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

September 7, 2011

Mr. T. Preston Gillespie, Jr.
Site Vice President
Duke Energy Carolinas, LLC
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION - NRC SPECIAL INSPECTION REPORT 05000269/2011017, 05000270/2011017, AND 05000287/2011017

Dear Mr. Gillespie:

On July 8, 2011, the U.S. Nuclear Regulatory Commission (NRC) completed a special inspection at Oconee Nuclear Station Units 1, 2, and 3. The inspection assessed the capability of the Standby Shutdown Facility (SSF) Auxiliary Service Water subsystem to perform its safety function. A special inspection was warranted based on the risk and the deterministic criteria of involved operations that exceeded, or were not included in, the design bases of the facility and involved repetitive failures or events involving safety-related equipment or deficiencies in operations as specified in Management Directive 8.3, "NRC Incident Investigation Program." The inspection was performed in accordance with Inspection Procedure 93812, "Special Inspection," and focused on the areas discussed in the inspection charter described in the inspection report.

The enclosed inspection report documents the inspection results which were preliminarily discussed with you and members of your staff on July 8, 2011. A final exit meeting was held with you and members of your staff on August 16, 2011. The determination that the inspection would be conducted was made by the NRC on July 1, 2011, and the inspection started on July 5, 2011.

The inspection examined activities conducted under your license as they relate to safety, compliance with the Commission's rules and regulations, and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents one licensee-identified and two NRC-identified findings of potentially greater than very low safety significance which were determined to be violations of NRC requirements. One finding concerned failure to maintain design control of the SSF. Two findings concerned incorrect operability determinations of the SSF. These findings did present an immediate safety concern; however, corrective measures were implemented by the licensee. The safety significance of these findings has not been determined; therefore, no notice of violation is being issued at this time.

Also, one NRC-identified finding of very low safety significance was identified which was determined to be a violation of NRC requirements. However, because of the very low safety significance and because it is entered into your corrective action program, the NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2 of the NRC Enforcement Policy. If you contest this NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN.: Document Control Desk, Washington DC 20555-001; with copies to the Regional Administrator Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at Oconee. In addition, if you disagree with the characterization of 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 Oconee.

In accordance with 10 CFR 2.390 of the NRC's Rules of Practice, a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

George A. Hutto, Acting Chief
Reactor Projects Branch 1
Division of Reactor Projects

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

Enclosure: Inspection Report 05000269/2011017, 05000270/2011017 and 05000287/2011017
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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/RA/

George A. Hutto, Acting Chief
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Letter to T. Preston Gillespie from George A. Hutto dated September 7, 2011

SUBJECT: OCONEE NUCLEAR STATION - NRC SPECIAL INSPECTION REPORT 05000269, 270, 287/2011017

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.:	05000269, 05000270, 05000287
License No.:	DPR-38, DPR-47, DPR-55
Report No.:	05000269/2011017, 05000270/2011017 and 05000287/2011017
Licensee:	Duke Energy Carolinas, LLC
Facility:	Oconee Nuclear Station, Units 1, 2 and 3
Location:	Seneca, SC 29550
Dates:	July 5, 2011, through July 8, 2011
Inspectors:	J. Austin, Senior Resident Inspector, Harris (Lead) K. Ellis, Resident Inspector, Oconee S. Walker, Senior Reactor Inspector, DRS M. Riches, Operations Engineer, DRS B. Parks, Reactor Systems Engineer, NRR\DSS
Approved by:	George A. Hutto, Acting Chief Reactor Projects Branch 1 Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000269/2011017, 05000270/2011017, and 05000287/2011017; July 5 – July 8, 2011; Oconee Nuclear Station Units 1, 2, and 3; Special Inspection

This report documents a special inspection performed by a senior resident inspector, a resident inspector, a senior reactor inspector, a reactor systems engineer, and an operations engineer to review the circumstances surrounding the operability determination associated with the Standby Shutdown Facility (SSF) Auxiliary Service Water (ASW) subsystem. One licensee-identified and two NRC-identified findings of potentially greater than very low safety significance and one NRC-identified finding of very low safety significance were identified. The significance of most findings is indicated by their color (Green, White, Yellow, or 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. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process."

Mitigating Systems Cornerstone

- TBD: A licensee-identified potentially greater than Green apparent violation (AV) of 10 CFR 50, Appendix B, Criterion III, Design Control, was identified when the licensee failed to maintain design control of the Standby Shutdown Facility (SSF). Because the safety significance of this finding is potentially greater than Green, it is being treated as an NRC-identified finding.

  The failure to maintain design control of the SSF was a performance deficiency (PD). The PD was more than minor because it was associated with the Mitigating Systems Cornerstone attribute of Design Control and adversely affected the cornerstone objective in that failure to maintain equipment qualification did not provide reasonable assurance that the SSF Auxiliary Service Water subsystem would perform its safety function. A Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. A cross-cutting aspect was not identified because the finding does not represent current plant performance. (Section 4OA5.1)

- TBD: An NRC-identified potentially greater than Green apparent violation of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures, and Drawings, was identified when the licensee failed to perform an adequate operability evaluation for the Standby Shutdown Facility (SSF) Auxiliary Service Water (ASW) subsystem in accordance with NSD 203, Operability/Functionality.

