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

November 14, 2011

Mr. T. Preston Gillespie, Jr.
Site Vice President
Duke Energy Carolinas, LLC
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION - COMPONENT DESIGN BASES INSPECTION - NRC INSPECTION REPORT 05000269/2011010, 05000270/2011010, AND 05000287/2011010

Dear Mr. Gillespie:

On September 30, 2011, U. S. Nuclear Regulatory Commission (NRC) completed an inspection at your Oconee Nuclear Power Plant. The enclosed inspection report documents the inspection results, which were discussed on September 29, 2011 with you 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 team reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents six NRC-identified findings of very low safety significance which were determined to be violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the NRC Enforcement Policy because of their very low safety significance and because they were entered into your corrective action program. If you contest these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Oconee Nuclear Station. In addition, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region II, and the NRC Resident Inspector at the Oconee Nuclear 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 Web site at http://www.nrc.gov/reading-rm/adams.htm (the Public Electronic Reading Room).

Sincerely,

/RA/

Binoy B. Desai, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos.: 50-269, 270, 287
License Nos.: DPR-38, 47, 55

Enclosure: Inspection Report 05000269/2011010, 05000270/2011010, AND 05000287/2011010

w/Attachment: Supplemental Information

cc w/encl: (See page 3)

the 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/

Binoy B. Desai, Chief
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Docket Nos.: 50-269, 270, 287
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w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-269,270,287

License Nos.: DPR-38, 47, 55

Report No.: 05000269/2011010, 05000270/2011010, AND 05000287/2011010

Licensee: Duke Energy Carolinas, LLC

Facility: Oconee Nuclear Station

Location: 7800 Rochester Highway
Seneca, SC 29672

Dates: August 29 – September 30, 2011

Inspectors: P. Higgins, Senior Reactor Inspector (Lead)
L. Mellen, Senior Inspector
J. Hamman, Reactor Inspector
T. Lighty, Reactor Inspector
M. Yeminy, Contractor
G. Skinner, Contractor
M. Riley, Trainee

Approved by: Binoy B. Desai, Chief
Engineering Branch 1
Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000269, 270, 287/2011010; 8/29/2011 – 9/30/2011; Oconee Nuclear Station; 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. Six findings of very low significance (Green) were identified during this inspection. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). The cross-cutting aspects were determined using IMC 0310, "Components Within the Cross Cutting Areas". Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review.

NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform a pressurizer safety valve and pressurizer Power Operated Relief Valve (PORV) analysis that included input parameters consistent with current plant design bases. The licensee entered the issue into their corrective action program as PIP O-11-11449 and performed additional analyses and evaluations to assure operability of components.

  The licensee's failure to perform a calculation determining the adequacy of the pressurizer safety valves, PORV, and downstream piping at the design basis accident pressure is a performance deficiency (PD). This PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of equipment performance to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, the pressurizer safety valves, pressurizer PORV and downstream piping operate to mitigate the overpressure transient caused by the design basis rod ejection accident. However, these valves and associated piping were analyzed at a lower pressure than the pressure determined in the (Updated) Final safety Analysis Report (UFSAR) Chapter 15 analysis for that accident creating a reasonable doubt that this equipment would operate properly during that design basis accident. Failing to analyze this equipment at the proper pressure resulted in a failure to ensure its availability, reliability and capability to respond to initiating events to prevent undesirable consequences. The finding was of very low safety significance because it was a design deficiency confirmed not to result in the loss of operability or functionality. The team determined that no cross cutting aspect was applicable because this finding was not indicative of current licensee performance. (Section 1R21.2.1)

- Green. The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform adequate calculations to support the Keowee generator voltage trip setpoints provided in Technical Specification 3.8.1.17. The licensee entered these issues into their corrective action program as PIPs O-11-10907 and O-11-11120, and performed evaluations to provide

reasonable assurance that components would have adequate voltage pending formal re-analysis.

The team determined that the failure to perform adequate calculations to support the Keowee generator voltage trip setpoints provided in Technical Specification 3.8.1.17 was a performance deficiency (PD). The PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety related plant Motor Operated Valves (MOVs) and Motor Control Center (MCC) starters would have adequate voltage to perform their safety function following a failure of a Keowee generator voltage regulator. The finding was considered to be of very low safety significance (Green) since this was a design deficiency confirmed not to have resulted in a loss of operability or functionality. The team determined that no cross cutting aspect was applicable because this finding was not indicative of current licensee performance. (Section 1R21.2.3)

- Green. The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, “Design Control”, for the licensee’s failure to perform adequate voltage calculations for safety-related Motor Control Center (MCC) 120VAC control circuits. The licensee entered these issues into their corrective action program as PIPs O-11-10907 and O-11-11120, and performed evaluations to provide reasonable assurance that components would have adequate voltage to enable them to perform their intended safety function.

The team determined that the failure to perform adequate design calculations for 120VAC control circuits was a performance deficiency (PD). The PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety MCC starters would have adequate control voltage to perform their safety function during all required conditions. The finding was considered to be of very low safety significance (Green) since this was a design deficiency confirmed not to have resulted in a loss of operability or functionality. The team determined that no cross-cutting aspect was applicable because this finding was not indicative of current licensee performance. (Section 1R21.2.3)

- Green. The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, “Design Control”, for the licensee’s failure to perform adequate voltage calculations for safety-related 4160V circuit breaker 125VDC control circuits. The licensee entered these issues into their corrective action program as PIPs O-11-11438, and performed evaluations to provide reasonable assurance that components would have adequate voltage pending formal re-analysis.

The team determined that the failure to perform adequate design calculations for 125VDC control circuits was a performance deficiency (PD). The PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition, the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety related circuit breakers would have adequate control voltage to perform their safety function during all required conditions. The finding was considered to be of very low safety significance since this was a design deficiency confirmed not to have resulted in a loss of operability or functionality. The team determined that no cross cutting aspect was applicable because this finding was not indicative of current licensee performance. (Section 1R21.2.12)

- Green. The team identified a Green non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion V, “Instructions, Procedures and Drawings”, for the licensee’s failure to maintain complete and accurate procedures for installation of the Standby Shutdown Facility (SSF) submersible pump using the alternate means of pump installation. This condition could have prevented installation of that pump in the time frame required if the primary means of pump installation became unavailable. The licensee was not capable of completing the required alternate means of installing the SSF submersible pump as documented in procedure AM/0/1300/059 “Pump-Submersible-Emergency SSF Water Supply-Installation and Removal”, which is required to be completed for sections of “Loss of SSW” and “Standby Shutdown Facility emergency operating procedures”. The licensee implemented compensatory measures to ensure the primary method is always available and entered the issue into their corrective action program as PIP O-11-10962.

The team determined that the failure to maintain complete and accurate abnormal operating procedures for SSF submersible pump installation is a performance deficiency (PD). This PD is more than minor because it affected the Mitigating Systems Cornerstone attribute of design control to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. In addition, if left uncorrected, the alternative means for installing the SSF submersible pump, which provides required cooling water to the SSF safety related equipment (SSF Diesel, SSF ASW pump, etc.) during a LOOP as documented in AM/0/1300/059 could not be accomplished. This finding was considered to be of very low safety significance since it was not a design or qualification deficiency, did not result in the loss of any system safety function and was not risk significant due to seismic, flooding or severe weather. The inspectors determined that the finding had a cross cutting aspect of adequate emergency equipment in the resources component of the human performance area. The licensee did not have emergency equipment available as specified in their procedures. [H.2(d)](Section 1R21.2.15)

- Green. The team identified a Green non cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, “Design Control”, for the licensee’s failure to account for the full range of emergency AC power frequencies allowed by the surveillance procedure when evaluating the performance of safety related pumps. The licensee entered the issue into their corrective action program as PIPs O-11-10959, O-11-10954, O-11-10917, and

O-11-11015 and performed additional analyses and evaluations to provide reasonable assurance of operability of components.

The team determined that the failure to perform engineering evaluations for the full range of emergency AC power frequencies allowed by the surveillance procedure when evaluating safety related pump performance is a performance deficiency (PD). This PD was more than minor because it affects the Mitigating Systems Cornerstone attribute of design control to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. In addition, if left uncorrected, the finding had the potential to lead to a more significant safety concern in that safety- related equipment may not operate properly at all emergency AC power frequencies allowed by the surveillance procedure. This finding is similar to IMC 0612, Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, pumps and fans operating at the high end of the allowable AC frequency will operate at higher speed generating flow rates that exceed the design flow rates. This is non-conservative because a higher flow rate elevates the net positive suction head required for the pumps. It is also non-conservative because air vortices will start forming at higher water levels in tanks and other suction sources. The deficiencies described above resulted in a reasonable doubt that safety-related equipment could perform their functions under the most limiting conditions. The finding was of very low safety significance because it was a design deficiency confirmed not to result in the loss of operability or functionality. The team determined that no cross-cutting aspect was applicable because this finding was not indicative of current licensee performance. (Section 1R21.4).

