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

May 31, 2002

EA-00-137

Duke Energy Corporation
ATTN: Mr. W. R. McCollum
Site Vice President
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION - NRC SUPPLEMENTAL INSPECTION REPORT 50-269/02-07, 50-270/02-07, AND 50-287/02-07

Dear Mr. McCollum:

On May 3, 2002, the NRC completed a followup supplemental inspection at your Oconee Nuclear Station. The enclosed report documents the inspection findings which were discussed on May 3, 2002, with you and other members of your staff.

This followup supplemental inspection was a further examination of your corrective actions associated with a White finding in the mitigating systems cornerstone previously discussed in Supplemental Inspection Report 50-269,270,287/01-09. The current inspection was performed because, at the conclusion of the previous supplemental inspection, the inspectors determined that your corrective actions had not been sufficiently developed.

Based on the results of this inspection, the NRC determined that your corrective actions (both planned and already completed) are appropriate to resolve Oconee's deficient tornado mitigation strategy and that the inspection objectives of Inspection Procedure 95002, "Inspection for one Degraded Cornerstone or any Three White Inputs in a Strategic Performance Area," have been satisfied. Therefore, the open White finding related to the use of the spent fuel pool as a suction source for the high pressure injection pump during certain tornado events is closed.

During the inspection, the inspectors identified one issue of very low safety significance (Green), that was determined to involve a violation of NRC requirements. However, because of its very low safety significance and because it has been entered into your corrective action program, the NRC is treating this issue as a non-cited violation, in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny the non-cited violation in the enclosed report, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report, 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 Oconee.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure 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/

Victor M. McCree, Deputy Director
Division of Reactor Projects

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

Enclosure: NRC Supplemental Inspection Report 50-269,270,287/02-07
(w/Attachment)

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos:	50-269, 50-270, 50-287
License Nos:	DPR-38, DPR-47, DPR-55
Report No:	50-269/02-07, 50-270/02-07, 50-287/02-07
Licensee:	Duke Energy Corporation
Facility:	Oconee Nuclear Station, Units 1, 2, and 3
Location:	7800 Rochester Highway Seneca, SC 29672
Dates:	April 29 - May 3, 2002
Inspectors:	R. Gibbs, Senior Resident Inspector - Sequoyah W. Rogers, Senior Reactor Analyst
Approved by:	V. McCree, Deputy Director Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS
Oconee Nuclear Station, Units 1, 2, and 3

IR 05000269,270,287/02-07, 4/29-5/3/2002, Duke Energy Corporation, Oconee Nuclear Station, Units 1, 2, & 3: Followup supplemental inspection for degraded mitigating systems cornerstone.

The inspection was conducted by a senior resident inspector and a senior reactor analyst. The inspection identified one Green finding which was a non-cited violation. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609 "Significance Determination Process" (SDP). Findings for which the SDP does not apply are indicated by "No Color" or by the severity level of the applicable violation. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described at its Reactor Oversight Process website at http://www.nrc.gov/NRR/OVERSIGHT/Assess/index.html.

Cornerstone: Mitigating Systems

The NRC performed this followup supplemental inspection to assess the licensee's corrective actions associated with a deficient tornado mitigation strategy. This finding was previously discussed in NRC Inspection Report 50-269,270,287/01-09. A followup inspection was necessary because, at the end of the previous inspection, the licensee's corrective actions were not fully developed. During this followup inspection, performed in accordance with Inspection Procedure 95002, the inspectors determined that the licensee's corrective actions (both planned and already completed) were appropriate to resolve Oconee's deficient tornado mitigation strategy. The inspectors determined that corrective actions to address the licensee's lack of understanding of the licensing and design basis for tornadoes were appropriately specified, prioritized, and scheduled in a formal tracking system. Furthermore, plans were in place to measure the effectiveness of those corrective actions to prevent recurrence.

Based on this information, the open White finding related to the use of the spent fuel pool as a suction source for the high pressure injection pump during certain tornado events is closed.

Findings

- Green. The inspectors identified a non-cited violation of 10CFR50, Appendix B, Criterion III, Design Control, in that the licensee had not required the pressurizer safety valves to reseat after passing hot reactor coolant during certain events involving no core cooling and a delay in establishing secondary side heat removal (e.g., auxiliary service water tornado pump injection).