  The failure to perform an adequate operability evaluation for the SSF ASW subsystem was a performance deficiency (PD). The PD was considered more than minor because it was associated with the Design Control attribute of the Mitigating System Cornerstone and adversely affected the cornerstone objective in that the licensee failed to assure the SSF pressurizer heater breakers would function under expected environmental conditions before declaring the SSF operable but degraded/nonconforming (OBDN). A Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. The PD was related to the cross-cutting aspect of using conservative assumptions in the Decision-Making component of the Human Performance cross-cutting area in that the licensee declared the SSF OBDN without validated testing to demonstrate the SSF pressurizer heater breakers would function under design basis conditions. [H.1(b)] (Section 4OA5.5)

- TBD: An NRC-identified potentially greater than Green apparent violation of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures, and Drawings, was identified when the licensee failed to perform a 50.59 evaluation for a compensatory measure for the Standby Shutdown Facility (SSF) Auxiliary Service Water subsystem in accordance with NSD 203, Operability/Functionality.

  The failure to perform a 50.59 evaluation of a compensatory measure in accordance with NSD 203 was a performance deficiency (PD). This PD was more than minor because it was associated with the Procedure Quality attribute of the Mitigating Systems Cornerstone and adversely affects the cornerstone objective in that the revised guidance in AP/0/A/1700/025 could not be used as a compensatory measure to support the SSF as operable but degraded/nonconforming (OBDN) without prior NRC review and approval. A Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. The PD directly involved the cross cutting aspect of using conservative assumptions in decision making in the Decision-Making component of the Human Performance cross cutting area in that the licensee relied on an unapproved analysis method to support a compensatory measure. [H.1(b)] (Section 4OA5.5)

- Green: An NRC-identified non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion III, Design Control, was identified for the licensee's failure to maintain the Standby Shutdown Facility (SSF) pressurizer heater breakers and associated electrical components as safety-related components or seismically-qualified as specified in the SSF licensing basis documents.

  The failure to maintain SSF systems, structures, and components (SSCs) as safety-related and seismically-qualified as required by the SSF licensing basis was a performance deficiency (PD). This PD was more than minor because it was associated with the Mitigating Systems Cornerstone attribute of Configuration Control and adversely affects the cornerstone objective in that failure to maintain equipment qualification did not provide reasonable assurance that the SSF Auxiliary Service Water subsystem would perform its safety function. The finding was of very low safety significance because the finding involved a design or qualification deficiency confirmed not to result in loss of operability or functionality. The PD directly involved the cross-cutting aspect of thoroughly evaluates problems such that the resolutions address causes and extent of conditions, as necessary including evaluating for operability in the Corrective Action Program component of the Problem Identification and Resolution cross-cutting area for not properly evaluating an immediate determination of operability (IDO). [P.1(c)] (Section 4OA5.7)

REPORT DETAILS

Background:

The SSF served as a backup to existing safety systems and provided an alternate and independent means to achieve and maintain Hot Standby for 72 hours for mitigating station blackout (SBO), tornado, high-energy line break events, and specific fire and internal/external flood events. The SSF would be manually operated only when installed normal and emergency systems were inoperable. The SSF was designed to control reactor pressure and temperature using the Reactor Coolant Makeup (RCMU) and the ASW subsystems and a dedicated power supply from the SSF emergency diesel generator. The ASW subsystem was used to control reactor pressure and temperature in Hot Standby via natural circulation cooling of the reactor coolant system (RCS). RCS pressure and temperature was controlled by providing feedwater to the once-through steam generators (OTSGs) in conjunction with the pressurizer heaters powered from the SSF to compensate for heat losses from the pressurizer and maintain RCS pressure for natural circulation cooling.

Plant Event Summary:

On June 2, 2011, the licensee identified that the installed breakers, located inside containment, supplying power from the SSF to pressurizer heaters may not withstand the expected 267°F temperature inside containment due to the loss of containment cooling. The breakers were equipped with a thermal overload feature that would have caused the breakers to trip below 267°F. The pressurizer heaters were required to support operation of the SSF ASW subsystem. The licensee declared the ASW subsystem inoperable and entered the 7-day Limiting Condition for Operation (LCO) for TS 3.10.1 Condition A. The licensee followed two strategies to address the inoperability. One strategy involved adding guidance to AP/0/A/1700/025 to control RCS pressure with a water-solid pressurizer by adjusting the makeup and letdown of the RCMU subsystem to maintain RCS pressure. ASW feedwater flow to the OTSGs was adjusted as necessary to promote RCS natural circulation cooling. The other strategy was to replace the installed pressurizer heater breakers with breakers that did not have a thermal overload feature.

The licensee completed replacing the breakers on June 8, 2011, however; the ASW subsystem was declared OBDN because the breakers were commercial grade and had to be environmental qualified for the expected containment temperature of 267°F. On June 24, 2011, the licensee was informed by the testing laboratory that three of four breakers being tested tripped before reaching the required temperature of 267°F. The licensee performed an IDO and determined that the ASW subsystem was OBDN because the revision to AP/0/A/1700/025 allowed the ASW subsystem to meet its design function using water-solid operation for RCS pressure control.

Special Inspection Charter

Based on the deterministic and conditional risk criteria specified in Management Directive 8.3, NRC Incident Investigation Program, a Special Inspection was initiated in accordance with NRC Inspection Procedure 93812, Special Inspection Team. The inspection focus areas included the following special inspection charter items:

1. Assess the ability of the SSF to meet its design basis functions with the as found condition.

2. Assess the revised SSF abnormal operating procedure AP/0/A/1700/025, Standby Shutdown Facility Emergency Operating Procedure, to determine the likelihood of success when using the new RCS pressure control strategy to maintain RCS subcooling following a loss of all SSF-powered pressurizer heater banks.

3. Assess the licensed operators' training and capability to successfully implement the revised SSF abnormal operating procedure to maintain the reactor stable in hot standby for a period of 72 hours.