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R21 Component Design Bases Inspection

.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 1.3 or Birnbaum value greater than 1 $X10^{-6}$. The sample included 17 component reviews, five related operator actions, and five operating experience items.

The team performed a margin assessment and detailed review of the selected risk-significant components to verify that the design bases had been correctly implemented and maintained. This design margin assessment considered original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition issues. Equipment reliability issues were also considered in the selection of components for detailed review. These reliability issues included items related to failed performance test results, significant corrective action, repeated maintenance, maintenance rule status, Regulatory Issue Summary (RIS) 05-020 (formerly 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.

.2 Results of Detailed Reviews

.2.1 Pressurizer Power Operated Relief Valve

a. Inspection Scope

The team reviewed the UFSAR, Technical Specifications (TS), Piping and Instrument Diagrams (P&IDs), applicable plant calculations, and drawings to identify the design bases requirements of the Pressurizer PORVs. The team examined records of bench testing, maintenance activities, and applicable corrective actions to verify that potential degradation or low margin design issues were being monitored, prevented or corrected. Additionally, the team reviewed station operating and off-normal procedures to verify that design basis requirements have been adequately translated into procedures and instructions. The team could not perform a walkdown of the PORV because of the limitations associated with its location. The team reviewed design basis calculations performed for the qualification of the PORV discharge piping, establishing the limiting conditions for the pipe stress analysis. The team reviewed design bases documentation, maintenance records, and drawings to verify that the design and the material condition are consistent with design requirements. The team reviewed station emergency operating procedures and limiting UFSAR analysis such as Rod Withdrawal accident

and Rod Ejection accident affecting the Pressurizer PORV and Safety Valves to verify that their use and operation are consistent with accident analysis assumptions documented in the UFSAR.

b. Findings

Introduction: The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform a pressurizer safety valve and PORV analysis that includes input parameters consistent with current plant design bases. Specifically, the technical details of the actual analysis could not be provided to the inspectors by the licensee, the input data failed to include the required 3% setpoint drift, and the analysis failed to include updated, more limiting values associated with UFSAR Chapter 15 accident analysis.

Description: The licensee failed to perform an adequate pressurizer safety valve and PORV blowdown analysis that included current plant input parameters. The analysis was determined to be deficient in the following areas:

(1) Calculation OSC-1692, Rev. 1, Oconee Pressurizer Safety Valve Blowdown Analysis, did not include the technical details of the actual analysis (RETRAN5); rather, it only contained input data cards and the output graphs of pressures and flow rates as functions of time. Therefore, the analysis could not be reviewed or validated.

(2) The pressurizer and PORV analysis calculation used UFSAR Chapter 15.2 peak primary pressure of 2515 psia associated with a Rod Withdrawal Accident during plant startup. The calculation failed to include a 75 psi safety valve setpoint drift required by Technical Specification 3.4.10, hence, the calculation analyzed the pressure and flow transient beginning at 2515 psia, rather than 2590 psia which would take into account the required setpoint drift. In addition, the current UFSAR's peak pressure for this accident was 2731.2 psig calculated at the bottom of the reactor, which translates to an expected pressure of at least 2590 psia at the safety valves elevation. The results of this non-conservative calculation were used in a computer program to calculate forces used in analysis of pipe stress on the downstream piping.

(3) The maximum peak primary pressure was not associated with UFSAR Chapter 15.2 Rod Withdrawal Accident as was used in the analysis; rather, a peak primary pressure of 2979 psig was calculated to result from the UFSAR Chapter 15.12, Rod Ejection accident. 2979 psig was also the pressure calculated at the bottom of the reactor, resulting in pressure greater than 2800 psig at the pressurizer safety valves. There was no analysis to determine the adequacy of the pressurizer safety valves and PORV at the current design basis peak pressure of over 2800 psig resulting from the design basis rod ejection accident discussed in UFSAR Chapter 15.12.

The licensee entered these concerns into their corrective action program as PIP O-11-11449 and performed additional analyses and evaluations to assure operability of components.

Analysis: The team determined that the licensee's failure to perform a calculation determining the adequacy of the pressurizer safety valves, PORV, and downstream piping at the appropriate design basis accident pressure, which was approximately 300 psi greater than the analyzed pressure, was a performance deficiency (PD). This PD was more than minor because it affected the Mitigating Systems cornerstone attribute of equipment performance to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, the pressurizer safety valves, pressurizer PORV and downstream piping operate to mitigate the overpressure transient caused by the design basis rod ejection accident. However, these valves and associated piping were analyzed at a lower pressure than the pressure determined in the UFSAR Chapter 15 analysis for that accident, creating a reasonable doubt that this equipment would operate properly during that design basis accident. Failing to analyze this equipment at the proper pressure resulted in a failure to ensure its availability, reliability, and capability to respond to initiating events to prevent undesirable consequences. The team screened this finding in accordance with IMC 0609, "Significance Determination Process", Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings", and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The team determined that no cross-cutting aspect was applicable because this finding was not indicative of current licensee performance.

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, "Design Control" requires in part, that design control measures provide for verifying or checking the adequacy of design. Contrary to this, calculation OSC-1692, Rev. 1, Oconee Pressurizer Safety Valve Blowdown Analysis, as of September 30, 2011, did not analyze the pressurizer PORV and safety valves at the limiting conditions specified in Chapter 15 of the UFSAR. Also, adequate results of this calculation were not used to determine the forces associated with the operation of the pressurizer safety valves and PORV and the pipe stress calculations of the downstream piping did not use the correct forces. Because this finding is of very low safety significance and because it was entered into the licensee's corrective action program as PIP O-11-11449, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as NCV 05000269, 270, 287/2010010-01, "Failure to Analyze the Pressurizer Safety valves and PORV and Downstream Piping at the Correct Pressure".

.2.2 Diesel Service Water Pump

a. Inspection Scope

The team reviewed the UFSAR, PI&Ds, test data, system health, vendor manual, as well as operating and surveillance procedures to identify design, maintenance, and operational requirements related to pump flow rate, developed head, achieved system flow rate, net positive suction head (NPSH), and minimum flow requirements. The inspectors reviewed pump line up, pump capacity, as well as the correlation between calculated requirements, test acceptance criteria, and test results. The inspectors reviewed calculations related to pump flow, head, and net positive suction head and compared them to the performance requirements to ensure that the pumps were capable of functioning as required under loss of offsite power with electrical power

supply from the Standby Shutdown Facility (SSF) Diesel Generator. This review included an assessment of pump operation at the range of SSF Diesel frequency allowed by test procedures for unrestricted plant operation. Maintenance, in-service testing, corrective action documents, and design change histories were reviewed to assess the potential for component degradation and the resulting impact on design margins and performance. Additionally, the team walked down the Diesel Service Water pump and its components to verify that the installed configuration was consistent with design bases information and to visually inspect the material condition of the pumps.

b. Findings

No findings were identified.

.2.3 Low Pressure Injection MOVs 3LP-19 and 3LP-20

a. Inspection Scope:

The team reviewed applicable portions of the plant's TS, UFSAR, and Design Basis Specification to identify design basis requirements for MOVs 3LP-19 and 3LP-20. The team reviewed sources of power for the valves, including preferred offsite power and the standby Keowee source to determine whether they were reliable and had sufficient capacity and capability under worst case accident conditions. This review included review of load flow and voltage drop calculations, including MCC control circuits, and review of protective relaying schemes. The inspectors compared valve testing data with the design requirements to verify that valve performance was adequate. The inspectors reviewed calculations that determined required valve actuator torque and thrust limits and traced these requirements to the vendor-supplied data. The inspectors interviewed the system engineer and MOV engineer to discuss the valve analysis as well as operational and maintenance history to verify that potentially degraded conditions were being appropriately addressed. Control logic diagrams were reviewed to verify that controls and interlocks were consistent with the design-basis performance requirements and operating procedures. Operating procedures were reviewed to verify that component operation and alignments were consistent with the design and licensing bases. Test procedures and recent test results were reviewed against design bases documents to verify that acceptance criteria for tested parameters were supported by calculations and component specification and that individual tests and analyses served to validate component operation under accident conditions. The inspectors examined maintenance rule documentation to verify that the valves were properly scoped, and monitored. Vendor documentation, preventive and corrective maintenance history, and corrective action system documents (PIP) were reviewed in order to verify that potential degradation was monitored or prevented and that scheduled component replacements were consistent with vendor recommendations and equipment qualification life.

b. Findings

Finding 1. Failure to Perform Adequate Calculations to Support Keowee Voltage Trip Setpoints

Introduction: The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform adequate calculations to support the Keowee generator voltage trip setpoints provided in Technical

Specification 3.8.1.17. Specifically, no calculation was available to demonstrate that the voltage trip setpoint limits specified in TS 3.8.17, which are measured at the generator, would result in adequate voltage at safety related loads at all voltage distribution levels.