  The finding was of more than minor significance because if left uncorrected this same issue would become more significant. Without appropriate design controls to maintain this reseat function of the current valves and on the purchase of replacement valves, the function could be credibly lost. Loss of this function would have an actual impact on safety due to the initiation of a loss of coolant accident. However, because the currently installed valves would reseat, this issue presently does not effect the operability or reliability of a mitigating system function. As such, this issue is of very low safety significance (Section 02.03B.(8)).

Report Details

01 Inspection Scope

The NRC performed this supplemental inspection, using Inspection Procedure 95002 (Degraded Cornerstone), to determine whether licensee corrective actions were sufficiently developed to address deficiencies in the Oconee tornado mitigation strategy. These deficiencies were identified in NRC Inspection Report 50-269,270,287/01-09, which documented the NRC's initial 95002 supplemental inspection of two previously identified White findings in the mitigating systems cornerstone. The inspectors assessed whether the licensee had provided assurance that their corrective actions to this low to moderate risk significant performance issue were sufficient to address the contributing cause of the White findings, which was a lack of understanding of the licensing and design basis of tornado mitigation. More specifically, the inspectors focused on whether the corrective actions had been appropriately specified, prioritized, and scheduled in a formal tracking system, and whether quantitative or qualitative measures of success for determining the effectiveness of the corrective actions had been established. To assess the licensee's corrective actions, the inspectors reviewed: applicable Problem Investigation Process reports (PIPs), including the planned and completed corrective actions associated with tornado mitigation strategy; the current revision of the Tornado Design Basis Project Plan; and the draft probabilistic risk assessment (PRA) for tornadoes. Key individuals involved in the resolution of the PIP reports and in development of the tornado PRA model were interviewed. The modification package for providing electrical power to essential unit auxiliary equipment at the Keowee hydroelectric station and information related the Unit 3 main control room north wall were reviewed. Walkdowns of the Keowee modification and the Unit 3 control room wall were also performed.

02 Evaluation of Inspection Requirements

02.03 Corrective Actions

A. Tornado Design Basis Project Plan Review

The inspectors reviewed the licensee's Tornado Design Basis Project Plan, dated February 6, 2002. The plan included major aspects of the licensee's overall corrective action plan to resolve the deficient tornado mitigation strategy. The plan was an overview of project elements and milestones supporting the licensee's intention to submit a license amendment for tornado mitigation based on probabilistic insights. The licensee considered the plan and tornado mitigation license amendment as the means towards a better understanding of the overall strategy for tornado mitigation.

One key element of the plan was a proposed modification to harden the west penetration and cask decontamination tank room walls, making them tornado proof for design basis winds and missiles, with the intent of designating the standby shutdown facility as a deterministic tornado mitigation strategy. In addition, there was the recognition that other risk significant strategies (e.g., use of the auxiliary service water (ASW) pump for secondary plant cooling) would be included in the licensing basis. Another significant initiative was a detailed review of tornado risk using probabilistic methods. All of the technical issues identified in the previous supplemental inspection

report and discussed in this inspection report were addressed in the plan with specific corrective actions and schedules for completion.

The inspectors reviewed the plan and discussed it with engineering and licensing personnel. The inspectors noted that PIPs O-01-01225 and O-01-02791 included the key corrective actions addressed in the plan. The inspectors reviewed these actions as they related to the licensee's understanding of tornado mitigation to ensure that appropriate corrective actions were specified, prioritized, and scheduled. In addition, the inspections ensured that measures had been established for the licensee to evaluate their corrective actions for effectiveness. In particular, the inspectors noted that the licensee had planned to submit a revised tornado licensing basis amendment to the NRC in the second quarter of 2002. Under corrective action (CA) 1 of PIP O-01-01225, a multi-plant PRA was completed on August 31, 2001. From this multi-plant assessment, a risk insight review was performed and corrective actions were established. In addition, a comprehensive evaluation of a revised PRA model for tornadoes was undertaken. The revised PRA model was under validation with issuance imminent. Upon issuance, the licensee planned a review of the model results for risk insights and an evaluation for possible facility improvements. PIP O-01-02791 CA 6 documented these actions with a projected completion date in June 2002.