4. Assess the thermo-hydraulic analysis performed to justify the feasibility of the revised operating methodology including the impact of temperature and pressure transients on core cooling, subcooling margin and challenges to the integrity of the RCS; i.e., the licensee's safety evaluation of the compensatory measures contained in the operability evaluation.

5. Assess the licensee's implementation of their operability determination process in the evaluation of the SSF's operability based on the identified condition including the 50.59 screening used to approve the use of water-solid operations as an acceptable method of RCS pressure control during SSF-credited events.

6. Assess the licensee's activities related to the problem investigation performed to date (e.g., root cause analysis, extent of condition, additional equipment failure mechanisms, etc.)

7. Assess the licensee's classification of the pressurizer heater breakers as being non-safety related, including the acceptability of placing the breakers into operation before completing testing.

4. OTHER ACTIVITIES

4OA5 Other Activities

.1 Assess the ability of the SSF to meet its design basis functions with the as found condition.

a. Inspection Scope

The inspectors reviewed the licensee's current licensing basis which included the Updated Final Safety Analyses Report (UFSAR), Technical Specifications (TS) and TS Bases, and various system Design Bases Specification Documents (DBDs) to verify the design functions and credited safety functions of the SSF and its associated systems.

The inspectors reviewed the applicable Safety Evaluation Reports (SER) and various correspondences between NRC and the licensee to obtain insights into the approved SSF licensed design requirements. The inspectors also reviewed the design change packages and supporting information to assess the adequacy of the licensee's actions for the ASW system and the impact on the SSF to meets its design basis function. Documents reviewed are listed in the Attachment.

b. Findings

Introduction: A licensee-identified potentially greater than Green AV of 10 CFR 50, Appendix B, Criterion III, Design Control, was identified when the licensee failed to maintain design control of the SSF. During original construction of the SSF in 1983, breakers assigned to the SSF for powering the pressurizer heaters were not reviewed to ensure that they would perform their safety function under elevated containment temperatures during certain SSF events. Because the safety significance of this finding is potentially greater than Green it is being treated as an NRC-identified finding.

Description: On June 2, 2011, the licensee identified that the installed pressurizer heater breakers supplying power from the SSF may not withstand the expected 267°F temperature inside containment due to the loss of containment cooling during SBO and seismic-induced turbine building flooding events. The breakers were equipped with a thermal overload feature that would have caused the breakers to open prematurely under elevated containment temperature preventing the SSF ASW subsystem from performing its safety function. Pressurizer heaters, powered and controlled from the SSF, were required for long term pressure control to maintain natural circulation cooling for the RCS during SSF events. However, a turbine building flood or a SBO event would have resulted in loss of containment cooling causing elevated containment temperatures. The elevated containment temperatures could cause the breakers powering the pressurizer heaters from the SSF to trip. If the pressurizer heaters were lost, RCS pressure would lower causing the formation of steam bubbles at the top of the hot legs which would interrupt natural circulation. The modification to power pressurizer heaters from the SSF used breakers that had not been tested to verify they would function at the expected containment temperatures during an SBO or seismic-induced turbine building flooding.

Analysis: The failure to maintain design control of the SSF was a PD. The PD was more than minor because it was associated with the Mitigating Systems Cornerstone attribute of Design Control and adversely affects the cornerstone objective in that failure to maintain equipment qualification did not provide reasonable assurance that the SSF ASW subsystem would perform its safety function. The finding was assessed using IMC 0609, Attachment 4, and determined that a Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. Therefore, the significance of this finding is to be determined (TBD). A cross-cutting aspect was not identified because the finding does not represent current licensee performance.

Enforcement: 10 CFR Part 50, Appendix B, Criteria III, Design Control, required, in part, that measures shall be established to assure that deviations from appropriate quality and design standards are controlled and that the review for suitability of application of equipment essential to safety-related functions of SSCs is maintained. Contrary to the above, from 1983 until June 1, 2011, the licensee failed to review for suitability of application of equipment essential to safety-related functions of SSCs. The licensee implemented a modification to the SSF that used installed breakers which had not been tested to verify they would function at elevated containment temperatures and maintain the SSF functionality in accordance with the licensing and design bases. Because this finding is potentially greater than Green, this violation is being treated as an AV: AV 05000269, 270, 287/2011017-01, Pressurizer Heater Breakers Would not have Functioned During Certain SSF-Credited Events.

c. Observations

The inspectors determined that the SSF ASW subsystem could not perform its design function because the pressurizer heaters breakers were non-conforming.

.2 Assess the revised SSF abnormal operating procedure AP/0/A/1700/025, Standby Shutdown Facility Emergency Operating Procedure, to determine the likelihood of success when using the new RCS pressure control strategy to maintain RCS subcooling following a loss of all SSF-powered pressurizer heater banks.

a. Inspection Scope

The inspectors reviewed AP/0/A/1700/025, Revisions 24 and 25, to determine if the changes would allow operators to control RCS pressure to prevent lifting of the pressurizer safety valves and to maintain RCS subcooling. The impact of these operational changes on the RCMU letdown valve and the Main Steam Safety Valves (MSSVs) over a 72-hour period was also assessed. Inspectors performed the following activities to evaluate the changes to AP/0/A/1700/025. Documents reviewed are listed in the Attachment.