Description: The Keowee generators incorporate protective relays to detect voltage and frequency variations that could damage or cause failure of connected safety loads to operate properly during an emergency. This protection is necessary because for some scenarios involving an accident with the loss of offsite power, the redundant safety buses of an accident unit are connected to a single Keowee generator. Without this protection, a failure of the generator's governor or voltage regulator could cause failure of redundant safety loads. Technical Specification 3.8.1.17 specifies that the voltage and frequency out of tolerance relays trip the power path breakers from the affected generator unit after a 5±1 second time delay. The trip setpoints are as follows:

- Undervoltage ≥ 12.42 kV and ≤ 12.63 kV
- Overvoltage ≥ 14.90 kV and ≤ 15.18 kV
- Underfrequency ≥ 53.992 Hz and ≤54.008 Hz
- Overfrequency ≥ 65.992 Hz and ≤66.008 Hz

These setpoints equate to allowable variations of ±10% from the generator nominal ratings of 13.8kV and 60Hz. Upon tripping of the breakers on the degraded generator, control logic transfers the affected loads to the remaining Keowee generator. This finding will address the issues relating to the voltage trip setpoint. The issues relating to allowable frequency variations are discussed elsewhere in this report.

During the licensing phase of the trip relays, the Duke response to NRC questions dated October 7, 1999 stated that the setpoints chosen were based on the allowable variations in voltage for electrical equipment to operate normally. The CDBI team noted that no calculation was available to demonstrate that the selected voltage limits, which are measured at the generator, would still result in adequate voltage at safety related loads at all voltage distribution levels. In response to the team's concerns, the licensee initiated PIP O-11-10907 and performed an Immediate Determination of Operability (IDO). As part of the IDO, the licensee performed a Failure Modes and Effects Analysis (FMEA) that concluded that the minimum voltage following a credible failure of a Keowee voltage regulator would be 13.2kV (-4.3%). The initial IDO referred to calculation OCC-5952 that analyzed operation of safety buses with Keowee generator output voltage of 13.0kV. The team noted that Calculation OSC-5952 was classified as "inactive" and it referred to superseded calculation OSC-4581 for MOV voltage. The team further noted that the calculation contained insufficient information to determine whether there was adequate voltage for MCC control circuits. In response to these additional concerns, the licensee initiated PIP O-11-11120 and revised the IDO for PIP O-11-10907. The revised IDO referenced a new revision to OSC-5952 which was prepared to address MOV voltage, and also provided sufficient information to show that the results of OSC-5952 bounded the MCC voltages used as inputs to existing MCC control circuit calculations.

Analysis: The team determined that the failure to perform adequate calculations to support the Keowee generator voltage trip setpoints provided in TS 3.8.1.17 was a performance deficiency (PD). The PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the

cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety related MOVs and MCC starters would have adequate voltage to perform their safety function following a failure of a Keowee generator voltage regulator. The team screened this finding in accordance with IMC 0609, "Significance Determination Process", Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings", and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The team determined that no cross cutting aspect was applicable because this finding was not indicative of current licensee performance.

Enforcement: 10 CFR 50, Appendix B, Criterion III, "Design Control", requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, as of September 30, 2011, the licensee's design control measures failed to adequately check the design of the Keowee protective voltage relays. Specifically, the licensee failed to perform adequate calculations to support the setpoints specified in Technical Specification 3.8.1.17. Because this violation was of very low safety significance and because the issue was entered into the licensee's CAP as PIPs O-11-10907 and O-11-11120, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as NCV 05000269,270,287/2011011-02 "Inadequate Calculations for Keowee Voltage Relays".

Finding 2. Failure to Perform Adequate Calculations for 120VAC MCC Control Circuits

Introduction: The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform adequate voltage calculations for safety-related 120VAC MCC control circuits. Specifically, there was reasonable doubt as to whether the safety related MCCs would have adequate control voltage to perform their safety function during all required conditions.

Description: Calculation OSC-5930, Attachment 1 lists acceptance criteria for various types of 120VAC contactors coil used in 600V and 208V MCCs, ranging from 65% to 78.4% of 120V rated voltage. The criteria for contactor pickup voltage was based on various tests and was lower than the criteria specified in applicable National Electrical Manufacturing Association (NEMA) standards (NEMA ICS-2) of 85%. The team noted the following concerns relative to this criteria:

- For Sylvania TMs only two specimens each of size 1 and 2 were tested, providing inadequate basis for the rating.
- For Joslyn Clark and Cutler Hammer contactors the calculation took credit for Control Power Transformer boost (approximately 2-4%) that had already been credited in tests.
- Tests were conducted on contactors at shop ambient temperature (cold coil). Contactors may be required to operate in service with hot coils. This could raise the pickup voltage by approximately 4%.

- The acceptance criteria in the calculation did not provide margin over test criteria to account for degradation over the service life of the contactors. Contactors are not periodically tested to confirm low pickup voltage capability.
- The calculation contains incomplete or obsolete information; i.e., contactors that have been replaced; test reports missing.

In response to this concern, the licensee initiated PIP O-11-11440 to evaluate the need for testing to validate previous test values. In addition, the team noted that voltage calculations for several safety related control circuits had not been included in Calculation OSC-5930. In response to this concern, the licensee initiated PIP O-11-11510. The Immediate Determination of Operability (IDO) for this PIP evaluated 21 Unit 1 MCC control circuits that had not been evaluated in Calculation OSC-5930 and concluded, based on estimated circuit length, that there was reasonable assurance that they were bounded by calculations for other circuits that showed the worst case calculated available voltage to be 78.3% of rated voltage.

Analysis: The team determined that the failure to perform adequate design calculations for 120VAC MCC control circuits was a performance deficiency (PD). The PD was more than minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety related MCC starters would have adequate control voltage to perform their safety function during all required conditions. The team screened this finding in accordance with IMC 0609, “Significance Determination Process”, Attachment 4, “Phase 1 - Initial Screening and Characterization of Findings”, and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The team determined that no cross cutting aspect was applicable because this finding was not indicative of current licensee performance.

Enforcement: 10 CFR 50, Appendix B, Criterion III, “Design Control”, requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, as of September 30, 2011, the licensee’s design control measures failed to adequately check the design of the 120VAC control circuits. Specifically, the licensee applied acceptance criteria for control components that was less than manufacturer’s published ratings without adequate supporting documentation, and failed to analyze the adequacy of several 120VAC control circuits. Because this violation was of very low safety significance and because the issue was entered into the licensee’s CAP as PIPs O-11-11440 and O-11-11510, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as NCV 05000269,270,287/2011010-03 “Inadequate and Missing Control Circuit Voltage Calculations”.

.2.4 Spent Fuel Pool Level Affected by Letdown Flow

a. Inspection Scope

The team reviewed calculation OSC-0619, Rev. 34 and 35, "Analysis for Use of Spent Fuel Pool Inventory for Standby Shutdown Facility", which accounts for a letdown flow rate of about 35 gpm to the Spent Fuel Pool. The purpose of the review was to determine the impact of letdown flow into the SFP on pool level. The inspectors assessed the impact on pool level when letdown flow of about 35 gpm at about 525ºF enters the pool.

The team evaluated the heat stored in liquid water at 525ºF and the heat required to change the state of 212ºF water into steam. The heat content of one pound of water at 525ºF is about 518 Btu. The heat required to change the state of one pound of water at 212ºF into steam is about 970 Btu. Therefore, the team determined only a portion (about 53%) of the 35 gpm entering the pool will change state into steam while the other portion (about 47%) will remain in the pool, thereby raising its level. Hence, the team determined, although the letdown flow will accelerate the rising of pool temperature to 212ºF, its overall effect will be added level and greater time interval to reach the low level of one foot above the top of the spent fuel.

b. Findings

No findings were identified.

.2.5 Transformer CT-4

a. Inspection Scope

The team reviewed the design basis documentation, vendor manuals, and the updated UFSAR to identify the design bases function of transformer CT-4. The team reviewed calculations to verify that safety loads applied under design basis accident conditions do not exceed the transformer rating and to ensure that relays required to respond under accident conditions had the appropriate pickup current settings. The emergency power switching logic performance test was also evaluated to ensure the most reliable power source is available to the main feed busses under accident conditions. This included testing power from the Keowee hydro units through the use of transformer CT-4. The team reviewed replacement of contacts in the cooling fan control circuitry to verify that the modification did not degrade the component's performance capability and was incorporated into relevant procedures and drawings. The team reviewed maintenance and corrective action documentation specific to this transformer to determine whether any equipment exhibited adverse performance trends. The team also conducted walkdowns of the transformer to observe material conditions.

b. Findings

No findings were identified.