The inspectors noted that the modification to the west penetration and cask decontamination tank room walls was in the Initial Scoping Document phase of the modification process, which was targeted for completion in June 2002 (CA 18 of PIP O-01-02791). A detailed engineering design was expected to be completed by June 2003 with modification implementation in 2005. The inspectors discussed with engineering personnel the basis for this completion date. The licensee had other competing projects, such as the replacement of steam generators for all three units beginning in the fall of 2003. The inspectors considered the licensee's schedule to be reasonable.

From their review of the Tornado Design Basis Project Plan, the inspectors concluded that the licensee had made significant progress towards the overall understanding of the licensing and design basis for tornado mitigation.

B. PRA Model Update Review

The major elements of the deficient tornado mitigation strategy documented in the previous supplemental inspection report, coupled with the completed or scheduled corrective actions are discussed below. Also discussed are additional aspects of the deficient strategy identified since the previous inspection.

(1) Loss of Auxiliary Power to Keowee Hydroelectric Units

The PRA assumes that a tornado fails the Keowee overhead line, which is one of the long-term power sources for Keowee auxiliary equipment. De-energization of the Unit 1 safety related 4KV electrical buses in the turbine building through failure of the main feeder bus breakers from the same tornado wind effects or missiles would fail the remaining long-term power source (Bus 1TC) for the Keowee auxiliary equipment. Therefore, upon failure of the Unit 1 4KV buses, secondary side heat removal via ASW for any Unit (1, 2 or 3) would always be lost. Under PIP O-01-01225 (CAs 4, 6, 7, 8, 9)

the facility was modified in March 2002 under an urgent plant modification to install a switch, that when actuated upon failure of the 1TC bus, would enable Keowee to power its own auxiliary equipment. Associated operating procedures were revised to direct use of the switch. Under CA 6, the failure of the switch or operators failing to use the switch was incorporated into the revised PRA model.

The inspectors walked down the modification with engineering and operations personnel, and reviewed the applicable operating procedures and operator training modules. The inspectors also confirmed that the licensee had included in the PRA model a failure of the operator to align auxiliary power. The inspectors reviewed the failure probability and considered it to be reasonable. The modification did not cause an appreciable reduction in core damage frequency (CDF) due to the licensee's identification of other previously, unrecognized failure mechanisms discussed in Section 02.03B.(10). During the modification review, the inspectors identified that the licensee had not completed a formal timing of the required operator action to ensure it could be completed in one hour. The licensee immediately initiated PIP O-02-02455 and completed the validation, which revealed that the action could be performed in 39 minutes. Based on this review, the inspectors concluded that the licensee had taken appropriate corrective actions to resolve the condition.

(2) Turbine Driven Emergency Feedwater Pump Cooling

A tornado induced failure of the Unit 1 safety-related 4KV buses would de-energize the support systems that provide cooling water for the turbine driven emergency feedwater (TDEFW) pump. The licensee initiated CA 10 of PIP O-01-01225 to test whether the low pressure service water or high pressure service water systems were necessary to support the TDEFW pump, which could be used for secondary side heat removal in order to mitigate the consequences of a tornado. The test to determine whether the TDEFW pump requires external cooling to operate was scheduled for July 2002. Based upon the test results, sensitivity studies with Revision 3 of the PRA model will be performed to determine whether beneficial risk reductions are appropriate. The projected completion date for this is October 2002. This previously unrecognized TDEFW failure mechanism due to tornado effects was incorporated into the revised PRA model under CA 6 of PIP O-01-01225, resulting in an approximate 1E-6 CDF increase.