- Observed a licensed reactor operator (RO) on the SSF task simulator perform the actions for aligning the SSF for operation following an SBO and performing the actions for responding to a loss of pressurizer heaters.
- Observed a demonstration by the licensee’s training staff on the SSF task simulator performing the actions for controlling RCS pressure and temperature under RCS solid water conditions.
- Compared the RCMU letdown valve stroke restrictions to the RCS pressure trends observed on the SSF task simulator during RCS water-solid conditions.
- Reviewed the analysis of seat leakage testing on the MSSVs through 1,000 cycles at their lift point.

b. Findings

No findings were identified.

c. Observations

Through observations of SSF task simulator operations and a review of the changes to AP/0/A/1700/025, the inspectors determined that, although RCS pressure changes occurred at a more rapid rate during RCS water-solid conditions, it was within the operator's ability to control. While the rate of RCS depressurization (~10 psig/min) and the rate of repressurization (~30 psig/min) were higher, it would not result in exceeding the RCMU letdown valve stroke restrictions of three cycles/hr. In addition, a review of MSSVs seat leakage indicated minimal leakage following 1,000 cycles of the valves through their pressure lift setpoints which was in excess of the expected number of cycles over the 72-hour period. These observations assume that the SSF task simulator provided accurate modeling of the RCS pressure response using the simulator's transient thermal-hydraulic computer code during RCS water-solid plant operations.

.3 Assess the licensed operators' training and capability to successfully implement the revised SSF abnormal operating procedure to maintain the reactor stable in hot standby for a period of 72 hours.

a. Inspection Scope

In addition to observing demonstrations on the SSF task simulator, the inspectors reviewed training lesson plans developed to address the changes to AP/0/A/1700/025 as well as reviewing the existing training associated with SSF operations provided to the licensed operators in both the initial and continuing training programs. Inspectors performed the following activities to understand and evaluate the effectiveness of the training. Documents reviewed are listed in the Attachment.

- Reviewed the most recent lesson plan developed to address the loss of pressurizer heaters during SSF operations.
- Conducted interviews with six licensed ROs to evaluate their understanding of the changes to AP/0/A/1700/025 and assess their ability to respond to a loss of pressurizer heaters and to control RCS pressure and temperature from the SSF under these conditions.
- Reviewed the training analysis relating to SSF tasks.
- Held discussions with the licensee's training staff concerning the frequency of SSF training as part of the continuing training program and the training strategies used to inform the licensed ROs relative to the procedural changes for loss of the pressurizer heaters.

b. Findings

No findings were identified.

c. Observations

The inspectors determined that two different training strategies were employed in instructing the licensed ROs on the changes to AP/0/A/1700/025. A portion of the licensed ROs received training on the SSF task simulator through group demonstrations and individual exercises designed to recognize and respond to a loss of pressurizer heaters. The majority of the licensed ROs received training in a table-top discussion format with an instructor reviewing the changes to the procedure and responding to questions. The inspectors concluded that the training was adequate to allow the operators to perform the necessary actions to respond to a loss of SSF pressurizer heaters and control pressure and temperature under RCS water-solid conditions.

.4 Assess the thermo-hydraulic analysis performed to justify the feasibility of the revised operating methodology including the impact of temperature and pressure transients on core cooling, subcooling margin and challenges to the integrity of the RCS; i.e., the licensee's safety evaluation of the compensatory measures contained in the operability evaluation.

a. Inspection Scope

The inspectors reviewed OSC-2310, SSF Design Bases Evaluation, Appendix B and Appendix I. Appendix B evaluated the capability to establish and maintain natural circulation conditions after loss of pressure control caused by a water-solid RCS due to inoperable SSF pressurizer heaters. Appendix I evaluated the reactor core conditions until the RCS became water-solid, assuming the pressurizer heaters failed approximately 20,000 seconds into the event.

The inspectors reviewed licensing topical report (LTR) DPC-3000-PA, Thermal-Hydraulic Transient Analysis Methodology, Revision 4a, including safety evaluations and appendices pertaining to the methodology's qualification for modeling various events and thermal-hydraulic system transients. DPC-3000-PA described the method and qualification employed to use the RETRAN-02 transient thermal-hydraulic computer code for safety and transient analysis. The inspectors reviewed licensing basis documentation associated with the licensee's use of DPC-3000-PA for safety analysis and licensing basis events in UFSAR Chapter 15, including Sections 15.1.2, Topical Reports, and 15.6.7, Natural Circulation Capability Analysis.

The inspectors evaluated the adequacy of RETRAN-02 to model natural circulation cooling associated with the degraded SSF pressurizer heaters, which included analyses supporting that natural circulation cooling could be established and maintained under RCS water-solid conditions, and the analyses that determined how long a steam bubble would remain in the pressurizer before collapsing into a liquid under various conditions. The inspectors also evaluated if the licensee's use of RETRAN-02 to model these conditions constituted a departure from a method of evaluation described in the final safety analysis report as updated. Documents reviewed are listed in the Attachment.

b. Findings

No findings were identified.

c. Observations

The inspectors determined that RETRAN-02 had not been approved by NRC to analyze a pressurizer bubble collapse followed by depressurization/repressurization cycles of the RCS over a 72-hour period. DPC-3000-PA, Section 4.3.3, presented comparisons of RETRAN-calculated and observed natural circulation flow rates at various lowered-loop B&W PWRs as a function of power level which indicated that the RETRAN-02 calculation over-predicted the natural circulation flow rates. These natural circulation tests had been performed with a steam bubble in the pressurizer. Therefore, these tests did not validate the use of RETRAN-02 to analyze transitioning from a steam bubble to a water-solid condition in the pressurizer.

The inspectors determined that the method of evaluation described in UFSAR Section 15.6.7 did not include consideration of the natural circulation capabilities of the RCS in a water-solid condition for an extended period. The licensing basis evaluated natural circulation cooling with a steam bubble in the pressurizer. Therefore, using the RETRAN-02 code to evaluate natural circulation cooling with the RCS water-solid deviated from the NRC-approved methodology and the test data did not demonstrate that the evaluation was within the capabilities of RETRAN-02. The regulatory aspect for this issue is documented in Section 4OA5.5 b.1.