.2.6 Battery Charger CSF

a. Inspection Scope

The team reviewed battery charger sizing calculations to determine whether the chargers are capable of supplying their required load during worst case conditions, and recharge the batteries in the required time after discharge. The team reviewed AC load flow and voltage drop calculations to determine whether the chargers have adequate input voltage under worst case conditions. The team reviewed testing schedules and procedures to determine whether operability of the chargers is being adequately demonstrated. The team reviewed maintenance schedules, vendor recommendations, and procedures to determine whether the chargers are being properly maintained. The team reviewed maintenance and corrective action histories to determine whether there have been any adverse operating trends. In addition the team performed a walkdown of the equipment to assess material condition and the presence of hazards.

b. Findings

No findings were identified.

.2.7 Letdown Storage Tank (LDST) Level Transmitters HPILT0033P1, HPILT0033P2

Inspection Scope

a. The team reviewed the design, maintenance, and operation of the LDST level transmitters to determine whether there were any common cause failures that could degrade their safety function. The team reviewed setpoint documents, calculations, and calibration procedures to determine whether the setpoints are consistent with system design requirements described in the design bases. The team reviewed drawings including installation details, loop diagrams, isometrics and mechanical drawings to assess whether the determination of setpoints was consistent with the instrumentation design. The team reviewed elementary diagrams to determine whether system logic is consistent with the design bases and whether there were any adverse system interactions. The team reviewed maintenance and surveillance schedules, procedures, and completed work orders to determine whether the transmitters are being properly maintained. The team reviewed corrective action histories for Rosemount transmitters to determine whether there had been any adverse operating trends. In addition, the team performed a walkdown of the installed equipment to determine whether the installed configuration is consistent with design documents including drawings, and calculations, and to assess the presence of hazards.

b. Findings

No findings were identified.

.2.8 4160V 3TE Breaker 10

a. Inspection Scope

The team reviewed portions of the plant TS, UFSAR, DBDs, elementary and one line diagrams, and associated system lesson plans to establish an overall understanding of the design bases of the component and verify the capability of the breaker to perform its intended design function. The team reviewed schematic diagrams and calculations for the breaker to determine whether equipment operation was consistent with the design basis. Protective device settings circuitry diagrams were reviewed to determine whether the breaker was subject to spurious tripping. The team reviewed maintenance schedules and procedures, as well as vendor data to determine if scheduled maintenance activities were consistent with prescribed vendor recommendations. Recent corrective action documents and completed maintenance and test records were reviewed to assess if there were any adverse operating trends. Interviews of system engineers, health reports and visual inspection to assess observable material condition were utilized to verify that potential degradation was monitored or prevented, and that component replacement was consistent with in service/equipment qualification life.

b. Findings

No findings were identified.

.2.9 125 VDC DCSF Breaker 4B

a. Inspection Scope

The team reviewed portions of the plant TS, UFSAR, Design Basis Documents (DBDs), elementary and one line diagrams, and associated system lesson plans to establish an overall understanding of the design bases of the component and verify the capability of the breaker to perform its required design function. The team reviewed schematic diagrams and calculations for the breaker to determine whether equipment operation was consistent with the design basis. The inspection team reviewed calculations for the interrupting rating and maximum available fault current at the breaker to determine whether the breaker was properly sized for operation. The team reviewed maintenance records and procedures, as well as vendor data to determine if scheduled maintenance activities were consistent with prescribed vendor recommendations. Recent corrective action documents were reviewed to assess if there were any adverse operating trends. A field walk down of the breaker and breaker panel was performed to assess the observable material condition. Interviews of system engineers and health reports were utilized to verify that potential degradation was monitored or prevented, and that component replacement was consistent with in service/equipment qualification life.

b. Findings

No findings were identified.

.2.10 PORV Block Valve 3RC-4

a. Inspection Scope

The team reviewed portions of the plant TS, UFSAR, DBDs and associated system lesson plans to establish an overall understanding of the design bases of the component and its power supply and verify the capability of the PORV and power supply to perform the required function when called upon for service. PORV motor actuator data, work order history and maintenance procedures were reviewed to assess potential degradation and to verify that PORV and power supply performance was sufficient to satisfy design basis requirements. Wiring diagrams detailing the motor controls and logic were reviewed to verify valve operation upon demand signal. In addition, the team reviewed corrective action documents to verify that any potential degradation was being tracked and addressed appropriately. The inspectors conducted a walk down of the Unit 3 Control Room panel and SSF Control Room panel where manual controls are located.

b. Findings

No findings were identified.

.2.11 Borated Water Storage Tank (BWST) Level Transmitters

a. Inspection Scope

The inspectors reviewed portions of the plant TS, UFSAR, DBDs, and associated system lesson plans to establish an overall understanding of the design bases of the BWST level transmitters and verify the capability of the components to perform their design basis function. The team reviewed the Unit 1 instrument setpoint and uncertainty calculations, wiring and flow diagrams and elementary and schematic diagrams to verify that level switches were in accordance with design basis documents. Additionally, maintenance procedures and work records were reviewed, as well as vendor documents, to determine if scheduled maintenance activities were consistent with prescribed vendor recommendations. Recent corrective action documents and system health reports were utilized to verify that potential degradation was monitored or prevented, and that component replacement was consistent with in service/equipment qualification life. The team performed field walk downs of the BWST level switches to observe the existing conditions and configurations.

b. Findings

No findings were identified.

.2.12 4160V OTS1 SSF Switchgear Breaker 2 and Breaker 4

a. Inspection Scope

The team reviewed the design, maintenance, and operation of the 4160V circuit breakers to verify their capability to perform their required safety functions. The team's focus of the review was on the ability of the breakers to close on demand. The team reviewed one line drawings, elementary wiring diagrams, and calculations to determine the adequacy of 125VDC control power for the breakers. The team reviewed

maintenance schedules, vendor recommendations, and procedures to determine whether the breakers are being properly maintained. The team reviewed load flow and short circuit calculations to determine whether the breakers are being applied within their required ratings. The team review protective relaying schemes and calculations to determine whether the breakers are susceptible to spurious tripping. The team reviewed testing procedures, including post maintenance testing to determine whether operability is being demonstrated. The team reviewed elementary diagrams to determine whether system logic is consistent with the design bases. The team reviewed maintenance and corrective action histories to determine whether there have been any adverse operating trends. In addition, the team performed a walkdown of the installed equipment to determine whether the installed configuration is consistent with design documents including drawings, and calculations, and to assess the presence of hazards.

b. Findings

Introduction: The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control", for the licensee's failure to perform adequate voltage calculations for safety-related 125VDC control circuits. Specifically, there was reasonable doubt as to whether the 4160V safety related circuit breakers would have adequate control voltage to perform their safety function during all required conditions.

Description: Calculation OSC-6195 determined the adequacy of 125VDC control voltage to the ITE Type 5HK 4160V breakers in the SSF OTS1 switchgear. Appendix E of the calculation listed the rated operating voltage for the close coils as 100VDC. Section 5.2 of the calculation applied an alternate acceptance criterion of 70VDC for the close coils, based on testing documented in Test Report TR-144. The calculation determined that the lowest calculated voltage at the close coils of the SSF circuit breakers was 86.225VDC, and concluded that, since this was greater than 70VDC, the breakers were capable of operation. The team noted that the testing documented in Report TR-144 criteria consisted of tests on only three specimens, and did not control for conditions such as aging or coil temperature. Since the testing documented in Report TR-144 was not commensurate with testing typically performed by manufacturers to establish their published ratings, the team questioned why the 70V rating was adequate to support reliable operation over the life of the components. The licensee was not able to provide any information supporting the test as being adequate to support such operation. In response to the team's concerns, the licensee initiated PIP O-11-11438. The PIP noted that the coils of the 5HK 4160V breakers are tested every two years to close at a value of 85VDC per PM procedure IP/0/A/2001/003 A. Although the test value is very close to the lowest calculated voltage, the team concluded that the testing provided reasonable assurance of operability.

The team also questioned whether the 70VDC acceptance criteria was used for other safety related breakers and identified that this criteria had been used in Calculations OSC-4276 and OSC-8113 to evaluate all safety related 4160V Type 5HK breakers on the station. A review of Calculation OSC-8113 showed that the voltage at the close coil for all 4160V safety related circuit breakers were greater than the 85VDC used as the test voltage during PM testing.