(3) Operation of Atmospheric Dump Valves

(Closed) Unresolved Item (URI) 50-269,270,287/01-08-03: Operator Access To Steam Generator Atmospheric Dump Valves To Mitigate A Tornado. Due to the tornado effects (damage or debris) with intensities > F1, operator access to the atmospheric dump valves (ADVs) for depressurization could be compromised. Licensee submittals to support a July 28, 1989, safety evaluation report (SER) indicated that the upper surge tanks were susceptible to tornado effects. Even though the valves were located approximately 50 feet from the upper surge tanks, there was no discussion in the SER that recognized the valves were also susceptible, nor did the licensee's original PRA include the increased failure probability due to the effects of the tornado. Upon taking the tornado effects into account, the licensee determined a more accurate estimated failure probability for manually operating the ADVs and aligning the ASW pump would

be 0.55 versus the original PRA estimated failure probability of 0.1. This revised failure probability was incorporated into the draft PRA model, resulting in an estimated CDF increase of 9E-7. The original calculations used to derive the failure probability were not performed under the Quality Assurance Program of 10 CFR 50, Appendix B. In addition, the inspectors determined that there was no regulatory requirement that they be performed under Appendix B. Therefore, there was no violation of regulatory requirements.

(4) Access to Valve LP-28

Only upon damage to the borated water storage tank (BWST) by tornado effects would the SFP be aligned as the suction source of the high pressure injection (HPI) pump for reactor coolant system (RCS) makeup. However, the manually operated BWST isolation valve LP-28, which is located within a few feet of the tank, must be closed to avoid diverting the HPI pump available water supply in the respective SFP out the damaged BWST. During certain tornadoes, access to the valve could be compromised due to associated tornado debris and BWST rupture. Under PIP O-01-02791 CA 6, the licensee performed a more detailed analysis of the BWST tornado induced failure mechanisms. The results indicated that the tank could withstand wind speeds and resulting forces in excess of the highest postulated tornado (F5), but the tank could not withstand the missiles generated by tornadoes as low as F3 intensity. Using this information, the licensee estimated the failure probability of accessing and operating the valve to be 0.1, given a tank failure. This was incorporated into the draft PRA model, resulting in an estimated CDF increase of 7E-8.

(5) ASW Tornado Pump Flow Control

The licensee identified that there were potential run out and flow control difficulties with the ASW tornado pump when feeding multiple steam generators (SGs). The ASW tornado pump flow control is accomplished via differential pressure since the discharge lines do not contain flow instrumentation. The operator would be challenged during efforts to maintain the desired differential pressure band. Initial feeding of at least three SGs (i.e., more than one Unit) would place the pump in a run out flow condition. Also, if tornado related damage occurred to discharge piping in the unprotected west penetration room, pump run out conditions would worsen. Such piping damage would increase the difficulty to establish and maintain proper flow when feeding multiple SGs. In addition, the failure probability of using the ASW pump strategy was heightened by the complex communications between remote locations for feeding multiple SGs. The limitations on ASW system operation were incorporated into the draft PRA model and will be documented in the licensee's amendment request. Specifically, operating the ASW system to more than one unit was not considered credible. The subsequent CDF risk increase was estimated as 5E-8.

(6) Steam Generator Tubes Differential Temperature Issue

(Open) URI 269,270,287/01-08-02: Steam Generator Tube Stresses Resulting From Use of the Auxiliary Service WaterTornado Pump. Due to the time necessary to evaluate alternate core cooling strategies and to place the ASW tornado pump into service, the compressive SG tube stresses exceeded current manufacturer design limits on the tubes. Under associated PIP O-01-00940, a new compressive differential temperature limit of 108 degrees F was determined, assuming ASW operation at approximately 40 minutes. This temperature limit is one component of the postulated SG tube differential stresses associated with ASW tornado pump operations. With this new differential temperature input the structural analysis of existing tube flaws (axial and circumferential) was undertaken. The axial flaws were evaluated and determined acceptable. The circumferential flaw analysis, including actual tube stress testing, was completed by a contractor. However, the licensee had yet to receive the contractor's report and confirm acceptability. The licensee estimated that reviewing the contractor's report and incorporating the results into a Duke Power calculation would be completed in June 2002. While the inspectors were onsite, the licensee documented contingency actions in CA 4 of the PIP, should the final Duke reviews deem the results unacceptable. The contingencies included shorter frequency for SG tube inspections or reducing the time necessary to place the ASW tornado pump in service (including procedure and/or staffing changes). The safety significance of this design control violation will be ascertained after the NRC reviews the completed calculation. Therefore, this URI remains open.