.5 Assess the licensee's implementation of their operability determination process in the evaluation of the SSF's operability based on the identified condition including the 50.59 screening used to approve the use of water-solid operations as an acceptable method of RCS pressure control during SSF-credited events.

a. Inspection Scope

The inspectors reviewed the licensee's IDO for the potential of the SSF pressurizer heaters breakers to trip as documented in PIP O-11-6700. As part of the IDO review, the inspectors also reviewed the licensee's action of operating the reactor plant in a water-solid condition during SSF-credited events and the associated 10 CFR 50.59 safety evaluation to determine the appropriateness of the compensatory measure. The inspectors reviewed the licensee's current licensing basis which included a review of the UFSAR, TS, TS Bases, and various DBD Specifications to verify the design functions and credits safety functions of the SSF and its associated systems. Documents reviewed are listed in the Attachment.

b. Findings

1. Inadequate Operability Evaluation for SSF Pressurizer Heater Breakers

Introduction: An NRC-identified potentially greater than Green AV of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures, and Drawings, was identified when the licensee failed to perform an adequate operability evaluation for the SSF ASW subsystem in accordance with NSD 203, Operability/Functionality. The licensee declared the SSF ASW subsystem OBDN following replacement of the SSF pressurizer heater breakers without the necessary testing to demonstrate the breakers were environmentally qualified for expected elevated containment temperature.

Description: As described in the Plant Event Summary, the replacement SSF pressurizer heater breakers required environmental qualification. The licensee had performed limited environmental testing by heating the breakers in an oven under no-load conditions; however, this testing was not equivalent to the testing standard for environmental qualification. The licensee declared the SSF OBDN based on the results of this limited testing and on vendor data which indicated the breakers were insensitive to ambient temperature. During subsequent environmental qualification testing, it was discovered the SSF pressurizer heater breakers could not perform their design basis function at the expected elevated containment temperatures.

The inspectors reviewed the IDO documented in PIP O-11-6700, design modification information, and associated vendor data and determined the licensee relied on insufficient data to support the determination that the SSF was OBDN. The licensee's limited testing on the breakers was under no-load conditions which did not provide data on the impact high containment temperatures would have on the current-carrying capability of the breakers. Also, there was no vendor data available to support the position that the breakers would function under design basis conditions (e.g. high ambient temperatures). Additionally, while the vendor manual stated the breakers were ambient (temperature) insensitive, the manual also stated that "…high ambient (temperatures) may cause internal temperatures to exceed allowable temperature limits" under actual loaded conditions.

Analysis: The failure to perform an adequate operability evaluation for the SSF ASW subsystem was a PD. The PD was considered more than minor because it was associated with the Design Control attribute of the Mitigating System Cornerstone and adversely affected the cornerstone objective in that the licensee failed to assure the SSF pressurizer heater breakers would function under expected environmental conditions before declaring the SSF OBDN. The finding was assessed using IMC 0609, Attachment 4, and determined that a Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. Therefore, the significance of this finding is TBD. The PD was related to the cross-cutting aspect of using conservative assumptions in decision-making in the Decision-Making component of the Human Performance cross-cutting area in that the licensee declared the SSF OBDN without validated testing to demonstrate the SSF pressurizer heater breakers would function under design basis conditions. [H.1(b)]

Enforcement: 10 CFR Part 50, Appendix B, Criteria V, Instructions, Procedures, and Drawings, required, in part, that activities affecting quality shall be accomplished in accordance with instructions and procedures. NSD 203, Section 203.7, stated if a degraded/non-conforming SSC is declared operable or OBDN, the evaluation should clearly state the reasonable expectation of operability commensurate with the safety function of the SSC. Contrary to the above, from June 2, until June 24, the licensee failed to accomplish an activity affecting quality in accordance with instructions and procedures. The licensee did not perform an operability evaluation for the SSF ASW subsystem in accordance with NSD 203 in that the licensee relied on insufficient data to support the determination that the SSF was OBDN. Because this finding is potentially greater than very low safety significance, this violation is being treated as an AV and is designated as AV 05000269, 270, 287/2011017-02, Failure to Perform an Adequate Operability Evaluation for the SSF.

2. Failure To Evaluate A Compensatory Measure

Introduction: An NRC-identified potentially greater than Green AV of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures, and Drawings, was identified when the licensee failed to perform a 50.59 evaluation of a compensatory measure for the SSF ASW subsystem in accordance with NSD 203.

Description: As discussed in the Plant Event Summary, the licensee was notified that the replacement SSF pressurizer heater breakers failed environmental qualification testing on June 24. The licensee determined that the SSF was still OBDN based on guidance in AP/0/A/1700/025 which used RCS water-solid operation as an alternative method of pressure control during natural circulation cooling. However, the licensee did not consider that using the AP/0/A/1700/025 guidance was a compensatory measure which would have required a 50.59 evaluation. The licensee added guidance to AP/0/A/1700/025 to use RCS water-solid operations for pressure control which was used as a compensatory measure when the SSF was previously determined to be inoperable.

The inspectors questioned why the AP/0/A/1700/025 guidance was not considered a compensatory measure as it was being used to justify the SSF as OBDN. The licensee reviewed NSD 203 and determined the guidance was being used as a compensatory measure and a 50.59 evaluation should have been performed as required by NSD 203. When the licensee did a 50.59 evaluation, it was determined that the AP/0/A/1700/025 guidance relied on use of the RETRAN-02 thermal hydraulic code to analyze natural circulation cooling using RCS water-solid operations for pressure control. As discussed in Section 4OA5.4, this evaluation method required prior NRC review and approval before it could be used as a compensatory measure to support the SSF as OBDN.