Analysis: The team determined that the failure to perform adequate design calculations for 125VDC control circuits was a performance deficiency (PD). The PD was more than

minor because it affected the Mitigating Systems Cornerstone attribute of Design Control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition the finding is similar to IMC 0612 Appendix E, example 3.j because the issue resulted in a condition where there was a reasonable doubt with respect to operability of safety-related components. Specifically, there was reasonable doubt as to whether the safety-related circuit breakers would have adequate control voltage to perform their safety function during all required conditions. The team screened this finding in accordance with IMC 0609, "Significance Determination Process", Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings", and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in loss of operability or functionality. The team determined that no cross cutting aspect was applicable because the finding was not indicative of current licensee performance.

Enforcement: 10 CFR 50, Appendix B, Criterion III, "Design Control", requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, as of September 30, 2011 the licensee's design control measures failed to adequately check the design of the 125VDC control circuits. Specifically, the licensee applied acceptance criteria for control components that were less than manufacturer's published ratings without adequate supporting documentation. Because this violation was of very low safety significance and because the issue was entered into the licensee's CAP as PIP O-11-11438, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as NCV 05000269,270,287/2011010-04 "Inadequate Control Circuit Voltage Calculations".

.2.13 600V SSF MCC 3XSF Breaker 5A

a. Inspection Scope

The team reviewed the SSF MCC 3XSF Breaker 5A to confirm its ability to be manually opened in order to transfer the MCC to its alternate source. The team reviewed maintenance schedules, vendor recommendations, and procedures to determine whether the breaker is being properly maintained. The team reviewed testing procedures, including post maintenance testing to determine whether breaker operability is being demonstrated. The team reviewed maintenance and corrective action histories to determine whether there have been any adverse operating trends. In addition the team performed a walkdown of the equipment to determine whether the installed configuration was consistent with design documents, and to assess the presence of hazards.

b. Findings

No findings were identified.

.2.14 Main Steam Turbine Stop Valves

a. Inspection Scope

The team reviewed the main steam turbine stop valves to verify their capability to perform the required design function. The review included the licensing and design basis of the valves, review of recent corrective actions, review of recent test procedures and test results, review of associated operating procedures, walkdowns of the valves and related equipment, and interviews conducted with responsible engineering personnel. The team reviewed the test procedures associated with the valves to verify the valve controls and components were being completely tested. The team reviewed the results of recent valve tests to verify the results were acceptable. The team also conducted walkdowns of the valves and associated equipment to verify the material condition of the components.

b. Findings

No findings were identified.

.2.15 SSF Auxiliary Service Water (ASW) Pump

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and piping and instrumentation drawings (P&IDs) to establish an overall understanding of the design bases of the ASW pumps. Design calculations (i.e. minimum flow and NPSH) and site procedures were reviewed to verify the design basis and design assumptions had been appropriately translated into these documents. System walkdowns were conducted to verify that the installed configurations would support their design basis function under accident/event conditions and had been maintained consistent with design assumptions. Test procedures and recent test results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident/event conditions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was being monitored.

b. Findings

Introduction: The team identified a Green non-cited violation of 10 CFR Part 50, Appendix B, Criterion V," Instructions, Procedures and Drawings", for the licensee's failure to maintain complete and accurate procedures for installation of the SSF submersible pump using the alternate means of installation, which could have prevented installation of that pump in the time frame required if the primary means of pump installation became unavailable. The alternate means of pump installation is a manual hoist mechanism. The primary means of pump installation is a truck mounted hoist. The licensee was not capable of completing the alternate means of installing the SSF submersible pump as documented in procedure AM/0/1300/059 "Pump-Submersible-

Emergency SSF Water Supply-Installation and Removal", which is required to be completed for sections of "Loss of SSW" and "Standby Shutdown Facility emergency operating procedures". The licensee implemented compensatory measures to ensure the primary method is always available and entered the issue into their corrective action program as PIP O-11-10962.

Description: During a review of the ASW system, the team reviewed AP/0/A/1700/025 "Standby Shutdown Facility Emergency Operating", Revision 52, and AM/0/A/1300/059 "Pump-Submersible-Emergency SSF Water Supply–Installation and Removal", Revision 8. During walkdowns of the SSF and Appendix R equipment storage areas, several questions were raised regarding the required alternate method of installing the SSF submersible pump. Through interviews and questions it was determined that the alternate means for installing the SSF submersible pump could not be completed as documented in procedure AM/0/A/1300/059, because the manual hoist would be required during a loss of offsite power and no power would be available at the pump location. Thus, the manual hoist could not be used in the electronic winch mode to lower the pump into the pump bay. In addition, in the hydraulic cylinder with manual jack mode, which did not require electric power, the manual hoist did not allow enough vertical travel to lower the pump into the pump bay. Further, the procedure did not contain provisions for ensuring that the primary means of pump installation was always available.

Analysis: Failure to maintain complete and accurate abnormal operating procedures for SSF submersible pump installation was a performance deficiency (PD). This PD was more than minor because it affected the mitigating systems cornerstone attribute of design control to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. If left uncorrected, the alternative means for installing the SSF submersible pump which provides required cooling water to the SSF safety related equipment (SSF Diesel, SSF ASW pump, etc.) during a LOOP as documented in AM/0/1300/059 could not be accomplished. The team screened this finding in accordance with IMC 0609, "Significance Determination Process", Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings", and determined the finding was of very low safety significance (Green) because it was not a design or qualification deficiency, did not result in the loss of any system safety function and was not risk significant due to seismic, flooding or severe weather. The inspectors determined that the finding had a cross cutting aspect of adequate emergency equipment in the resources component of the human performance area. The licensee did not have emergency equipment available as specified in their procedures. [H.2(d)]

Enforcement: 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings" states in part that "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings". Contrary to this, as of September 30, 2011, the licensee did not have complete and accurate procedures for installation of the SSF submersible pump using the alternate method, which could have prevented installation of that pump in the time frame required if the primary means of pump installation became unavailable. Because this violation was of very low safety significance and because the issue was entered into the licensee's CAP as PIP O-11-10962, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as

NCV 05000269,270,287/2011010-05 “Inadequate Procedure for Installation of SSF Submersible Pump”.

.2.16 Steam Generator Supply from SSF ASW Pump, MOVs 1CCW-268, 2CCW-268,3CCW-268

c. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the valves. The team examined system health reports, records of surveillance testing, maintenance activities, and applicable corrective actions to verify that potential degradation was being monitored and prevented or corrected. The team also conducted interviews with plant personnel to discuss the history of the valve testing, maintenance, and details of the corrective actions that had been completed. The team also conducted a visual inspection of the valves to verify that any degraded material conditions were being appropriately addressed. In addition, the team verified that the power demand requirements for the valves were captured in electrical load and degraded voltage calculations. The team also verified that the worst case/highest differential pressure (dP) was used to determine the maximum valve opening and/or closing requirements to ensure that the valves would perform their intended safety-related design basis function. A review was conducted of the licensee’s testing procedures and results from actual diagnostic valve testing that was performed to verify that the MOVs were tested in a manner that would detect a malfunctioning valve and verify compliance with GL 89-10 program plan requirements.

d. Findings

No findings were identified.

.2.17 Main Condenser Vacuum Breaker, MOVs 1V-186, 2V-186, and 3V-186

a. Inspection Scope

The team reviewed the plant TS, UFSAR, DBDs, and P&IDs to establish an overall understanding of the design bases of the valves. The team examined system health reports, records of surveillance testing, maintenance activities, and applicable corrective actions to verify that potential degradation was being monitored and prevented or corrected. The team also conducted interviews with plant personnel to discuss the history of the valve testing, maintenance, and details of the corrective actions that had been completed. The team also conducted a visual inspection of the Unit 3 valve to verify that any degraded material conditions were being appropriately addressed. In addition, the team verified that the power demand requirements for the valves were captured in electrical load and degraded voltage calculations. The team also reviewed the manual torque calculation required to open the valves against a maximum dp on loss of offsite power to determine if the required operator actions could be completed. A review was conducted of the licensee’s testing procedures and results from actual diagnostic valve testing that was performed to verify that the MOVs were tested in a manner that would detect a malfunctioning valve and verify compliance with GL 89-10 program plan requirements.

b. Findings

No findings were identified.

.2.18 Reactor Coolant Makeup (RCMU) Pump (1,2,3HPIPU0005) and Piping

a. Inspection Scope

The team reviewed the plant technical specifications (TS), UFSAR, design basis documents (DBDs), and piping and instrumentation drawings (P&IDs) to establish an overall understanding of the design bases of the RCMU pumps. Design calculations (i.e. minimum flow and NPSH) and site procedures were reviewed to verify the design basis and design assumptions had been appropriately translated into these documents. The team reviewed a system modification to verify that the subject modifications did not degrade the component's performance capability and were appropriately incorporated into relevant drawings and procedures. Photographs of the pump and piping were reviewed because the system is not readily available at power, to verify that the installed configurations would support their design basis function under accident/event conditions and had been maintained consistent with design assumptions. Test procedures and recent test results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident/event conditions. Vendor documentation, system health reports, preventive and corrective maintenance history and corrective action system documents were reviewed in order to verify that potential degradation was being monitored.

b. Findings

No findings were identified.

