 2/25/04
Salem Inservice Testing Program Basis Data Sheets for valves 12 & 13SW20 and Trend Data for valve 21SW20, dated 2/26/04

Salem Inservice Testing Program Basis Data Sheets & Trend Data for valves 11, 12, 13 &14SW58; 11, 12, 13 & 14SW72; 22, 23 & 25SW58; and 22, 23 & 25SW72, dated 2/23/04
Salem Inservice Testing Program Basis Data Sheets & Trend Data for valves 1SW26 & 2SW26, dated 2/26/04, with the Valve Refueling Outage Justification, dated 6/1/02
S1.OP-ST.SW-0010(Q), Containment Fan Cooler Unit Service Water Valves, Rev. 12, dated 11/30/03, 12/03/03, 12/17/03, 01/05/04, 01/24/04, and 01/28/04
S1.OP-ST.PZR-0003(Q), Pressurizer PORV and Spray, and Reactor Head Vent Valves, Rev. 4, dated 10/29/02 and 11/04/02
S1.OP-ST.MS-0002(Q), Main Steam and Main Feedwater Valves, Rev. 8, dated 10/31/02, 11/02/02, 11/04/02, and 11/06/02
S1.OP-ST.MS-0003(Q), Steam Line Isolation and Response Time Testing, Rev. 7, dated 11/02/02 and 08/02/03
S1.OP-ST.AF-0004(Q), Auxiliary Feedwater Valves, Rev. 9, dated 04/09/03 and 07/01/03, Rev. 10, dated 09/11/03 and 12/11/03, and Rev. 1, dated 01/29/04
S1.OP-ST.AF-0003(Q), 13 Auxiliary Feedwater Pump, Rev. 27, dated 05/24/03, Rev. 28, dated 08/16/03 and 11/07/03, and Rev. 29, dated 01/29/04
S2.OP-ST.PZR-0003(Q, Pressurizer PORV and Spray, and Reactor Head Vent Valves), Rev. 7, dated 04/29/02, 04/18/03, and 11/04/03
S2.OP-ST.AF-0003(Q), Auxiliary Feedwater Pump, Rev. 37, dated 09/12/03 and 11/21/03
S2.OP-ST.AF-0004(Q), Auxiliary Feedwater Valves, Rev. 11, dated 11/17/03, Rev. 12, dated 01/09/04 and 01/31/04
S2.OP-ST.MS-0002(Q), Main Steam and Main Feedwater Valves, Rev. 15, dated 11/13/03
S2.OP-ST.MS-0003(Q), Steam Line Isolation and Response Time Testing, Rev. 14, dated 05/16/02 and 11/26/03

Vendor/Industry Documents:

316469-01 Ultra Air, Operating & Instruction Manual UHR Series Regenerative Desiccant Dryers, Rev. 1
Johnston Pump Company Letter to PSE&G regarding short and long term minimum flow requirements, dated August 28, 1995
VTD 135757, Lunkenheimer, Assembly of Air Operated Valve, Rev. 2
VTD 300086, Control Associates Fisher Controls, Type 164A Switching Valve M-139, Issue 4
VTD 320354, Seismic Qualification Documentation for ECAC, dated 02/14/1992
VTD 323704, Lunkenheimer, Air Actuator, Rev. 1

Logs:

SC.OP-DL.ZZ-0008(Q), Rev. 27, Circulating/Service Water Log, dated 12/14/03
SH.OP-AP.ZZ-0110(Q), Rev. 8, Control Room Narrative Logs, for Unit 1 dated 11/3/03, 1/1/04, 1/30/04 and 2/13/04-2/15/04; and for Unit 2 dated 12/6/03, 1/3/04, 1/31/04 and 2/13/04-2/15/04

Design Change Packages:

1EC-3685, 11 SW pump strainer filter media size change, Rev. 1
1EC-3184, Modifications to SBO Backup Air Compressor, Rev. 3
1EC-3176, CA Dryer Installation, Rev. 1,
1EC-3505, Control Area A/C System Upgrade, Rev. 0
1EC-3651, SA Compressor Control Modification, Rev. 2
1EC-3668, Install Bypass Line around SW223, Rev. 0

Engineering Analyses:

S-C-VAR-NEE-1117, Rev. 1, GL 89-10 closure summary for MOV program
S-2-RC-MEE-1108, Rev. 1, Salem Unit 2 Evaluation of the Pressurizer PORVs
S-1-VAR-NEE-1266, Rev. 1, GL 89-10, Closure summary for MOV program as implemented
S-2-SW-MDC-1555, Rev. 0, SW Pump Minimum Recirculation Pressure Controller

Miscellaneous:

System Description SD-M946, Rev. 0, Containment Penetration Cooling
Pump Performance Documentation for PSE&G VTD No. 317083, PS Rev. 3, dated April 4, 1997
Table 9-2A. Salem IST Program Basis Data Sheets- 1SW 185, SW chg pump clr 11
PSE&G Detail Design Specification, S-C-SW-MDS-0300-2, Service Water Pumps
UFSAR Chapter 15 DB/LB System Validations, SC.DE-BD.CA-0001, Control Air System
44215-1, Seismic Simulation Test Report for Various NEMA 12 Enclosures, Components, and ASCO Solenoid Valves, dated 12/16/78
Air Compressor Performance Monitoring & Trending Report, dated 02/24/2004
Inservice Testing Program test-result Summary Report for selected valves (Both Units), dated 03/08/2004
Impact Assessment of design changes banked against S-C-CA-MDC-0462, dated 03/09/2004
Impact Assessment of design changes banked against S-C-CA-MDC-1639, dated 03/08/2004
LR-N96298, Change to Commitment for Planned Maintenance on the ECAC, dated 09/13/1996
VTD 320354, Seismic Qualification Documentation for ECAC, dated 02/14/1992
CA Air Quality result Summary for past two years via SAP, dated 03/03/2004
ANSI/ISA-S7.3-1975, Quality Standard for Instrument Air, dated 11/16/1981
ANSI/ISA-7.0.01-1996, Quality Standard for Instrument Air, dated 11/12/1996
Salem Risk-Informed Inspection Notebook, USNRC, Revision 1
Information Notice 81-38, Potentially Significant Equipment Failures Resulting from Contamination of Air-Operated Systems, dated 12/17/1981
88-14, Instrument Air Supply System Problems Affecting Safety-Related Equipment, dated 08/08/1988)
NRC Generic Letter 96-06: Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions
NLR-N89062, Response to NRC Generic Letter 88-14
NLR-N90123, Supplemental information NRC Generic Letter 88-14
NLR-N90021, Response to NRC Generic Letter 89-13
NRC Generic Letter 90-06: Resolution of Generic Issue 70, "Power-Operated Relieve Valve and lock valve reliability," and Generic Issue 94,"Additional Low-Temperature Overpressure Protection for Light-Water Reactors," Pursuant to 10 CFR 50.54(f)
Licensing Requests, LR-N970362 & LCR S97-05, Supplemental Information for Exigent Request for Change to Technical Specifications Chilled Water System - Auxiliary Building Subsystem, dated 6/12/97

Nuclear Training Center Lesson Plans:

NOS05SW0NUC-05,Service Water - Nuclear Header, dated 5/22/03
NOS05SWTURB-03, Service Water - Turbine Header, dated 5/22/03
NOS05SWBAYS-05, Service Water System - Intake Bays, dated 10/24/03