Analysis: The failure to perform a 50.59 evaluation of a compensatory measure in accordance with NSD 203 was a PD. This PD was more than minor because it was associated with the Procedure Quality attribute of the Mitigating Systems Cornerstone and adversely affected the cornerstone objective in that the revised guidance in AP/0/A/1700/025 could not be used as a compensatory measure to support the SSF as OBDN without prior NRC review and approval. The finding was assessed using IMC 0609, Attachment 4, and determined that a Phase III analysis was required because the finding involved the loss or degradation of equipment designed to mitigate external initiating events. Therefore, the significance of this finding is TBD. The PD directly involved the cross cutting aspect of using conservative assumptions in decision making in the Decision-Making component of the Human Performance cross cutting area in that the licensee relied on an unapproved analysis method to support a compensatory measure. [H.1(b)]

Enforcement: 10 CFR Part 50, Appendix B, Criteria V, Instructions, Procedures, and Drawings, required, in part, that activities affecting quality shall be accomplished in accordance with instructions and procedures. NSD 203, Section 203.9.1, Compensatory Actions, stated that proposed compensatory actions that constitute changes to the facility or procedures as described in the UFSAR require application of 10CFR50.59 prior to implementation. Contrary to the above, from June 24 until July 8, 2011, the licensee failed to accomplish an activity affecting quality in accordance with instructions and procedures. The licensee did not perform a 50.59 evaluation in accordance with NSD 203 of a compensatory measure which the licensee used to determine that the SSF ASW subsystem was OBDN. It was subsequently determined that the compensatory measure could not be used because NRC review and approval was required prior to implementation. Because this finding is potentially greater than very low safety significance, this violation is being treated as an AV: AV 05000269, 270, 287/2011017-03, Failure to Perform a Safety Evaluation for a Compensatory Measure.

c. Observations

The inspectors noted an additional issue of concern regarding using water from the spent fuel pool to supply the SSF RCMU subsystem. This concern is documented in Section 4OA5, Other Activities.

.6 Assess the licensee's activities related to the problem investigation performed to date (e.g., root cause analysis, extent of condition, additional equipment failure mechanisms, etc.).

a. Inspection Scope

The inspectors reviewed PIP O-11-6700 to assess the licensee's investigation of the failure of the SSF pressurizer heater breakers.

b. Findings

No findings were identified.

c. Observations

A cause evaluation was not completed at the time of the inspection. PIP O-11-6700 contained the IDO for both June 6 and 24. The operability evaluation reviewed is documented in Section 4OA5.5. However, in this PIP several corrective actions were initiated to perform a preliminary extent of condition in specific areas. The reviews of these areas had not been completed by the licensee at the time of the inspection. The licensee noted that the final extent of condition review will be completed and documented in the cause evaluation process.

.7 Assess the licensee's classification of the pressurizer heater breakers as being non-safety related, including the acceptability of placing the breakers into operation before completing testing.

a. Inspection Scope

The inspectors reviewed several licensing basis documents including the UFSAR, TS, SERs, and licensee commitments to determine the appropriate design basis of the SSF pressurizer heaters. In addition, the inspectors reviewed related DBDs and design calculations to assess detailed supporting information for the design basis of the pressurizer heaters and associated electrical components. The inspectors evaluated the design modification packages that installed the new SSF pressurizer heater breakers to determine if design inputs and assumptions were appropriately considered and verified. In addition, the inspectors assessed the operability evaluation the licensee performed in response to the identified pressurizer heater degraded condition to determine if the licensee documented a reasonable justification for SSF operability. Documents reviewed are listed in the Attachment.

b. Findings

Introduction: An NRC-identified Green NCV of 10 CFR 50, Appendix B, Criterion III, Design Control. The SSF pressurizer heater breakers and associated electrical components were not maintained as safety-related components nor seismically qualified as specified in the SSF licensing basis documents.

Description: In a May 6, 1996, letter, the licensee identified SSCs that were designated as being safety-related since the original SSF licensing basis was established, as well as stated in subsequent commitments. As documented in the UFSAR, the licensee explicitly stated that "…all portions of the SSF required for mitigation of a seismic-induced Turbine Building flood shall be QA-1." A bank of pressurizer heaters, powered and controlled from the SSF, was credited for long-term RCS pressure control to assure the SSF ASW subsystem could perform its safety function of natural circulation cooling.

The inspectors noted that the pressurizer heater breakers and associated electrical components powered from the SSF were not maintained as safety-related components. In addition, the inspectors questioned if the pressurizer heater breakers were seismically qualified to mitigate a seismic-induced Turbine Building flood. The licensee determined that only the SSF Group B pressurizer heater breakers were in the seismic qualification safe shutdown equipment list. However, the pressurizer heater breakers had not been tested to determine if they were seismically qualified. Subsequently, based on seismic testing of the breakers, the licensee determined that they were acceptable.