.3 Review of Low Margin Operator Actions

a. Inspection Scope

The team performed a margin assessment and detailed review of five risk significant and time critical operator actions. Where possible, margins were determined by the review of the assumed design basis and UFSAR response times. For the selected operator actions, the team performed a walkthrough of associated Emergency Procedures (EPs), Abnormal Procedures (APs), Alarm Response Guidelines (ARGs), Operating Procedures(OPs), and other operations procedures with plant operators, maintenance personnel and engineers to assess operator knowledge level; adequacy of procedures; availability of special equipment when required; and the conditions under which the procedures would be performed. Detailed reviews were also conducted with operations and training department leadership to further understand and assess the procedural rationale and approach to meeting the design basis and UFSAR response and performance requirements. Operator and maintenance personnel actions were observed during plant walkdowns and during simulated performance of risk significant and time critical actions. Selected operator actions associated with the following events/evolutions were reviewed:

- Operator actions to recover ASW during Turbine Building flood.
- Operator actions to establish flow from standby shutdown facility reactor coolant makeup pump.
- Operator/ maintenance actions to provide long term source of suction for EFW pumps.
- Operator actions to deploy standby shutdown facility.
- Operator actions to isolate turbine-building flood within 60 minutes.

b. Findings

No findings were identified.

.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 the Oconee Nuclear Plant. The team performed an independent applicability review for issues that were identified as applicable to the Oconee Nuclear Plant and were selected for a detailed review. The issues that received a detailed review by the team included:

- GL 2007-01, Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients
- NRC Information Notice 99-13: Insights From NRC Inspections of Low and Medium-Voltage Circuit Breaker Maintenance Programs
- IN 2008-02, “Findings Identified During Component Design Bases Inspections” (Emergency AC Power Overfrequency)
- RIS-00-03, Performance of Safety Related Power Operated Valves Under Design Basis Conditions
- Review of potential breaker issues at Harris Nuclear Plant

b. Findings

Introduction: The team identified a Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, “Design Control”, for the licensee’s failure to account for the full range of emergency AC power frequency allowed by Surveillance Procedure PT/0/A/0620/016 Rev. 43, “Keowee Hydro Emergency Start Test”. Specifically, the licensee did not consider the full range of allowable emergency AC power frequency when analyzing the performance of safety-related pumps.

Description: The analyses for safety-related rotating equipment did not always account for the frequency variations of 60Hz +3% and -1% allowed by Surveillance Procedure PT/0/A/0620/016. The licensee entered this issue into the corrective action program as PIP O-11-10881 documenting that instances were found where the design basis safety analysis does not evaluate all affected safety related components with respect to the width of the Keowee Hydro Station frequency band as allowed by the surveillance procedure.

When assessing the performance of the High Pressure Injection pump, the licensee determined that the pump will not have sufficient net positive suction head when Keowee emergency power is supplied at 3% overfrequency (61.8 Hz) as allowed by surveillance procedure PT/0/A/0620/016. The licensee issued PIP O-11-10959 with an immediate determination of operability which called for establishment of administrative controls to ensure frequency limits are maintained at 60Hz +2.22%/-1%. No instances were identified by the team where past performance of the surveillance procedure resulted in a frequency measurement of greater than 60Hz + 2.22%.

While reviewing the extent of the condition, the licensee determined that other safety-related components were not evaluated for the full range of Keowee frequency. These components are: Building Service Pump (PIP O-11-10954), ESV (Vacuum) Pump (PIP O-11-10917), and Reactor Building Cooling System and Control Room Ventilation fans (PIP O-11-11015). These components were reevaluated during the inspection with a conclusion that they are capable of fulfilling their safety function at the full range of Keowee AC frequency currently allowed by the surveillance procedure (59.4 Hz to 61.8 Hz). The applicable calculations are awaiting revision.

Analysis: The team determined that the failure to perform safety analyses to confirm operability of safety related equipment within AC emergency power frequency limits as allowed by surveillance procedures was a performance deficiency (PD). This PD was more than minor because it affected the Mitigating Systems' Cornerstone attribute of design control to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. In addition, if left uncorrected, the finding would have the potential to lead to a more significant safety concern in that safety related equipment may not operate properly at all frequencies allowed by the surveillance procedure. This finding also closely parallels Inspection Manual Chapter 0612, Appendix E, Example 3.j because the calculation error resulted in a condition where there was a reasonable doubt on the operability of safety related components. Specifically, pumps and fans operating at the high end of the allowable AC frequency will operate at higher speed generating flow rates that exceed the design flow rate by 3%. This is non-conservative because a higher flow rate elevates the net positive suction head required for the pump. It is also non-conservative because air vortices will start forming at higher water levels in tanks and other suction sources. The deficiencies described above resulted in a reasonable doubt that safety-related equipment could perform their functions under the most limiting frequency conditions allowed by the surveillance procedure. The team screened this finding in accordance with NRC IMC 0609, "Initial Screening and Characterization of Findings", Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings", and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in the loss of operability or functionality. The team determined that no cross-cutting aspect was applicable because this finding was not indicative of current licensee performance.

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, "Design Control" requires in part that "measures shall be established to assure that applicable regulatory requirements and the design basis, are correctly translated into specifications, drawings, procedures, and instructions." Contrary to this, as of September 30, 2011, the safety analysis did not account for the 60 Hz +3% and -1% frequency band allowed by the surveillance procedure as related to operation of safety-related equipment. Because this finding was of very low safety significance and because it was entered into the licensee's

corrective action program as PIPs O-11-10959, O-11-10954, O-11-10917, and O-11-11015, this violation is being treated as a NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy and designated as NCV 05000269,270,287/2011010-06, "Failure to Account for the Full Range of Emergency Power AC Frequency When Evaluating the Performance of safety Related Components."

4. OTHER ACTIVITIES

4OA3 Follow-Up of Events and Notices of Enforcement Discretion

.1 (Closed) Unresolved Issue (URI) 05000269,270,287/2011017-05, Heat Addition to the Spent Fuel Pool from the Reactor Coolant Makeup Letdown Line.

a. Inspection Scope

Inspection Report 05000269,270,287/2011017 identified a URI associated with the analysis for using Spent Fuel Pool Inventory during a SSF event. That URI noted that justification for assumptions used in Calculation OSC-0619, "Analysis for use of Spent Fuel Pool Inventory for SSF" was not available. Specifically, support documentation to show that excluding the mass and heat input to the spent fuel pool from the RCS SSF letdown line is the bounding scenario with respect to maintaining one foot above the spent fuel at all times during a SSF event and the analysis to support the assumption that the fuel would remain in nucleate boiling for the SSF mission time was not available. The licensee initiated PIP O-11-8104 to document this deficiency and add supporting information to clarify these assumptions in the calculation.

The CDBI team reviewed calculation OSC-0619, which had been updated by the licensee in Revs. 35 and 36 to address the assumptions discussed in the URI. The purpose of the review was to determine the impact of letdown flow into the SFP on pool level and to determine if the fuel would remain in nucleate boiling for the SSF mission time. Following review of OSC-0619 Rev. 35 and 36, the team concluded that although the letdown flow will accelerate the rising of pool temperature to 212ºF, its overall effect will be added level and greater time interval to reach the low level of one foot above the top of the spent fuel. The team also concluded that, based on the maximum fuel assembly heat load, the fuel would remain in the nucleate boiling regime for the SSF mission time.

b. Findings

No findings were identified.