(7) Spent Fuel Pool Suction for High Pressure Injection

The inventory within the SFP was not sufficient to ensure a 24-hour mission time for an HPI pump in all conditions. Assuming operators could wait nine hours prior to placing the HPI pump into service, it was estimated that for ten percent of the time the SFP would be unable to supply the necessary suction source for the HPI pump. The ability of the SFP to perform this function is contingent on high SFP temperatures due to core offloads. Per PIP O-01-01225, CA 3, the licensee concluded not to improve the availability or reliability of this method. Rather, a licensing basis change, including the elimination of this flow path from the Updated Final Safety Analysis Report (UFSAR), would be submitted. The restrictions associated with operating an HPI pump with the SFP as a water supply was incorporated into the licensee's draft PRA model. The estimated CDF increase was 6E-7.

(8) Pressurizer Safety Valve Reseating

(Closed) URI 50-269,270,287/01-09-01: Establishment of Pressurizer Code Safety Relief Valves to Pass Water in Excess of 500 Degrees F and Then Reseat. Licensee design documents did not establish that pressurizer code safety relief valves were able to pass reactor coolant in excess of 500 degrees F and then reseat. For scenarios with no core cooling and the ASW tornado pump taking up to 40 minutes to be placed in service, the RCS would heat up and reactor pressure would increase. In response, the safety relief valves would open, releasing steam from the pressurizer and eventually hot water from the RCS. Upon ASW pump injection to the secondary side of the SGs, the RCS would de-pressurize below the safety valve set point. If the safety valves failed to

reseat, reactor coolant would continue exiting the RCS. Consequently, the ASW tornado pump and HPI pump combination would be unable to maintain adequate core cooling with this continuous loss of coolant. The licensee initiated PIP O-01-03651 to address this issue.

Due to inadequate design controls, the licensee had not required the pressurizer safety valves to function with "hot" reactor coolant. Based upon industry testing (which indicated that valves of this nature had been tested under "hot" water conditions and successfully reseated) and an actual event at another facility of the same nuclear steam supplier, the failure probability of the relief valves to reseat was not altered. Therefore, there was no change in the CDF and no operability concerns associated with the presently installed valves. Licensee corrective actions, as documented in PIP O-01-03651, included revising the design bases document to require the pressurizer code safety relief valves to pass "hot" water and reseat, designating corrective actions to ensure the nozzle ring settings were properly controlled, designating an evaluation for any maintenance rule changes and designating an evaluation to determine if any other design control efforts were needed to ensure liquid relief capability.

The licensee's inadequate design control of the pressurizer code safety valves was of more than minor significance because if left uncorrected this same issue would become more significant. Without appropriate design controls to maintain this reseat function of the current valves and on the purchase of replacement valves, the function could be credibly lost. Loss of this function would have an actual impact on safety due to the initiation of a loss of coolant accident. However, because the currently installed valves would reseat, this issue presently does not affect the operability or reliability of a mitigating system function. As such, this issue is of very low safety significance (Green).

10 CFR 50, Appendix B, Criterion III, Design Control requires that, where a test program is used to verify the adequacy of a design feature, it shall include suitable qualification testing under the most adverse design conditions. Contrary to this requirement, during the development of the licensing and design basis for tornado mitigation, the licensee failed to ensure the pressurizer safety valves would reseat after passing hot water during certain tornado events. However, because the violation is of very low safety significance and was entered into the licensee's corrective action program, the violation is being treated as a Non-Cited Violation (NCV) consistent Section VI.A.1 of the NRC Enforcement Policy, and is identified as NCV 50-269,270,287/02-07-01, Inadequate Testing of Pressurizer Code Safety Valves. This issue was entered in the licensee's corrective action program as PIP O-01-03651.