Analysis: The failure to maintain SSF SSCs as safety-related and seismically qualified as required by the SSF licensing basis was a PD. This PD was more than minor because it is associated with the Mitigating Systems Cornerstone attribute of Configuration Control and adversely affected the cornerstone objective in that failure to maintain equipment qualification did not provide reasonable assurance that the SSF ASW subsystem would perform its safety function. The finding was assessed using IMC

0609, Attachment 4, and determined that the finding was of very low safety significance because the finding involved a design or qualification deficiency confirmed not to result in loss of operability or functionality. The PD was directly related to the cross-cutting aspect of thoroughly evaluates problems such that the resolutions address causes and extent of conditions, as necessary including evaluating for operability in the Corrective Action Program component of the Problem Identification and Resolution cross-cutting area for not properly evaluating in IDO. [P.1(c)]

Enforcement: 10 CFR Part 50, Appendix B, Criteria III, Design Control required, in part, that measures shall be established to assure that deviations from appropriate quality and design standards are controlled and that the review for suitability of application of equipment essential to safety-related functions of SSCs is maintained. Contrary to the above, from 1996 until July 8, 2011, the licensee failed to maintain the SSF pressurizer heater breakers and associated electrical components as safety-related QA-1 and seismically-qualified components in accordance with the licensing and design bases. Because this finding is potentially greater than very low safety significance, this violation is being treated as an NCV: NCV 05000269, 270, 287/2011017-04, Failure to Maintain SSF Pressurizer Heater Breakers as Safety-Related Components.

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

Introduction: The inspectors identified an URI associated with the analysis for using Spent Fuel Pool Inventory during a SSF event.

Description: The inspectors reviewed Calculation OSC-0619, Analysis for use of Spent Fuel Pool Inventory for SSF, and determined that justification was not available for two critical assumptions that directly impact the technical justification necessary to protect the integrity of the spent fuel in the spent fuel pool during a SSF event. 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. PIP O-11-8104 was initiated to document this deficiency and add supporting information to clarify the assumptions in the calculation. Pending the results of this additional inspection an Unresolved Item will be opened and designated as URI 05000269, 270, 287/2011017-05, Heat Addition to the Spent Fuel Pool from the Reactor Coolant Makeup Letdown Line.

4OA6 Meetings, Including Exit

On July 8, 2011, the special inspection team leader presented the preliminary inspection results to Mr. T. Preston Gillespie, Site Vice President, and members of his staff. On August 16, 2011, a final exit was held with Mr. Gillespie and members of his staff. No proprietary information is included in this inspection report.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel
K. Alter, Regulatory Compliance Manager
E. Burchfield, Vice President Nuclear (Corporate Office)
G. Byers, Principal Engineer
R. Freudenberger, Regulatory Support Manager
T. Gillespie, Site Vice President
M. Ledford, Nuclear Supply Chain
D. Nix, Operations Support
T. Patterson, Safety Assurance Manager
T. Saville, Safety Assurance Manager
J. Sites, Nuclear Supply Chain Manager

NRC Personnel
J. Bartley, Chief, Reactor Projects Branch 1, Division of Reactor Projects Region II
A. Sabisch, Senior Resident Inspector, Oconee

LIST OF REPORT ITEMS

Opened

05000269, 270, 287/2011017-01	AV	Pressurizer Heater Breaker Installation That Would not have Functioned During Certain SSF-Credited Events (Section 4OA5.1)
05000269, 270, 287/2011017-02	AV	Failure to Maintain SSF Pressurizer Heater Breakers as Safety-Related Components (Section 4OA5.5)
05000269, 270, 287/2011017-03	AV	Failure to Perform an Adequate Operability Evaluation for the SSF (Section 4OA5.5)
5000269, 270, 287/2011017-05	URI	Heat Addition to the Spent Fuel Pool from the Reactor Coolant Makeup Letdown Line (Section 4OA5.8)

Opened and Closed

05000269, 270, 287/2011017-04	NCV	Failure to Maintain SSF Pressurizer Heater Breakers as Safety-Related Components (Section 4OA5.7)

LIST OF DOCUMENTS REVIEWED

Design Basis Documents and System Descriptions
OSC-619, Analysis for use of Spent Fuel Pool Inventory for SSF, Rev 34
OSC-8670, SSF RCS Temperature Instrument Loop Uncertainty, Rev. 02
OSC-2742, SSF RCS Pressure A and B LOOP Instrument Uncertainty, Rev. 10
DBD Specification OSS-0254.00-00-1005, SSF ASW System, July 10, 1995
UFSAR Chapter 9, Standby Shutdown Facility, Dec 31, 2009
UFSAR Section 5.4.6.2, Pressurizer Heaters, December 31, 2009

NSD 209, 10CFR50.59 Process, Rev. 14
NSD 203, Operability/Functionality, Rev. 23
10CFR50.59 Screen, Replace SSF PZR Heater Panelboard
10CFR50.59 Screen, SSF EOP Rev. 51
10CFR50.59 Screen, SSF EOP Rev. 21
EC 106229, Unit 3 - Replace SSF PZR Heater Panelboard Breakers
EC 106230, Unit 2 - Replace SSF PZR Heater Panelboard Breakers
EC 106231, Unit 1 - Replace SSF PZR Heater Panelboard Breakers

Design Specifications
OSS-0176.00-00-0002, Standby Shutdown Facility, Rev. 4
OSS-0254.00-00-1004, SSF RC Makeup System, Rev. 35
OSS-0254.00-00-1005, SSF Auxiliary Service Water System, Rev. 27
OSS-0254.00-00-1033, Reactor Coolant System, Rev. 33
OSS-0254.00-00-2014, 4160/600/120 V SSF Essential AC Power System, Rev. 8
OSS-0254.00-00-4021, Oconee Definition of QA Condition 1, Rev. 7
OSS-0254.00-00-4022, Oconee QA Condition 5 Program, Rev. 0