4OA6 Meetings, Including Exit

On September 29, 2011, the team presented inspection results to members of the licensee's staff. Proprietary information that was reviewed during the inspection was returned to the licensee.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:
Kent Alter, Regulatory Affairs Manager
Thomas Ray, Engineering Manager
Michael Bailey, I&C Systems Manager
Jim Kammer, Design Engineering Manager
Ed Burchfield, Operations Superintendent

NRC personnel
A. Sabisch, Senior Resident Inspector, Oconee
G.Ottenberg, Resident Inspector, Oconee

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

05000269,270,287/2011010-01	NCV	Failure to Analyze the Pressurizer Safety valves and PORV and Downstream Piping at the correct Pressure (Section 1R21.2.1)
05000269,270,287/2011010-02	NCV	Inadequate Calculations for Keowee Voltage Relays (Section 1R21.2.3)
05000269,270,287/2011010-03	NCV	Failure to Perform Adequate Calculations for MCC Control Circuits (Section 1R21.2.3)
05000269,270,287/2011010-04	NCV	Inadequate Control Circuit Voltage Calculations for 4160V breakers (Section 1R21.2.12)
05000269,270,287/2011010-05	NCV	Inadequate Procedure for Installation of SSF Submersible Pump (Section 1R21.2.15)
05000269,270,287/2011010-06	NCV	Failure to Account for the Full Range of Emergency Power AC Frequency When Evaluating the Performance of safety Related Components (1R21.4)

Closed

05000269,270,287/2011017-05	URI	Heat Addition to the to the Spent Fuel Pool from The Reactor Coolant Makeup Letdown Line (4AO3)

LIST OF DOCUMENTS REVIEWED

Licensing Documents

TS, Current
UFSAR,Current
SER and Supplements
Duke Letter J.W. Hampton to NRC, Licensee Event Report 287/97-03, 6/2/97
Duke Letter W.R. McCollum to NRC, Commitments from July 23, 1997 Predecisional Enforcement Conference, 7//28/97
Duke Letter W.R. McCollum to NRC, Request for Additional Information regarding Technical Specification Amendment for Keowee Voltage and Frequency Protection Modification, 10/7/99
Duke Letter W.R. McCollum to NRC, Request for Technical Specification Amendment for Keowee Voltage and Frequency Protection Modification, 7/27/99
Duke Letter W.R. McCollum to NRC, Response to Request for Additional Information on the Oconee Emergency Power System, 3/17/98
Final Report - Emergency Electrical Power System and Other Related Matters - Oconee Nuclear Station, Units 1,2, and 3, January, 1999

Calculations

OSC-1692, Oconee Pressurizer Safety Valve Blowdown Analysis, Rev. 1
OSC-2820, Appendix F, LPI Crosstie Setpoints, Rev. 30
OSC-2820, Appendix I, BWST Vortex, Rev. 32
OSC-7993, Attachment UU, Analysis of Pump Overspeed, Rev. 4
OSC-8268, U1 LPI Hydraulic Calculation, Rev. 4
OSC-619, Analysis for use of spent fuel pool inventory for standby shutdown facility, Rev. 35
OSC-6051, Verification of Alternate Method used to fill spent fuel pools following operation of SSF RC makeup system, Rev. 6
OSC-1579, HPI pumps NPSH analysis, Rev. 6
OSC-7993, RBS system hydraulic evaluation for proposed modification, Rev. 4
OSC-4672, LPSW system LOCA/LOOP response, Rev. 10
OSC-5599, Evaluation of valve operator, Rev. 18
OSC-6195, Oconee Nuclear Station Units 1, 2 and 3 SSF 125 VDC Power System Voltage Drop, Battery and Inverter Sizing, Rev 7
OSC-3189, BWST Level Uncertainty, Rev 8
OSC 4300, Electrical Protective Relay Settings, Rev. 6
OSC 5952, Oconee-Keowee Underground Analysis Using Cyme, Rev. 005
OSC-2059, U1 AC Power System Voltage and Fault Duty Analyses, Rev. 25
OSC-2060, U2 AC Power System Voltage and Fault Duty Analyses, Rev. 25
OSC-2061, U3 AC Power System Voltage and Fault Duty Analyses, Rev. 21
OSC-3951, Electrical Design Inputs for Urgent NSM-ON-52850 (230KV Switchyard Degraded Voltage Scenario), Rev. 13
OSC-4300, Protective Relay Settings, Rev. 13
OSC-4506, Letdown Storage Tank Instrumentation Accuracy Calculation, Rev. 9
OSC-4616, Letdown Storage Tank Operating Curve – Maximum Allowable Pressure vs. Indicated Level, Rev. 9
OSC-5579, Design Inputs and 10CFR50.49 Evaluation for NSM-ON-52950, Rev. 14
OSC-5930, Unit 1 Motor Starter Circuit Voltage and Fuse Adequacy Calculation, Rev. 12
OSC-5952, Keowee Underground Path Analysis Using Cyme, Rev. 5

OSC-5952, Keowee Underground Path Analysis Using Cyme, Rev. 5, ICC 5d
OSC-5960, HPI Pump Suction Pressure w/LDST Level @ 40", Rev. 4
OSC-5971, Electrical Design Inputs for NSM's ON-32885/00, ON-12885/00, ON-22885/00 (Type IV), Rev. 4
OSC-6195, Oconee SSF DC System Voltage and Fault Current Analysis / Battery and Inverter Sizing, Rev. 6
OSC-7608, U1/2/3 AC Power System ETAP Model Base File, Rev. 10

Completed Procedures

PT/1/A/0610/001 J, Emergency Power Switching Logic Functional Test, 5/30/11

Corrective Action Documents

O-10-03222, Main valve of PORV 2RC-66 was removed during 2EOC-24, failed to open at 2450 psig after successfully opening at both 45 psig and 530 psig pressures, 5/2/10
O-03-02846, Configuration management actions associated with revisions to engineering calculations that support Keowee frequency limits, 5/9/03
O-00-03229, Oconee is not meeting the upper limit of voltage and frequency as defined in Technical Specification SR 3.8.1.9.a, 9/5/2000
O-09-03017, Unit Three 4160V Main Feeder Bus 1 and 2 Voltages High
O-09-02349, Mobile 28 Grease to be used during breaker refurbishment
O-10-08398, Proposed Violation of 10CFR50.49 (f)
O-08-01267, Failure of Swap Over Circuitry, 03/10/2008
O-09-01315, Replace relay 2-2 in transformer CT4, 03/04/2009
O-09-07746, Transformer Ct-4 Cooling Stat Alarm, 10/22/2009
O-05-02626, 1" diameter pipe grew thermally to a point of becoming unsupported, dated 4/4/05
O-05-04503, SSF RCMU pump suction temperature gauges and RCS loop temperature gauges oscillating, dated 7/10/05
O-05-06866, Previous testing of RCMU pump vibration testing not in accordance with IST, dated 10/25/05
O-05-07638, Oil pressure switch wiring for trip circuit was loose at the penetration, dated 11/14/05
O-06-02959, U3 RCMU pump tripped, dated 7/3/06
O-06-02978, SSF RCMU pump discharge relief valve 3HP-404 lifted, dated 5/15/06
O-06-06919, 1HP-020 MOV motor failed, dated 10/20/06
O-06-07085, 1HP-404 failed seat leakage and set pressure as found criteria, dated 10/24/06
O-06-07655, SSF Emergency Operating Procedure does not direct initial Main Steam isolations from control room, dated 11/09/06
O-06-08663, U1 SSF RCMU oil leakage, 12/13/06
O-06-08846, U3 SSF RCMU low oil pressure lite did not illuminate, 12/18/06
O-07-07107, 3HP-405 would not operate from SSF control switch, 12/3/07
O-07-07123, Issues when the SSF RCMU pump is operated during testing, 12/6/07
O-09-08081, 1HP-404 failed as found set pressure test, 10/28/09
O-09-08333, U1 RCMU pump packing leak, 11/07/09
O-10-02448, 1HP-417 would not operate from closed to open position, 4/4/10
O-10-05607, OSC-5501 RB temperature exceeded previously EQ analyzed temperatures, 8/16/10
O-10-10146, SSF Submersible pump installation, 12/1/10
O-11-02928, SSF Submersible pump equipment issue, 3/20/11
O-09-02586, 3V-186 would not operate from control room, 4/26/09

O-09-02773, Review of SSF RC Makeup Pump Packing Leakage, dated 4/29/09
O-09-06236, Changes to SSF environmental CR temperature and RB Temperature no incorporated into LOOP accuracy calculation dated 9/2/09
O-10-09169, RCMU pump suction Accumulator leaking, dated 11/7/10
O-10-10555, Strainer identified in the SSF RCMU pump lube oil system, dated 12/12/10
O-11-09461, U3 RCMU pump found with degraded suction pressure, dated 8/9/11
O-10-09812, Need engineering to review U3 SSF RCMU pump check valve stroke data, dated 11/7/10
G-10-00135, IN 10-03 Failures of MOVs due to degraded stem lubricant, dated 2/8/10
O-03-01220, Test Reports not Part of Dukes Document Management System, 3/6/03

Design Basis Documents (Functional System Descriptions)

OSS-0254.00-00-1028, Design Basis Specification for the Low Pressure Injection and Core Flood System (LPI), Rev 39
OSS-0254.00-00-4013, Design Basis Specification for the Oconee Single Failure Criterion, Rev 4
OSS-0254.00-00-1033, Design Basis Specification for the Reactor Coolant System, Rev 33
OSS-0254.00-00-1008, Standby Shutdown Facility Diesel Support Systems, Rev 37
OSS-0254.00-00-2020, Standby Shutdown Facility 125 VDC Essential Power System, Rev 9