(9) Unit 3 North Control Room Wall

The north wall of the Unit 3 main control room was not originally designed and constructed to withstand the effects (wind force, missiles, and differential pressure) of differing tornado intensities. This is contrary to the UFSAR, which indicates that the control rooms should be designed to withstand tornado loads. The licensee initiated PIP O-01-02827 to evaluate this condition. The inspectors reviewed the PIP and discussed

the associated corrective actions with structural engineers. The licensee determined that the wall in question was capable of withstanding the force created by design basis tornado winds. Although deterministic methods indicated that the wall did not have sufficient energy absorption capacity to stop certain missiles at design wind speed, the licensee's evaluation indicated that missile effects were probabilistically negligible. The licensee's most recent corrective actions focused on the differential pressure effects because their initial calculation indicated that when assuming zero venting capacity (to reduce the differential pressure effects) that the design differential pressure of 3 psid would be exceeded. In May 2002 under CA 6 of the PIP, the licensee completed an additional study and determined that when considering the combined effects of wind speed and differential pressure that the calculated capacity of the wall would be exceeded. As a result, the licensee proposed a minor modification to the wall to "provide ventilation from the control room during a design basis tornado sufficient to prevent failure of the remaining wall sections of the north wall." This was documented as CA 10 of the same PIP and was scheduled to be further evaluated for implementation by the end of May 2002. Currently, as documented in the PIP, the licensee considers the Unit 3 control room north wall to be non-conforming with the UFSAR; but, has determined that the Unit 3 control room is operable. Pending further NRC review, this issue will be identified as URI 50-287/02-07-02: Unit 3 Control Room Wall Not Designed to Withstand Tornado Loads.

(10) Additional Tornado Mitigation Deficiencies

Due to the licensee's corrective actions since the previous supplemental inspection, identified modeling errors revealed additional limitations in the deficient tornado mitigation strategy. These limitations involved postulated tornadoes that cause the loss of electrical power to the battery chargers of multiple units (an additional 6E-7 CDF change) which fail vital instrumentation needed for the emergency feed water system and the ASW tornado pump system; loss of the 4160 VAC standby bus feeders that pass from the Units 1 and 2 tornado protected blockhouse to the Unit 3 main feeder bus (an additional 2.5E-6 CDF change); and the collective effects of a tornado that fail the BWST and west penetration room of a particular unit coupled with the failure of electrical connections between the standby and main feeder buses for multiple units (an additional 2.8E-6 CDF change). These limitations were incorporated into the current draft PRA model. The inspectors reviewed these issues with the licensee's PRA analyst and concluded that the licensee's evaluations appeared reasonable.

(11) Probabilistic Estimation of Current Tornado Mitigation Strategy

The present estimate of CDF from a tornado on a particular reactor unit is approximately 2.2E-5 versus the 1.4E-5 prior to taking into consideration all the failure mechanisms identified in the sections above. This represents an increase in CDF of 8E-6. Tornado effects alone, accounted for an estimated 6E-6 of the revised CDF. This was higher than what the NRC estimated in a 1989 Safety Evaluation Report of tornado effects on secondary side heat removal, which was less than 1E-6 (the Safety Evaluation Report's acceptance criteria). The upcoming license amendment request will provide the NRC with the opportunity to review and evaluate the change in risk estimate.

C. Corrective Actions Effectiveness Review

The inspectors reviewed the assessment planning form associated with the licensee's intentions to perform an evaluation of the effectiveness of their corrective actions for the deficient tornado mitigation strategy. Plan number ONS-DBG-006-02 was scheduled to be started in the second Quarter of 2002. Although the plan was not detailed at the time of the inspection, it did address all the technical issues and deficiencies discussed in this report for evaluation of effectiveness.

D. Conclusions

As discussed in Supplemental Inspection Report 50-269,270,287/01-09, the inspectors determined that the original licensee performance deficiency associated with the limitations of the SFP as the HPI suction source when mitigating a tornado was an example of a "deficient tornado mitigation strategy."

There were two major facets to the performance deficiency. The first was improper design control as evidenced by such issues as: (1) an inadequate calculation supporting the use of the SFP as the suction source for an HPI pump; (2) the lack of a SG tube integrity analysis in scenarios using the ASW tornado pump; and (3) the lack of design controls associated with the pressurizer safety relief valves ability to reseat after passing "hot" reactor coolant. Second was an incomplete understanding of how postulated tornadoes affected secondary side heat removal, including the multi-unit interactions and their effects. This was evidenced by such failures to recognize: (1) the ASW tornado pump system can only be operated in a single unit mode; (2) ADV accessibility and operation due to tornado effects; (3) closure of valve LP-28 following BWST damage; (4) loss of TDEFW pump cooling; (5) loss of indication for emergency feedwater and the ASW tornado pump systems; and (6) loss of auxiliary equipment power to the Keowee hydroelectric units.