Design Changes
EC 106229, Replace SSF Pressurizer Heater Panelboard Breakers Unit 3
EC 106230, Replace SSF Pressurizer Heater Panelboard Breakers Unit 2
EC 106231, Replace SSF Pressurizer Heater Panelboard Breakers Unit 1

Drawings
O-0702-B, One Line Diagram, 4160 and 600V Essential Load Centers, Auxiliary Power Systems, Standby Shutdown Facility, Rev. 20
O-0703-K, One Line Diagram, 600V and 208V Essential Motor Control Centers, Auxiliary Power Systems, Standby Shutdown Facility, Rev. 64
O-726, Interconnection Diagram, Pressurizer Heaters U1, Rev. 21
O-1726, Interconnection Diagram, Pressurizer Heaters U2, Rev. 21
O-2726, Interconnection Diagram, Pressurizer Heaters U3, Rev. 23
O-767-A62, Connection Diagram, Unit 1 Reactor Building Penetrations, Type B6 Penetration, No. WA7, Rev. 2
O-1767-A63, Connection Diagram, Unit 2 Reactor Building Penetrations, Type CB6 Penetration, No. WD02, Rev. 4
O-2767-A65, Connection Diagram, Unit 3 Reactor Building Penetrations, Type B6 Penetration, No. WD2, Rev. 3
OEE-149-8, Elementary Diagram, Unit 1 SSF Pressurizer Heater Group B Bank 2, Rev. 24
OEE-149-12, Elementary Diagram, Unit 1 SSF Pressurizer Heater Group C Bank 2, Rev. 3
OEE-249-10, Elementary Diagram, Unit 2 SSF Pressurizer Heater Group B Bank 2, Rev. 24
OEE-249-15, Elementary Diagram, Unit 2 SSF Pressurizer Heater Group C Bank 2, Rev. 3
OEE-349-10, Elementary Diagram, Unit 3 SSF Pressurizer Heater Group 3B Bank 2, Rev. 24
OEE-349-15, Elementary Diagram, Unit 3 SSF Pressurizer Heater Group C Bank 2, Rev. 6

Licensing Documents
TS and TS Bases, Current
UFSAR,Current
SER and Supplements

Calculations
OSC-6100, Instructions for Preparing Event Mitigation Database, Rev. 4
OSC-6658, Turbine Building Flood Event Mitigation Requirements, Rev. 7

Plant Procedures
AP/0/A/1700/025, Standby Shutdown Facility Emergency Operating Procedure, Revision Rev. 24
AP/0/A/1700/025, Standby Shutdown Facility Emergency Operating Procedure, Revision Rev. 24
EDM 601, Modification Test Plan, Rev. 14
NSD 408, Testing, Rev. 14

Corrective Action Documents
PIP O-11-8094, Extent of condition review for SSF pressurizers
PIP O-11-7918, Questions regarding removal or 10CFR50.59 rescreening of procedure steps associated Compensatory Actions upon resolution of OBDN conditions
PIP O-02-1066, Pressurizer ambient heat losses are greater than calculated in OSC-3144, impacting SSF ASW system Operability
PIP O-11-7635, Test specimens of SSF Pressurizer Heater Breakers Installed by EC-106229, 106230, and 106231 tripped during qualification testing
PIP O-02-1066, Problem discovered while preparing a test to determine Pzr ambient heat loss

Miscellaneous
OM 254-0409.001, Main Steam Safety Valve Cycle Life Test Program, Rev. 1
Job Performance Measure, CRO-47; Activate the SSF, Rev. 17
SSF Licensed RO Task-to-Training Matrix
PSF-090, Part1: SSF Operation Following a Loss of Power, HPI, Component Cooling, and All Feedwater – Part 2: SSF Solid Plant Operations, Rev. 5
PSF-091, SSF Operation Following a Loss of Power and All Feedwater, Rev. 00a
PSF-092, SSF Operation Following a Fire/Station Blackout at BOC, Rev. 0
Licensed Operator Four-year Training Plan, 07/07/11
Training and Qualification Guide TQ-002444101, Following Fire, Flood or Sabotage, Place and Maintain Units in Hot Shutdown from SSF by Procedure, Rev. 004a
Purchase Order 00147307, New GE Breakers Installed in Units 1, 2, and 3
Kinetrics Inc. Test Procedure for Testing of Circuit Breaker Panels – Phase I for Duke Oconee, June 21, 2011
Safety Evaluation For the Environmental Qualification of Safety-Related Electrical Equipment, Oconee Units 1, 2, and 3, April 11, 1983
Safety Evaluation for the Oconee Nuclear Station Standby Shutdown Facility, April 28, 1983
Issuance of Amendments – Oconee Units 1, 2, and 3, May 11, 1992
Generic Letter 83-28 Supplemental Response – Oconee Units 1, 2, and 3, August 3, 1995
Oconee QA-1 Licensing Basis and Generic Letter 83-28, Section 2.2.1, Subpart I Supplemental Response, April 12, 1995
Oconee QA-1 Licensing Basis and Generic Letter 83-28, Section 2.2.1, Subpart I Supplemental Response, July 10, 1995
Oconee QA-1 Licensing Basis and Generic Letter 83-28, Section 2.2.1, Subpart I Supplemental Response, May 6, 1996

Oconee Nuclear Station Units 1, 2, and 3 RE: Plant-Specific Safety Evaluation Report for Unresolved Safety Issue A-46 Program Implementation, Including Keowee Hydro Station and Switchyard, September 9, 1999

Elevated Temperature Tests of ONS SSF Pressurizer Heater Breakers, Metallurgy File #4611, June 30, 2011

Vendor Manual

GET-7002D, Spectra RMS Molded Case Circuit Breakers, 04/2008