Design Specifications

OSC-6619, Maximum LPSW System Pressure, Rev. 4
OSS-0254.00-00-2005, Design Basis Specification for the Keowee Emergency Power, Rev. 18
OSS-0254.00-00-1033, Spec for Pressurizer Code Safety Valves, Rev. 33
OSS-0254.00-00-1008, Specification for SSF Service water Strainer, Rev. 37
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OS-351-4, Diesel Engine Service water Pump, Rev. 0
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Design Changes

EC 101671, Show That Struthers-Dunn PM-17AY-120 Contactors are Equivalent, Rev. 000
EC 101693, Replace 6” Class C SSF ASW CS Piping, Rev. 000

Drawings

OM 201-0591.001, Power Operated Relief Valve, Rev. 6
OM 254-0207.001, Valve Assembly, Rev. D10
OM 254-0204.001, Safety Relief Valve, Rev. D6
OM 254-0206.001, Safety Relief valve, Rev. D8
OM 254-0205.001, Safety Relief Valve, Rev. D12
OM 2201-0454.001,14 inch 300 pound Gate Valve, Rev. D5
OFD-102A-3.3, P&ID Low Pressure injection System, Rev. 22
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OM 245-0658.001, Valve Assembly 10 Inch 1500 LB Swing Check Valve C.S., Rev. DE
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OM 245-2289.001, SMB-1 Standard Unit, Rev. D4
OM 2201-0454.001, 14 Inch Gate SMB-1 575 Volt, Rev. D6
OFD-122A-1.1, P&ID Main Steam System, Rev. 22
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OM 254-0396.001, Dresser Electromatic Relief valve, Rev. 5
OSFD-133A-2, Standby Shutdown Facility, Rev. 1
OEE -317-49, Elementary Diagram 4160 Switchgear # 3TE, Unit #10 Low Pressure Injection Pump Motor No. 3C, Rev 10
OM 302-0425-001, 4160 Switchgear Group No. 3TE, ITE Circuit Breakers General Arrangement, Rev 7
O-2702, One Line Diagram 6900 & 4160 Station Auxiliary System, Rev 23
OEE-117-1, Elementary Diagram Breaker Internal Diagram, Rev 6
O-0702-B, One Line Diagram 4160 and 600V Essential Load Centers Auxiliary Power Systems Standby Shutdown Facility, Rev 20
OFD-100A-3.2, Flow Diagram of Reactor Coolant System (Pressurizer), Rev 33
O-0703-G, One Line Diagram Station Auxiliary Circuits 600/208Y/400, Rev 83
O-0703-K, One Line Diagram 600V and 208V Essential Motor Control Centers Auxiliary Power Systems Standby Shutdown Facility, Rev 66
O-2703-G, One Line Diagram Station Auxiliary Circuits 600/208V, Rev 70
O-2720-A, Connection Diagram Reactor Coolant System, Rev 41
OEE-163, Elementary Diagram Standby Shutdown Facility (EOC Sys) SSF Diesel Control, Rev 4
OEE-350, Elementary Diagram Pressurizer Relief Block Valve 3RC-4, Rev 7
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O-759-J, Interconnection Diagram 125 VDC SSF Distribution Center DCSF Units F01A thru F04C, Rev 2
O-0704-E, One Line Diagram Station Auxiliary Circuits 208Y/120 VAC, Rev 25
O-705, One Line diagram 120 VAC &125 VDC Station Auxiliary Circuits Instrumentation Vital Buses, Rev 97
O-0706, One Line Diagram Essential SSF 125 VDC Auxiliary Power Systems, Rev 15
OM 308-0312 002, GTE-Sylvania Unit Specifications MCC DCSF Distribution Center, Rev 4
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0-703-G, One Line Diagram Station Auxiliary Circuits 600/208/408, Rev 82
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OM-300-46, Transformer CT4 Westinghouse DWG #5764D81, Rev D7
OM-300-42, Transformer CT4 Westinghouse DWG #5764D80 Schematic Diagram, Rev D6
OFD-121C-1.1 U1 Flow Diagram of Vacuum System, Revision 17
OFD-121C-2.1 U2 Flow Diagram of Vacuum System, Revision 11
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OM 351-91 “C” Plug 4” Wrench operated, dated 8/23/79
OEE-121-45 Turbine Controls Stop Valve Test Solenoids and Fast Acting Trip Line Solenoids, Revision 4
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OEE-151-39 Reactor Coolant Makeup Pump Motor Controls, Revision 7
OEE-151-39A Reactor Coolant Makeup Pump Motor Controls, Revision 11
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OEE-163-16B Standby Shutdown Facility SSF Control Transfer, Revision 3
OEE-251-39 Reactor Coolant Makeup Pump Motor Controls, Revision 6
OEE-251-39A Reactor Coolant Makeup Pump Motor Controls, Revision 8
OEE-263-01 SSF Transfer, Revision 3
OEE-263-01A Standby Shutdown Facility Control Transformer, Revision 1
OEE-263-01B Standby Shutdown Facility Control Transfer, Revision 2
OEE-263-02 SSF Transducer Power and Metering, Revision 2
OEE-351-39 Reactor Coolant Makeup Pump Motor Controls, Revision 7
OEE-351-39A Reactor Coolant Makeup Pump Motor Controls, Revision 9
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OEE-363-01A Standby Shutdown Facility Control Transformer, Revision 1
OEE-363-01B Standby Shutdown Facility Control Transfer, Revision 3
O-0703-K 600V and 208V Essential Motor Control Centers Auxiliary Power Systems SSF, Revision 66
D8032324J, Auxiliary Control System Schematic Diagram High Pressure Injection, Rev. DH
D8032326E, Auxiliary Control System Analog Switching Diagram Dwg. High Pressure Injection – 1HP3& 4 – Part 1, Rev. DU
K EE-0113-05-D, Elementary Diagram 2 of 3 Phases Out of Tolerance (Frequency and/or Voltage) Logic Circuitry, Rev. 1
K EE-0113-05-E, Elementary Diagram 2 of 3 Phases Out of Tolerance (Frequency and/or Voltage) Logic Circuitry, Rev. 0
K-700, One Line Diagram Relays and Meters 13.8-230KV, Rev. 33
K-702, One Line Diagram 600 Volt Station Auxiliary Circuits, Rev. 52
K-707, Elementary Diagram A.C. Circuits Generators No. 1 and 2 Transformer No. 1, Rev. 26
O-422-X-1, Instrument Details, Letdown Storage Tank Level Instruments 1HPIPG0437, IHPILT003P1 and IHPILT003P1, Rev. 12
O-702, One Line Diagram 6900V & 4160V Sta Auxiliary Sys, Rev. 34
O-702-A, One Line Diagram 6900V & 4160V Sta Auxiliary Sys, Rev. 30
O-702-A1, One Line Diagram 6900V & 4160V Sta Auxiliary Sys, Rev. 21
O-702-A2, One Line Diagram 6900V & 4160V Sta Auxiliary Sys, Rev. 14
O-702-B, One Line Diagram 4160 and 600V Essential Load Centers Auxiliary Power Systems Standby Shutdown Facility, Rev. 20
O-703-G, One Line Diagram Station Auxiliary Circuits 600/208V/480, Rev. 82
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O-705, One Line Diagram 120VAC & 125VDC Station Aux. Circuits Instrumentation Vital Buses, Rev. 97
OEE-117-1H, Elementary Diagram Standby Breaker Closing Initiation & Load Shedding Initiation & Testing, Rev. 14

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OEE-117-92-0D, Elementary Diagram SSF 4160V Switchgear OTS1 HK Breaker Wiring Diagram, Rev. 0
OEE-117-93-0A, Elementary Diagram SSF 4160V Switchgear OTS1 Comp. No. 2 Motor Feeder, Rev. 0
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OEE-151-05, Elementary Diagram 1B HPI BWST Suction Vlv. 1/51/8 (1HP-25) 1HP VA0025, Rev. 16
OEE-151-05-01, Elementary Diagram 1B HPI BWST Suction Vlv. 1/51/8 1HP VA0025, Rev. 8
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OEE-151-56, Elementary Diagram Letdown Storage Tank Level and Pressure Instrumentation Power Supply (Train 1), Rev. 0
OEE-151-57, Elementary Diagram Letdown Storage Tank Level and Pressure Instrumentation Power Supply (Train 2), Rev. 0
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OEE-76-1, External Grid Trouble Protective Channel No. 1 Logic Diagram, Rev. 0
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OEE-76-3, 230KV Switchboard Red & Yellow Bus Potential External Grid Protection System, Rev. 12
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O-11-10430, Leaks Identified during walkdown, dated 8/31/11
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