The risk effects of this performance deficiency were collectively estimated to be of low to moderate risk significance (i.e., between 1E-6 and 1E-5), which was consistent with the original performance deficiency's risk characterization. Since the overall risk significance was in the same range as the original findings, these additional examples of the root/contributing cause of the performance deficiency were not independently evaluated using the significance determination process.

Through the licensee's comprehensive extent of condition reviews, the licensee gained a more complete understanding, using risk insights, of tornado effects on secondary side heat removal. With that information the licensee made facility changes, scheduled facility changes to improve secondary side heat removal capability and scheduled reviews to consider further secondary side heat removal capability improvements. Also, given these additional risk insights, the licensee scheduled a submittal of a licensing amendment to the NRC requesting a licensing basis change for tornado mitigation. In conclusion, the inspectors determined that the licensee sufficiently demonstrated that the corrective actions for this low to moderate risk significant finding (both the SFP suction source and the deficient tornado mitigation strategy) were sufficiently accomplished or scheduled to address the root causes and the contributing causes to prevent recurrence. Accordingly, the open White finding related to a deficient

engineering calculation used for the strategy of supplying the HPI pump from the SFP for tornado mitigation identified in IR 50-269,270,287/00-07 and discussed in IR 50-269,270,287/01-09 is closed.

3.0 Management Meetings

The inspectors discussed the preliminary results of the inspection on May 3, 2002, with Mr. W. McCollum, site vice president, and other members of licensee management and staff.

SUPPLEMENTAL INFORMATION

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E. Burchfield, Design Basis Group Manager
R. Burley, System Engineer
S. Burton, Technical Specialist
D. Coyle, Operations Procedures Manager
C. Davis, Civil Engineer
D. Garland, Operations Support
R. Harris, System Engineer
R. Hester, Civil/Mechanical Engineer
L. Kanipe, General Office Risk Analyst
L. Llibre, Civil Engineer
S. Newman, Regulatory Compliance Engineer
L. Nicholson, Regulatory Compliance Manager
J. Rowell, Senior Engineer
W. Sample, Site Structural Engineer
J. Smith, Regulatory Compliance Technician
J. Wald, Keowee Operator
J. Weast, Regulatory Compliance Engineer

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-287/02-07-02	URI	Unit 3 Control Room Wall Not Designed to Withstand Tornado Loads (Section 02.03B.(9))

Opened and Closed

50-269,270,287/02-07-01	NCV	Inadequate Testing of Pressurizer Code Safety Valves (Section 02.03B.(8))

Previous Items Closed

50-269,270,287/01-08-03	URI	Operator Access to Steam Generator Atmospheric Dump Valves to Mitigate a Tornado (Section 02.03B.(3))

50-269,270,287/01-09-01	URI	Establishment of Pressurizer Code Safety Relief Valves to Pass Water in Excess of 500 Degrees F and Then Reseat (Section 02.03B.(8))

Discussed

50-269,270,287/01-08-02	URI	Steam Generator Tube Stresses Resulting From Use of the Station Auxiliary Service Water Pumps (Section 02.03B.(6))

DOCUMENTS REVIEWED

PIP O-01-1225
PIP O-01-03651
PIP O-01-0940
PIP O-01-02791
PIP O-01-02827
PIP O-02-02455
Work Request 98228525
1989 Safety Evaluation Report
AP/0/A/2000/001, Keowee Hydro Station - Natural Disaster
AP/0/A/2000/002, Keowee Hydro Station - Emergency Start
AP/0/A/2000/003, Keowee Hydro Station - Auxiliary Power Recovery
OP/0/A/2000/100, KHS - Alarm Response Guide SA-1
KHS, AP/0/A/2000/003, Auxiliary Power Recovery Handout (Operator training guide)
Plant Drawing No. O-1026-05, Auxiliary Building Unit -3 (Control Room)
Modification Activation Request Form 247, Harden Aux Bldg Walls to Provide Protection
Tornado Design Basis Project Plan
Planning Assessment Form ONS-DBG-006-02